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Centre of Excellence in Accounting and Reporting for Co-operatives

International Journal of

Co-operative Accounting & Management (IJCAM)

Through the Centre of Excellence in Accounting and Reporting for Co-operatives (CEARC) at the Sobey School of Business, Saint Mary's University in Canada, the journal explores a diverse range of topics related to accounting and management in co-operatives, credit unions, and mutual organizations.

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The Centre of Excellence in Accounting and Reporting for Co-operatives (CEARC) in the Sobey School of Business at Saint Mary's University was created because the co-operative business model, with its unique business purpose, values and principles, is not adequately served by the same approach to accounting used by investor-driven firms.

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Vol. 7 No. 2

Letter from the Editors

IN THIS ISSUE OF IJCAM we are pleased to publish four papers and a book review. The first paper, *Cooperative Synergy: Unleashing the Power of Dairy Cooperatives in Achieving Sustainable Development Goals*, is by Mallika Kumar, Associate Professor, Shri Ram College of Commerce, University of Delhi and Sagar Wadkar and Shrija Sinha, both from the National Cooperative Union of India. It uses a case study to explore the role of dairies in contributing to SDGs. In the second paper, Edward Keddy examines the role of the balanced scorecard in motivating employees of Arctic Co-operatives. In the third paper, Evan Proven studies the feasibility of creating a Multi-Stakeholder Network that would leverage the capabilities and resources of stakeholder members to reduce the upfront cost of constructing low-income housing units to a high-performance and resilient building standard. The fourth paper, *Enabling First Nation Pension Access with Tenets of Cooperative Governance*, by John Horn, explores the complex topic of access to pensions for First Nations employees. The issue concludes with a book review by Peter Davis on the critically acclaimed book by Michio Kaku (2023), *Quantum Supremacy: How the Quantum Computer Revolution Will Change Everything.*

Call for Papers

In addition to our regular edition of IJCAM in 2025, we are also issuing a call for a special edition focusing on Co-operatives and Indigenous Issues.

- Submission deadline for both editions – September 30, 2024

Papers related to management topics should be submitted to Peter Davis: pd8@leicester.ac.uk and those focusing on accounting and reporting should be submitted to Daphne Rixon: daphne.rixon@smu.ca.

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Co-operative Accounting and Reporting

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Cooperative Synergy: Unleashing the Power of Dairy Cooperatives in Achieving Sustainable Development Goals

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Shrija Sinha, Research Officer, National Cooperative Union of India, India

Abstract: The study presents the general concept of cooperatives, with a particular emphasis on dairy cooperatives, emphasizing their role in fostering collaboration, inclusion, and social growth. It emphasizes the significance of cooperatives in achieving various Sustainable Development Goals (SDGs). The study aimed to explore the intricate relationship between dairy cooperatives, using the case of "AmulFed Dairy of India" as an example, and their role in advancing the SDGs. The study adopted an exploratory case study approach to collect data and gain a comprehensive understanding of the AmulFed's contributions to the SDGs. The primary finding of the study is that dairy cooperatives, as represented by AmulFed Dairy, are closely aligned with all seventeen SDGs. Finally, the study recognizes and commends AmulFed for its consistent dedication to achieving prosperity, equity, and sustainability within the dairy sector and among its participants. This study emphasizes the critical role of dairy cooperatives in furthering sustainable development and demonstrates their positive influence across multiple dimensions of societal well-being.

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Keywords: AMUL, Cooperatives, Dairy, India, Sustainable Development Goals

1. Introduction

The world we live in is marked by diverse challenges. Around 656.4 million people worldwide live in extreme poverty, meaning they survive on less than $1.90 per day (Lakner et al., 2022). When it comes to 'inequality', people round the globe are witnessing disparities in terms of both income and wealth, with wealth inequality being particularly pronounced. Approximately 10% of the worldwide population receives 52% of global earnings, while the poorest 50% of the population earns only 8.5%. Furthermore, ownership is even more concentrated. Half of the global population owns only 2% of global wealth, whereas 10% of the global population controls 76% of total global wealth (Chancel et al., 2022). The overall health disparity round the globe in terms of access to healthcare, child mortality, maternal health, malnutrition and disease prevalence is a matter of grave concern.

Similar is the case of global education disparity. According to the UNESCO Report, 2022, in low-income countries, out of school rate for lower secondary level, upper-secondary level is as high as 39 per cent and 61 per cent respectively. While talking about the high-incomes countries, 3% of the students are out of school at lower secondary level compared to 8 per cent in upper secondary level. In low-income countries, 65% of girls between the age of 15 and 17 are not in school. People globally are facing problems in terms of access to clean water and sanitation. According to UNICEF data (2023), about 2.2 billion people lack access to safely managed water services. As many as 115 million people in the world still collect drinking water directly from rivers, lakes, and other surface water sources. The findings show stark differences, with the poorest and those residing in remote areas having the lowest likelihood of using a basic service. In most nations, women and girls continue to bear the burden of collecting water.

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The condition of environmental degradation is also similar. According to the reports of 'The World Counts (2023)', annually, around 55 billion tons of fossil energy, minerals, metals, and biomass are extracted from the Earth. Based on the present deforestation rate, it is projected that around 5-10% of tropical forest species will become extinct with each successive decade. On an hourly basis, about 1,692 acres of arable land are undergoing desertification. The effect of climate change is also visible: Earth's temperature has risen by an average of 0.14° Fahrenheit (0.08° Celsius) per decade since 1880, or about 2° F in total. The above stark statistics leave out the further complications of regional wars, the criminal networks trafficking people and drugs and engaging in enslavement. Often corruption at state levels and the misuse of the latest technological innovations for disinformation and manipulation add further dimensions to this multifactored global crisis. All these factors add emphasis and urgency for global cooperation to address these issues.

1.1 United Nation's Sustainable Development Goals

The holistic term 'Sustainable Development' focuses on intergenerational equity of resources for meeting present as well as future needs (Brundtland Report, 1987); improving quality of life without compromising environmental sustainability or harming the prospects for future generations (Murphy, 2006); and development that meets current needs and goals without jeopardising future ones (Daly, 1990; Pearce et al., 1989). According to UN secretary-general Antonio Guterres, 'sustainable development', fundamentally, emphasizes upholding human rights, ensuring peace and security. He focused on leaving no one behind, by reducing inequalities within as well as between nations, reaching those most at risk, and bolstering our resolve to prevent conflict and maintain peace (Voinea, 2018). Thus, it will be fully justified to recognise sustainable development as the concept which seeks to achieve a balance between social equity, economic growth and environmental well-being by adoption of a sustainable package of practices in all aspects of development.

The year '2015' witnessed a vigorous, inclusive and comprehensive call for sustainable development in the form of the United Nations' Sustainable Development Goals (SDGs). It was also known as the 'Global Goals', as they were a universal call to end poverty, safeguard the planet, and ensure that all people enjoy peace and prosperity by 2030 (Odey et al., 2021). SDGs are an ambitious plan inclusive of 17 goals and 169 targets related to poverty, food, health, education, women, water, energy, economy, infrastructure, inequality, habitation, consumption, climate, marine ecosystems, institutions for peace, and sustainable development (Carreira et al., 2017). The SDGs have a set deadline of 2030, so they are even called 'AGENDA-2030'.

1.2 India and Sustainable Development Goals

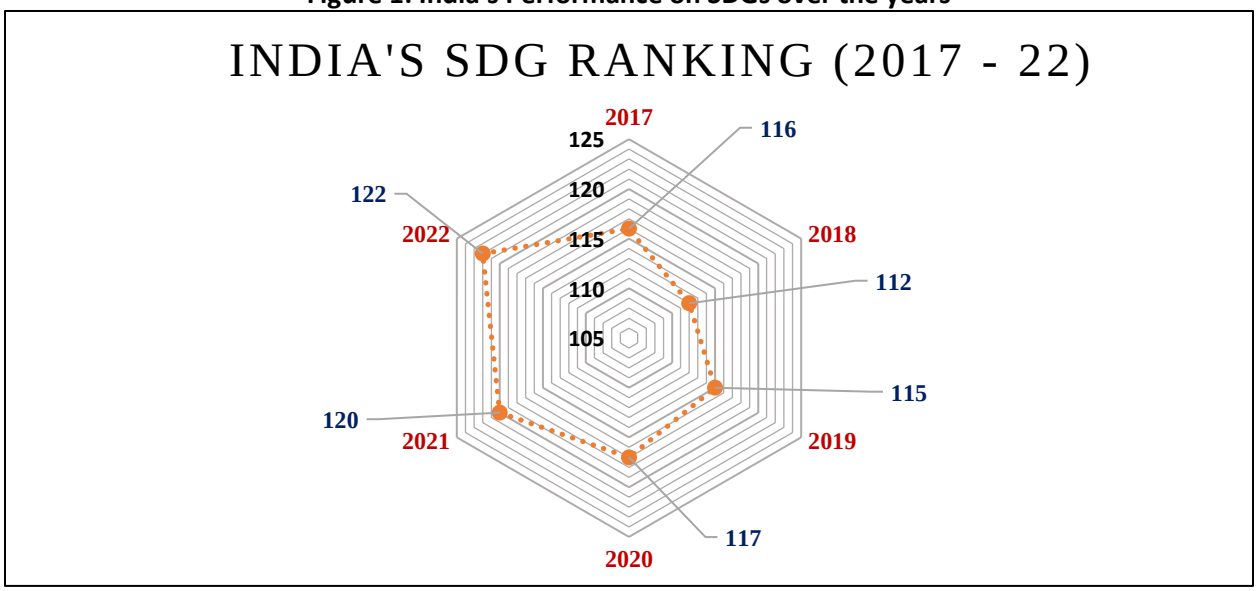
On one hand, 'India' happens to be the world's largest democracy with a federal parliamentary system, fifth largest economy globally, expected to rise to the third position in near future (Economic Survey, 2022-23), emerging market and an active influencer of international affairs. However, on the other hand India faces many social, economic, and environmental challenges such as low per capita income, poverty, hunger, energy security, water security, increasing population, sanitation, poor health care, depleting natural resources and climate change (Bansal et al., 2020, Singh & Rahman, 2021). India was one of the 193 United Nations member states to adopt the SDGs and commit itself as a stakeholder to meet the 2030 agenda for sustainable development (Singh & Rahman, 2021). India has been instrumental in the formation of the SDGs, and the country's national development objectives are reflected in SDGs (NITI Aayog, 2017).

Over the years, India has vociferously advocated and worked towards attaining the different SDGs. India has maintained approximate constancy in the overall SDG Index and Ranking over the years as represented in Figure 1. Indian government through its implementing agency 'National Institution for Transforming India' (NITI Aayog) and evaluation agency 'The Ministry of Statistics and Programme Implementation' (MOSPI) are carrying out a mapping of all SDGs and government sponsored schemes running parallel to these SDGs for their grass-root implementation. Some significant positive shifts made by India over the years with the SDGs functional have been described below.

- **SDG 1: No Poverty** - Over the years, India has made considerable progress in decreasing poverty. According to the World Bank (2021), India's poverty rate has dropped from 21.6% in 2011 to 9.7% in 2019.

- **SDG 2: Zero Hunger** - India has made progress in reducing hunger and improving food security. The Global Hunger Index (GHI) score for India has improved from 38.9 in 2000 to 27.2 in 2021. It should be noted here that a lower score in the index indicates lower hunger levels (Von Grebmer et al., 2021).
- **SDG 3: Good Health and Well-being** –
  - ✓ Under-five mortality rate decreased from 126 per 1,000 live births in 1990 to 34 per 1,000 live births in 2019 (UNDP, 2020).
  - ✓ Maternal mortality ratio declined from 556 deaths per 100,000 live births in 1990 to 113 deaths per 100,000 live births in 2016 (World Bank, 2021).
- **SDG 4: Quality Education** - The literacy rate in India increased from 64.8% in 2001 to 74.04% in 2011 and further to 77.70% in 2021 (National Statistical Office of India, 2021).
- **SDG 5: Gender Equality** - The percentage of seats held by women in the national parliament (Lok Sabha) increased from 4.4% in 1990 to 14.4% in 2020 (World Bank, 2021).
- **SDG 7: Affordable and Clean Energy** - India's total installed renewable energy capacity reached around 98 gigawatts (GW) as of 2021, accounting for nearly 24% of the country's total installed capacity (Ministry of New and Renewable Energy, Government of India, 2021).
- **SDG 11: Sustainable Cities and Communities** - The Smart Cities Mission aims to develop 100 smart cities across India. The mission focuses on aspects like efficient energy use, sustainable transport, and improved livability (UN-Habitat. MoHUA, GoI. 2023).

Figure 1: India's Performance on SDGs over the years



Source: SDG Index Report, UN, 2017 -2022

Though India is progressing well in all the aspects of SDGs, but still India has a long way to go. There are a few reports which certainly give an idea about volume of work the country has to do. According to National Annual Rural Sanitation Survey, 2019-20, conducted by Independent Verification Agency (IVA) under the World Bank support project to the *Swachh Bharat Mission* Grameen (SBM-G), only 64.9 per cent of rural population have access to improved sanitation facilities. About 15 per cent of the rural population doesn't have safe, functional and hygienic toilets, 10 per cent of Indian villages are not 'Open Defecation Free'. Similarly, the NITI Aayog's Composite Water Management Index (2019) reported that the states of Maharashtra, Gujarat, Karnataka, Jharkhand, Andhra Pradesh and Rajasthan, Uttar Pradesh, Punjab, Delhi, Bengaluru, and Chennai have been facing serious Water scarcity since 2018. India is experiencing an acute water challenge, the country has per capita water availability close to or lower than 1000m3, which is just the threshold amount described by the 'Falkenmark Index'.

According to the Annual Status of Education Report (ASER), 2019, 25% of youngsters in rural India are still unable to read simple text proficiently even after four years of schooling. India is one of the world's largest emitters of greenhouse gases and faces numerous environmental challenges, including air pollution, deforestation, and water pollution (Chopra, 2016). All the 1.4 billion population of India are living in areas where the annual average level of particulate pollution exceeds the World Health Organization guideline. About 94 percent of them reside in areas where the air quality exceeds India's own standard. A quarter of India's population is exposed to pollution levels not seen in any other nation, and 248 million residents of northern India are projected to lose more than eight years of life expectancy if pollution levels continue (Greenstone & Fan, 2020). India was ranked 140 out of the 189 countries, indicating significant gender disparities in areas such as education, health, and economic participation (The Gender Inequality Index, 2020). According to the National Crime Records Bureau, about 405,861 crimes against women were reported in 2019, highlighting the persisting challenges of gender-based violence.

The Global Nutrition Report, 2021 highlighted that there has been no significant improvement in areas of anaemia, under-5 wasting, adult male and female obesity and adult male and female diabetes. There has been a 15% increase in deaths due to poor diet in India since 2010. The report points out the loophole in India's public distribution system (PDS) even though the PDS aims to distribute essential commodities to the marginalized population at subsidized rates to ensure food security for all. India's PDS faces persistent problems like fake supply of ration cards leaving the poor out, selling the commodities on the open market, not supplying permitted amounts of food grains by the fair price shops, replacing good quality food grains with cheap varieties, etc.

1.3 The Present Status of Cooperatives in India

A cooperative is defined as an autonomous association of people united voluntarily to meet their common economic, social and cultural needs and aspirations through jointly-owned and democratically-controlled enterprises (ICA, 1995). Cooperatives around the globe have one billion members, provide 100 million jobs and the top 300 cooperatives are worth 1.6 trillion-dollars, equivalent to the 9th largest economy in the world. Cooperatives are highly relevant and important in the realization of the SDGs as they offer an opportunity to mobilise the poorest of the community. Being member service driven rather than having their performance measured by Return of Capital Employed (ROCE), their economic model is able to address the disparity in ownership at the global level and contribute to sustainable economic growth, social development and environmental responsibility.

According to the United Nations, cooperatives, in their purpose and operation, are naturally sustainable organizations. They can be considered as a business that is encouraged to implement the 2030 Agenda for Sustainable Development. The 2030 agenda for sustainable development explicitly recognizes co-operative enterprises as important players within the private sector to achieve the SDGs (Gicheru, 2016). The International Cooperative Alliance (ICA) has identified targets within the 17 SDGs of most relevance to co-operatives and grouped them into main action areas: eradicating poverty, improving access to basic goods and services, and protecting the environment and building a more sustainable food system (Iyer, 2020).

Cooperatives contribute to a sustainable future with their inclusiveness and transparent accountability for achieving the SDGs. They support the United Nations in the implementation of the SDGs, creating the framework for sustainable business practices at all levels- economic, social and environmental. Several initiatives as well as activities have been undertaken by cooperatives from local to global levels in the fields of agriculture, manufacturing, banking, industry, consumption, technology, etc., for contributing to the SDGs in many diverse and unique ways (Gicheru, 2016). The following contributions are made by cooperatives at a global level: sustainable economic growth and starting of ventures to reduce poverty; food security through sustainable agriculture and food fortification to end hunger (Schwettmann, 2014); health management for good health (Leviten, 2009)**;** educational projects to ensure quality education; and promotion of diversity for gender equality (Lafont & Ribeiro-Soriano, 2023). Cooperatives have been instrumental in ensuring sustainable use of water and sea water desalination to ensure sanitation for all (Deane & Mac Domhnaill, 2021), sustainable investments for economic growth (Brief, 2015).

The case of the cooperative development of India's Dairy Industry

India today is the largest producer of milk in the world, contributing about twenty-three per cent of milk produced worldwide, but India's position during 1950s and 1960s was drastically different. India was a milk deficit nation and

was dependent on imports for meeting its requirements. The annual compound growth rate in milk production during the first decade after independence was 1.64%, which declined to 1.15% during the 1960s. In 1950-51, per capita consumption of milk in the country was only 124 grams per day. By 1970, this figure had dropped to 107 grams per day, one of the lowest in the world and well below the minimum recommended nutritional standards. India's dairy industry was struggling to survive. This evolution in India's dairy scenario can be augmented to the stellar role played by the dairy cooperative.

India, under the leadership of late Prime Minister Lal Bahadur Shastri, established National Dairy Development Board in 1965 with a mandate to support the creation of the 'Anand Pattern' of dairy cooperatives across the country through the Operation Flood (OF) programme, which was to be implemented in phases. The 'Anand Pattern' generally known as Anand Milk Union Limited (AMUL) is essentially a cooperative structure comprising village-level Dairy Cooperative Societies, which promote district-level unions, which in turn promote state-level marketing federations. Operation Flood was implemented in the following phases:

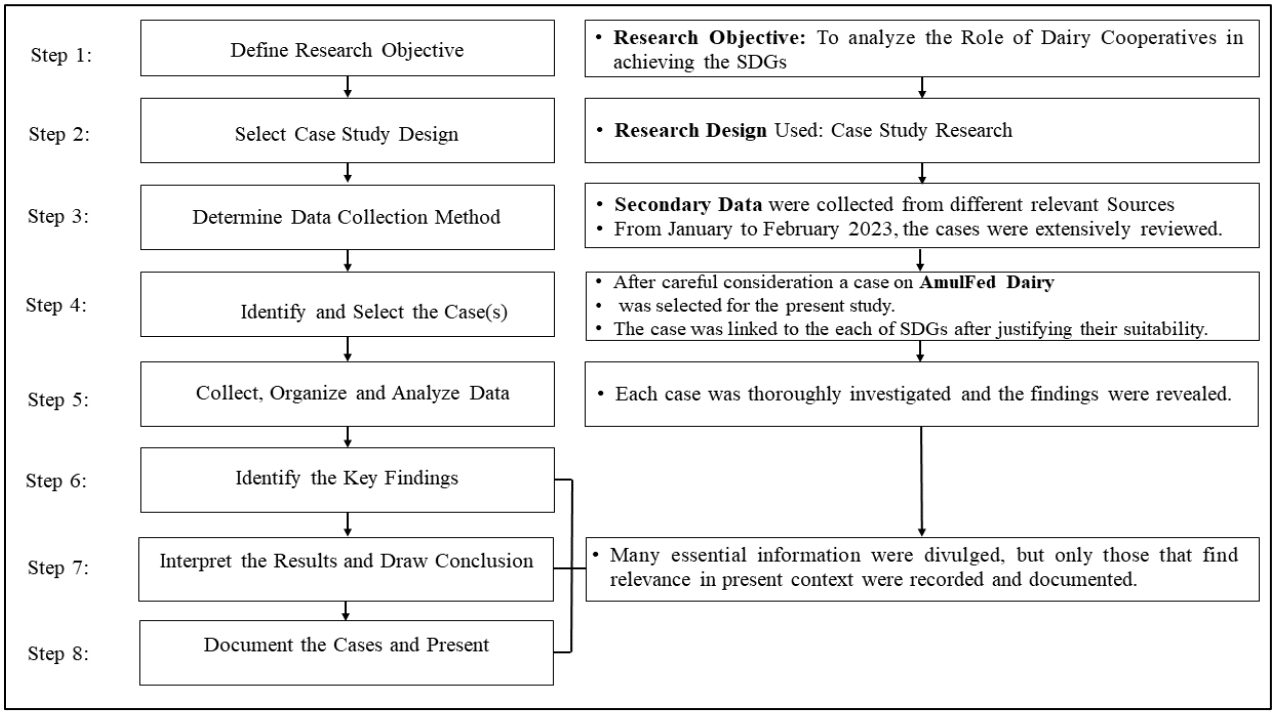
- Phase I (1970–1980) was financed by the sale of skimmed milk powder and butter oil donated by the European Union (then the European Economic Community) through the World Food Programme.
- Phase II (1981–1985) increased the number of milk sheds from 18 to 136; urban markets expanded the outlets for milk to 290. By the end of 1985, a self-sustaining system of 43,000 village cooperatives with 4,250,000 milk producers had been covered.
- Phase III (1985–1996) enabled dairy cooperatives to expand and strengthen the infrastructure required to procure and market increasing volumes of milk. This phase added 30,000 new dairy cooperatives, which led to a total of 73,000.

Milk production of India in 1950-51 was merely 17 million tonnes (MT), which with the efforts of these cooperatives has increased to 210 million tonnes in 2020-21. Today, world milk production is growing at the rate of two per cent, whereas in India, its growth rate is more than six per cent. The per capita availability of milk in India is much higher than the world average. In three decades (the 1980s, 1990s and 2000s), the daily milk consumption in the country rose from a low of 107 grams per person in 1970 to 427 grams per person in 2020-21 as against the world average of 322 grams per day during 2021.

2. Methodology

The present investigation uses 'case study' research design to probe the role played by the dairy cooperatives in realizing the SDGs through the lens of 'AmulFed Dairy', a unit of the "Gujarat Cooperative Milk Marketing Federation Ltd. (GCMMF)". The case study method involves in-depth exploration of a phenomena, event, individual, group, or organisation in its real-life setting. It seeks to comprehend the case and gather rich, thorough data from numerous sources. Case studies use qualitative methods including interviews, observations, and document analysis to investigate complicated occurrences and build theories (Yin, 2018; Flyvbjerg, 2011; Baxter & Jack, 2008; Stake,1995). Case study research method is appropriate to use, when the researcher is probing 'why' or 'how' type of questions and the phenomenon to be studied is in real-life context (Grauer, 2012). The complete methodology followed is shown in the form of a flow chart (Figure 2). For data collection, 'document analysis' approach was used.

Figure 2: Flow Chart Showing Case-Study Methodology



Followed: authors' own depiction adapted from Yin (2018).

3. Results and Discussion

This section illustrates the case of the 'AmulFed Dairy', a unit of the "Gujarat Cooperative Milk Marketing Federation Ltd. (GCMMF)" and depicts how dairy farmers at a grassroots level became active agents in the process of their own development and empowerment. In doing so, the study contributes to the ongoing research on dairy cooperatives' role in achieving SDGs in India.

Background

The innovative and inspiring dairy cooperative model started in 1946 as a symbol of protest against the middlemen in Anand, Gujarat. The cooperative, which started initially as Kaira District Cooperative Milk Producers Union Ltd, led by Pioneers like Morarji Desai and Tribhuvan Das moved strength by strength under the guidance of Dr. Verghese Kurien, the Milk Man and Father of White Revolution in India. The AMUL model was instrumental in bringing white revolution in India with its three-tier structure. The "Amul girl" campaign, was a successful advertising and marketing tactic that improved brand recognition for AMUL. The cooperative's growth, diversification into different dairy products, and international recognition was in response to its success in the holistic transformation of communities.

AmulFed Dairy Gandhinagar, a division of the GCMMF, commenced its operations in September 1994 with the capability to process 1 million litres of milk daily. Over time, AmulFed Dairy, Gandhinagar has undergone full automation and evolved into a versatile manufacturing facility producing various goods. Presently, it boasts a milk processing capacity of over 6 million litres daily. This achievement positions it as one of the largest dairy plants in Asia, processing such a substantial volume of milk and transforming it into an array of value-added dairy items at a single site. AmulFed Dairy's primary objectives include receiving "Excess Milk" from the Member Union Dairies of Gujarat and providing wholesome and nutritious milk products in Ahmedabad and the adjacent regions. These successes demonstrate the importance of co-operation between co-operatives in achieving progressive change and improvements for small producers, their families and communities.

AmulFed Dairy and SDGs: Quantifiable measures taken by the cooperative

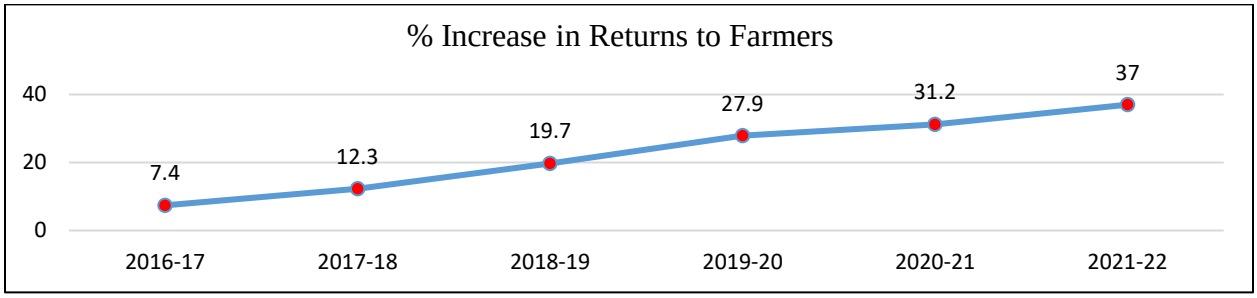
SDG 1: No Poverty

"Amul" provide rural livelihood by accepting milk from all 16.6 million milk producers of India and about 3.6 million milk producers from Gujarat. The depiction in Table 1 represents data only from Gujarat. Amul's operations were steady from 2016 to 2021, covering 20 districts and working with over 34.56 lakh [one lakh is equal to 100,000] milk producing farmers who poured milk to about 18,559 village cooperative societies. Notably, the amount of milk received each day increased steadily, demonstrating the cooperative's expansion from 152.71 lakh kg/day in 2016–17 to 215.96 lakh kg/day in 2020–21.

Table 1: Impact of AMUL on Rural Livelihood of Gujarat State of India

Year	No of Districts Served	No. of Village Producers Served (Lakhs)	No. of Village Cooperative Societies	Volume of Milk Receipt(Lakh Kg/day)
2016-17	20	34.56	17307	152.71
2017-18	20	34.56	18554	168.3
2018-19	20	36.16	18559	200.42
2019-20	20	36.36	18562	185.29
2020-21	20	36.37	18565	215.96

Figure 3: % Increase in Returns to Farmers (Considering 2015-16 % return as baseline)



From the above graph (Figure 3), we conclude that there has been a significant improvement in return to farmers, ranging from 7.4% in 2016-17 to 37 % in 2021-22. In addition, the cooperative provides gainful employment to about 925 employees and around 1,490 workers. Thus, we can conclude that Amul works to eradicate poverty in line with SDG 1 by promoting sustainable development, increasing incomes, and fostering economic opportunity through cooperative structures.

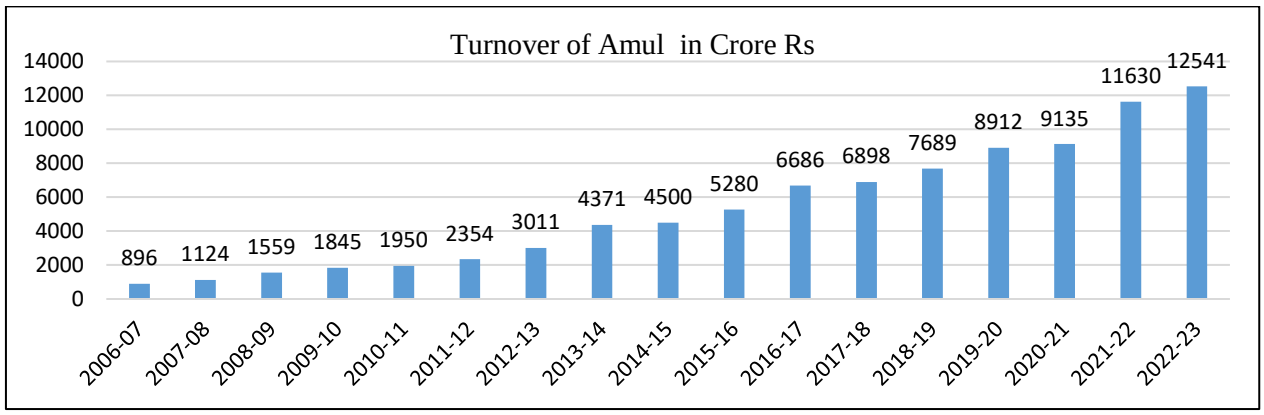
SDG 2: Zero Hunger

Amul has been instrumental in reducing hunger among the people directly and indirectly. The following measures have been taken that suggest and support the above statement:

- AmulFed Dairy is engaged in essential service business using its 236 outlets.
- AmulFed Dairy successfully managed significant raw milk inflow and met market demand during the COVID-19 pandemic in 2020 and 2021, adhering to regulatory norms.
- Amul offered free lunch, snacks, hostel facilities, medical compensation and hardship allowances to their workers during COVID times.

- The annual turnover, depicted in Figure 4, is also, being a co-operative (i.e., a business that distributes its surpluses to its members), a direct plausible indirect measure of hunger reduction in the participating communities. Rising turnover signifies a lift in dairy productivity, growing nutritional needs in a sustainable way.

Figure 4: Year – Wise Turnover of AMUL in Crore Rupees [one crore is equal to 10 million]



SDG 3: Good Health and Well Being

- Amul has launched a product line designed for nurturing health and providing their customers with nutrition. These product lines are:
  - ✓ **Probiotic Products Range** – Probiotic Buttermilk, Prolife Lassi, Amul Flaavyo (Yogurt), Frozen Yoghurt, Probiotic Chocobar ice-cream
  - ✓ **Camel Milk based Products Range** -- they help manage diabetes, provide immunity, promote growth and development, improve blood circulation and promote the cardio-vascular health.
  - ✓ Lactose Free Milk
  - ✓ **Milk with Goodness of Ayurveda** - Fortified with the nutrition of milk and memory boosting Bhrahmi, Sankhapushpi, Tulsi, Ashwagandha and other herbs.
- AmulFed Dairy Health, Safety and Well-being Policy is committed to provide a safe and healthy work environment. The total fatal accident, lost-time injuries frequency rate and occupational illness frequency rate for direct employees for three consecutive years (2020 -2022) has been zero.

SDG 4: Quality Education

- **Amul Vidya Bhawan** – Establishment of schools and provision of quality education and vocational training to underprivileged children of dairy farmers in rural areas.
- On the occasion of National Milk Day Celebration, AMUL organized various activities in schools like sports activities, quiz competitions, Drawing Competition, Essay Writing & Extempore Competition.

SDG 5: Gender Equality

Women employees are assigned equal roles and responsibilities vis-à-vis men employees. 116 female employees are discharging their duties in critical operations.

SDG 6: Clean Water and Sanitation

- Amul plants since its inception have maintained “Zero Liquid Discharge” plants.
- Amul has been working in the direction of water stewardship by following the principles of water recharge, reuse and recycle.
- For water recharge, a water harvesting plant has been installed at AMULFED office at Ahmedabad inclusive of a total of eleven number of recharge wells. This initiative resulted in 23 per cent of ground water drawl.
- A total of 700 kilos of water is recycled per day of which 20 per cent recycled water is used of total water consumption.

- Milk condensate generated by plant operations is reused, constituting 40 per cent of total water consumption.

SDG 7: Affordable and Clean Energy

- Amul has explored the use of renewable energy in the form of solar rooftop solutions. In 2019, the cooperative joined hands with 'Waaree Energies' (a leading solar PV manufacturer) for the panel installation works. The twelve-month performance of the installation has been depicted below in the form of Table 2.

Table 2: Year Wise Performance of Solar Roof Top Installation at AMUL

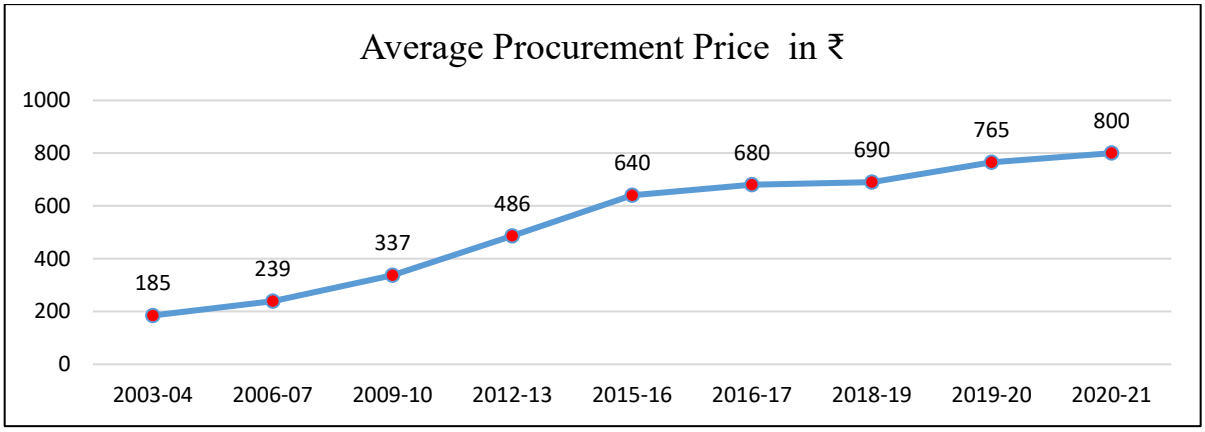
Year	Technology (Electrical)	Type of Energy	Total Installed Capacity (Kwp)	Total Generation (Million Kwh)	% Overall Electricity Energy
2018-19	Solar Roof Top	Solar	520	0.36	0.55
2019-20			1000	1.15	1.72
2020-21			1000	1.68	2.19
2021-22			1000	1.64	1.92
2022-23			1000	1.48	2.36

Note: Kwp – Kilowatt Peak, Kwh – Kilowatt hour

SDG 8: Decent Work and Economic Growth

- Figure 5 depicts Amul's average procurement price paid to milk producers pouring in their facilities have increased over the years ensuring a decent return to about 16.6 million milk producers.

Figure 5: Average Procurement Price Paid by AMUL to the General Milk Producers



- Talking about the economic growth of the cooperative, Amul has worked on a number of economic growth indicators:
  - ✓ **Product Manufacturing by Amul**

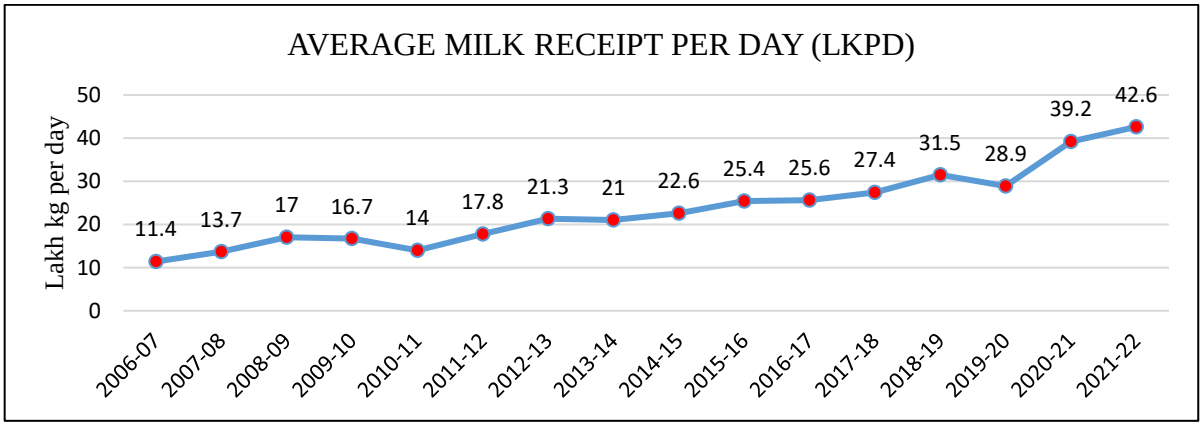
    Table 3 depicts the production patterns from 2019-20 to 2022-23 of the cooperative. Amul increased Ultra Heat Treatment (UHT) milk production from 1,899 to 2,502 lakh liters from 2019 to 2023, while milk pouch packing rose from 4,346.9 to 4,521.8 lakh liters in the same time frame. Ice cream production ranged from 17,574 to 19,721 kiloliters and fermented product output from 4,220 to 20,405 metric tons (MT). Milk powder production increased from 47,819 to 85,470 metric tons. Above indicators are the evidence of over the year economic growth of the cooperative.

Table 3: Year Wise Growth in Product Manufacturing by Amul

Year	Milk Pouch Packing (Lakh litres)	UHT Milk (Lakh Litres)	Fermented Products (MT)	Ice cream (kl)	Powder (MT)
2019-20	4346.9	1899	4220	17574	47819
2020-21	4521.8	1967	4223	10266	77689
2021-22	4494.8	2344	14227	14296	85470
2022-23	4497.51	2502	20405	19721	42569

- ✓ **Average Milk Receipts Per Day by Amul**
  Figure 6 shows the average milk receipt per day in Lakh Kilogram per day (LKPD) from 2006-07 to 2021-22. This statistic shows how much milk Amul receives every day. Starting at 11.4 LKPD in 2006-07 which gradually rose to 42.6 LKPD in 2021-22.

Figure 6: Average Milk Receipt Per Day by Amul



- ✓ Other Parameters like Turnover, Increase in Farmer's share in the Amul's income, and product line development have already been discussed in above SDGs.

SDG 9: Industry, Innovation and Infrastructure

- **Innovative Infrastructures Installed by Amul**
  - ✓ Segregation of high and low chilled water temperature requirements resulted in reduction in power consumption by about 700,000 kWh/annum.
  - ✓ Installation of new cooling tower in powder plant. Eliminating tail tank pump and reduction in power consumption by 60,000 kWh/annum.
  - ✓ Installation of paddle dryer for drying of Effluent Treatment Plant sludge, resulting in generation of solid fuel of 1 Ton/day. Potential reduction in annual fuel consumption is 160 metric tonnes of oil equivalent.
  - ✓ Installation of Ghee barrel melting tunnel resulting in reduction in steam consumption by 320 MT per annum and fuel saving of 24,000 standard cubic meters (SCM)/annum.
- **Digitalization** of the plant and work of Amul.
- **Innovative Product line development** as discussed in above SDG 3.

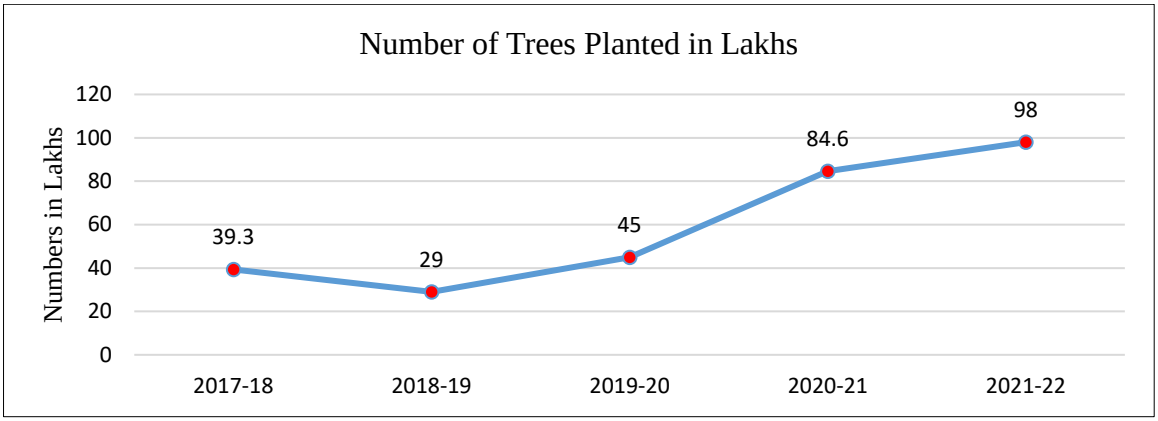
SDG 10: Reduce Inequalities

- Equality in opportunity, treatment, and wages for both male and female employees, and milk producers.

SDG 11: Sustainable Cities and Communities

- Mass Tree Plantation Drive is facilitated by Amul on Independence Day each year. This important initiative taken by the cooperative is helping to offset carbon emissions and provide a healthier environment. Figure 7 depicts the number of trees planted by Amul over the year.

Figure 7: Mass Tree Plantation Drive and number of Trees Planted Over the Years



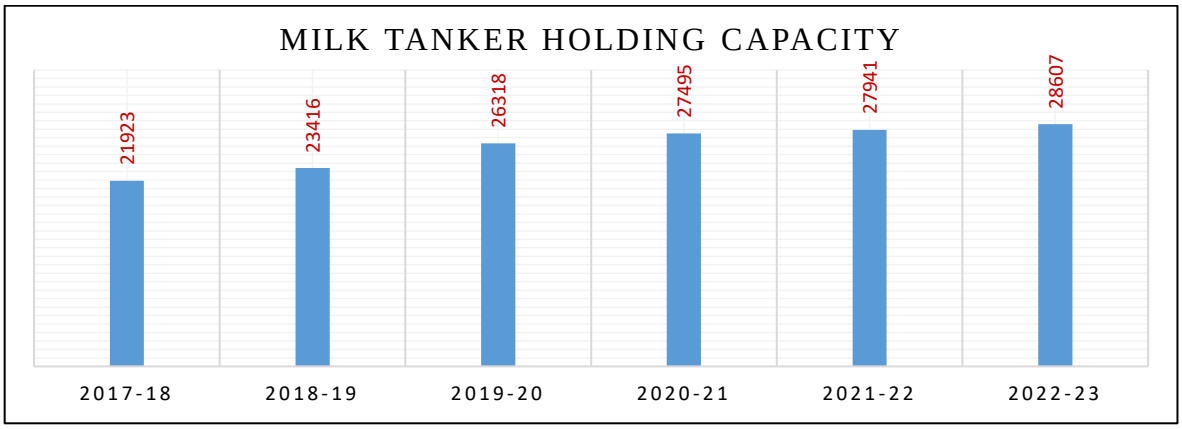
- Other measures are reduction in water usage, water stewardship, reduction in greenhouse gas emissions, etc.

SDG 12: Responsible Consumption and Operations

Amul has been taking appropriate steps towards responsible production/operations and consumption of plants under them. Some of the most important measures to justify the above made statement are discussed below:

- **Efficient Increase in Milk Tanker Capacity**
  Figure 8 represents a steady increase in the annual milk tanker storage capacity of AMUL, from 21,923 in 2017-18 to 28,607 in 2022-23. This gradual increase in the milk tanker holding capacity over the years highlights AMUL's dedication in optimizing dairy operations and its capacity to adapt to increasing milk production.

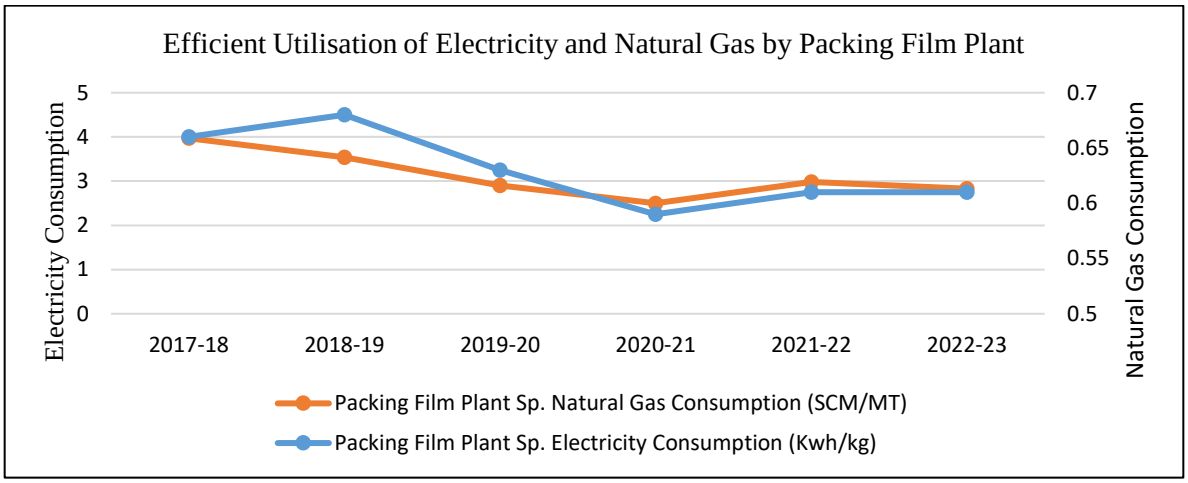
Figure 8: Milk Tanker Holding Capacity of Amul Over the Years



- **Efficient Management of Packing Film Plant**
  Figure 9 plots the details for specific electricity and natural gas consumption per unit for Amul's Packing Film Plant from the financial year 2017-18 to 2022-23. It demonstrates the plant's efforts to improve energy efficiency and its alignment with Sustainable Development Goal 12, which revolves around responsible

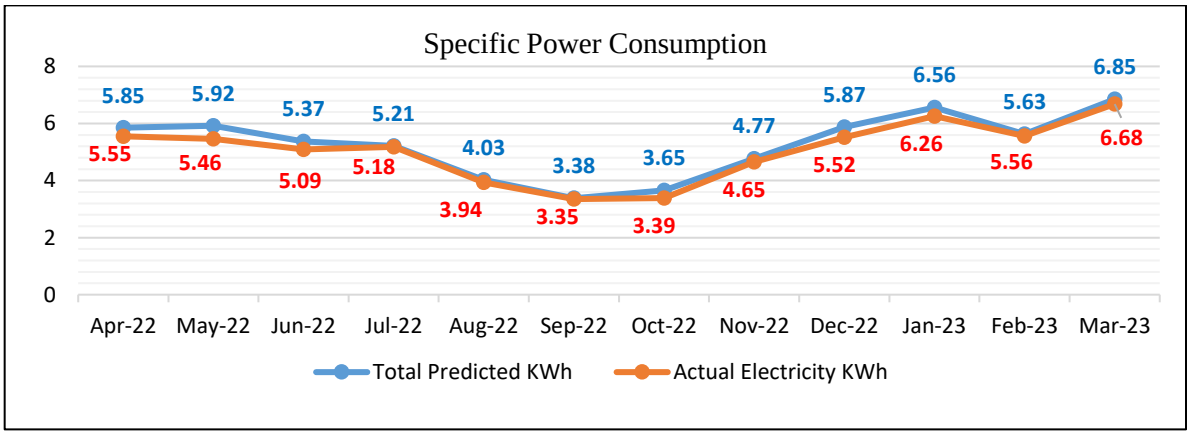
consumption and production. Notably, the graph demonstrates a consistent decline in the consumption of both electricity and natural gas over the years. The decrease in electricity consumption from 0.66 Kwh/kg in 2017-18 to 0.61 Kwh/kg in 2022-23, as well as the decrease in natural gas consumption from 3.97 SCM/MT in 2017-18 to 2.83 SCM/MT in 2022-23, demonstrates the AMUL's sincere efforts to resource efficiency and effective production.

Figure 9: Efficient Utilisation of Electricity and Natural Gas by Packing Film Plant



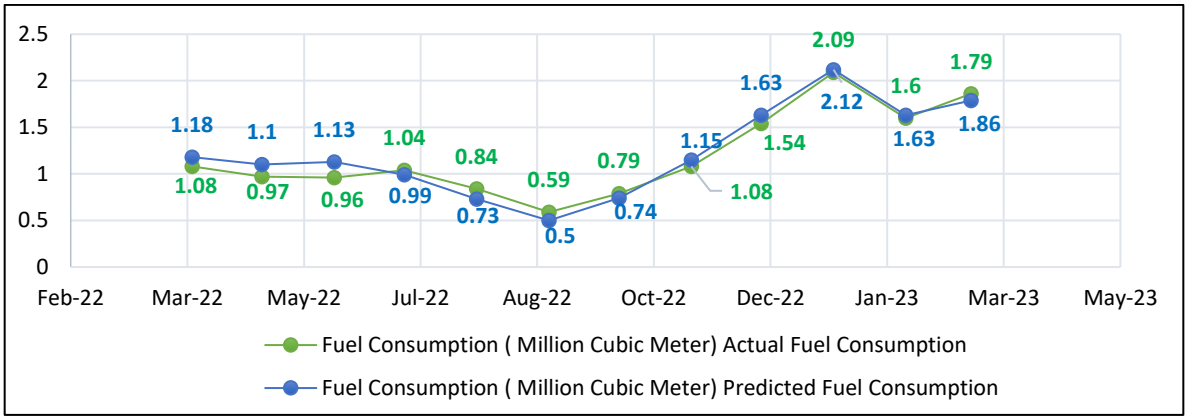
- **Efficient Reduction in Power Consumption**
  Figure 10 compares the total predicted electricity consumption in kWh and actual electricity kWh consumption by Amul Plant from April 2022 to March 2023. It can be seen from the graph that the actual electricity used by the plant is less than the predicted one, thus directly adhering to SDG 12 which focuses on responsible consumption and production.

Figure 10: Efficient Reduction in Power Consumption (Actual vs Predicted)



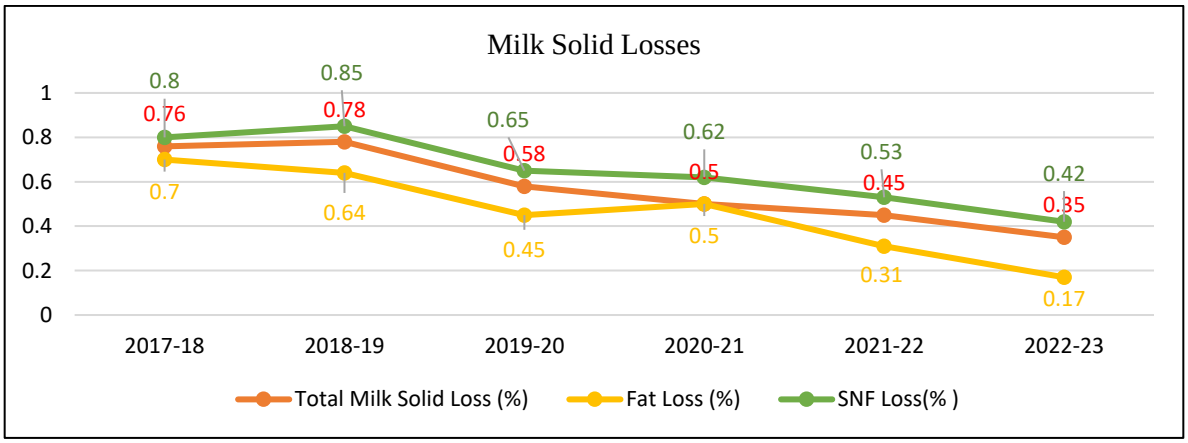
- **Efficient Reduction in Fuel Consumption (Million Fuel Cubic Meter)**
  Figure 11 depicts a comparison between the total predicted fuel consumption and actual electricity consumption in million fuel cubic meter by Amul Plant from April 2022 to March 2023. It can be seen from the graph that the actual fuel consumption by the plant is less than the predicted one. The efficient and effective production and operational management of the cooperative directly adheres to SDG 12 which focuses on responsible consumption and production.

Figure 11: Efficient Reduction in Fuel Consumption (Million Fuel Cubic Meter)



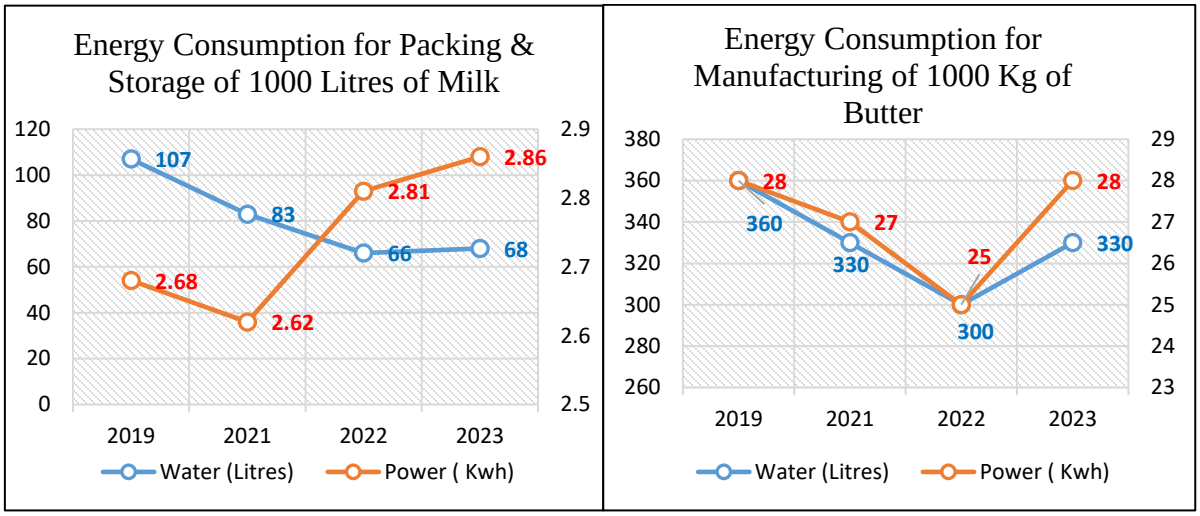
- **Reduction in Milk Solid Losses**
  Efforts to reduce operational wastage are also a significant step towards attaining SDG 12. From Figure 12, it can be concluded that Amul's milk solid losses in terms of total milk solid loss, fat loss, and SNF (Solid-Not-Fat) has seen a significant decline from 2017-18 to 2022-23, highlighting cooperative's efforts to efficiently manage resources and ensure optimum operational utilization complying to 12th Sustainable Development Goal, which focuses on responsible consumption and production. The consistent reduction in milk solid losses across all categories, from 0.76% to 0.35% in total milk solid loss, reflects AMUL's continuous efforts in this direction.

Figure 12: Reduction in Milk Solid Losses Over the Years



- **Specific Utility Consumption**
  Amul's specific utility consumption for the production of its top five products like milk, UHT milk, Ice cream, Butter, and Powder Milk in terms of water, power, steam, chemical has seen some fluctuation. Figure 13 shows that, with the years passing, the utility consumption has declined, thus fulfilling the requirements for SDG 12 "governing responsible consumption and production".

Figure 13: Energy Consumption for the production of product



SDG 13: Climate Action

- **Optimizing Tanker Holding Capacity**
  Amul's effort to increase the milk holding capacity of milk tankers is resulting in reducing CO_2 Emissions. From the Table 4, it can be concluded that, due to increased milk tanker's capacity, the distance travelled mapping same route has significantly reduced from approximately 2 crore kms in 2021-22 to about 1.27 crore kms in 2022-23. Similarly, the total fuel used in the process has also reduced from approximately 57 lakh litres in 2021-22 to 39 lakh litres in 2022-23, thus, enormously reducing the carbon dioxide emitted from the process from approximately 33 lakh Kgs in 2021-22 to 25.5 lakh Kgs in 2022-23. This step taken is consistent with the SDG 12, i.e., Climate Action.

Table 4: CO_2 Emitted Per MT Milk

Year	Total Milk Receipt (MT)	Distance Travelled (Kms)	Total Fuel Used (Litres)	CO2 Emitted (Kg)	CO2 Emitted Per MT Milk
2021- 22	1551865	20010252	5717222	3312139	2.12
2022 - 23	1110721	12739659	3920877	2550033	2.03

- **Energy Efficient Packaging Film Plant**
  Amul is leaving no stone unturned in effectively managing energy in the packing plants. Efforts taken by the cooperative in this line have been described below in the Table 5.

Table 5: Steps Taken Towards Managing Energy Efficient Packaging Film Plant (in metric Tonnes)

Sustainability Efforts in Operations	Reduction in CO2 Emission (MT)
Savings in granules by in house manufacturing of Bottles Closures	430
CAP and Straw Cardboard box reuse	127
Solvent recycling by House Distillation	30
Reuse of Core and Converting Paper into Metal Core	14.8
Increasing Productivity and Reduced unprinted Wastage	5.7
Total Reduction in CO2 Emission (MT)	607.5

- **Steps towards Environment Compliance**
  The data from the Table 6 shows beverage production in millions of packs in two time frames from January 2022 to June 2022 and July 2022 to April 2023. In the first period, 193.9 million beverage packs and plastic straws were manufactured. No paper or compostable straws were used. After a plastic straw ban in July 2022, beverage manufacturing surged to 220.12 million packs without straws. The more environmentally friendly alternatives were 177.24 million paper straws and 42.88 million biodegradable straws.

Table 6: Increase in Paper and Compostable Straw Used in Millions

Period	Beverages Production (Million Packs)	Plastic Straw Used (Million)	Paper Straw Used (Million)	Compostable Straw Used (Million)
Jan 22 to June 22	193.9	193.9	-	-
July 22 to April 23 (Post ban)	220.12	Nil	177.24	42.88

- **Methane Gas Reuse as Biofuel**
  Amul uses methane as a biofuel. As shown in Table 7, the daily usage of the gas is at 4,200 standard cubic meters (SCM) which is equivalent to 3,018 SCM of natural gas. This biofuel consumption in the form of methane gas accounts for 9% of fuel usage, saving about Rs 141,844 daily and reducing CO2 emissions by 5855 kg.

Table 7: Initiatives for Methane Gas Reuse as Biofuel

Methane Gas Reuse as Biofuel	Amount
Methane Gas used as Biofuel Per Day	4200 SCM
Biogas Equivalent to Natural Gas	3018 SCM
Biofuel used out of Total Fuel Consumption	9%
Cost Benefit per Day	Rs 141,844
Reduction in Kg CO_2 Emissions per Day	5855 kg

- **Green House Gas Emission During Transportation**
  Table 8 depicts reduction in CO_2 emission by monitoring vehicle utilisation in Amul. CO_2 emitted in tonnes for ambient transportation has come down from 3,386 tonnes in January 2023 to 2,083 tonnes in March 2023. For refrigerated transportation, the emission was reduced from 72.51 tonnes in January 2023 to 38.09 tonnes in March 2023.

Table 8: Green House Gas Emission During Transportation

Emission Category	Month	Product Dispatch (MT)	Distance travelled (KMS)	CO_2Emitted (Tonnes)
Ambient Transportation	Jan 23	26973	5205374	3386
	Feb 23	24738	1790862	3320
	March 23	38103	1123397	2083
Refrigerated Transportation	Jan 23	1493	181297	72.51
	Feb 23	1008	158315	63.32
	March 23	1157	95235	38.09

SDG 14: Life Below Water

- Measures like rainwater harvesting taken by Amul can be considered as appropriate for meeting the said SDGs.

SDG 15: Life on Land

- **Solid Waste Management:** Solid Waste generated by AMUL plant as operational losses, being 100% recyclable are sold to Central Pollution Control Board (CPCB), a national agency, and Gujarat Pollution Control Board (GPCB), which are state agency approved vendors.
- **Ethno Veterinary Practices (EVP) Promoted by AMUL**
  - ✓ AMUL has identified the EVP formulations for different types of disease conditions like pyrexia, Mastitis, Foot and Mouth Disease lesions, etc.
  - ✓ AMUL is implementing an EVP program as a part of their routine veterinary services to farmers' doorsteps.
  - ✓ The formulations are distributed in the form of sachets. The impact of the program has been depicted in the Table 9.

Table 9: Impact of Ethno Veterinary Practices Promoted by AMUL

Year	Disease Condition	Cured with EVP	Average Success Rate
Previous Year	44000	37000	84 %
Current Year	13889	11810	85 %

SDG 16: Peace, Justice and Strong Institutions

- AMUL has been a role model in Indian dairy cooperative sector. Under the guidance of National Dairy Development Board, the AMUL model has been replicated pan India. Thus, AMUL can be considered as a 'Strong Institution' as the cooperative ensures inclusiveness of all strata of the society. The cooperative, through transparency in milk collection and disbursement of payment, has been instrumental in promoting justice among its members.

- Further, Gujarat Cooperative Milk Marketing Federation, in order to build a strong institution and ensure peace, prosperity and justice among its member community, provides technical, managerial and marketing support. Some important programs taken by Amul in this direction have been described in Table 10.

Table 10: Important Programs Taken by Amul

S. No.	Program	Description
1	Animal Enumeration	Conducted an animal census in 14,253 village, covering 22.4 lakhs households in Gujarat.
2	Genomic Selection	Genomic Selection is a methodology used for selecting an individual animal for breeding. Memorandum of Understanding with National Dairy Development Board, Gujarat Biotechnology Research Centre, Government of Gujarat, etc., for utilization of their knowledge and skills towards effective implementation of program.
3	Sex- Sorted Semen Technology & Embryo Transfer Technology	Artificial Insemination to increase number of female calves. Embryo transfer technology to increase milk productivity per cattle. Utilisation of 2.2 Lakh Sex-Sorted Semen Doses.
4	Strategic Productivity Enhancement	Strategic Productivity Enhancement Program initiated in 4635 villages, covering 36.3 lakh animals. The Fertility Improvement Program, implemented in 4202 villages covering 3.45 lakh animals.
5	Entrepreneurship Development Program	Young and educated milk producers are trained in commercial dairy farming and management under the Entrepreneurship Development Program. 268 programmes conducted and trained 17499 milk producers.

SDG 17: Partnership for the Goal

- **Responsible Material Outsourcing**
  - ✓ Sourcing laminated paper used for aseptic packing from responsible packaging material suppliers like Tetra Pak and SIG (Signature Eco). Tetra Pak and SIG are registered under AARC (Action Alliance for Recycling Beverage Cartons) and recycle all waste laminates collected from market and convert them into value added products like chipboards, roof plates, pallets.

- ✓ The Kabadiwala and Tetra Pak India collaborated under the program "Mera Carton Meri Zimmedari" (My Carton, My Responsibility) for a mission to not only divert used cartons from landfill to recycling, but also to bring behavioural change and uplift the waste pickers community.

- AmulFed has taken appropriate measures for stakeholder's engagement and creating value for them.

4. Summary

The AmulFed Model, based on the above results, can be appropriately considered as a successful example of dairy cooperatives for achieving the Sustainable Development Goals. The model not only contributes to the "triple bottom line" agenda of sustainable business practice inclusive of social well-being, environmental health and just economy but also complies with the good governance objective of the goals. Their planning, management and operations significantly conform to all seventeen SDGs. The AmulFed work profoundly impacts the life of rural communities and can be an inspiration for all the dairy cooperatives.

Amulfed's collaborative approach with millions of milk producers in India, particularly in Gujarat (Indian State), their efforts to increase milk collection, substantial rise in farmer returns from selling of raw milk to cooperative, and generation of employment opportunities have yielded substantial benefits to the dairy farmers and employees associated to the cooperatives with respect to poverty reduction and rural livelihood.

5. Conclusion

The paper basically illuminates the role of dairy cooperatives in general and of AMULFed in particular in achieving SDGs overall. The case analysis revealed the strength of the dairy cooperatives in making the sector innately sustainable in terms of cooperative values and principles, democratic control, joint ownership and empowering local members and powering communities. The AMUL cooperative model can offer the framework for equitable participatory processes promoting transparency and accountability, collaboration with communities, governments, businesses, and other stakeholders to realize sustainable development.

In addition, the authors urge that the pioneering Amul model be replicated both within India and on a worldwide scale. Other cooperatives in India are working hard to duplicate this concept in its true spirit, with the help of the National Dairy Development Board. State level dairy cooperative brands work in tandem with Amul dairy model. This necessitates government assistance, infrastructural expenditures, and training initiatives to improve dairy farming techniques as well as dairy management and a cooperative-values-led leadership and management culture.

The Amul Model can be applied internationally to alleviate poverty and improve sustainable agriculture in underdeveloped countries. Farmers, governments, and the corporate sector must work together to develop dairy cooperatives that can raise communities out of poverty, provide food security, and contribute to the accomplishment of several SDGs. We can work toward a more egalitarian and sustainable global dairy business by scaling up and replicating the Amul model, thus protecting the small producer and their communities in the face of globalisation and its many accompanying threats.

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Motivating Employees Using a Balanced Scorecard

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Abstract: This study explores the journey of Arctic Cooperatives Limited, a medium-sized Canadian cooperative that, in 2018, adopted an important change in strategic direction with far-reaching impacts. This paper examines one element of this change, the implementation of a Balanced Scorecard inspired by the work of Côté (2019). This study examines whether a relationship exists between the implementation of a Balanced Scorecard and employee motivation and morale. To test for the presence of such a relationship, employee engagement data were collected for the years 2017-2023 and supplemented by a second short survey collecting additional input from employees of Arctic Cooperatives in 2023. The data showed a positive correlation between the implementation of the Balanced Scorecard and employee engagement *for those employees who thoroughly understood the components and purpose of the Balanced Scorecard*. This research contributes to the scholarly literature by showing that using a Balanced Scorecard as part of a cooperative's strategic key performance indicators can improve its ability to motivate employees within the organization. Implementing the Balanced Scorecard improved employee engagement and an elevated commitment/attachment toward the organization. These findings will inform Arctic Cooperatives Limited's board and management on best practices surrounding using a Balanced Scorecard and its impacts on employee engagement.

Edward Keddy is Vice President, Human Resources and Strategy at Arctic Co-operatives Limited.

Keywords: Balanced Scorecard, Engagement, Employee Morale, Organizational Behaviour

Introduction

Arctic Cooperatives Limited is a second-tier cooperative that has grown from a small organization to a federation with an annual revenue of more than $300 million. The cooperative currently has operations in six provinces and territories in Canada. During the federation's first fifty years, its success was measured almost exclusively through traditional financial metrics such as revenue, expenses, and net savings. In 2018, Arctic Cooperatives contacted Daniel Côté, a professor of management at HEC Montréal. Côté presented to senior management, Arctic Cooperatives Limited board members, and other cooperatives as part of a two-day executive education course through Saint Mary's University. This class, hosted in Arctic Cooperatives Limited's home office, was open to all interested cooperative participants. It successfully attracted more than a dozen cooperative entities worldwide in January 2018. During that seminar, Côté (2019) outlined his cooperative equilibrium model, which calls for cooperatives to actively balance the associational side of the organization with the enterprise side of the business. From those learnings, Arctic Cooperatives Limited's leadership decided to change how its organizational success is measured and, following Côté's teachings, developed and implemented a Balanced Scorecard model. This tool helps "balance the decision process to align the organization with its mission and strategy" (Côté, 2019, p. 250).

It has been six years since Arctic Cooperatives implemented its Balanced Scorecard, and the question has arisen as to whether its implementation has affected employee motivation and engagement. This research topic needs to be explored using a blend of evidence-based management and exploratory research. The research focuses on one organization, Arctic Cooperatives Limited, from 2017-2023, a timeframe that spans the period before (2017) and after (2018-2022) the Balanced Scorecard was introduced. Arctic Cooperatives Limited has some practical questions about employee engagement and its relationship, or lack thereof, to using a Balanced Scorecard that, if answered, would serve as critical guidance for its future strategic plans. This research investigation would also be essential to offer specific advice to Arctic Cooperatives on what elements of its strategy are effective and what could need revision and renewal.

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The research questions this project explores, then, are:

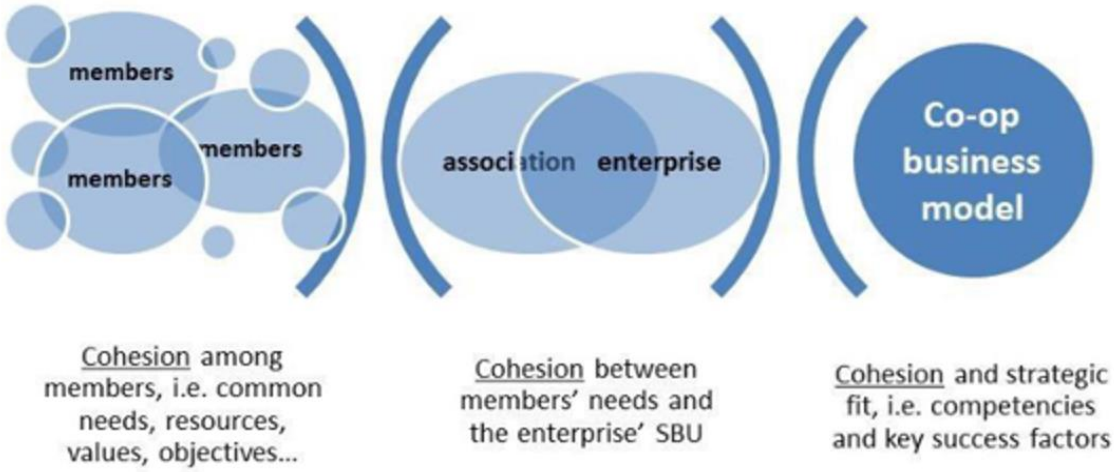
> *1) Is there a relationship between Arctic Cooperatives Balanced Scorecard implementation in 2018 and overall employee engagement?*
>
> *2) Based on the findings, what are the future recommendations for Arctic Cooperatives Balanced Scorecard efforts?*

There is value in exploring these questions as there is a missing element in the current research. As the literature review will demonstrate, using a Balanced Scorecard is well-established to increase financial success in cooperatives and non-cooperative business entities (Kaplan & Norton, 1996; Dhamayantie, 2018; Côté, 2019). However, there is a gap in the literature as most do not directly address whether implementing a Balanced Scorecard also influences the organization's overall employee engagement or commitment toward the organization. This research is also significant as it will expand the general knowledge of what does and does not motivate employees of cooperatives. In addition, most research discussed is specific to corporations. This research will determine whether a Balanced Scorecard is also potentially practical as a motivational tool within the context of a medium-sized Canadian cooperative. Finally, this research project is exploratory, assessing and investigating an organizational initiative's impact spanning the six years over which the scorecard has been in use.

Literature Review and Application to Research Topic

The literature review spans two broad themes, scorecard scholarship and engagement research. Firstly, using a Balanced Scorecard to measure the success of an organization is reviewed. Kaplan and Norton (1996) suggest separating an organization's goals and objectives into four categories: financial, internal business processes, learning and growth, and customer measurement. By focusing on measurements outside of just financial results, Kaplan and Norton (1996) highlight that "the measures on a balanced scorecard [can be] used by executives in a different way - to articulate the strategy of the business" (p. 56). Building on the work of Kaplan and Norton, Côté (2019) applies the Balanced Scorecard to the cooperative model. He bases his conceptual framework on two overarching concepts, the existence of cooperative duality and the need for a cooperative to constantly manage its cooperative equilibrium. Cooperative duality, shown in Figure 1, is a recognition of the uniqueness of the cooperative model where there are pressures from traditional management training ("enterprise needs") that compete with the membership's needs ("associational needs"). Côté (2019) refers to this as the "association-enterprise duality" (p. 46).

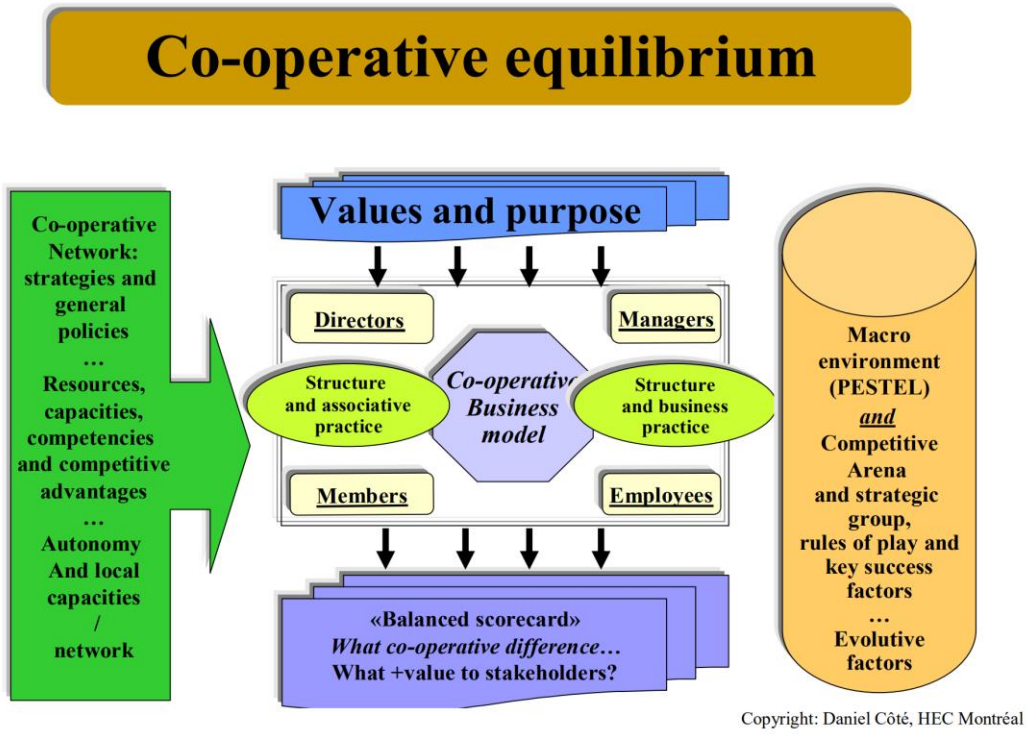
Figure 1: Côté's Cooperative Duality



From *Cooperative Management-An Effective Model Adapted to Future Challenges (p.47),* by D. Côté, 2019, JFD Inc. Copyright 2019.

To manage the tension of duality, Côté suggests a formal structured approach to managing the enterprise and associative parts of the business, which he expresses through the cooperative equilibrium model in Figure 2. The cooperative equilibrium model is a framework that essentially recognizes constantly competing factors at play within a cooperative. To be successful, there must be ongoing management to maintain a harmonious equilibrium or balance within the organization. A modified Balanced Scorecard is the best practice Côté recommended to achieve this balance. Côté (2019) suggests that "the scorecard is a social auditing tool. It is intended to be a symbolic representation of how well… coop measures up to its mission" (p. 187). Like Kaplan and Norton, Côté (2019) suggests separating a cooperative's goals into four sections; however, he replaces the customer category recommended by Kaplan and Norton with measurements related to cooperative membership (p. 253). It was Côté's conceptual framework and version of a cooperative Balanced Scorecard that the management of Arctic Cooperatives Limited used when it developed and implemented its Balanced Scorecard in 2018.

Figure 2: Côté's cooperative equilibrium model



From Cooperative Management-An Effective Model Adapted to Future Challenges (p. 50), by D. Côté, 2019, JFD Inc. Copyright 2019.

Balanced scorecard

Kaplan and Norton (1996) and Dhamayantie (2018) find that a Balanced Scorecard effectively measures and influences an organization's overall performance and strategy. One of the significant differences between the two studies is that Dhamayantie advocates for Balanced Scorecards to be explicitly used to measure and improve the organization's focus on cooperative principles. In contrast, Kaplan and Norton do not mention the cooperative model. However, they imply that it would be effective in any organization to "communicate the strategy of the business and to help align individual, organizational, and cross-departmental initiatives to achieve a common goal" (Kaplan & Norton, 1996, p. 56).

Regarding the first research question about the relationship between implementing a scorecard and employee engagement, Kaplan and Norton (1996) suggest employee satisfaction and training are effective measures of success within a successful Balanced Scorecard's learning and growth portion of the measurement tool. Arctic Cooperatives

Limited's Balanced Scorecard can be compared to this standard to ensure the design and implementation meet the best practice standards suggested by Kaplan and Norton. Kaplan and Norton (1996) and Calderón Molina et al. (2014) also have suggestions on how best to implement a Balanced Scorecard to ensure its success. Those best practices can also be compared to how Arctic Cooperatives implemented Balanced Scorecards in 2018. One of the areas not discussed by Kaplan and Norton (1996), Dhamayantie (2018), or Côté (2019), however, is whether implementing a Balanced Scorecard would directly influence or motivate cooperative employees. My research explores this gap.

While the previous authors do not address whether implementing a Balanced Scorecard would influence employee motivation, a study from Cignitas et al. (2022) explored a line of inquiry similar to my research question. They sought to see "whether there is a quasi-experimentally demonstrable relationship between Balanced Scorecard (BSC) and employee well-being" (p. 103). An extensive meta-analysis involving over a hundred separate studies concluded that there is indeed a strong relationship between employee happiness and a general increase in the performance of organizations and that the Balanced Scorecard application broadly supports employee happiness. The study thus concluded that "the reviewed empirical studies have found out there is a positive impact of BSC on employee well-being" (Cignitas et al., 2022, p.105).

Calderón Molina et al.'s (2014) research was also conclusive that a Balanced Scorecard, implemented effectively, directly impacts employee commitment and overall job satisfaction. While coming to a similar conclusion as Cignitas et al. (2022), Calderón Molina et al.'s study differed in that it focused extensively on the process of implementing a Balanced Scorecard and concluded that this process significantly impacted the tool's effectiveness in increasing job satisfaction. Drawing on employee surveys from the retail sector before and after the Balanced Scorecard's implementation over two years, Calderón Molina et al. (2014) found that "the results of our study demonstrate that an appropriate implementation of the BSC … fosters an improvement of the employees' commitment, organizational climate, job satisfaction, satisfaction with supervision and job dedication" (p. 1001).

Engagement Research

The second broad theme that explored in this literature review is the area of engagement research. Desmidt (2016), Anaza and Rutherford (2012), and Basterretxea and Story (2018) as well as Vlachos et al. (2013) and Skudiene and Auruskeviciene (2010) all explore the relationship between an organization's purpose (Mission) and how that purpose relates to how employees feel about the organization. The focus of the five articles is slightly different, with Desmidt (2016) focusing on the written stated purpose of the organization through mission statements. Anaza and Rutherford (2012) focus on the ownership model and its potential effects on engagement, while Basterretxea and Story (2018) focus on the influence of customer identification with various stakeholders and how those associations can be used as a predictor of job engagement. Vlachos et al. (2013) and Skudiene and Auruskeviciene (2010) specifically focus on an organization's use of Corporate Social Responsibility (CSR) and its effects on job satisfaction and employee motivation. All authors express similar hypotheses that employee engagement or motivation levels could be influenced positively if the organization's purpose is defined successfully.

However, the research findings were mixed. On the positively correlated side, Desmidt's (2016) research finds that an organization's purpose communicated through a powerful mission statement is associated with increased employee motivation. Vlachos et al.'s (2013) study hypothesizes that people are more intrinsically motivated if they feel that their work is important, and that internal Corporate Social Responsibility positively correlates with internal employee motivation. Their research concludes that "the findings suggest that internal and external CSR activities positively correlate with internal employee motivation" (Vlachos et al., 2013, p. 62). The authors also suggest that employees care about social responsibility actions because they enjoy sharing the same socially conscious values with their company. They go on to state this is "important for most people because according to social identity theory, working for a socially responsible company strengthens [an] employee's self-image, helps to identify themselves with the certain group[s] and in such a way to fulfill the[ir] need for belonging and membership" (p. 54). Finally, on the positively correlated side, Skudiene and Auruskeviciene's (2010) research findings state: "as predicted by H4, job satisfaction positively relates to employee CSR-induced intrinsic attributions" (p. 582). They go on to say that "fairness theory suggests that employee attitudes can be influenced by the extent to which employees consider their employing organization's actions (e.g., CSR actions) to be fair" (p. 580).

Anaza and Rutherford (2012) report that their empirical analysis does not support their hypothesized (positive) relationship between organizational purpose and employee engagement. Basterretxea and Story's (2018) research also hypothesized a positive correlation between the cooperative ownership model and employee/owners' willingness to expend more discretionary effort for the organization's success. Their results did not fully support that hypothesis, with one organization seeing a positive correlation and the other seeing a negative one. They noted, "in both cases, we find some positive responses to employee ownership running alongside negative scores" (p. 315).

The literature review around the engagement theme shows that scholarly research results both support and disprove similar hypotheses around employee engagement and motivation, indicating that external environmental factors may significantly influence how the surveyed employees feel and engage with the measured content. The arguments from authors such as Basterretxea and Story (2018) that employees generally have higher or lower expectations, which could lead to lower engagement scores, appear to have substance and need to be considered when reviewing Arctic Cooperatives Limited's research. Skudiene and Auruskeviciene (2010) also warn of potential limitations to this research in that CSR-induced attributions and job satisfaction refer to an individual's deeply held beliefs. Sometimes those beliefs are not well understood even by the respondents themselves. This limitation will also be at play while reviewing Arctic Cooperatives research.

Some environmental factors discussed during the literature review that will likely affect my research are organizational structure, organizational culture, the industry Arctic Cooperatives operates in, and communication and scorecard implementation practices. All have material impacts on the success or outcomes of engagement activities. However, it is essential to note that no Canadian cooperatives were researched during this literature review. The context of operating a medium-sized Canadian cooperative during a tumultuous period of history, given three years of a worldwide pandemic, is expected to play a significant role in the results of this research project.

Conceptual Framework for Research

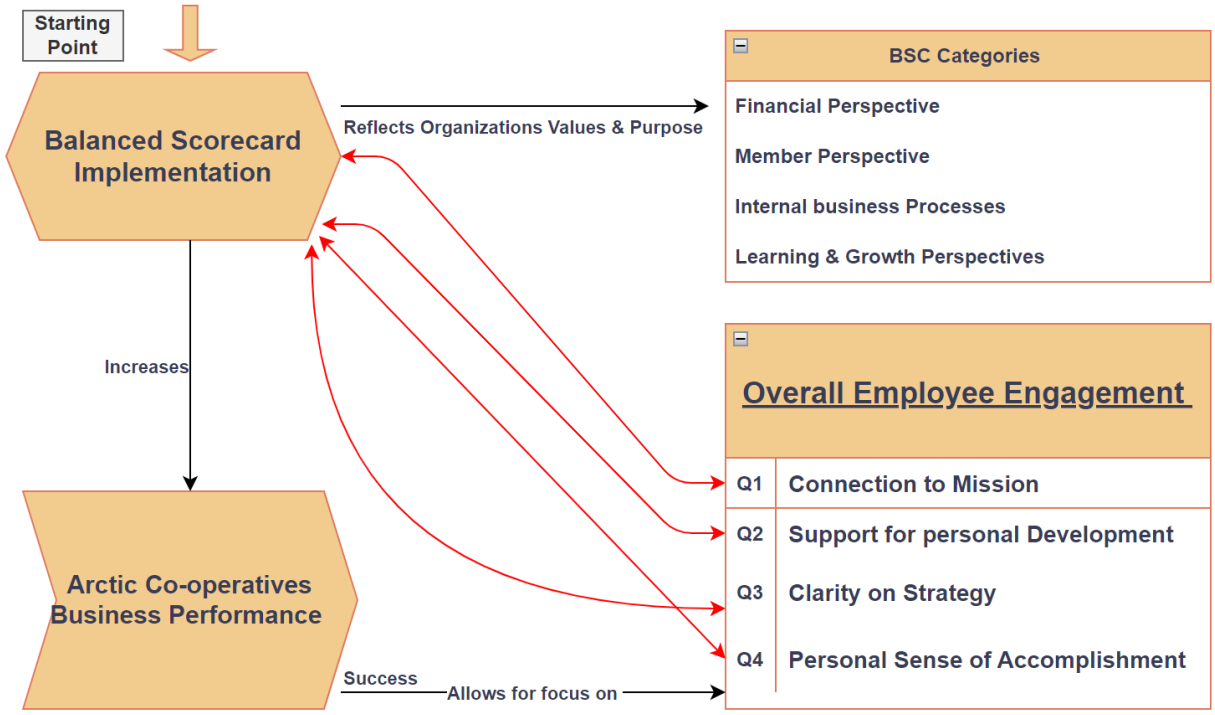
Bringing the multiple theories together leads to the conceptual framework and the lens through which this research was explored and conducted. I accept that Côté's (2019) cooperative duality and cooperative equilibrium apply to Arctic Cooperatives. A Balanced Scorecard modelled after Côté's recommendations was created and implemented to manage the associative side of the cooperative business. A Balanced Scorecard's effectiveness in improving organizational performance is well established, and so this aspect of the conceptual framework is also accepted as a proven reality (Côté, 2019; Kaplan & Norton, 1996; Dhamayantie, 2018; Cignitas et al., 2022). This increased performance and alignment of values allow employees to feel more connected to the cooperative's mission (Desmidt, 2016). Employees appreciate the support opportunities for continued professional development the Balanced Scorecard model ensures, and employees achieve greater clarity on the organization's strategy (Cignitas et al., 2022). As employees see their contributions' impacts, they feel a greater sense of personal accomplishment combining to achieve a high overall sense of employee engagement (Cignitas et al., 2022; Skudiene & Auruskeviciene, 2010). For this conceptual framework, Cignitas et al.'s (2022) definition of engagement is used: *"Employee engagement … has been defined by researchers as greater work calling, organizational commitment, and low employee turnover, in association with employees' positive perception over the meaning and personal development they gain through work"* (p. 103).

There are significant direct and indirect effects that a Balanced Scorecard's implementation has on an organization. This research focuses on measuring greater work calling, organizational commitment and positive perception aspects of this employee engagement definition. While a good data point for measuring employee engagement, employee turnover rates are considered out of this project's scope.

A well-established direct effect of using a Balanced Scorecard is the increased business performance of the organization that allows it to pursue meaningful re-investment into the organization. Nearly all authors supported this direct effect during the literature review. So, I consider it a reality in this paper, and do not further explore its validity. However, this framework's indirect effects are of great interest and represent the main areas I desired to explore. The heightened financial capacity of the organization allows it to pursue actions that reflect the values and purpose the organization wishes to convey to its members and its internal stakeholders. I believe there is a potential link between the pursuit of an organization's values and purpose and employees' overall engagement and

motivation to work for such an organization. This exploratory research tests the proposed conceptual framework's validity. It seeks to explore, validate, or disprove the indirect expected connections between the implemented Balanced Scorecard and four main factors of employee engagement. These four factors represented as Q1-Q4 are in no specific order of importance, but they are expected to correlate directly with overall employee engagement. Q1 represents employees' sense of connection to the mission. Q2 represents employees' feelings of clarity around the organization's strategy. Q3 represents employees' feelings of being supported through personal development. Q4 represents the personal sense of accomplishment that employees feel. Figure 3 is a visual representation of the conceptual framework of this study linking together the various theories of Balanced Scorecard and Employee Engagement.

Figure 3: Framework of Study



Conceptual Framework of Research

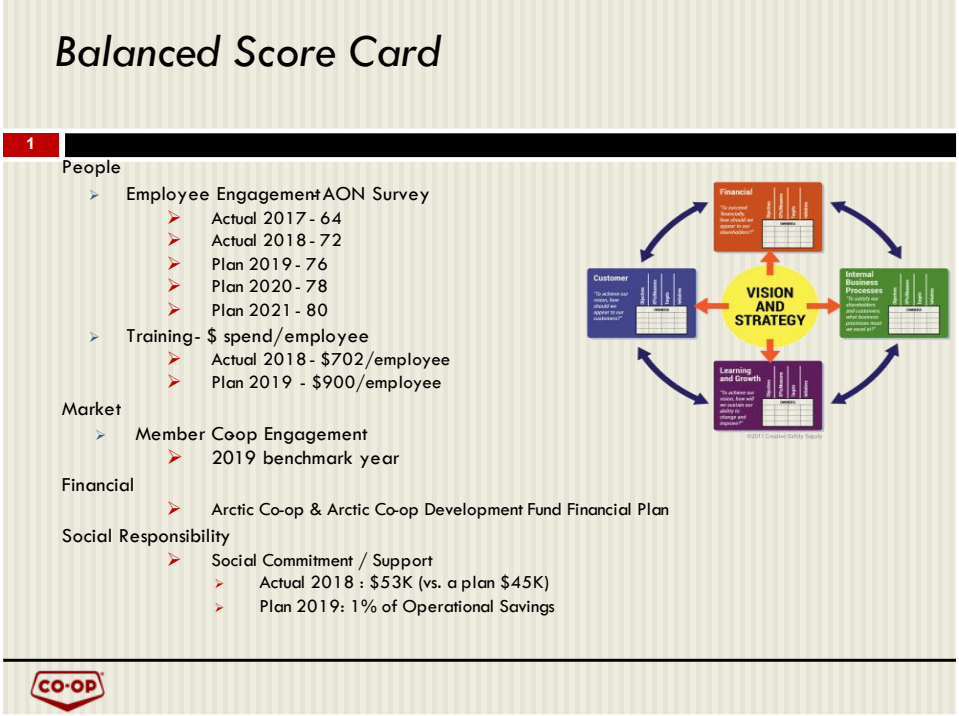
Balanced Scorecard Best Practices for Implementation

Kaplan and Norton (1996) and Calderón Molina et al. (2014) clearly state that how an organization approaches implementing its Balanced Scorecard is nearly as important as what the tool measures. Kaplan and Norton (1996) suggest correctly implementing the Balanced Scorecard tool should include undertaking the following seven specific steps during the first 12 months of the change.

(1) Clarify board commitment and vision.
(2) Communicate corporate BSC to middle managers.
(3) Develop business unit scorecards.
(4) Eliminate non-strategic investments and launch corporate change programs.
(5) Communicate the BSC to the entire company.
(6) Establish individual performance objectives.
(7) Conduct monthly and quarterly reviews.

Calderón Molina et al.'s (2014) case study of a retail organization implementing a new Balanced Scorecard appears to have followed Kaplan and Norton's implementation plan very closely. This could be a factor in why the organization saw such success in relating its BSC efforts with an increase in job satisfaction and commitment. A review of the historical records of Arctic Cooperatives Limited showed its Balanced Scorecard implementation only achieved four of the seven recommended action items from Kaplan and Norton's work. The three recommendations that were missing in the Arctic Cooperatives case were "Develop business unit scorecards"; "Eliminate non-strategic investments and launch corporate change programs"; as well as "Establish individual performance objectives." What effects these omissions have on the research question's overall results will be discussed later in this paper. An example of Arctic Cooperatives Ltd Balanced Scorecard used in 2018 can be found below in Figure 4.

Figure 4: Arctic Cooperatives Limited Balanced Score Card circa 2018.



Methodology

This research was focused on the organizational level of Arctic Cooperatives Limited within a specific moment (2017-2023). The research started with an analysis of the year before the Balanced Scorecard change occurred and reviewed six years after the Balanced Scorecard was implemented. The literature review was focused on peer-reviewed journals and scholarly works dealing with broad concepts such as Balanced Scorecard research, employee engagement research, and best practices for BSC implementation. These general concepts helped determine what circumstances lead to changes in employee engagement and what causes employees to put additional discretionary effort into their work. Then, a deep dive analysis of survey results was completed.

To clarify this research methodology, I will define my use of various terms that are reused throughout the research. I often refer to both primary and secondary data. Primary data represents survey information collected for the specific purpose and intention of conducting this research. Conversely, secondary data represents survey information conducted by other reputable sources but originally for purposes unrelated to this research question. This "secondary" data is being used and interpreted to find information related to the explored research question, but the author did not influence its creation or distribution. When I refer to "quantitative data" in this research, I am referring to survey information that is measured and expressed inherently through numerical representation, such as the percentage of those surveyed that viewed a statement favourably. When I refer to qualitative data, I am

referring to statement-based responses from participants, which then are analyzed and whose meaning is interpreted and compiled. All primary (questions created by the author) qualitative data (statements from the participants) are fill-in-the-blank questions posed to employees. Some of the literature reviewed utilized custom surveys (Desmidt, 2016; see also Anaza & Rutherford, 2012), while others analyzed existing internal data that was initially collected for purposes independent of the specific research being explored (Basterretxea & Story, 2018). This research utilizes both methods.

This research has extensive access to existing secondary data, with over seven years of quantitative secondary data available for the project. However, a smaller primary survey was also conducted to complement that data and give it deeper context and meaning in relation to the researcher's conceptual framework. This primary quantitative and qualititative survey comprised five questions embedded in the Kincentric engagement survey given to all Arctic Cooperative staff in May 2023. The primary survey was administered through the same third party that collected the previous secondary data, Kincentric Canada. The survey questions were submitted to Kincentric Canada, and they compiled the results. The primary and secondary data for the years 2017-2023 had an employee participation rate of over 90% for every year reviewed, and so is highly representative of the organization's entire workforce during the specific time explored.

These data results were obtained digitally for six of the seven years reviewed, with the missing year manually inputted for comparative purposes. The secondary data set for six of the seven years examined also had qualitative data that has been analyzed to provide non-numerical data and context for the results. However, after reviewing all seven years of qualitative data, there were no employee responses or statements outside the primary survey relating to the research question being explored. Every year of secondary engagement data, there were between 70 and 120 individual questions totalling an entire database of nearly seven hundred questions. As the research explored attempts to connect changes related to the Balanced Scorecard implementation over time, the approach was to narrow the secondary data set to five questions that remained unchanged throughout the explored period. This limited the secondary dataset to thirty-five individual questions (five per year).

The 2023 primary survey included unfiltered employee comments directly related to the research topic to give detail and context to the extensive secondary data already collected. The analytical tools for the quantitative data used for the research are descriptive, such as using frequency measures, comparative analysis, and line graphs to demonstrate trends. I also sought to demonstrate interdependences between two variables, such as strategic direction and engagement levels. These data sets have been combined with the primary qualitative text data to complete hypothesis testing to reach a conclusion to the research questions.

Secondary Data Analysis and Results

To answer the research question, previously completed Arctic Cooperatives Limited employee engagement surveys from 2017-2023 were reviewed. As a baseline, data from 2017 was collected as it represented the state of the organization before the Balanced Scorecard was implemented. The surveys are a robust representation of the entire workforce at Arctic Cooperatives Limited. Participation was extremely high throughout the period, with between 97 and 117 employees completing the survey yearly. The scoring for all survey questions reviewed was a standard six-point Likert scale ranging from Strongly Agreeing to Strongly Disagreeing with the stated question. The data below presents the results regarding the percentage of employees who answered favourably to the statement, which means the proportion of employees who responded strongly agree or agree with the statement. Those who answered slightly agree, slightly disagree, disagree and strongly disagree with the statement were considered unfavourable for this research.

Table 1: Survey Data for Arctic Cooperatives Ltd for 2017-2023 shows employees' positive perception scores in factors the conceptional framework links to engagement.

Arctic Cooperatives Limited	2017	2018	2019	2020	2021	2022	2023
Mission	N/A	79	83	85	65	73	79
Strategy	60	74	69	74	63	67	68
People	79	74	82	84	82	86	90
Sense of Accomplishment	77	79	82	85	74	77	82
Overall Engagement	64	72	83	79	67	69	67

The first survey question that was explored involved the organization's overall mission and how employees felt about its ability to provide meaningful direction to the individual. The survey question itself is labelled as "mission" in the tables and line graphs. The question asked throughout all available years of employee surveys was, please respond to the following statement: "This organization's mission provides meaningful direction to me." Baseline information for 2017 was not available for this question as the question was newly introduced in the 2018 Kincentric survey. However, between 2018 and 2020, the response to this question rose by six points and then dropped 14 points from the 2018 baseline in 2021 (65) and remained six points below baseline 2018 numbers in 2022 (73) and matched 2018 baseline numbers in 2023.

The second survey question explored whether the organization's senior leadership provides clear strategic direction to employees. The survey question itself is labelled as "Strategy" in the tables and line graphs. The question that was asked was, please respond to the following statement: "Senior Leaders provide clear direction for the future." Baseline information for 2017 was available for this question, with an initial favourable score of 60. Between 2018-2020 there was an increase in this category of 14 points in 2018, 9 points in 2019, and 25 points from the baseline in 2020. However, similar to the mission question, the overall score dropped significantly in 2021 and 2022 and 2023, representing a much smaller increase over baseline 2017 data of 3 points, 7 points and 8 points, respectively.

Figure 5: Mission and Strategy: Percentage of Favourable Responses, 2017-2023

The third survey question explored employees' perspectives on the organization's learning and development support, a vital component of the new Balanced Scorecard. The survey question is labelled as "People" in the table and graphs. The question asked was, please respond to the following statement: **"**This organization strongly

supports the learning and development of its employees." Baseline information was available for this question, with 2017 data at 79% favourable. However, after the Balanced Scorecard was implemented in 2018, the score dropped 5 points from the 2017 baseline before it eventually increased by 3 points from the baseline in 2019 and 5 points from the baseline in 2020. Unlike the other data points presented, the "people" category did not significantly decline in 2021, 2022 and 2023, respectively, still representing an increase over the 2017 baseline of 3 points in 2021, 7 points in 2022, and 11 points in 2023.

The fourth survey question reviewed employees' feelings of accomplishment, another vital consideration for employee motivation and engagement. The survey question itself was labelled as "sense of accomplishment" in the tables and line graphs. The question asked, please respond to the following statement: "I get a sense of accomplishment from my work." Baseline information from 2017 was available for this question, with a favourable response rate of 77. In subsequent years, after the Balanced Scorecard was implemented, "sense of accomplishment" increased from the baseline by 2 points in 2018, 5 points in 2019, and 7 points in 2020. Like most of the other survey questions, a decline from the baseline was experienced in 2021 of 3 points and 0 points in 2022 before this category showed an improvement from the 2017 baseline of 5 points in 2023.

Figure 6: People and Sense of Accomplishment: Percentage of Favourable Responses, 2017-2023

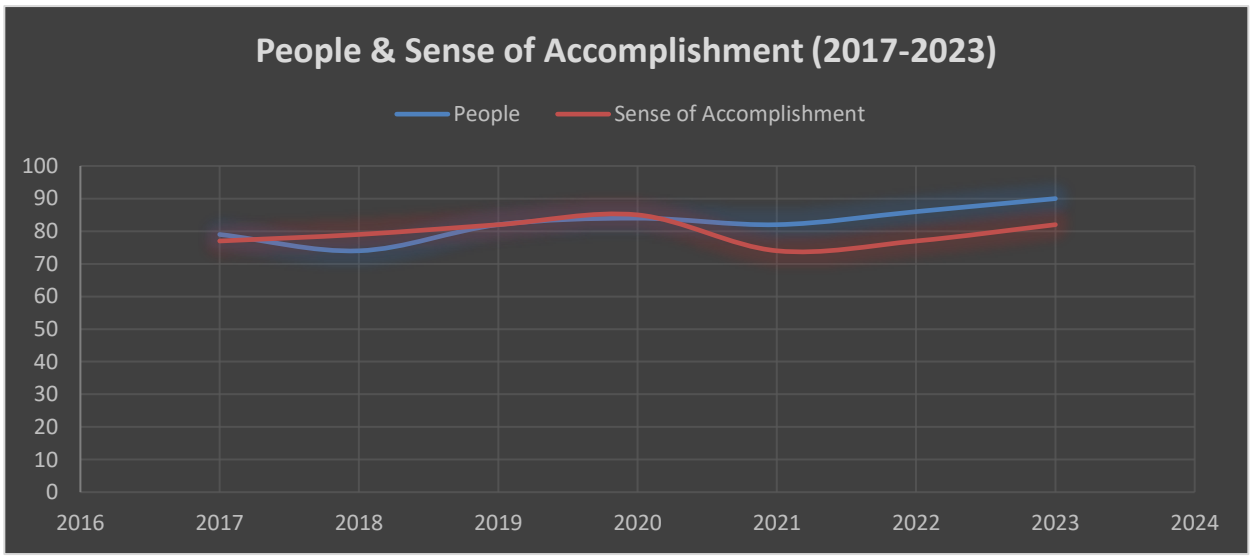


Table 2: Secondary data intercorrelation between factors and overall employee engagement

	Mission	*Strategy*	*People*	*Sense of Accomplishment*	*Overall Engagement*
Mission	1				
Strategy	0.800994035	1			
People	0.073565779	0.211045305	1		
Sense of Accomplishment	0.88732829	0.730459086	0.120133663	1	
Overall Engagement	0.919146453	0.604996994	0.179532179	0.84486238	1

Testing the correlation between the four variables (Q1-Q4) and overall engagement using the Pearson correlation method demonstrates that all measured variables show at least some positive correlation to overall employee engagement, as hypothesized in the researchers' conceptual framework. Both connection to mission and personal

sense of accomplishment variables show a robust correlation to overall engagement at 0.91R and 0.88R, respectively. Clarity on strategy is also considered strongly correlated with a correlation of 0.60R. Support for personal development under the people category showed the weakest correlation of all the data reviewed and is considered very weakly correlated under the Pearson method coming in with a value of 0.179R. Taken as a whole, all anticipated variables showed some level of positive correlation to overall employee engagement. This research sample thus adequately supports the four expected engagement influencers. Support for personal development, anticipated to be a material factor in this research's conceptual framework, also positively correlates to employees' overall engagement. However, it is weaker than initially predicted based on the secondary data reviewed.

The data has demonstrated a strong correlation between three of the four factors that the conceptual framework expected to influence overall engagement. The three factors that demonstrated a strong correlation to engagement also showed an improvement over the 2017 baseline data between 2018-2020, corresponding with the implementation of the Balanced Scorecard. Although the same three factors experienced declines in the subsequent years 2021-2023, major external factors, such as the worldwide pandemic, are suspected of having played a significant role in the outcomes of those data points as employees had previously completed their engagement survey in March of 2020. So the effects of the worldwide coronavirus pandemic did not appear in the data until the 2021 engagement data set. The survey data results from 2021 to 2023 would have fully captured the reality of coronavirus, and that substantially influenced the results. Thus, there seems to be evidence of a positive relationship between implementing a Balanced Scorecard and the subsequent increase in employee perception in three of the four hypothesized factors influencing overall employee engagement.

Primary Survey Data Analysis

The primary survey was conducted in May 2023 and was administered by Kincentric Canada from questions provided by me and vetted by the project's supervisor (see Appendix for the full survey). It was offered to all Arctic Cooperatives Limited full-time staff with more than three months of service. It comprised five questions, with two multiple-choice questions and three fill-in-the-blank questions. There was no introduction or leading statements before the commencement of the survey, and no one within the organization was aware that there would be questions related to Arctic Cooperatives Limited's Balanced Scorecard implementation on the annual engagement survey for 2023.

Employee understanding of what the Balanced Scorecard is within the organization

The first question in the primary survey was designed to test the current knowledge base of employees by asking them to describe in their own words what they know about Arctic Cooperatives Balanced Scorecard. Of the 116 employees surveyed, 24 didn't answer or declined to respond. I have assumed that those who didn't respond didn't do so due to a lack of knowledge of the tool. Next, 28 employees responded to the question but were either incorrect or wrote that they didn't understand it well enough to articulate its components or purpose. A further total of 64 employees were able to respond accurately with relevant information on Arctic Cooperatives' Balanced Scorecard and demonstrated knowledge of its components, its purpose or both. This question demonstrated that 55% of those surveyed within the organization had a sufficiently in-depth understanding of the Balanced Scorecard tool to describe it accurately. A 2015 achievers survey showed that, on average, only 39% of employees know their organization's mission statement. Arctic Cooperatives employees' knowledge base of 55% having in-depth knowledge of a component of its strategy is impressive. It establishes that its existence could be related to employees' feelings of commitment and engagement for those familiar with it. It also means that its potential impact is limited to those who understand the Balanced Scorecard and that the commitment or engagement of 45% of the staff within Arctic Cooperatives Limited could not be influenced by the Balanced Scorecard due to their lack of knowledge of it.

Balanced Scorecard Impact on day-to-day work

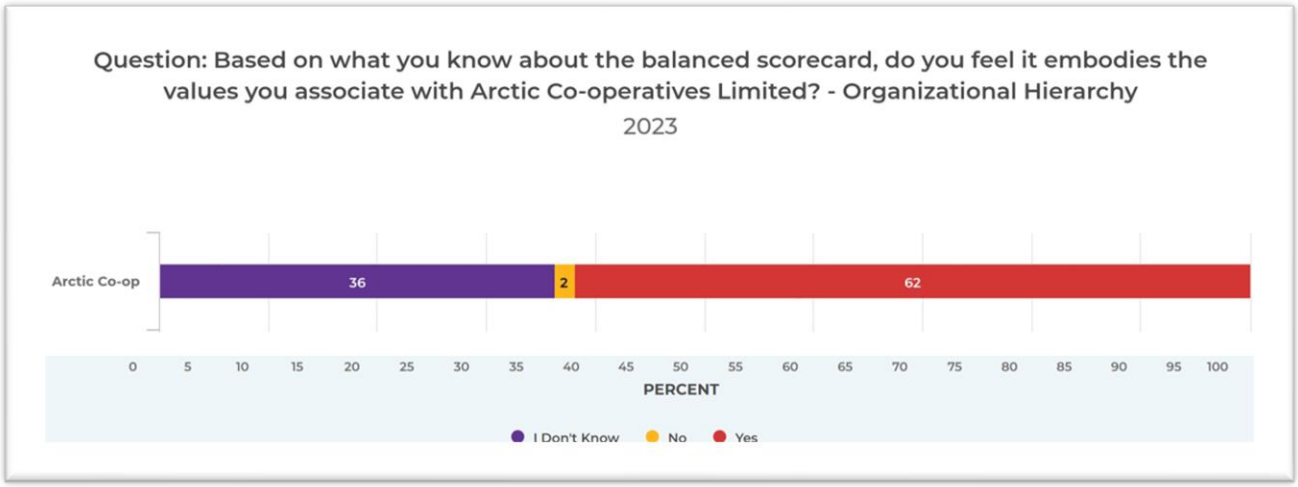
The second question was designed to determine whether employees felt implementing a Balanced Scorecard directly impacted their day-to-day work. Out of the 116 employees surveyed, seven didn't answer. Like the first question, I assumed the employees couldn't answer due to a knowledge gap, representing 6% of those given the survey. Next, 32 employees agreed with the statement that they "don't know how it affects my work," representing

27.6% of those given the survey. Eight individuals responded that the Balanced Scorecard has "no effect on what I do," representing 6.9% of those given the survey. Thirty-seven employees responded that the Balanced Scorecard "affects some of the things I do," denoting 31.9% of those given the survey. And lastly, 32 employees answered that they believe the Balanced Scorecard "affects everything I do," representing 27.6% of those given the survey. Combining the responses of those who answered that the Balanced Scorecard impacts some things or everything that the employees do, provides a total of 59.5% of employees at Arctic Cooperatives who believe the organization's implementation of a Balanced Scorecard impacts their day-to-day work. This response is similar to the total number of employees demonstrating active knowledge of the Balance Scorecard and establishes a linkage between the Balanced Scorecard and employee behaviour. These results also support the conceptual framework that an indirect link exists between the Balanced Scorecard implementation and the hypothesized factors that drive overall employee engagement.

Is the Balanced Scorecard a proxy that represents the values of Arctic Cooperatives Limited?

The last multiple-choice question on the primary survey tested the conceptual framework and hypothesized that employees view the Balanced Scorecard as a proxy for the organization's values and purpose. The question asked whether employees feel the Balanced Scorecard embodies the values they associate with Arctic Cooperatives Limited. The results shown in Figure 8 demonstrate that 62% of the staff body of Arctic Cooperatives agreed that the Balanced Scorecard reflects the organization's values. These results support and validate the conceptual framework's hypothesis that the Balanced Scorecard tool serves as a proxy in representing the cooperatives' organizational values from the perspective of the organization's employee base.

Figure 7: Values Question: Percentage Breakdown of Responses, 2023



Qualitative Insights linking Balanced Scorecard to Q1-Q4

Part of the conceptual framework hypothesized an indirect linkage between the Balanced Scorecard implementation and four factors expected to impact overall employee engagement. The four factors' correlation to overall engagement was tested using seven years of secondary data, and it was shown that three of the four factors Q1, Q3 and Q4, were strongly correlated, with Q2 being weakly correlated. In addition, when reviewing the qualitative insights from the 2023 Kincentric primary survey, employee comments were explored to see if their raw comments either supported or did not support the indirect linkages theory in the conceptual framework.

Q1: Represents employees' connection to the mission. During the 2023 primary survey, employees openly expressed their thoughts that there is a connection between the Balanced Scorecard and the organization's mission, with the words "Mission or Vision" being mentioned over a dozen times within the employee comments. Some described the Balanced Scorecard as "translating the general mission/vision of the company". At the same time, other employees stated that the Balanced Scorecard "embodies the mission and vision of the organization and drives

all initiatives". While only limited value can be given to a small set of individual comments, the comments further support the hypothesis that the Balanced Scorecard tool enhances employees' feelings of connection to the organization's mission and vision.

Q2: Represents the Balanced Scorecard's support for personal development and its potential effects to improve overall employee engagement. In the primary survey open-ended question, the words "Learning/Training/Development" were mentioned twenty-eight separate times, by far the most commented-on attribute of the Balanced Scorecard that participants of the survey noted. It is evident within the comments that support for personal development is very important to employees. Some employees' comments are very straightforward in linking the Balanced Scorecard category of personal development and their overall employee engagement levels. For example, one comment from the primary survey stated, "I provide my satisfaction rating each year, which contributes to the people's Kincentric Rating. I am in training, which means the training dollars are reported as being spent on my training. Delegate satisfaction is based on the work I do for our Co-op and delegates. Donations that I contribute are matched in some of the great causes we support". Another comment highlights the employee's feeling of satisfaction in knowing that the Balanced Scorecard ensured the cooperative focuses on non-financial items such as personal development when they stated its "comforting that the organization values more than just the bottom line and focuses on training of employees". Based on the responses, it is clear that employees view personal development as indirectly linked to the Balanced Scorecard's implementation.

Q3: Represents employees' feelings of clarity around the organization's strategy and its potential effects to improve overall employee engagement. In the primary survey, open-ended questions, "Strategy or Strategic," were mentioned fourteen times in employees' responses when asked to discuss what they know about the Balanced Scorecard. One employee who identified in the comments as a non-manager was particularly enlightening as they described the organization's strategic link to the Balanced Scorecard and highlighted a desire to see further changes made. The employee commented, "balanced scorecard is a great tool to manage and evaluate our strategic initiatives and goals. From the staff meeting, I know that the senior leaders have clear goals and strategies to achieve them, which is great. However, I don't think there are enough specific measurements to evaluate the success of each goal. Although, as an employee, I also want to contribute to achieve those goals, I haven't had a guide or clear communication from leaders on how my work contributes to them". Comments from employees such as the one above highlight that some see the Balanced Scorecard as a means to provide clarity around the organization's strategy, and these actions are meaningful to employees. While individual comments are limited in their ability to generalize, the primary survey is supportive that there is an indirect link between the Balanced Scorecard and how employees view clarity around the cooperative's organizational strategy.

Q4: Represents the personal sense of accomplishment that employees feel and whether implementing a Balanced Scorecard affects that feeling of accomplishment. The words accomplishment or satisfaction only appeared in the open-ended comments four times; however, some comments supported the concept that the Balanced Scorecard led to a greater sense of personal accomplishment. For example, one described the Balanced Scorecard as "meeting business and personal needs equally". At the same time, another commenter stated that "we work together to improve our social and economic well-being, we work together in honesty, openness and social responsibility. All things I personally agree with". While the evidence is not overwhelming for Q4, employee comments support an indirect linkage between the Balanced Scorecard and a personal sense of accomplishment.

The Emergence of Covid-19 and its Effects on Employee Morale

One of the realities of reviewing data over a prolonged period of time is that world events and irregularities can occur during the reporting period. This was the case with this research on employee engagement within Arctic Cooperatives Limited. In March 2020, the world was faced with a once-in-a-generation worldwide pandemic. As noted by Nahar and Thakur (2022), "the COVID-19 outbreak, which had no apparent immediate solution, threw workers and management into turmoil and panic" (p. 9). Employees of Arctic Cooperatives Limited experienced this turmoil similarly to the rest of the world. The 2020 data compiled for this research was not affected by Covid-19 due to timing. All employees had already completed the survey in 2020, well before the threat and reality of Covid-19 became widespread in Canada. However, the 2021-2023 results took place under the total influence of those

circumstances, and this reality needs to be considered when interpreting those years' data. Nahar and Thakur's study on the Impact of Covid-19 on employees' morale is clear that the experience had a generally negative effect on employee morale. Nahar and Thakur (2022) conclude that "the study findings are in accordance with the results of Howe et al. (2021) and Lazim et al. (2020), who suggest that prolonged working hours and feelings of isolation may negatively hamper the morale of the employees. Also, uncertain times like pandemics often tend to create emotionally disturbing experiences resulting in a decrease in their morale and satisfaction with the firm" (p. 9). The negative impacts and stressors Covid-19 had on employees likely had a material effect on Arctic Cooperatives' employee engagement results in 2021-2023. This reality was considered when factoring in the results and conclusions of the primary and secondary data analyzed in this research.

Conclusion

This research project set out to determine whether there was a relationship between Arctic Cooperatives Balanced Scorecard being implemented in 2018 and the cooperative's employees' feelings of overall engagement. By creating a conceptual framework developed from other authors' theories, this research tested the validity of that framework to systematically determine whether indirect linkages between implementing a Balanced Scorecard and employee engagement could be found. Through the custom primary survey, it was demonstrated that employees of Arctic Cooperatives do view the Balanced Scorecard as a proxy for the organization's values. It was hypothesized within the conceptual framework that four main factors contributed indirectly to overall employee engagement and that the Balanced Scorecard implementation influenced those factors. The secondary analysis and qualitative employee comments established that the factors Q1, Q3 and Q4 all saw a strong positive correlation between themselves and overall employee engagement from the data. Q2 demonstrated a weaker positive correlation through the secondary data. Still, the qualitative employee comments strongly supported Q2. Therefore, I concluded that Q2 is still validated as an active indirect factor in overall engagement. Lastly, the conceptual framework hypothesized that implementing the Balanced Scorecard directly affected the four factors that were believed to drive overall organizational engagement. The primary survey analysis supported this assertion that there is an indirect link between the Balanced Scorecard and the four factors initially thought to affect engagement. Based on the evidence, the Balanced Scorecard correlates positively with overall employee engagement for those employees familiar with the tool. The subsequent drop in engagement seen from 2021-2023 can be primarily attributed to external circumstances brought on by the worldwide pandemic that began to affect the employee data results starting in the 2021 survey year.

Recommendations

Research question #2: What are the future recommendations for Arctic Cooperatives Balanced Scorecard efforts based on the findings?

This research project confirmed that employees of Arctic Cooperatives Limited who know and understand the Balanced Scorecard view it as an important expression of the organization's values and as a meaningful indirect motivator. The research also confirmed that the Balanced Scorecard impacts employee behaviour daily, with 59.5% of staff stating that it affects some things or everything the employees do daily. This high percentage of impact on day-to-day actions from staff suggests that the tool is relatively effective in motivating and influencing employees. It also means improvements to the Balanced Scorecard tool would likely significantly impact employees' day-to-day work. Additionally, the research demonstrated that in 2023, 55% of the staff accurately understood the Balanced Scorecard and could spontaneously demonstrate knowledge of its components, purpose or both when tested. That indicates that the previous communication strategy of the organization has been partially successful in transferring that knowledge to staff throughout the organization but that with specific recommendations to the communication strategy, there is an opportunity to impact even more employees within the cooperative. Thus, the recommendation for Arctic Cooperatives Balanced Scorecard efforts is to make minor adjustments to the tool, which has shown some effectiveness but has room for improvement. A complete revision of the communication strategy is also recommended to ensure the remaining 45% of the staff complement understand the tool sufficiently to describe its components and purpose to fellow employees effectively.

Revision of the Balanced Scorecard Tool

Based on this research, specific recommendations can be made to enhance the Balanced Scorecard tool. During the literature review, it was evident from authors such as Vlachos et al. (2013) and Skudiene and Auruskeviciene (2010) that Balanced Scorecards focused on an organization's Corporate Social Responsibility can be a compelling motivator for employees. Although Arctic Cooperatives' current Balanced Scorecard does incorporate social responsibility in the realm of donations and community impact, this area of the scorecard is recommended to be enhanced through an additional focus on the sustainability and environmentalism of the organization. The literature demonstrated that this is a powerful motivator, and its inclusion within Arctic Cooperatives' Balanced Scorecard tool would likely make it even more effective. Kaplan and Norton's (1996) and Calderón Molina et al.'s (2014) Balanced Scorecard recommendations also suggest that Arctic Cooperatives could enhance the Balanced Scorecard tool by developing department-level business unit scorecards that include personal performance objectives or goals. In the primary survey comments, some employees expressed confusion over how they could impact the Balanced Scorecard within their position. One commenter wrote, "Even though the balanced scorecard was mentioned at the staff meeting, I didn't think that my jobs are aligning a lot". Having the Balanced Scorecard key elements developed at the business unit level would make it much more apparent to employees how their efforts throughout the entire organizational structure can directly affect the outcomes intended through a Balanced Scorecard. Adding individual goals in the form of performance objectives would also ensure accountability and enhance the perceived importance of the Balanced Scorecard throughout the cooperative.

Revised Communication Strategy

Many primary survey employee comments highlighted their knowledge of the Balanced Scorecard and the organization's progress towards their goals through the staff meeting and manager meeting process. Continuing that portion of the previous communication strategy would be recommended as it appears effective. Since 45% of staff could not discuss the components and purpose of the Balanced Scorecard meaningfully, it would be recommended to incorporate it within new hire orientation models conducted through the organization's learning management software. This would ensure consistent messaging and sufficient reach as this method can track employee completion rates and generate reports to the cooperative. In addition to this change, including the Balanced Scorecard monitoring on the company's external and internal digital platforms would ensure the Balanced Scorecard information would be highly visible to employees between quarterly staff update meetings. The company's website, accessible to all stakeholders, would increase the transparency and visibility of the initiative. Internal communication tools such as Arctic Cooperatives Limited's newly created intranet would also be a recommended tool to potentially give monthly updates on organizational Balanced Scorecard goals and as a forum for employees to discuss the tool in a less formal setting.

Additionally, if the Balanced Scorecard was enhanced so that department and business unit-level scorecards were developed, they could be incorporated into monthly divisional meetings. Similarly, if employees are expected to establish individual performance objectives as part of their personal performance process, those goals would be discussed during their one-on-one conversations with their direct supervisor, which are mandated to occur within Arctic Cooperatives at least bi-weekly. Formal performance reviews are conducted every six months within Arctic Cooperatives. So that would present another opportunity for the Balanced Scorecard to be communicated and discussed bi-annually.

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Appendix

Primary Survey Questions: (administered through Kincentric Canada May 4th, 2023)

Arctic Co-operatives Limited

84%

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2023 Arctic Co-Op Engagement Survey

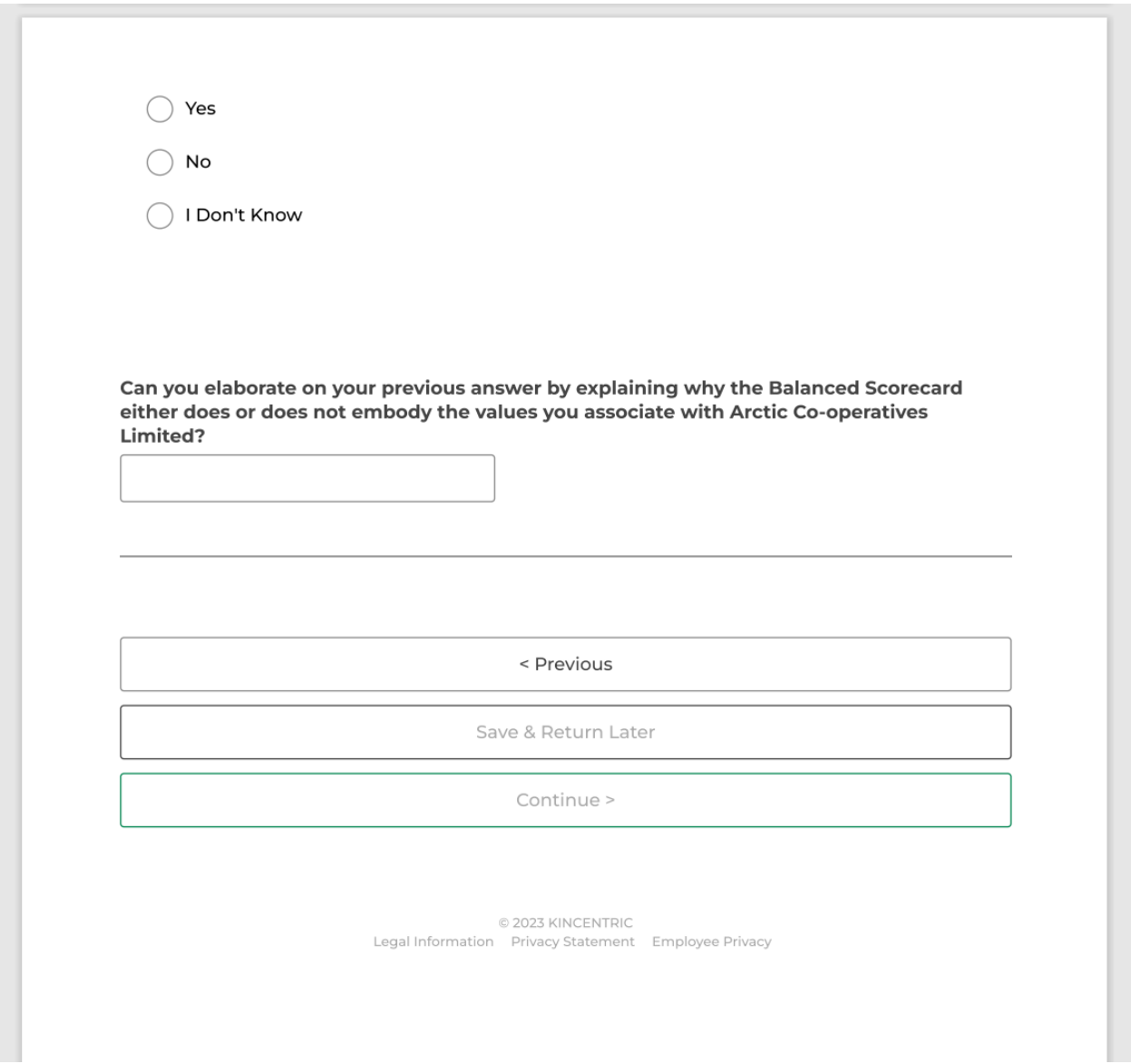
Arctic Co-operatives uses something called a Balanced Scorecard to guide its decision-making. Please share what you know about this tool.

Reflecting on what you just shared about your understanding of the balanced score card, how would you describe its impact on your day-to-day work ?

- ◯ It affects everything I do
- ◯ It affects some of the things I do
- ◯ It has no affect on what I do
- ◯ I don't know how it affects my work

Can you elaborate on your answer by explaining how the balance score affects, or does not affect, your day-to-day work?

Based on what you know about the balanced scorecard, do you feel it embodies the values you associate with Arctic Co-operatives Limited?


Yes
No
I Don't Know
Can you elaborate on your previous answer by explaining why the Balanced Scorecard either does or does not embody the values you associate with Arctic Co-operatives Limited?
< Previous
Save & Return Later
Continue >
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THRIVE

Arctic Co-operatives Limited

Engagement Report
EDWARD KEDDY

Listen

= 116 | 2023 | 2022 | Group | Arctic Co-op

Arctic Co-operatives uses something called a Balanced Scorecard to guide its decision-making. Please share what you know about this tool.

79%
RESPONSE RATE

RESPONDENTS
92

It is something that measures result/ performance within the organization.

This is a tools for monitoring the strategic decisions by the company in different perspective (financial, customer, bus. process & learning and growth)

it is used to identify, improve, and control a business's various functions and resulting outcomes

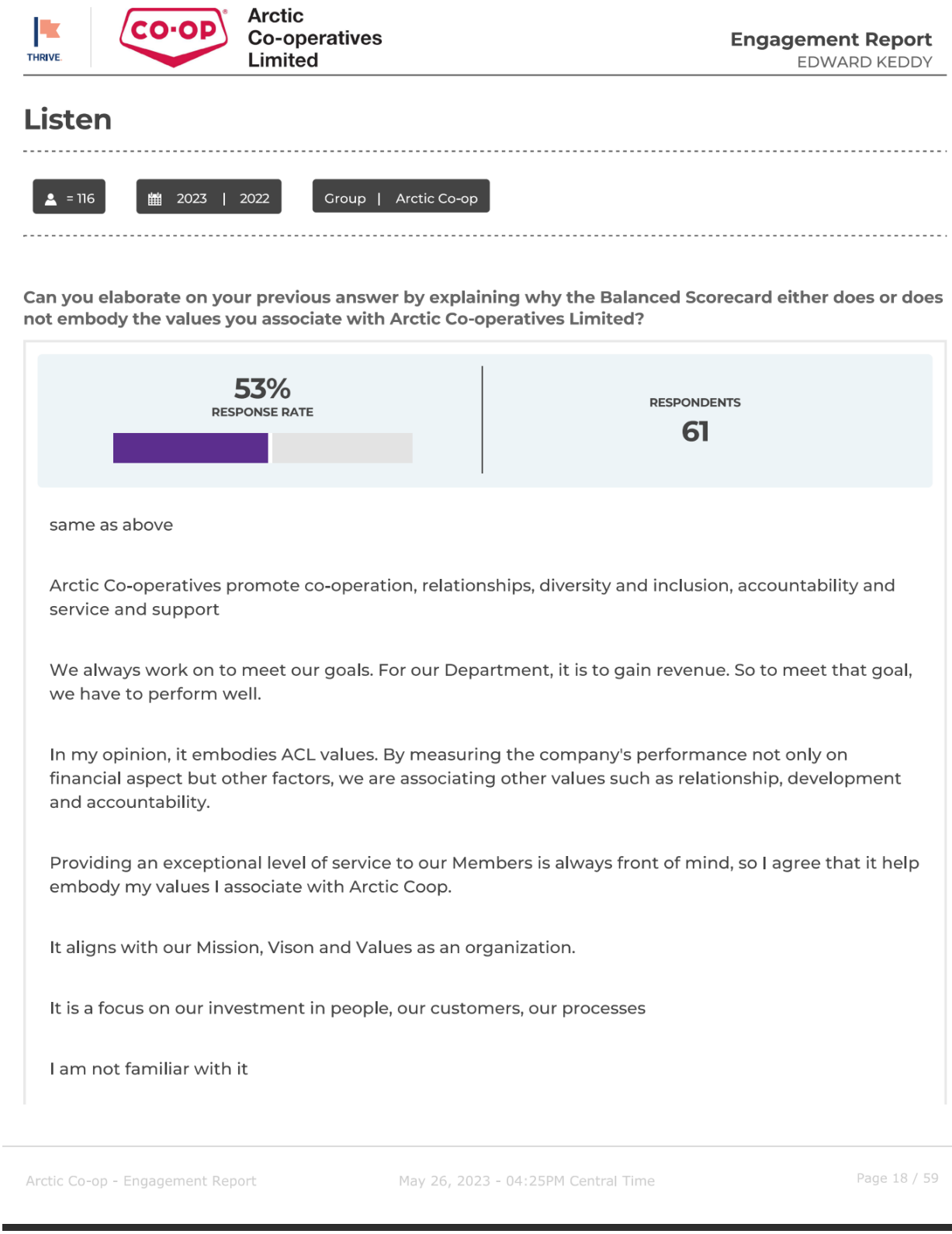
Used to make changes in the office environment?

This tool measures social and economic measures of the organization with a focus on key aspects such as training & staff development and social causes of the community.

i've seen it before: learned it in university and have seen application of it in my previous and current job

It is reviewed by all employees of Arctic Cooperatives Limited for better visibility of health of an organization

A performance tool used to assess an individual performance throughout the year, keeps track of their successes and areas for improvement .



THRIVE

Arctic Co-operatives Limited

Engagement Report
EDWARD KEDDY

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= 116 | 2023 | 2022 | Group | Arctic Co-op

Can you elaborate on your previous answer by explaining why the Balanced Scorecard either does or does not embody the values you associate with Arctic Co-operatives Limited?

53%
RESPONSE RATE

RESPONDENTS
61

same as above

Arctic Co-operatives promote co-operation, relationships, diversity and inclusion, accountability and service and support

We always work on to meet our goals. For our Department, it is to gain revenue. So to meet that goal, we have to perform well.

In my opinion, it embodies ACL values. By measuring the company's performance not only on financial aspect but other factors, we are associating other values such as relationship, development and accountability.

Providing an exceptional level of service to our Members is always front of mind, so I agree that it help embody my values I associate with Arctic Coop.

It aligns with our Mission, Vison and Values as an organization.

It is a focus on our investment in people, our customers, our processes

I am not familiar with it

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Multi-stakeholder Networks: Developing High-Performance Low-Income Housing within the Doughnut

Evan Proven, Master in Management, Co-operatives and Credit Unions, Saint Mary's University, Canada

Abstract: The need for additional affordable housing units in Manitoba is growing. Housing that only meets the National Building Code is inadequate to maintain affordability in the long term given rising energy costs and the effects of climate change on weather. Research shows that high-performance and resilient building methodologies can help to drastically reduce Total Cost of Building Ownership (TCBO) though their implementation requires additional capital in the construction phase. The aim of this research project was therefore to study the feasibility of creating a Multi-Stakeholder Network (MSN) in Winnipeg, Manitoba that would leverage the capabilities and resources of stakeholder members to reduce the upfront cost of constructing low-income housing units to a high-performance and resilient building standard. The Doughnut Economics (DE) concept provides context for why co-operatives should measure the environmental and social impact of business activities to ensure that they stay within the "doughnut", a visual representation of the space between environmental and social boundaries where humanity can thrive. The research identified five key stakeholder groups that would provide core competencies to meet the MSN's objectives. Each stakeholder completed a questionnaire to corroborate the hypothesis regarding their contributions and to gauge interest in MSN membership. The results determine a high probability that our MSN concept could be implemented in Winnipeg. The research builds on the understanding of affordable housing needs in Winnipeg and identifies the TCBO savings potential of high-performance and resilient building measures. Recommendations are made for systems-based frameworks with absolute performance targets like the Passive House building standard and DE to achieve desired outcomes. This research project also highlights the importance of trust, reciprocity, and shared values and principles in reducing the governance costs of MSNs.

Evan Proven is founding member and current Vice President of Sun Certified Builders Co-op, a high-performance builder's co-operative in Winnipeg.

Keywords: Multi-Stakeholder Network, Doughnut Economics, Co-operatives, Low-Income Housing, High-Performance Buildings

Introduction

Social and environmental issues are becoming more and more complex to the point that no single organization can sufficiently address them (De Bakker et al., 2019, cited in Eikelenboom & Long, 2022; Wageningen Centre for Developmental Innovation, 2019). Research has shown that networking has the potential to create "innovative organizational forms . . . [which are] a strategic advantage for co-operatives" (Novkovic, 2014, p. 47). Multi-Stakeholder Networks (MSNs) provide a diversity of perspectives that can help to drive "values-centred decision-making . . . toward a shared purpose" (Martins Rodrigues & Schneider, 2022, pp. 32–33), which reduces transactional and governance costs (Novkovic & Holm, 2011). Co-operative business models are typically aligned with progressive ideals of sustainability through their adherence to *Concern for Community*, the seventh principle of co-operatives (International Co-operative Alliance [ICA], 1995); however, the rapidly deteriorating global economy requires co-ops to move beyond sustainability towards regenerative economic models like Doughnut Economics (DE) (Novkovic, 2020; Miner & Novkovic, 2020; Raworth, 2017b; Wilson et al., 2021). The DE model visualizes social and environmental boundaries and provides a framework to analyse economic activity, ensuring it adequately addresses social issues while not disrupting critical ecosystems (Raworth, 2017a). Through the context of DE, this research project proposes the development of an MSN to address the challenges of developing low-income housing to a high performance and resilient building standard and determines the feasibility of creating such an MSN in Winnipeg, Manitoba.

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This research builds on the understanding of network governance best practices and highlights the importance of trust and diversity in stakeholder networks. It contributes to the understanding of affordable housing needs in Winnipeg and makes recommendations for the use of high-performance and resilient building measures to reduce the Total Cost of Building Ownership (TCBO). This research also shows the importance of incorporating absolute as opposed to relative performance targets in relation to project analysis which provides context for choosing systems based frameworks such as DE and the Passive House International (PHI) building standard (Bernhardt, 2020; Raworth, 2017a).

Background

High-Performance and Resilient Housing

Models of low-income housing development that do not meet high performance and resilient building standards do not adequately address the needs of low-income families. Housing units that only meet the Manitoba Building Code create a liability for building owners and tenants as the Code's requirements are insufficient to protect them from energy, maintenance, and recapitalizations cost increases, severe weather events, or natural disasters (Cole, n.d.). Using lower-quality components and finishes leads to more frequent maintenance and recapitalization of building components, which can increase in frequency and cost as the building ages. Building materials that contain high amounts of embodied carbon from their manufacture and transportation contribute to greenhouse gas emissions which in some cases can surpass the lifetime emissions created by the building's operations (Magwood, 2018). The TCBO analysis shown in Figure 1 illustrates how the implementation of high-performance and resilient building methods at the time of construction can drastically reduce the energy consumption, carbon emissions, cost of maintenance, and cost and frequency of recapitalization of components over the building's useful lifetime (Cole, 2018) compared to a Code built version of the same building. The TCBO model also shows that up to 78% of lifetime ownership costs are spent on energy, maintenance and replacing ageing components, while roughly 20% are spent on the cost of construction. The remaining 2% of TCBO is allocated to demolition and recycling at the end of the building's useful lifetime (W. Cole, personal communication, June 2018).

Figure 1:Total Cost of Building Ownership Analysis - Manitoba Case Study

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Minimum Code Compliant Home vs High Performance Home

FRONT ELEVATION

Summary

This case study compares a Minimum Code Compliant Home (MCH) that uses natural gas heat, to a High Performance Home (HPH) with passive house features. Our findings show that the average increase in initial cost for a HPH over MCHis typically only 4% to 10%. But when the total cost of home ownership is considered, the savings are:

- $16,000 over 12-years (average time people own a home),
- $84,000 over 25-years (the typical mortgage term) and
- $375,000 over 60-years (the typical life of a home).

Background

Building owners, designers, or government economists, do not use a consistent method of determining the investment value and cost savings when it comes to investing in energy efficient and/or sustainable building features. The most common techniques used are simple payback, return on investment (ROI), or net present value (NPV). However, these parameters do not show the real value of HPH, and are often calculated over some arbitrary time period, such as 10 or 20 years, or over the useful life of a single building component. A better approach would be to:

- Evaluate the whole building, as opposed to a single component.
- Evaluate the useful life of the building, which could easily be 60-years. This period could be extended considerably by making the building more sustainable and durable.
- Determine the value by calculating the Total Cost of Building Ownership (TCBO). The TCBO is determined using the SEEFAR-Valuation© which includes all the costs of building ownership such as mortgage interest, utility costs, maintenance, GHG emission tax, property tax, insurance, etc.

It is important to understand that a High Performance Building is, "*a building that integrates and optimizes all major high-performance building attributes, including energy efficiency, durability, life-cycle performance, and occupant productivity*". This definition is important because 'high performance' is more than just energy efficiency.

The durability and sustainability of building material is important because it has an impact on how often building components need to be replaced and at what cost. An easily recyclable metal roof with a 60-year plus life is more durable than asphalt shingles with a 20-year life that end up in landfill. In addition, occupant comfort, productivity and a building free from harmful materials is important. In an effort to simplify the analysis for this study, however we do not include a comparative analysis of options for more durable materials.

This case study is focused on a comparative analysis of the TCBO of a MCH (using natural gas heat) to a HPH (all electric) with passive house features. The tables below describe the construction features and costs of each home.

The Home Comparison Construction Features

Table 1 is a comparison of the home construction features of the MCH versus the HPH:

TABLE 1	Minimum Code Compliant Home (MCH)	High Performance Home (HPH)
Utility description summary	Natural Gas Heating	All Electric
R-value of above grade walls	R15.9	R60
R-value of attic space	R48	R100
R-value of below grade walls	R15.9	R52
R-value of foundation floor		R48
Area of conditioned space	1,700 ft²	1,700 ft²
Window type	Dual pane	Triple pane, Low E, Gas filled
Window area	17.2 m2	18.68 m2
Exterior door type	Two insulated steel	Two insulated fibreglass
Heating system description	Natural Gas condensing furnace	3350 watts of Electric baseboards
Cooling system description	Electric air conditioning	Sub-soil heat exchanger - 10 watt pump
Ventilation system description	HRV	High efficiency HRV
Water heating description	Electric glass lined steel tank	Electric fibreglass tank
Lighting description	CFL	LED
Appliance description	Electric	Electric

Table 2 shows the initial capital cost of the homes. The first row shows costs of the components that affect energy consumption; this includes many of the items described in the construction comparison. The first row also shows that the HPH has an 18% higher cost for energy configuration construction.

The second row shows that the cost of non energy-related components were intentionally kept identical to eliminate the impact of differences in the preferences for how the home is finished.

The last row shows the total construction cost, which is only 8% higher for the HPH.

TABLE 2	Minimum Code Compliant Home (MCH)	High Performance Home (HPH)	Total Cost Differences
Energy-related construction costs	$145,000	$170,988	18%
Non energy-related construction costs	$174,000	$174,000	0%
Total Construction Costs	$319,000	$344,988	8%

There are additional inputs to the SEEFAR-Valuation© such as equipment cost, equipment life in years, energy costs and consumption, cost escalations, etc. These all have a bearing on the TCBO, but are not shown in order to simplify for this case study.

Results

Table 3 shows the differences between the TCBO for the MCH and the HPH:

TABLE 3	Minimum Code Compliant Home (MCH)	High Performance Home (HPH)	Total Savings	Savings %
Greenhouse gas emissions (kg)	4,055	19	4,036	99.5%
Energy use index (EUI) (kWh/ft2/year)	18.5	3.8	14.7	80%
TCBO at 12-years	$102,000	$86,000	$16,000	16%
TCBO at 25-years	$266,000	$182,000	$84,000	32%
TCBO at 60-years	$960,000	$605,000	$375,000	38%

The first row shows that the greenhouse gas (GHG) emissions are 99% lower for the HPH, since the electricity in Manitoba is generated from hydro, whereas the MCH burns natural gas.

The second row shows the Energy Use Index (EUI). The energy consumption is 80% lower for the HPH. This is important because utility rates are rising faster than inflation due to the addition of the carbon tax and aging utility infrastructure that is in need of renewal.

Rows three, four and five compare the TCBO over 12-years, the average time people own a home; 25-years, the typical mortgage term; and, 60-years, the useful life of the building.

Every building has its own unique characteristics that should be accounted for to optimize the investment value. The SEEFAR-Valuation© allows the user to optimize the selection of building components in terms of energy use and durability. This will help to lower the TCBO level.

How would the TCBO be affected by using more durable materials such as ceramic tile floors, metal roofing, or adding solar photovoltaic panels, etc?

A SEEFAR-Valuation© will help answer these types of questions in the most definitive way by monetizing the relevant benefits of each option.

1. The US National Institute of Building Sciences: https://www.nibs.org/page/hpbc

A Cautionary Note on Case Study Conclusions

The SEEFAR-Valuation© demonstrates that the life-cycle variance in the total cost of building ownership (TCBO) between different designs for two similar homes can easily be in the six-figure range. Therefore, drawing 'general' conclusions about the TCBO differences between any two home types can prove to be misleading. The same risk applies when drawing TCBO conclusions based on units of 'building area'.

As a matter of financial logic, homes that are more sustainable are more likely to have lower TCBO levels; larger homes are more likely to have higher TCBO levels; and, homes that reduce heat loss through high performance building envelopes can be expected to have lower TCBO levels than homes that offset heat loss through mechanical systems. For that reason, it is recommended that the SEEFAR-Valuation© assessment be conducted on each home design option being considered.

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SRP CANADA
Sustainable Renewal Planning Inc.

Note. Adapted from *Manitoba Case Study,* by Wayne Cole, 2018, p. 38. Copyright 2018 by Sustainable Renewal Planning. Adapted with permission.

The installation of adequate insulation, metal roofing, and metal siding are all effective ways to reduce ownership costs. When installed correctly using a high-performance building methodology these building components may never need to be replaced for the useful lifetime of the building and require little to no maintenance. Insulating the building envelope reduces the energy requirements for heating and cooling, increases occupant health and comfort, and makes the building safe during short-term extreme temperature events or power outages. The reduction of heating and cooling requirements also allows for the specification of smaller and less costly equipment, which reduces construction costs, energy demand, and the cost of recapitalizing those systems at the end of their useful lifetimes. Additionally, high-performance building methods reduce moisture in the building envelope (the building's exterior walls and roof), protecting the structure from rot, which can lead to costly repairs (Serroukh & Hashemi, 2021). Metal roofing and siding components have a potential service life of over 60 years (Ryan, 2014) and can be recycled at the end of their lifetime. These components further protect the building envelope to minimize moisture infiltration and extend the lifetime of structural components.

In addition to Canada's National Building Code, several types of green building standards promise to increase building performance. It is fundamental to understand how the models work to gauge their potential to achieve high-performance results that meet expectations. The current recommended regulatory approach is to establish "absolute performance targets" (Passive House Canada, 2022, para. 4) that clearly outline the maximum allowable energy consumption and minimum allowable ratings of building components that must be met to achieve certification (Bernhardt, 2020). In contrast, the current National Building Code and some green building standards use "relative performance targets" (Passive House Canada, 2022, para. 4). Relative building standards compare a proposed building to a fictional reference building of the same design but built to the minimum allowable Code requirements. The proposed building is then determined to be a percentage better than the reference. This method has been discredited as an indicator of building performance and has led to a "building performance gap" (Bernhardt, 2020) where the actual building performance falls below the anticipated performance. The most stringent high-performance building standards use advanced modelling software that predict building performance based on multiple data inputs from the design specifications and absolute performance targets. The combination of these elements along with post construction testing and verification of critical assemblies guarantees that buildings perform to expectations which is key to achieving owner satisfaction.

Incorporating resilient building materials and high-performance building methodologies typically comes at a cost premium in the range of 7%-15% (Freeman, 2017). The COVID-19 pandemic has exacerbated building material prices related to high-performance and resilient measures adding to the cost premium. Cellulose is a common insulation material in high-performance wall systems and its price has increased almost 5% since 2019. Plywood air vapour barriers are another common feature of high performance wall systems and plywood is also used as a gusset system for a "Larson Truss" (Proven, 2014), a popular framing component used to make thick exterior walls. The price of sheet goods has increased dramatically since 2019 with 3/8" plywood seeing a 58% cost increase. The cost of sheet metal for roofing and siding has similarly increased 47% since 2019 (Proven, 2023). TCBO modelling, however, shows that upfront cost premiums are typically recovered within six years (Passive House Canada, 2022), though the pandemic's effect on material pricing has yet to be factored into TCBO models.

Regenerative Economic Transition

The ICA Statement of Co-operative Identity (ICA, 1995) outlines the values and principles that all co-operatives should embrace. The ICA has reassessed the *Statement of Co-operative Identity* approximately every 30 years to ensure the statement remains relevant to the global co-operative movement. As the current ICA statement was adopted in 1995, the 33rd World Co-operative Congress chose the theme of *Examining our Co-operative Identity* for the 2021 proceedings in preparation for re-examining the ICA Statement. In their discussion paper prepared for the congress, Wilson et al. (2021) described the current global changes and disruption that provide the context for a reassessment of co-operative values and principles such as: full digitalization of the global economy; greater access by girls and women to education and socioeconomic roles more traditionally associated with men; growing insecurity of employment for young people; rising mistrust of authority and growth of populism; worsening environmental degradation and climate emergency; aging of the population and declining birthrates in developed countries; and the effects of the pandemic (pp. 6-7). They noted that the seventh principle, *Concern for Community,* was created in 1995 to address such evolving challenges. The wording of this principle was chosen to align with the

United Nations definition of sustainable development which is "[d]evelopment that meets the needs of the present without compromising the ability of future generations to meet their own needs" (ICA, 2015, p. 86). In light of the current state of global affairs, the re-assessment of the seventh principle should include a review of novel economic frameworks such as Doughnut Economics (Raworth, 2017a), which outline a necessary transition from mere sustainability to regenerative practices (Novkovic, 2020).

Earth Systems scientists have made it clear that if we do not take action in the next nine years we are potentially triggering a climate crisis that would lead to mass extinction (Friedlingstein et al., 2022). Building construction techniques that incorporate high-performance and resilient measures drastically lower greenhouse gas emissions emitted from building construction and operation to the point of potential reductive effects (Magwood, 2018).

The complexity of economic transition creates a challenge beyond the capacity of any individual organization (Wageningen Centre for Developmental Innovation, 2019). An MSN approach creates the potential for solving complex social and economic challenges to ensure humanity stays within the Doughnut (Leviten-Reid & Fairbairn, 2011; Raworth, 2017a, 2017b).

Housing Needs

Households that spend 30% or more of their total income on housing costs are deemed to live in unaffordable housing. Manitoba's rate of unaffordable housing was 17.3% in 2021 (Statistics Canada, 2022b). This was a drop of 1.7% from 2016, but the decrease is unlikely to continue as COVID-19 related benefits were a significant contributor to income over the past three years. The combination of record high inflation and the resulting government measures of increasing interest rates as well as the phasing out of pandemic benefits in 2022 will have drastic effects on the average shelter-cost-to-income ratio (Statistics Canada, 2022a, 2023).

Statistics Canada measures low-income in several ways. Using the low-income measure, after tax, which establishes a threshold based on median household income adjusted for household size, 15.9% of Winnipeg households, representing 109,540 people, met the low-income criteria in 2016. Using the low-income cut-off, after tax, which establishes a threshold based on the share of an individual's or family's income spent on housing, food, and clothing, 13.3% of individuals in private households in the Winnipeg Census Subdivision (CSD), a total of 91,940 people, met the low-income criteria in 2016 (Carter et al., 2020).

Social housing refers to housing units that have some form of subsidies in place. These housing units are predominantly owned and operated by Manitoba Housing, a branch of the provincial government, or in partnership with non-profit housing providers that receive subsidies and funding through Manitoba Housing. Social housing is specifically geared towards low-income families (Carter et al., 2020). End Homelessness Winnipeg estimates that between 67 and 193 additional social housing units need to be developed every year from 2018-2025 to meet the growing demand of low-income families (Kotyk, 2018). This mirrors the findings of Carter et al. that the lack of available affordable and social housing in Winnipeg must be addressed (2020).

Ownership Costs and Affordability

Adequate Housing refers to units that "are not requiring any major repairs" (Carter et al., 2020, p. 156). In 2016, 24.8% of housing units in the Winnipeg CSD fell below adequacy standards. The number was much higher in the Centennial and Midland zones where 47.4% and 32.9% of housing units failed to meet the adequacy standards respectively (Carter et al., 2020). Winnipeg has an older housing stock than other cities with 34.5% of dwellings being built on or before 1960. Looking at housing adequacy by age, it is clear the older stock is falling into disrepair with 58.5% of housing built in 1960 or before needing significant repairs. In Winnipeg, the older dwelling units tend to be in the poorest neighbourhoods with the greatest need for low-income housing. The 2016 data suggests that the low-income housing stock is more likely to be built on or before 1960 and also more likely to fall below adequacy standards (Carter et al., 2020). The census data also shows that, year over year, more money is being spent on repairs and maintenance, with owner occupied dwellings in Manitoba increasing their expenditures by an average of 18.6% per year between 2011 – 2021 (Statistics Canada, 2022c, tbls. 34-10-0095–01). Landlord and tenant occupied dwellings similarly increased their expenditures 11% per year over the same period. This data could be affected by

pandemic income supplements and other pandemic related financial implications as the highest increase in spending by far occurred between 2020 and 2021 (Statistics Canada, 2022c, tbls. 34-10-0095–01).

In addition to repair and maintenance costs, factors such as energy prices, mortgage rates, rental rates, and home prices are outpacing income growth. From 2016 to 2023, Winnipeg household income rose 21.5% from a median of $68,331 to a median of $83,000 (Carter et al., 2020; Government of Canada, 2023). Between 2017 and 2022, Manitoba's electricity rates increased by 13.8% and the base rate increased 13.9%. From February of 2018 to August of 2022, primary Natural Gas prices in Manitoba increased by 159.4% (Manitoba Hydro, n.d.). From 2017 to 2023 the average home resale price in Winnipeg rose by 22.8% to an average price of $349,490 and the average two bedroom rental unit rate increased by 22% to $1350/month (Canada Mortgage and Housing Corporation, 2023; Canadian Real Estate Association, n.d.; Carter et al., 2020). In 2016, the average mortgage interest rate in Manitoba was between 2.08% and 2.3% but has since increased significantly to between 4.39% and 5.99% in 2023 (True North Mortgage, n.d.). Even though these interest rates are still historically low, the cost of housing in Winnipeg makes it difficult to move from rental tenure to ownership tenure (Carter et al., 2020). These data points show that the TCBO in Winnipeg is steadily increasing disproportionately to income, which will further increase the number of families that experience unaffordable housing or meet low-income criteria. New affordable housing developments should thus aim to reduce TCBO through the implementation of high-performance and resilient building methods.

Housing Affordability Programs

Several incentives are available to help reduce the cost of constructing energy efficient buildings. Efficiency Manitoba is the provincial body responsible for sustainability programs and currently has two incentives for commercial or institutional buildings. The first is a $2 per square foot rebate that only requires buildings to perform 5% better than the Manitoba Energy Code (Efficiency Manitoba, n.d.). The cost reduction provided by this incentive is minimal, representing between < 1% and < 2% of the hard construction cost per square foot of a multi-level multi-unit building (Altus Group, 2018). The second incentive provides up to $10,000 to cover the cost of energy modelling for new builds (Efficiency Manitoba, n.d.).

The City of Winnipeg has developed the Affordable Housing NOW (AHN) program offered in partnership with Canada Mortgage and Housing Corporation's (CMHC) National Housing Strategy. Eligible projects have access to two funding options. The first is a Tax Increment Financing program which offers approved projects up to an 80% reduction in incremental property taxes for either 15 or 25 years based on the project's attributes. Projects located in the Downtown area or a designated Housing Improvement Zone and owned by non-profits or Indigenous governments are eligible for the 25-year program. The second funding option is a Capital Grant that is awarded on a merit-basis to projects that vastly exceed the minimum project requirements. The Capital Grant provides $10,000 per affordable housing unit to a maximum of $250,000 in total project funding for projects that are owned by a non-profit or Indigenous government. The buildings must also offer at least 50% of units at affordable housing rates which are defined as being 60% of the median market rate and also offer an undetermined number of housing units at income-tested rates and rented to low-income households per the Manitoba Housing Social Housing Rental Program Income Limits (City of Winnipeg, n.d.). AHN has another incentive program offered to non-profit low-income housing providers where city owned surplus lots can be purchased at 50% of their assessed value. The AHN has earmarked six surplus lots to be made available for $1 provided that the housing units are constructed to a Net Zero emissions standard (Raddatz, 2022).

In addition to the AHN programs, CMHC also offers the National Housing Co-Investment Fund, which provides access to affordable and forgivable loans to help with affordable housing construction projects. The fund requires a partnership between some level of government and either non-profit or private sector partners focusing on projects geared towards mixed-income, mixed tenure, and mixed-use including affordable housing. Eligible projects must be energy efficient with a requirement to "achieve a minimum 25% decrease in energy consumption and Greenhouse Gas emissions outlined in the requirements of the 2015 National Energy Code for Buildings . . . or a 15% decrease relative to the 2017 National Energy Code" (Canada Mortgage and Housing Corporation, n.d.).

Housing Partnership Canada is a lending institution dedicated to affordable housing development in Canada. Housing Partnership Canada created the Housing Investment Corporation (HIC) with support from CMHC's Affordable

Housing Innovation Fund to assist non-profit and co-operative housing providers in accessing capital markets through an institution that understands affordable housing development. The HIC is "a sector-based financing vehicle . . . provid[ing] expertise in housing development and regeneration, finance, and underwriting required to bridge the gap between housing providers and debt investors" (Housing Investment Corporation, 2023a). The HIC offers low-cost financing including 30+ year fixed rate loans, low administration fees, and financial and housing knowledge and expertise to assist with development projects (Housing Investment Corporation, 2023b).

Passive House

The Passive House Institute (PHI) is an internationally recognized voluntary building certification organization that promotes the Passive House Standard for energy-efficient buildings, setting the criteria and guidelines for energy-efficient buildings. PHI set an exceptionally high absolute performance target for their standard, resulting in a 90% reduction in primary energy use compared to conventionally constructed buildings. The approach embraces a holistic model that views a building as a system of interdependent components working together to achieve a high-performance outcome (International Passive House Association, n.d.). The PHI standard incorporates the following principles of high-performance buildings (first developed by Saskatoon engineer Harold Orr) (Hough, 2018, para. 7).

- Measure where energy leakages occur in houses.
- Minimize the waste of energy.
- Educate builders on how to build and retrofit houses to an acceptable energy standard.
- Develop computer modelling software to design energy efficient homes prior to construction.

PHI offers three main categories of building standards including PHI for new builds, EnerPhit for retrofits, and PHI Low Energy Buildings for new builds that do not meet the requirements for PHI certification yet still meet a high-performance threshold. Attention to conservation and minimizing energy loss helped to determine the "[g]eneral minimum criteria for all standards" (Passive House Institute, 2023, p. 13), which contribute to lowering the cost of building construction and increasing energy efficiency. The concepts include:

- Frequency of overheating – the building must be designed to stay cool in summer either by shading and thermal insulation or with properly sized active cooling equipment.
- Frequency of excessive humidity – interior humidity must be maintained below 60% to avoid mould growth.
- Minimum thermal protection – two factors are considered: hygiene and comfort. The hygiene criteria ensures that no condensation forms on any interior surface to remove the possibility of mould growth. The comfort criteria ensures that adequate insulation is installed using a thermal bridge free design so that interior surface temperatures remain within allowable limits.
- Occupant satisfaction – this section covers many of the systems that contribute to occupant comfort such as: operable windows, user-operated lighting control, user operated temperature control, adequately sized and controllable ventilation systems, measures to address low humidity, sound reduction measures to reduce ventilation noise, and ventilation duct placement to remove draughts. (Passive House Institute, 2023)

Another feature of PHI design is building form factor, which aims to maximize interior volume while minimizing wall area. The optimum shape for a building and the baseline for PHI design is a cube, an easy-to-build shape with the maximum interior volume per exterior area. PHI building criteria work in conjunction to drastically reduce TCBO and construction costs by reducing the energy required to operate the building throughout the year and protecting the building from humidity and temperature fluctuation that can harm building components. The resulting buildings are inherently more sustainable, cost effective, and resilient than conventionally built homes due to the focus on reducing energy consumption using passive systems.

The cost of building ownership is increasing due to both economic and environmental factors. This is leading to a growing population for whom housing costs are becoming impossible to manage. While the initial cost of incorporating high-performance and resilient building measures does exceed that of conventional construction, these elements permanently reduce TCBO, which can lead to large savings for building owners. They also provide

additional safety, security, and comfort to occupants and reduce operational greenhouse gas emissions compared to code-built buildings, making their implementation a clear benefit to future generations.

Literature Review

Multi-Stakeholder Networks

A business network is a group of companies directly or indirectly connected by social or economic ties. Their relationships are built through "repeated exchanges" (Öberg, 2019, p. 124) where companies learn from, adapt to, and invest social and financial resources in each other. Business networks are known for innovation and creating new ideas (Öberg, 2019). A Multi-Stakeholder Network is a complex business network strategy implemented by co-operative enterprises. MSN's can be comprised of only co-operatives or can extend membership beyond co-ops to other business forms (Martins Rodrigues & Schneider, 2022). Co-operatives that exist in co-op dense areas are likely to exhibit a very high degree of strategic networking that provides necessary support including financial, technical, and human resources in both start-up and growth stages of co-op development. Networks enact innovations and expose co-ops to better access to goods and services (Girard & Langlois, n.d.; Mezani & Zamangi, 2010; Novkovic & Holm, 2011).

Stakeholders are "groups or individuals that can significantly affect or are significantly affected by an organization's activities" (Harrison & St. John, 1996, p. 47). They can be categorized as being primary or secondary, where the former has a direct relationship with the organization and the latter is representational. MSNs can be formed with varying stakeholder structures and their exchanges revolve around "social interactions" towards a "highly focused purpose" (Martins Rodrigues & Schneider, 2022, p. 32) allowing the MSN to leverage the skillsets of their various stakeholders to fulfil social and economic goals (Eikelenboom & Long, 2022; Leviten-Reid & Fairbairn, 2011; Martins Rodrigues & Schneider, 2022; Novkovic & Holm, 2011). MSNs are unique from other forms of co-operative networks as they are not governed by an apex organization but rather come together as a group of autonomous organizations that can include non-co-operative entities "operate[ing] relatively independently of other stakeholder groups, while taking advantage of particular synergies" (Martins Rodrigues & Schneider, 2022, p. 32).

Freundlich observes that MSNs typically organize in three different ways:

- Creation of common institutions and policies tailored to their needs, providing access to goods and services that the conventional market fails to provide.
- Firm-to-firm collaboration seeking business synergies and economies of scale.
- Coordination of business activities and strategic alliances. (Freundlich, 2015)

Some economics-based management theories view humans as "utterly self-serving, interested in maximizing immediate utility only" (Pirson & Turnbull, 2011, p. 102) ignoring the potential for stakeholders to interact as partners. They suggest that due to the heterogeneous nature of stakeholders, decision-making will be costly and inefficient leading to the eventual demise of the MSN (Leviten-Reid & Fairbairn, 2011; Roloff, 2008). From the perspective of these theories, stakeholder involvement must be carefully managed to mitigate the potential for stakeholders to cause harm to the organization or contribute to environmental uncertainty (Harrison & St. John, 1996; Roloff, 2008). Empirical research tends to disprove these theories showing instead that MSN actors can be more invested in collective ambitions over individual interests, following a humanistic paradigm in which "human beings are not maximizing their own utility, but balancing the interests of themselves and people around themselves in accordance with general moral principles" (Dierksmeier & Pirson, 2008; Hauser, 2006; Lawrence, 2010 in Pirson & Turnbull, 2011, p. 103). The focus on collective ambitions allows for efficient and focused decision-making and problem solving using innovative organizational forms to achieve economies of scale and agility in an evolving environment (Harrison & St. John, 1996; Leviten-Reid & Fairbairn, 2011; Martins Rodrigues & Schneider, 2022; Novkovic, 2014; Novkovic & Holm, 2011; Roloff, 2008).

Group interactions demonstrating reciprocation and honest communication fulfill basic human psychological needs (Perkins, 2015; Sacchetti & Tortia, 2014) and form the basis of trusting relationships that are essential for cooperation and humanistic governance (CME SMU, 2021; Martins Rodrigues & Schneider, 2022; Roloff, 2008; Sacchetti & Tortia, 2014). MSNs are created through these interactions where common values are established with

a shared "vision of something bigger" and a focus on stewardship (Lund, 2021, p. 6). MSNs have been categorized as "platforms for deliberative democracy" that "facilitat[e] learning and collaboration" and serve to create innovative solutions to social issues (Roloff, 2008, pp. 243, 244).

The governance of MSNs closely aligns with the features of the co-operative enterprise model such as democratic decision-making, joint ownership and control, and people centredness (Miner & Novkovic, 2020). As such, all stakeholders can create and review the rules that govern the MSN, which also creates trust and a sense of ownership between stakeholders.

The diversity and heterogeneity of stakeholders lead to good governance where "divergent opinions" are treated as assets (Langlis & de Bertoli, 2006, as cited in Leviten-Reid & Fairbairn, 2011) and can lead to the uncovering of novel perspectives (Eikelenboom & Long, 2022). The context and lived experience of each stakeholder affects the decision making process overcoming the individual's inability to "peer outside of the linguistic fabric in which we find ourselves and our cognitive domains braided" (Espinosa et al., 2007, p. 334). Governance systems are typically deliberative and direct at the development stage but shift to constantly evolving systems as environmental changes and opportunities arise or when the needs and goals of stakeholder members shift over time (Novkovic & McMahon, 2023). Novkovic and McMahon (2023) cited Ghoshal and Morgan (1996) and Simon (1979) in posing that organizations can be seen as the product of the "human inability to fully process information under conditions of complexity and uncertainty" (p. 22). The complexity of global issues surrounding sustainability and development have moved beyond the capacity of any single entity's ability to solve; therefore, a multi-stakeholder organizational approach is required (Wageningen Centre for Developmental Innovation, 2019).

The literature shows that polycentric governance models are ideal for MSN governance as they incorporate accountability and mutual support instead of agency theory models or economics-based management theories built on mistrust. Polycentric models use a systems-based approach that breaks down complexity into smaller and more manageable nodes of independent decision-making incorporating democratic processes to govern towards their shared ambition. This power distribution allows for transparency and checks and balances within the system while reducing transactional costs due to the alignment of the organization's goals and the blurring of separation between management and governance roles. These features of polycentric governance can reduce both group and individual bias and help reduce the burden of overwhelming information faced by more homogenous organizations. MSN governance is a marked shift from traditional rigid agency and economic theory-based systems that view humans as opportunistic and requiring control to avoid self-serving behaviour. The humanistic foundations of MSN governance lead to structures that are diverse and draw on the lived experience of stakeholders to meet human needs and promote human dignity (Martins Rodrigues & Schneider, 2022; Novkovic, 2014; Novkovic & Holm, 2011; Novkovic & McMahon, 2023; Novkovic & Miner, 2015; Roloff, 2008; Turner & Wills, 2022).

Trust has been established as an essential mechanism in stakeholder relationship development to facilitate cooperation (Massaro et al., 2019, as cited in Martins Rodrigues & Schneider, 2022; Roloff, 2008). Trust is built on societal and institutional norms and reciprocity that is further supported by shared values and principles such as the ICA statement of co-op identity (Bachmann & Inkpen, 2011; Girard & Langlois, n.d.; Leviten-Reid & Fairbairn, 2011; Martins Rodrigues & Schneider, 2022). Trust allows more flexible formal agreements and reduces the need for highly-complex legal mechanisms of control (Martins Rodrigues & Schneider, 2022; Novkovic, 2014). Institutions like co-ops can act as facilitators of trust where they leverage behavioural norms, reputations, and codes of conduct such as the ICA statement to act as "third party guarantor[s]" that reduce the risk of investing in a trust relationship (Bachmann & Inkpen, 2011, p. 285).

Bachman and Inkpen (2011) identified the need for contractual agreements and "reliable contract law" (p. 289) when dealing with multiple stakeholders, while other researchers have advised against the "formalization and monitoring of contractual agreements" (Harrison & St. John, 1996, p. 58) as they can reduce trust and create conflict. Martins Rodrigues and Schneider (2022) identified in their case study of the Namasté Solar Network that partnerships were originally developed through informal relationships and alliances that grew into more formal arrangements for co-op-to-co-op business. They noted that the Namasté Network focused on fostering a shared culture beyond "structural ties" to connect the stakeholders (p. 47). Sacchetti and Tortia (2014) noted that the

inclusion and participation of diverse stakeholders serves to build trust and reduces conflicts which can help to overcome “contractual failures” (p. 68). The level of complexity of contractual frameworks for network coordination and control mechanisms depends on the understanding of stakeholders as partners for reciprocal information and knowledge sharing or as contributors to environmental uncertainty requiring careful management.

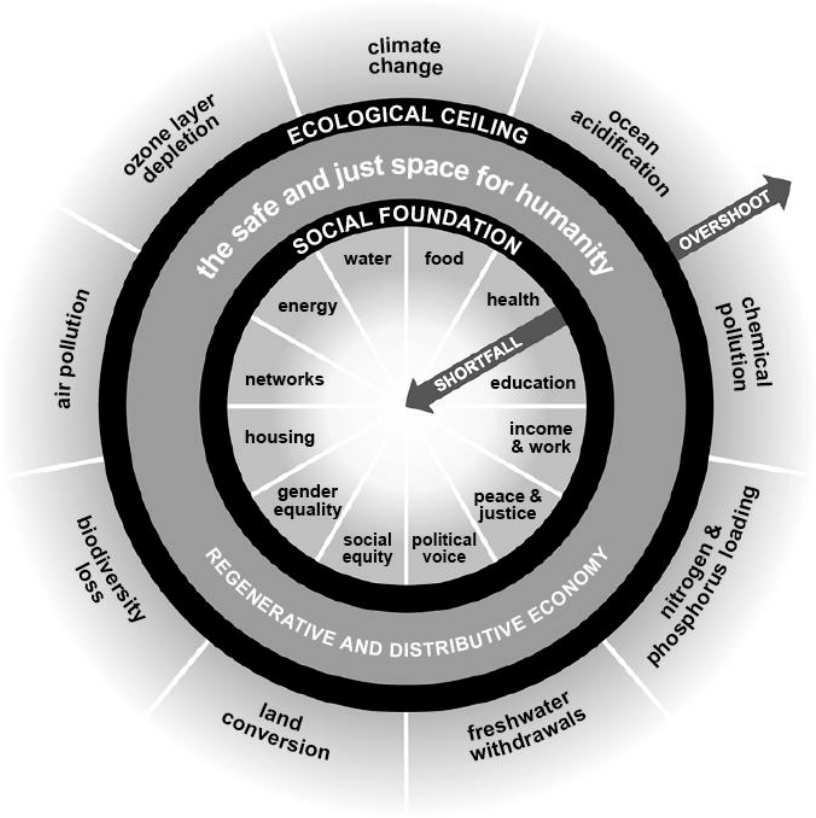
An MSN approach to tackling affordable housing is a good fit as MSNs are often formed to address social issues. An MSN that includes a diversity of stakeholders, each with a specific contribution toward low-income housing development, should allow for novel approaches to tackle the initial cost of incorporating high-performance and resilient building measures in low-income building projects. If the MSN is created with co-op and SE members, then the potential for reduced transactional cost should be more easily realized due to common values and principles and an alignment of goals.

Doughnut Economics

The MSN proposed in this project aims to address social and ecological issues. Current affordable housing projects in Winnipeg must meet high-performance building standards, while high-performance building projects must incorporate adequate, affordable housing units. Addressing these issues through an MSN requires appropriate performance indicators to ensure the organization’s economic activity meets expectations regarding the convergence of social and sustainability components. The Doughnut Economics (DE) framework created by economist Kate Raworth establishes social and ecological thresholds that all economic activity must operate within to change the global economic system to a more humanistic model described as “meeting people’s needs without disrupting biophysical processes” (Turner & Wills, 2022, p. 1). Raworth has identified three major flaws in the current economic system: ecological context, work, and inequality. The current economic system requires constant Gross Domestic Product (GDP) growth, which ignores ecological limits (Raworth, 2017a). Inequality is increasing, creating a greater divide between the richest and poorest, a problem the current economic system intensifies (Ross, 2019). Economic theory states that the worsening inequality is inherent to our economic system, but that growth will eventually correct it. Raworth has countered this theory stating that inequality is a design flaw and that many options exist to redistribute wealth to those who help create it (Raworth, 2017b).

In response to the failures of our current economic system, Raworth has proposed the DE model, shown in Figure 2, which visually represents the social and ecological constraints the global economy must operate within to create a “safe and just space for humanity” (Raworth, 2017a). The social constraints, identified in the inner ring of Figure 2, were developed by Raworth in 2011 while working for Oxfam and consist of twelve basic human needs that no person should go without. The social constraints are also part of the United Nation’s Sustainable Development Goals established in 2015 (Raworth, 2017a).

Figure 2: The Doughnut Economics Model



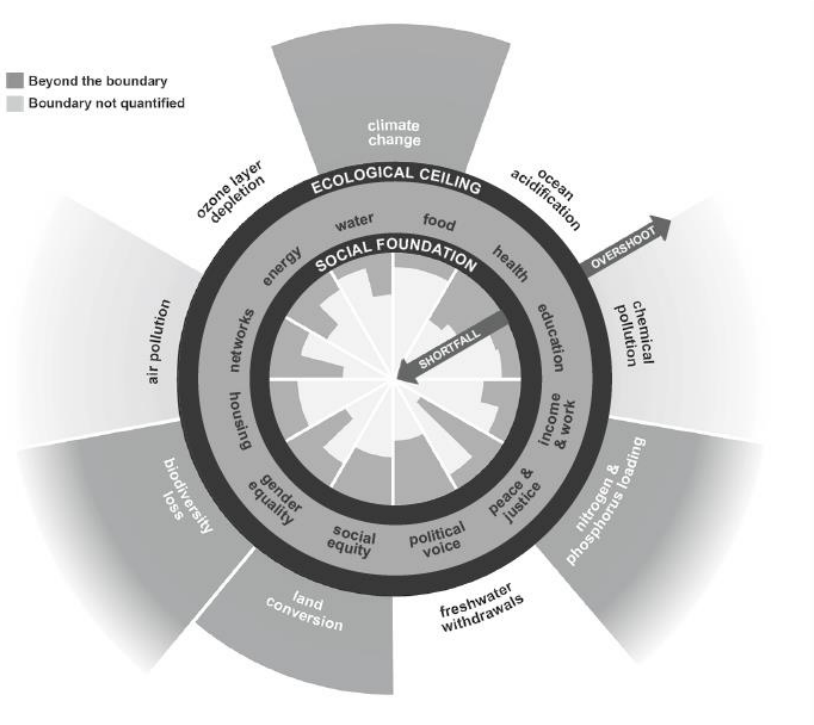
Note: Adapted from *Doughnut Economics* (p.38), by Kate Raworth, 2017, Copyright 2017 by Kate Raworth.

On the other hand, the nine ecological constraints shown in the outer ring of Raworth's Doughnut relate to the processes identified by scientists as critical to maintaining stable climate conditions. Global economic activity is now "the single biggest driver of planetary change" (Raworth, 2017a, p. 41) and the DE model enables a better assessment of the social and environmental impact of economic activity at various scales from global to local to ensure that humanity can find a "dynamic balance" (Raworth, 2017a, p. 45) and thrive.

Scaling sustainability models, from global to local, has its challenges. Turner and Wills (2022) acknowledge the probability of novel issues in implementing the Doughnut: "Though planetary boundaries were not designed to be downscaled, translating their meaning to sub global scales is important to align with decision-making processes" (p. 2). They go on to note the work comes with technical challenges and "also raises normative questions about tolerance to risk in approaching biophysical thresholds, which may vary across contexts, as well as historical justice issues relating to inequities in past resource use" (p. 2). The authors also recommend "absolute rather than relative performance in relation to social and ecological goals, demanding a holistic approach that reflects and responds to the ways in which places are implicated in sustainability challenges" (Turner & Wills, 2022, p. 3). The challenge then becomes striking a balance between scientifically established thresholds and locally relevant and acceptable goals, which requires the integration of multiple stakeholders to provide the contextual information needed to establish local performance targets. The authors recommend a polycentric governance approach which allows for "adaptive and reflexive governance" (Turner & Wills, 2022, p. 6) built on collaborative relationships and shared goals.

As of 2017, social and ecological thresholds in many areas have been exceeded as shown below in Figure 3. Ecological boundaries have been overshot in climate change, chemical fertilizer loading, biodiversity loss, and land conversion. There are also shortfalls in every single social category "limit[ing] the potential of so many people's lives in the twenty-first century" (Raworth, 2017a, p. 43). Raworth has noted that this generation is the first to understand humanity's effect on the natural world and likely the last with any chance to change course. A logical first step towards change is assessing all current and proposed economic activity per the DE framework to ensure opportunities are created for future generations instead of liabilities. According to Cook (2018), the second phase of the co-operative life cycle includes establishing co-operative health metrics. The DE model should be included as part of the assessment of all co-ops to ensure their activity falls within the doughnut.

Figure 3: Global Economic Assessment



Note. Global Economic Assessment using the Doughnut Economics Model, Adapted from *Doughnut Economics* (p.44), by Kate Raworth, 2017, Copyright 2017 by Kate Raworth.

Multi-stakeholder Network Prototype and Research Methodology

Multi-stakeholder Network Concept

As a founding member and current Vice President of a high-performance builder's co-operative in Winnipeg, I worked with my colleagues to devise a prototype MSN to examine the feasibility of creating such a network in Winnipeg, Manitoba. Our initial study does not focus on financial viability but on the potential for building the organizational network. The co-operative's direct and indirect experience in working within the local construction sector helped to identify the following five stakeholder organizations that would be the key contributors of skills, knowledge, and expertise and form the initial membership base:

- low-income housing providers

- lenders
- general contractors
- material suppliers
- high performance building specialist

We propose that a critical criterion for all stakeholders would be that they use either co-operative or Social Enterprise (SE) incorporation models to ensure shared values and principles and allow for the implementation of Principle Six – Cooperation among Co-operatives (ICA, 1995). The preference for co-operative and SE stakeholders should foster the development of co-operative networking innovations due to their shared values and principles (Novkovic, 2014; Novkovic & Holm, 2011). Adding SE stakeholders would also give the MSN access to grants and charitable donations only available to SE organizations. Each stakeholder should also have some vested interest in low-income housing, whether through their business operations or through their mission and vision statement, as MSN literature shows that a shared goal is required to align the network (Martins Rodrigues & Schneider, 2022). The following section describes the hypothesized potential contributions of each stakeholder with reference to unique capabilities and features of potential stakeholders in each category.

Low Income Housing Providers

In Winnipeg, most low-income housing units are owned and operated by Manitoba Housing, which administers the government of Manitoba's Social Housing Rental Program. Other units are owned and operated by non-profit housing providers supported by the Manitoba Non-Profit Housing Association (MNPHA), or by private market rental housing (Kotyk, 2018). The rental program uses a rent-geared -to-income system where a tenant's rent is based on their gross household income. The difference between the tenant's rent and the market rate is paid by the provincial government to non-profit and private market rental housing providers via a subsidy administered by Manitoba Housing (Province of Manitoba, n.d.). As one of the goals for our MSN is to lower the upfront and operational costs associated with low-income housing, we included a Non-Profit Housing Provider (NPHP) based on the hypothesis that an NPHP could act as a developer for both single-family and multi-family low-income housing projects. We also hypothesized that an NPHP would then act as owner/operator of the building once completed. An institution like MNPHA could facilitate trust building between the MSN and MNPHA members.

Lenders

Obtaining project financing for low-income housing development is challenging. The pre-construction phase of development can be costly and without flexible and affordable lending products projects can be delayed or even abandoned. The development of low-income housing units therefore requires a lender committed to supporting low-income housing projects. Credit unions in other Canadian provinces have already implemented programs to support low-income development and environmentally friendly consumer choices. For example, Vancity Credit Union in British Columbia established an Affordable Housing Accelerator Program and Fund which supports non-profit, Indigenous, and co-operative housing organizations through the pre-construction process of low-income housing development by providing grant funding, affordable low-cost loans, and development training and advice (Vancity, n.d.). We hypothesize that a Manitoba credit union could provide the same type of low-income housing development programming that Vancity offers.

Providing impact investment is another tool lenders could offer the MSN to support its goals. Impact investments are defined as "investments made into companies, organizations, and funds to generate a measurable, beneficial social or environmental impact alongside a financial return" (Wikipedia, 2023a). Assiniboine Credit Union (ACU) in Winnipeg has developed grant and sponsorship programs to support organizations involved in community enterprise development and environmental sustainability (ACU, 2022b). ACU's Manager of Environmental Sustainability has indicated in personal conversation that they would be willing to create pilot mortgage programs to incentivise high-performance buildings.

General Contractors

A General Contractor (GC) is typically required to manage the construction of complex building projects. The GC would be responsible for supervising building construction including supervising the jobsite and managing sub-contractors. An ideal GC stakeholder in the MSN would already be involved in developing low-income housing and

have experience in high-performance and resilient construction methods. The GC should be familiar with Integrated Project Delivery, which mirrors the MSN model in that "all disciplines in a construction project work as one firm . . . where the entire building team including owner, architect, general contractor, building engineers, fabricators, and subcontractors work collaboratively throughout the construction process" (Wikipedia, 2023b, para. 3). Integrated Project Delivery processes have been shown to reduce cost overruns due to mistakes and miscommunication, reduce waste, reduce conflict between stakeholders, and increase product quality (Wikipedia, 2023b). The GC should also be familiar with high-performance building standards like PHI to reduce the cost of training in high-performance building methodology. Purpose Construction (PC) in Winnipeg is a non-profit social-enterprise GC that has recently started developing single family low-income housing units. PC's social enterprise incorporation model allows them to access charitable donations and other public and private funding to develop low-income housing and implement energy efficient building construction methods. PC has already taken steps towards increasing the efficiency of their homes including the training of their workforce as PHI certified tradespersons.

Material Suppliers

Construction projects require a reliable supply of appropriate materials and delivery coordination to ensure the construction process can proceed without delay. Due to the issues of embodied carbon, Material Suppliers (MS) need access to local organic based materials to minimize the building's lifetime carbon emissions. We hypothesize that an MS that uses a co-op or SE incorporation model can serve to reduce transaction costs (Borzaga et al., 2011) which could help the MSN reduce construction costs. Federated Co-ops Ltd. (FCL) supports multiple consumer co-ops around Manitoba which often provide lumber and building material sales. Although none are located within the City of Winnipeg, Homestead Consumers Co-operative Ltd (HCC) operates out of Portage La Prairie, Manitoba, a smaller city located just under 85 kilometers to the west. As Winnipeg is the major distribution hub in Manitoba, HCC owns warehouse space in the city and can ship most materials directly from their distribution centre, which reduces delivery costs. FCL also administers a Community Investment Fund and Co-op Community Spaces Program. The MSN could access these grant programs through one of the non-profit stakeholders.

High Performance Building Specialists

High-performance buildings must be carefully designed, built, and tested to optimize energy efficiency. A High-Performance Building Specialist (HPBS) would assist in the design and development and perform energy modelling on low-income housing to ensure that important elements like the building form factor and intersection details are optimized to maximize efficiency at the lowest possible cost premium (Bernhardt, 2020). Using a system like PHI with its absolute performance targets establishes a clear expectation for the GC to meet. The HPBS team should include PHI certified design consultants familiar with PHI design and construction to ensure the project meets performance expectations. The HPBS team would also oversee and provide quality control for the installation of critical assemblies, provide trades training to the GC, conduct the required performance testing, verify that assemblies have been constructed to design specifications, and provide final analysis and submit certification documentation for the projects to ensure that performance targets have been met.

Research Methodology

To determine the feasibility of creating an MSN to develop low-income housing using high performance and resilient building standards, we followed the methods and definitions below:

- High performance buildings meet Passive House International's Low Energy Building Standard which requires that the building use less than 30kWh/square meter of treated floor area for heating demand and achieve a pressurization test result of less than 1 air change/hour at 50 pascals of pressure (Passive House Institute, 2023).
- Resilient building features are made of durable materials that have a longer average service life and can be easily repaired or replaced. Resilient materials should also be recyclable at the end of their useful lifetime, have a low embodied carbon designation, and be organically based wherever possible to facilitate the sequestration of carbon within the building (Magwood, 2018).

Based on those parameters, market research in the form of a questionnaire was distributed to stakeholders with the capacity to make critical contributions to support the goals of the MSN. We included five core stakeholders for this

initial study and sent the questionnaire to individual representatives within each stakeholder group, noting that this is not an exhaustive list of potential stakeholders. To narrow down our initial choices, we first identified which core stakeholders would be required to perform fundamental functions within the MSN. Then, we developed a list of criteria that each stakeholder should meet based on the ICA statement of Co-operative Values and Principles to optimize relationship building and create the potential for innovative collaboration.

The questionnaires, attached as the Appendix, were designed to reflect the initial function or role expected of each selected stakeholder based on their current work in Manitoba and additional contributions identified by themselves. The data from the questionnaires were analyzed using qualitative methods to assess the feasibility of the proposed MSN.

Secondary data from the literature review helped build the description of the MSN in the questionnaires to provide context for the applicability of an MSN in addressing a complex social need like low-income housing. Additional public data, summarized earlier in the Background section, provided insight into homeownership trends in Manitoba, quantifying the changing costs of homeownership, and determining the demand for low-income housing development in Winnipeg. SEEFAR Building Analytics data was incorporated to show the effect of high performance and resilient building methodologies on TCBO. Federal, provincial and civic programs to aid in reducing the upfront build cost were also identified. Using the combined data, we have highlighted the benefits of investing in high-performance and resilient building methodologies for low-income housing and the potential for reducing the upfront cost through government programs and innovative stakeholder contributions. The circular economy concept of DE has been presented as context for why sustainable and regenerative economic models are needed to prevent our economic activities from causing the collapse of critical environmental and social systems. The DE model describes a pathway towards a more humanistic and distributive economic system.

Our study has been limited to a small sample of specific stakeholders in Winnipeg that may be unique in their combination of purpose and capacity which may lead to difficulties in replicating the MSN in other locations. Future research considerations should include identifying other stakeholder groups that could contribute to the MSN's goals.

Analysis and Discussion

This section evaluates the results of the empirical market research conducted through stakeholder questionnaires and discusses the participation of specific stakeholders from each group.

Questionnaire Results

Themes emerging from the questionnaire responses include:

- Unanimous interest in joining the MSN
- An alignment of the goals of the MSN and their respective organization's mission and vision
- Confirmation of the possibility of partnership with other co-ops or SE
- Support for contractual requirements
- Interest in business networking
- The potential for time constraints to limit each stakeholder's ability to meaningfully participate in the MSN

The following section describes each individual organization and details their responses.

Manitoba Non-Profit Housing Association

Based on its current work in Manitoba, we identified MNPHA as the "Low-income Housing Provider" stakeholder. MNPHA is a local association representing over 100 non-profit housing providers in Manitoba. Their vision statement references sustainable and affordable housing, and their mission is to support non-profit housing providers in creating an affordable housing sector that achieves economic, social, and environmental sustainability. MNPHA supports their membership by developing programs and services including professional development, knowledge exchange through networking and conferences, and sector advocacy through the engagement of governments, stakeholders, and funding providers on behalf of their membership. MNPHA bridges the non-profit housing sector

with other organizations that support "resilience, relevance, and innovation" (Manitoba Non-Profit Housing Association, 2023). MNPHA indicates that as a representative association they would play an advisory and advocacy role in the MSN. They identified that a partnership with the MSN would allow MNPHA's members to connect with high-performance building experts to assist in construction and renovation programs to increase building performance and provide additional resources to help overcome challenges they face in fundraising to incorporate high-performance building standards into their developments. MNPHA suggested they could advocate for the development of high-performance building incentive programs with various levels of government and program funders. They would also help to identify NPHPs that support the incorporation of high-performance and resilient building methods into low-income housing development which forms the shared goal of our MSN concept.

MNPHA identified potential issues that NPHPs would face in participating in the MSN. To meet funders' requirements, NPHPs often prioritize short term affordability over long-term TCBO savings. The competing priorities of funders and NPHPs could create challenges in securing funding to cover the cost premium of high-performance and resilient measures. Due to Winnipeg's relatively small affordable housing sector, finding enough MSN members to maintain momentum may be challenging. MNPHA indicated that although it can facilitate network development, it cannot evaluate business partnerships or make business recommendations to its membership. Still, MNPHA would connect organizations it felt could benefit from each other's expertise and could act as a facilitator of institutional trust. Due to their advisory role, MNPHA indicated they would not require any formal contractual agreement with the MSN.

Assiniboine Credit Union

As the representative of the "Lenders" stakeholder group we identified a potential partnership with ACU, a 75-year-old credit union based in Winnipeg with seventeen branches located around the city. ACU's vision is "a world where innovative financial services in local communities contribute to a sustainable future for all". Its mission is "providing financial services for the wellbeing and resilience of our members, employees, community, and environment" (ACU, 2022a). ACU outlined their main contributions as follows:

- providing access to capital where funding gaps exist
- governance and management training for governance leaders within the MSN
- lobbying government and key stakeholders such as appraisers and developers

Partnering with the MSN would help ACU fulfill their mission by investing in local initiatives that benefit people and the planet and accomplish their mandate to support the development of safe and affordable housing. ACU recommended that the MSN should develop relationships with the public sector to access existing low-income housing funding programs. ACU indicated that the contractual level they would require to participate would be a simple Memorandum of Understanding (MOU).

Purpose Construction

As a representative of the "General Contractor" stakeholder group we identified PC, a non-profit SE already involved in the construction of single-family low-income housing in Winnipeg. PC has implemented a strategic plan to upgrade its affordable housing work to meet high-performance building standards and already has an MOU with Sun Certified Builders Co-op (SCBC) for training services on high-performance building methods.

PC is also developing a relationship with the Jubilee Fund in Winnipeg to develop novel affordable homeownership models such as rent-to-own. They are also collaborating with a trades training program run by Corrections Canada that operates a prefabrication plant for building components. Corrections Canada has indicated interest in developing a high-performance prefabricated wall system but needs assistance in training and technical capacity to implement their plan. PC acknowledged that they have faced challenges in trying to meet Efficiency Manitoba's New Homes Program requirement of 20% better energy performance than code at a price that met affordable housing criteria. However, they proposed that the novel concept of the MSN and the potential training opportunities provided by the partnership could serve to increase the social impact of the projects, which could be attractive to current and future funding bodies.

Homestead Consumers Co-operative

Representing the "Material Suppliers" stakeholder group, we identified HCC. This organization operates Co-op Home Centre, a building supply consumers co-operative, and is a member of the Co-operative Retailing System run by FCL. HCC's mission and vision include enhancing community life by building relationships, working together, leading in service, and positively impacting communities. Joining the MSN and participating in developing high-performance and resilient low-income housing would fit the HCC's mission and vision and fulfill their commitment to Corporate Social Responsibility. In addition to acting as MS for building projects, HCC indicated that they could provide an advisory role and participate as steering committee members. They also have valuable experience in the building industry which they would bring to the MSN. HCC also indicated that they would benefit from enhancing the technical expertise of their own staff at their Home Centre locations and by expanding their business network. As their area of operation is mainly in Portage la Prairie and the surrounding area, HCC acknowledged that they would prioritize supporting projects in their home community and not necessarily those in Winnipeg.

Time commitments were indicated as a potential barrier to HCC's participation in the network. FCL, the apex body that supports HCC, has several community investment programs that provide sponsorship and donations to non-profit organizations and community projects. HCC indicated that the MSN could qualify to receive support from FCL's existing programs.

Sun Certified Builders Co-operative

Representing the "High Performance Building Specialist" stakeholder group we identified SCBC, a multi-stakeholder co-op based in Winnipeg specializing in new construction and renovations incorporating Passive House building methodologies with a focus on reducing TCBO through high-performance and resilient building methods. SCBC stated that high-performance and resilient building measures like air tightness and proper insulation are necessary for low-income housing because they dramatically reduce TCBO. SCBC indicated that in addition to the hypothesized contributions identified in the questionnaire they could contribute to the MSN through capital investments or committee membership. However, they also indicated that the time commitment required to participate fully could be a limiting factor. SCBC suggested that the MSN could result in a new independent co-operative. Given the innovative network concept, they suggested that the MSN could qualify for funding through CMHC for a pilot project.

Discussion and Conclusions

Our study focused on the feasibility of creating an MSN in Winnipeg with five key stakeholders forming the initial membership. The questionnaire results confirmed our hypothesis regarding stakeholder's potential contributions. There is a high interest among all the stakeholders in joining the MSN though most of them indicated that their capacity to participate may be hindered by a lack of time. Additionally, the low-income housing provider stakeholder identified that as a representative association they do not actually develop, own, or operate low-income housing units, but rather could help in convening connections between the MSN and their NPHP members who could provide those critical services instead. Further research is required to find an appropriate "Low-income Housing Provider" and "Material Supplier" located in Winnipeg to participate in the MSN.

Our study results corroborate the existing literature (Bachmann & Inkpen, 2011; Martins Rodrigues & Schneider, 2022; and Novkovic, 2014) showing the presence of social norms such as trust and reciprocity in co-operative networks, reducing the rigidity of contractual requirements. Three of the five research participants indicated that their organizations would not necessarily require formal agreements to join the MSN. Our data also suggests that the challenges of building low-income housing to a high-performance and resilient standard have been difficult to overcome by individual stakeholders, which echo the multi-stakeholder rationale proposed in the literature review. Themes consistent in the literature review include using systems-based approaches to complex issues, the importance of networks in managing complexity, and the establishment of absolute performance targets as opposed to relative targets (Bernhardt, 2020; Novkovic, 2014; Novkovic & Holm, 2011; Novkovic & McMahon, 2023; Novkovic & Miner, 2015; Raworth, 2017a).

Existing research on affordable housing needs in Winnipeg shows that additional housing units must be built to satisfy the growing demand. Historical data shows that homeownership costs are rising disproportionately to income so new construction projects must be built using methods that reduce TCBO. High-performance building standards

such as PHI are well suited to reduce build cost and TCBO because their systems-based approach incorporates absolute performance targets and passive design elements that reduce complexity. The development of affordable housing using a high-performance building standard aligns with the seventh principle of co-operatives. However, due to the growing inequality caused by the current economic system, co-ops must move beyond mere sustainability towards regenerative systems such as the DE framework, which also uses a systems-based approach with absolute performance targets. DE provides rationale for transitioning the current economic system from GDP growth to a more humanistic focus of providing a just and sustainable future for all of humanity.

Co-operative networks have the potential to create innovative organizational structures, and when aligned around a shared purpose, these networks leverage trust and reciprocity between stakeholders. The specific capabilities of each stakeholder contribute to reducing transactional and decision-making costs while the potential of achieving a larger scope of impact is enhanced. MSNs created around co-op values and principles can quickly build trust based on co-op institutional norms which allows for contractual ambiguity and reduces the need for complex control structures. Some grant and financing programs that support affordable housing development in Winnipeg are only available to non-profit organizations and others also require public-private partnerships providing further context for the use of an MSN approach for this project.

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Appendix

Research Questionnaire - Feasibility Study: Developing High-Performance Low-Income Housing using a Multi-stakeholder Network Approach

Respondent - Manitoba Non-Profit Housing Association

The purpose of this survey is to help determine the feasibility of establishing a Multi-stakeholder Network (MSN) in Winnipeg that would develop multi-unit residential low-income housing units to a high-performance and resilient building standard. As outlined in the Informed Consent Form, an MSN is a business networking strategy employed by Co-ops and Social Enterprises to achieve economies of scale in the pursuit of social and economic goals. MSN's typically form to address a common goal rather than one specific to an individual stakeholder. Through this survey we hope to gain information on our stakeholder groups to corroborate our hypothesis about their contributions.

This survey focuses on one organization from each of the following stakeholder groups: low-income housing providers, lenders/impact investors, general contractors, material suppliers, high performance building specialists. We assume that the Manitoba Non-Profit Housing Association (MNPHA) could represent the low-income housing provider stakeholder group. Among possible contributions, we estimate that low income housing providers could contribute to the MSN by acting as the developer for low-income multi-unit residential building projects. We also understand that this stakeholder group could become the owner or property manager of projects developed by the MSN. We hypothesize that the MNPHA could contribute to the MSN by using its knowledge of the low-income housing sector to build key relationships between its membership and the MSN. These rolls are initial hypothesis subject to change during the research development, open to other suggestions and proposals coming from MNPHA.

Does the opening paragraph of this survey accurately describe MNPHA's potential contributions to the MSN?

- (●) Yes
- ( ) No

Are you aware of any contributions not listed that MNPHA could provide to help the MSN achieve its goals? If none please indicate.

MNPHA could also contribute to advocacy/government relations with funders that have grant and financing programs targetted to energy retrofits and new low-income housing development

Based on the brief description of the MSN in the Informed Consent form, your organization would be _____ join(ing) such a network?

- ○ very interested in
- ◉ interested in
- ○ unlikely to
- ○ not interested in

If interest is indicated, in what capacity would your organization join the MSN? What kind of skin would you put in the game? (advisor, steering committee member, investor, stakeholder member etc.) Briefly describe what you envision MNPHA's participation in the MSN would look like.

Advisor; MNPHA has limited capacity to engage in networks that take a great deal of time and generally prioritizes those that our members themselves prioritize. We can provide advice and connections, disseminate information to housing providers, organize events/workshops, etc.

Does high-performance low-income housing development fit with MNPHA's mission and vision?

- ◉ Yes
- ○ no

If yes, please explain how.

MNPHA's mission is to support our members to create a thriving, sustainable non-profit housing sector. Sustainability includes economic, social, and environmental sustainability.

What benefit do you see for MNPHA in becoming a member of this MSN?

The ability for our members to be connected to those with expertise and capacity in development and renewal to be able to create/rennovate their buildings; the ability to reduce costs and constraints in high-performance low-income housing and support partners to solve challenges that have prevented housing providers from developing or reonnovating to high standards (maintenance, technical challenges, limited capacity to oversee projects, etc.)

Please describe any hesitations your organization might have about joining the MSN?

Competing priorities can be a challenge - our members prioritize affordability (often due to funders' requirements, which focus on short-term affordability rather than life-cycle costs) and have extremely limited resources to undertake development or renewal. Additionally, with low-income housing development at such a small scale (300 units a year maximum), it is difficult to build up the expertise and business services and attracting members to the network may be a challenge due to the limited market. Finally, without in-house capacity ourselves to assess business partners and consultants, MNPHA avoids making recommendations to our members and rather gives them contact information for organizations that have direct experience with various businesses and consultants to collect their own recommendations and make decisions based on their needs and capacity.

Please describe any novel solutions you are aware of that would support the goals of the MSN (lowering the cost of constructing multi-unit residential buildings, reducing the cost of the resulting debt payments required to address the additional cost of high performance and resilient building methods, reducing the total cost of building ownership)? If none please indicate.

Would a partnership with other nonprofits or co-ops be acceptable to your stakeholders/board?

- (●) Yes
- ( ) No

What level of agreement would be required by your organization to create a partnership with other MSN stakeholders?

- (●) Informal
- ( ) Contract
- ( ) Memorandum of Understanding
- ( ) Incorporation of a new Co-operative

Please describe any funding opportunities you are aware of that could be available to support the MSN or its goal? If none please indicate.

Community Housing Transformation Centre; Federation of Canadian Municipalities; Efficiency Manitoba; CMHC

Other than the competencies/contributions identified in this survey, please describe any competencies/contributions that you think would be necessary for the success of the MSN?

Research Questionnaire - Feasibility Study: Developing High-Performance Low-Income Housing using a Multi-stakeholder Network Approach

Respondent - Assiniboine Credit Union

The purpose of this survey is to help determine the feasibility of establishing a Multi-stakeholder Network (MSN) in Winnipeg that would develop multi-unit residential low-income housing units to a high-performance and resilient building standard. As outlined in the Informed Consent Form, an MSN is a business networking strategy employed by Co-ops and Social Enterprises to achieve economies of scale in the pursuit of social and economic goals. MSN's typically form to address a common goal rather than one specific to an individual stakeholder. Through this survey we hope to gain information on our stakeholder groups to corroborate our hypothesis about their contributions.

This survey focuses on one organization from each of the following stakeholder groups: developers, lenders/impact investors, general contractors, material suppliers, high performance building specialists. We assume that Assiniboine Credit Union (ACU) falls into the lenders/impact investors stakeholder group. Among possible contributions, we estimate that ACU could contribute to the MSN by acting as a lender to finance the development in low-income multi-unit residential building projects. We also understand that ACU could provide impact investments to help fund the MSN. These rolls are initial hypothesis subject to change during the research development, open to other suggestions and proposals coming from ACU.

Does the opening paragraph of this survey accurately describe ACU's potential contributions to the MSN?

- (●) Yes
- ( ) No

Are you aware of any contributions not listed that ACU could provide to help the MSN achieve its goals? If none please indicate.

Promotion, Advocacy, Training and Education

Based on the brief description of the MSN in the Informed Consent form, your organization would be _____ join(ing) such a network?

- (●) very interested in
- ( ) interested in
- ( ) unlikely to
- ( ) not interested in

If interest is indicated, in what capacity would your organization join the MSN? What kind of skin would you put in the game? (advisor, steering committee member, investor, stakeholder member etc.) Briefly describe what you envision ACU's participation in the MSN would look like.

As deemed necessary and relevant based on financial cooperative mandate

Does supporting high-performance low-income housing development fit with ACU's mission and vision?

- (●) Yes
- ( ) no

If yes, please explain how.

We use finance for good to help members (including not for profit housing) fulfill their mandate in providing access to safe, affordable housing.

What benefit do you see for ACU in becoming a member of this MSN?

Aligns with ACU's mission to reinvest in our community to benefit people and planet.

Please describe any hesitations your organization might have about joining the MSN.

Time commitment to fully engage

Please describe any novel solutions you are aware of that would support the goals of the MSN (lowering the cost of constructing multi-unit residential buildings, reducing the cost of the resulting debt payments required to address the additional cost of high performance and resilient building methods, reducing the total cost of building ownership)? If none please indicate.

1. Provide access to a capital fund in cases where equity gaps exists for financing. 2. Also to train and educate management and governance level leaders within the sector. 3. Lobby government and key stakeholders (eg appraisers, developers) to partner in stimulating new affordable housing stock.

Would a partnership with other co-ops or nonprofits be acceptable to your stakeholders/board?

- (●) Yes
- ( ) No

What level of agreement would be required by your organization to create a partnership with other MSN stakeholders?

- ( ) Informal
- ( ) Contract
- (●) Memorandum of Understanding
- ( ) Incorporation of a new Co-operative

Please describe any other funding opportunities you are aware of that could be available to support the MSN or its goal? If none please indicate.

NIL

Other than the competencies/contributions identified in this survey, please describe any competencies/contributions that you think would be necessary for the success of the MSN?

Cross sectoral collaboration between public, private and not for profit sectors

Research Questionnaire - Feasibility Study: Developing High-Performance Low-Income Housing using a Multi-stakeholder Network Approach

Respondent - Purpose Construction

The purpose of this survey is to help determine the feasibility of establishing a Multi-stakeholder Network (MSN) in Winnipeg that would develop multi-unit residential low-income housing units to a high-performance and resilient building standard. As outlined in the Informed Consent Form, an MSN is a business networking strategy employed by Co-ops and Social Enterprises to achieve economies of scale in the pursuit of social and economic goals. MSN's typically form to address a common goal rather than one specific to an individual stakeholder. Through this survey we hope to gain information on our stakeholder groups to corroborate our hypothesis about their contributions.

This survey focuses on one organization from each of the following stakeholder groups: developers, lenders/impact investors, general contractors, material suppliers, high performance building specialists. We assume that Purpose Construction (PC) falls into the general contractors stakeholder group. Among possible contributions, we estimate that PC could contribute to the MSN by providing labour and managing sub trades for the development in low-income multi-unit residential building projects. We also understand that as a nonprofit Social Enterprise PC can access grants and charitable donations to help fund the development of low-income housing units. These rolls are initial hypothesis subject to change during the research development, open to other suggestions and proposals coming from PC.

Does the opening paragraph of this survey accurately describe PC's potential contributions to the MSN?

- (●) Yes
- ( ) No

Are you aware of any contributions not listed that PC could provide to help the MSN achieve its goals? If none please indicate.

We are currently developing a relationship with the Jubilee Fund to structure investment into affordable homeownership models - specifically rent-to-own. We would be happy to bring that relationship to the table.

We also have a relationship with CorCan, a trades training program within Stoney Mountain Penitentiary to pre-fabricate wall sections of our housing builds. They have indicated an interest in developing pre-insulated high performing wall sections in their shop, but currently lack the training capacity/knowledge to lead that process.

Based on the brief description of the MSN in the Informed Consent form, your organization would be _____ join(ing) such a network?

- (●) very interested in
- ( ) interested in
- ( ) unlikely to
- ( ) not interested in

If interest is indicated, in what capacity would your organization join the MSN? What kind of skin would you put in the game? (advisor, steering committee member, investor, stakeholder member etc.) Briefly describe what you envision PC's participation in the MSN would look like.

We would be happy to join in whatever capacity is most useful. We are committed to developing affordable housing using social finance models, and are deeply interested n exploring opportunities to make that housing as high performing from an energy use perspective as possible while protecting affordability.

Does supporting high-performance low-income housing development fit with PC's mission and vision?

- (●) Yes
- ( ) no

If yes, please explain how.

We have a strategic goal of continuing to expand our affordable housing work, and to exploring opportunities for 'net zero' (or similar high performance builds) as we continue to expand our work.

What benefit do you see for PC in becoming a member of this MSN?

We would love to do this work in partnership with other interested groups, specifically groups that add expertise around energy performance.

Please describe any hesitations your organization might have about joining the MSN.

In the past, we haven't been able to make the numbers work on housing that is both high energy performance and affordable. We've been able to build to Efficiency Manitoba New Home Standard (20% better then code I believe), but making the numbers work has been really challenging.

Please describe any novel solutions you are aware of that would support the goals of the MSN (lowering the cost of constructing multi-unit residential buildings, reducing the cost of the resulting debt payments required to address the additional cost of high performance and resilient building methods, reducing the total cost of building ownership)? If none please indicate.

I think partnering with social enterprise to leverage training funding opportunities and deepen the social impact of the build is a really novel move and quite attractive to funders.

Would a partnership with other nonprofits or co-ops be acceptable to your stakeholders/board? *

- (●) Yes
- ( ) No

What level of agreement would be required by your organization to create a partnership with other MSN stakeholders?

- ○ Informal
- ○ Contract
- ◉ Memorandum of Understanding
- ○ Incorporation of a new Co-operative

Please describe any other funding opportunities you are aware of that could be available to support the MSN or its goal? If none please indicate.

https://impact.canada.ca/en/challenges/building-for-the-future

Other than the competencies/contributions identified in this survey, please describe any competencies/contributions that you think would be necessary for the success of the MSN?

Research Questionnaire - Feasibility Study: Developing High-Performance Low-Income Housing using a Multi-stakeholder Network Approach

Respondent - Homestead Consumers Co-operative

The purpose of this survey is to help determine the feasibility of establishing a Multi-stakeholder Network (MSN) in Winnipeg that would develop multi-unit residential low-income housing units to a high-performance and resilient building standard. As outlined in the Informed Consent Form, an MSN is a business networking strategy employed by Co-ops and Social Enterprises to achieve economies of scale in the pursuit of social and economic goals. MSN's typically form to address a common goal rather than one specific to an individual stakeholder. Through this survey we hope to gain information on our stakeholder groups to corroborate our hypothesis about their contributions.

This survey focuses on one organization from each of the following stakeholder groups: developers, lenders/impact investors, general contractors, material suppliers, high performance building specialists. We assume that Homestead Consumers Co-operative (HCC) falls into the material suppliers stakeholder group. Among possible contributions, we estimate that HCC could contribute to the MSN by providing discounts on building materials supplied for the development in low-income multi-unit residential building projects. These rolls are initial hypothesis subject to change during the research development, open to other suggestions and proposals coming from HCC.

Does the opening paragraph of this survey accurately describe HCC's potential contributions to the MSN?

- (●) Yes
- ( ) No

Are you aware of any contributions not listed that HCC could provide to help the MSN achieve its goals? If none please indicate.

*if formal Status of MSN or a stakeholder in the MSN is in a non-profit potential donations could be available. Sponsorship of programs could also be an option.

Based on the brief description of the MSN in the Informed Consent form, your organization would be _____ join(ing) such a network?

- ○ very interested in
- ◉ interested in
- ○ unlikely to
- ○ not interested in

If interest is indicated, in what capacity would your organization join the MSN? What kind of skin would you put in the game? (advisor, steering committee member, investor, stakeholder member etc.) Briefly describe what you envision HCC's participation in the MSN would look like.

HCC has the capacity to be a stakeholder member and potentially an advisory role and or steering committee member. HCC has expertise in the home and building industry, along with vested interests in social and environmental responsibility.

Does supporting high-performance low-income housing development fit with HCC's mission and vision?

- ◉ Yes
- ○ no

If yes, please explain how.

HCC purpose/ Vision is "Enhancing Community Life". HCC achieves this purpose statement by working Together, building relationships, leading in service and positively impacting communities with every interaction. High-performance housing has positive environmental benefit and finding solutions for the lack of availability of low income housing would support HCC Vision and Mission through Corporate Responsibility

What benefit do you see for HCC in becoming a member of this MSN?

Finding solutions for social and environmental issues. HCC would enhance its corporate citizenship. HCC would see benefits in networking and working with others in the same industry, enhancing expertise at our locations. HCC could be a potential supplier of building materials. HCC would be interested in programing communities that they serve, ex Portage La Prairie. HCC could be a supplier of materials for projects

Please describe any hesitations your organization might have about joining the MSN.

Time commitments,

Please describe any novel solutions you are aware of that would support the goals of the MSN (lowering the cost of constructing multi-unit residential buildings, reducing the cost of the resulting debt payments required to address the additional cost of high performance and resilient building methods, reducing the total cost of building ownership)? If none please indicate.

could a model such as the Habitat for Humanity program be utilized?

Would a partnership with other co-ops or nonprofits be acceptable to your stakeholders/board?

- (●) Yes
- ( ) No

What level of agreement would be required by your organization to create a partnership with other MSN stakeholders?

- ○ Informal
- ◉ Contract
- ○ Memorandum of Understanding
- ○ Incorporation of a new Co-operative

Please describe any other funding opportunities you are aware of that could be available to support the MSN or its goal? If none please indicate.

as mentioned above, Sponsorships and/or donations could be available based on the locations of the projects (in the communities that HCC servers, Portage La Prairie etc.)

Other than the competencies/contributions identified in this survey, please describe any competencies/contributions that you think would be necessary for the success of the MSN?

Research Questionnaire - Feasibility Study: Developing High-Performance Low-Income Housing using a Multi-stakeholder Network Approach

Respondent - Sun Certified Builders Co-operative

The purpose of this survey is to help determine the feasibility of establishing a Multi-stakeholder Network (MSN) in Winnipeg that would develop multi-unit residential low-income housing units to a high-performance and resilient building standard. As outlined in the Informed Consent Form, an MSN is a business networking strategy employed by Co-ops and Social Enterprises to achieve economies of scale in the pursuit of social and economic goals. MSN's typically form to address a common goal rather than one specific to an individual stakeholder. Through this survey we hope to gain information on our stakeholder groups to corroborate our hypothesis about their contributions.

This survey focuses on one organization from each of the following stakeholder groups: developers, lenders/impact investors, general contractors, material suppliers, high performance building specialists. We assume that Sun Certified Builders Co-op (SCBC) falls into the high performance building specialist stakeholder group. Among possible contributions, we estimate that SCBC could contribute to the MSN by providing design, energy modelling, and construction labour services for the development in low-income multi-unit residential building projects. We also understand that as a co-operative SCBC can provide its services at a reduced profit margin to help fund the development of low-income housing units. These rolls are initial hypothesis subject to change during the research development, open to other suggestions and proposals coming from SCBC.

Does the opening paragraph of this survey accurately describe SCBC's potential contributions to the MSN?

- (●) Yes
- ( ) No

Are you aware of any contributions not listed that SCBC could provide to help the MSN achieve its goals? If none please indicate.

Potential Passive House Certification services

Based on the brief description of the MSN in the Informed Consent form, your organization would be _____ join(ing) such a network?

- (●) very interested in
- ( ) interested in
- ( ) unlikely to
- ( ) not interested in

If interest is indicated, in what capacity would your organization join the MSN? What kind of skin would you put in the game? (advisor, steering committee member, investor, stakeholder member etc.) Briefly describe what you envision SCBC's participation in the MSN would look like.

SCBC would like to be as involved as possible - investor, stakeholder member, committee member, service provider, etc.

Does supporting high-performance low-income housing development fit with SCBC's mission and vision?

- (●) Yes
- ( ) no

If yes, please explain how.

SCBC formed as a way to build high performance buildings, which we saw as necessary for human survival. This provides meaning and gainful employment to our members. We want these buildings to be the default for groups providing low income housing as the operating costs are much lower.

What benefit do you see for SCBC in becoming a member of this MSN?

We have experience in the design and construction of High Performance Buildings (HPB) as well as the desire to contribute to our community. Our cooperative structure lends itself to community benefit.

Please describe any hesitations your organization might have about joining the MSN.

Time commitments and labour turnover.

Please describe any novel solutions you are aware of that would support the goals of the MSN (lowering the cost of constructing multi-unit residential buildings, reducing the cost of the resulting debt payments required to address the additional cost of high performance and resilient building methods, reducing the total cost of building ownership)? If none please indicate.

Our building method involves insulation and airtightness. Investing in these systems generally results in lower TCBO. Our method is proven and can be certified.

Would a partnership with other co-ops or nonprofits be acceptable to your stakeholders/board?

- (●) Yes
- ( ) No

What level of agreement would be required by your organization to create a partnership with other MSN stakeholders?

- ( ) Informal
- ( ) Contract
- ( ) Memorandum of Understanding
- (●) Incorporation of a new Co-operative

Please describe any other funding opportunities you are aware of that could be available to support the MSN or its goal? If none please indicate.

Federal Greener Homes Initiative, Efficiency MB programs, CMHC might have funding for "pilot" projects.

Other than the competencies/contributions identified in this survey, please describe any competencies/contributions that you think would be necessary for the success of the MSN?

Strong project management.

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Enabling First Nation Pension Access with Tenets of Cooperative Governance

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Abstract: As First Nations pursue self-government agreements, it is crucial to evaluate access to pensions for First Nations employees and members to foster economic stability and intergenerational wealth creation. Access to a pension plan and the reliable retirement income it provides yields benefits and outcomes that align with myriad objectives of nationhood, such as enhanced community well-being and inclusive economic development. This project aims to establish a theoretical framework for the cooperative self-governance of a pension plan for First Nations in British Columbia, Canada. The analysis presented in this essay focuses on how cooperative multi-partnering facilitates decision-making efficiency and economic access that aligns with the needs of individual members, employers, First Nations, and other partners. Its purpose is to provide information, rather than direct guidance, to Indigenous communities. It is the prerogative of First Nations, in harmony with their traditional values and cultural practices, to determine whether and how tenets of the cooperative model can offer practical solutions to address systemic issues affecting Indigenous Peoples. Importantly, this approach acknowledges and respects the sovereignty and agency of First Nations in shaping their own future.

John Horn is a graduate of the Master of Management, Co-operatives and Credit Unions program, Saint Mary's University. He is a senior people and culture leader in the Canadian non-profit sector, and he also co-founded and leads The Potentiality, a consulting firm that elevates the business case for building healthy and thriving communities in work and life. A fifth-generation settler, he lives in Victoria – on the unceded traditional territory of the Lekwungen peoples – with his wife and two boys.

This project reflects John's personal research and perspective; it is not endorsed by organizations within Canada's or British Columbia's pension ecosystem.

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Keywords: pensions, Indigenous self-government, multi-participant co-operatives, BC First Nations, pension plans

Introduction

First Nations citizens are more reliant on public retirement income, such as the Canada Pension Plan (CPP)[1] than all other communities in the country, including other racialized and historically marginalized groups. First Nations seniors also have less income than the total Indigenous average in Canada (Block et al., 2021, pp. 5-6). According to Statistics Canada, the current annual pension payment for Indigenous citizens living in First Nations is $32,574 per year, compared to $43,408 for White Canadians (Kei et al., 2019). Further, pension income accounts for nearly 25% of retirement income for First Nations citizens, compared to 14% for White Canadians (Kei et al., 2019). Such disparities arise from structural inequities and unique barriers to social, economic, and cultural inclusion that have made it difficult for Indigenous communities to achieve economic growth on their terms. Economic development in Indigenous communities requires a holistic approach that incorporates elements of culture, community healing, traditional practice, and empowerment.

Prior to the arrival of European settlers, Indigenous peoples practiced forms of government that reflected their diverse economic, social, cultural, and geographic needs (BC Treaty Commission, 2023). Today, in Canada, self-determination has become a central component of the ongoing process of reconciling with Indigenous peoples and addressing the past injustices of colonialism and the Indian Act[2]. Self-determination for Indigenous peoples means

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that they have the right to make decisions about their own futures and to participate fully in the political, social, and economic systems of the country. As part of self-government negotiations between governments and First Nations, new governance frameworks, institutions, and tactics for improving community well-being are being explored (First Nations Health Council, 2011, p. 3). Evidence suggests that there is not one over-arching best practice governance model that will replace the Indian Act, thus self-governing First Nations will introduce a variety of governance frameworks, such as the cooperative model, in the years ahead (Faille & Seaman, 2023). Allies of reconciliation need to remove numerous economic, social, and political barriers that impede economic development in Indigenous communities, including socio-economic marginalization (National Collaborating Centre for Indigenous Health [NCCIH], 2020, pp. 14-17).

The cooperative enterprise model enables democratic governance and member inclusion through its guiding principles and values. It aligns in many ways with the goal of improving socioeconomic, cultural, health, and environmental outcomes in First Nations, including through an employer-sponsored pension plan for employees of any First Nations' institutions. The Délįnę Got'ine Government is Canada's first Indigenous/public self-government, representing one government for all people of the community of Délįnę, Northwest Territories. The Nation's Chief Negotiator of the treaty, Danny Gaudet, noted how democracy and member-inclusion factored into decision-making for how environmental, cultural, and economic assets would be managed by the community: "...the beneficiaries will always continue to have direct say in control of the assets and moneys being managed and spent ... We will always work with members about what's happening with their money, we will always inform them that they get to make the decisions themselves" (Délįnę Got'ine Government, 2016).

The National Consortium for Indigenous Economic Development (NCIED) exists to "unite Indigenous, academic, community, government and business leaders to understand and foster the conditions for effective collaboration between Indigenous and non-Indigenous enterprises" (NCIED, 2023). Patrick Kelly, interviewed as part of this research, indicated that employer and community-funded pension plans represent an opportunity to help align the economic and social needs of First Nations in British Columbia (BC) with self-governance and self-determination.

There are strong connections between the cooperative model, Canadian public sector pension plans' mandate to administer pensions, and the economic needs of BC First Nations. By enabling tenets of the cooperative model through evolving their advisory services and cultivating partnerships with Indigenous communities, Canadian pension administrators can provide information to First Nations, such as pension plan optionality, governance models, and a scan of Canada's pension landscape, that might be used to create economic access through pensions for First Nations as self-governance agreements are negotiated across the province.

This essay explores the following research question: What tenets of the cooperative business model might enable First Nations' self-determination through pension access? It builds on existing research, policy, and business development options for pension plans and investment firms to co-create a First Nations pension plan within the existing ecosystem and policy frameworks.

Methodology

This project focuses on how Canadian pension administrators might navigate Indigenous autonomy as well as relationships with existing pension plans. Using a comparative analysis approach, the paper explores the differences between joining an existing pension plan versus First Nations forming and governing their own plan autonomously (as well as different pension plan and governance options within Canada's and BC's pension ecosystems). It relies on secondary sources and primary research by interviewing partners and subject matter experts. Interviews were conducted with Patrick Kelly of the First Peoples Group (February and March 2023) and Chanze Gamble, who is a graduate student and project coordinator with NCIED (April and May 2023). The approach blends various research strategies and theories grounded in intercultural understanding and Canadian colonial and Indigenous history.

As Ranjoo Seodu Herr notes, "the passion to resuscitate and reinvigorate their egalitarian and democratic nonliberal cultural values and institutions has been the primary driving force behind the movement by contemporary members of [I]ndigenous [P]eoples for their collective right to self-determination" (Herr, 2017). This said, existing pension plan governance models, such as the joint trustee model have the opportunity to evolve and enable principles like

democratic member control, independence and autonomy, and/or cooperation, which are reflected in both the cooperative model and many Indigenous governance practices (Dél̨nę Got'ine Government, 2016). As self-governing First Nations, like Tsawwassen and Dél̨nę Got'ine Government, seek greater control over their assets through enhanced democratic participation, aligning governance with the cooperative model has potential to foster democratic member control and resource optimization, reflecting pre-colonization communities' principles.

The First Nations Pension Conversation

An intersectional analysis of retirement income and savings in Canada published by the Canadian Centre for Policy Alternatives (CCPA) found that Indigenous seniors have less retirement security and higher poverty rates than white seniors in Canada. While public pensions, such as the Canadian Pension Plan (CPP) and Old Age Security (OAS), are available, these benefits were designed to be supported by workplace pension plans and individual savings and investments (Block et al., 2021, pp. 5-6). Public pensions account for almost half (47 per cent) of Indigenous seniors' income, with private pension sources providing just 25 per cent of income. Further, a much lower share of First Nations seniors (43 per cent of men and 37 per cent of women) draw upon registered pension plans and registered retirement savings plan (RRSP) income than do white seniors (70 per cent of men and 62 per cent of women). Further, those First Nations households that do contribute into registered pension plans and RRSPs make smaller contributions (up to 30 per cent lower), which typically equates to smaller benefits in retirement (Block et al., 2021, pp. 17-18). The share of the population in receipt of a Guaranteed Income Supplement (GIS) is another clear indicator of First Nations seniors' poverty. Greater than 50 per cent of First Nations men and almost 60 per cent of First Nations women receive GIS. In addition, the GIS amounts they receive are higher than for other Indigenous or white seniors, further indicating that First Nations seniors' other income is very low.

Pension access, as part of the nationhood discussions, aligns with the typical experience offered to employees of self-government institutions, such as municipal services, economic development agencies, and health and education providers. Such access would promote retirement security and bridge the gap between Indigenous and White seniors' retirement income. It could support many of the objectives and desired outcomes of nationhood and self-government. Access to a pension plan for First Nation employees could also provide additional legitimacy for the employer, as a registered pension plan is a valuable benefit for employees and employers. For employees, there could be tax savings (for Indigenous peoples not situated on a reserve), increased household savings, and improved retirement security. For employers, a pension plan could improve competitiveness and support greater recruitment success, retention due to increased employee satisfaction and commitment, and improved compensation efficiency (Canadian Centre for Economic Analysis, 2021, p. 7; RHN Chartered Professional Accountants, 2020).

Pensions can also improve community well-being, as they support economic development in communities and improved health and wellness for members and their households because a large portion of retirement income is spent in a retiree's local community. Access to a stable retirement income can mitigate adverse health and social impacts associated with poverty. Increased income and its relative stability can also make it easier for individuals to better meet their daily needs and provide for their families, reducing some of the mental health stressors, and improving retirement satisfaction (NCCIH, 2020, pp. 4-6). Institutional investors, like defined benefit pension plans, can contribute to the Indigenous economy through partnership with Indigenous people in key areas like procurement, capacity development, and direct investment in Indigenous businesses, projects, and Indigenous-led impact investing products and funds (like Raven Capital, Many Nations Financial Services, Impact Investment Fund, or the Indigenous Growth Fund). Improving access to capital and wealth sharing increases Indigenous equity participation in resource development and infrastructure projects, which significantly improves the socioeconomic status of Indigenous communities participating in those projects (Arjaliès et al., 2021, pp. 62-64).

As First Nations co-create tax policies that harmonize with federal and provincial tax legislation from a revenue-generating and legal perspective (Welters, 2023), there will be opportunities to co-design First Nations pensions with legislation that reflects the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) and Canada's Truth and Reconciliation Commission's (TRC) Calls to Action (2015) in order to create economic stability for employers and members.

Cooperation and Indigenous Self-determination

Many aspects of Indigenous self-determination intersect with a First Nations' pension plan that is autonomously (perhaps cooperatively) governed. The right of self-determination is enshrined in international law and is grounded in the principles of sovereignty, autonomy, and self-governance. In Canada, provincial, territorial, and federal governments must work as equal partners with Indigenous Peoples and communities to determine the governance and funding models that will work best in meeting their unique and diverse needs and priorities. All levels of government must be committed to and support, through policy and adequate resources, the development of Indigenous driven programs and services, regardless of whether these serve urban Indigenous populations or Indigenous Peoples who have negotiated self-governing agreements. Writing from a community health perspective, Halseth and Murdock (2020) argue that "while one model may be promising, Indigenous Nations across the country are unique and distinct, and therefore need to be creative in designing a control model that works for them" (p. 70). As Indigenous communities across Canada transition away from the Indian Act, they will identify their own priorities, address their own unique needs, and utilize governance approaches that reflect their own worldviews and community contexts.

The Government of Canada is working in partnership with Indigenous peoples to undo the systemically racist, colonizer-imposed systems of governance and administration in favour of Indigenous control and delivery. All levels of governments and non-Indigenous partners across all sectors are working with Indigenous peoples to facilitate the transition toward self-government, which is a "fundamental Indigenous right and principle of international law, as set out in the United Nations Declaration on the Rights of Indigenous Peoples" (Government of Canada, 2020). Negotiated agreements put decision-making power into the hands of Indigenous governments who make their own choices about how to deliver programs and services to their communities, which is evidenced in the Tsawwassen First Nation. The Tsawwassen First Nation's traditional territory is located across the Southwest coast of British Columbia and cuts west across the Salish Sea to Galiano Island and includes all Saltspring, Pender and Saturna Islands. Its territory continues northeast to include the Point Roberts Peninsula and the watersheds of the Serpentine and Nicomeckl rivers (Tsawwassen First Nation, 2023). The Nation's Members' Guarantees Act, which "…affirms the responsibility of the Tsawwassen government to deliver certain obligations to Tsawwassen members…" and "…can only be modified by a vote of at least 2/3 of Members voting in a referendum…" (Childs, 2023) reflects the type of decision-making by self-governing First Nations that better protects members' culture and language, lands, and economic potential by involving citizens in decision making.

From governing pension plans to community health strategies, Indigenous communities are evaluating models of governance that align with their values, cultural practices, and unique needs. Although most pension design and governance models will undoubtedly include partnerships between Indigenous and various levels of non-Indigenous entities, the multi-jurisdictional context of Indigenous Peoples in Canada will require Indigenous Services Canada, in partnership with First Nations, Inuit, and Métis Peoples and communities, to be creative in co-designing governance and economic models that work for them (Halseth & Murdock, 2020, p. 70). During an interview, Patrick Kelly of First Peoples Group noted the connections between generational wealth creation through pensions and the cooperative model "because the whole cooperative model is based on … people buying in with their membership and participating with sweat equity … There's a whole value system that plays out in the more mature cooperatives that is the equivalent of … the dividends that accrue out of a pension that you get every month."

Exploring Pension Access for First Nations

Aligning governance models with tactics for unlocking access to financial services is critical for Indigenous Peoples in Canada. Many Indigenous communities have faced systemic economic exclusion, leading to high levels of poverty, unemployment, and economic inequality. In response, the Canadian government has implemented several programs aimed at promoting economic development and financial inclusion for Indigenous communities; however, Indigenous peoples continue to face significant barriers to accessing financial services, particularly when it comes to navigating the complexities of the pension ecosystem (Block et al., p. 17). A significant challenge facing Indigenous peoples in accessing and controlling pension funds is the lack of culturally appropriate financial services. Across Canada, Indigenous values and practices differ significantly from those of mainstream financial institutions, leading to a lack of trust and understanding between Indigenous peoples and financial service providers. Additionally, many

Indigenous peoples may not feel comfortable discussing financial matters with non-Indigenous individuals, leading to a lack of communication, and understanding between these groups (Arjaliès et al., pp. 42-45). This challenge is compounded by the lack of pension expertise within Indigenous communities (across Canada and within BC).

Despite these challenges, there have been some positive developments in recent years that have aimed to promote Indigenous self-determination in the realm of finance and pension funds, such as the creation of the Aboriginal Financial Institutions, whose mandate is to "provide developmental lending, business financing and support services to First Nations, Métis, and Inuit businesses in all provinces and territories" (National Aboriginal Capital Corporations Association, 2021). This initiative has helped to promote economic development and financial inclusion in many Indigenous communities. The First Nations Financial Management Board (FMB) recognizes the need (and opportunity) to align the diversity of requirements, such as policy, environmental stewardship, cultural protection, economic development, and more, for Indigenous communities to achieve self-determination. In a recent request for proposal to consulting and financial services firms with pension expertise, the First Nations FMB is seeking to "address the investment services gaps faced by Indigenous governments, trusts, and institutions … [that] … require the same investment tools that non-Indigenous governments have to unlock the full potential of their investments" (Donaldson, p. 2).

Generally, the knowledge and capacity to create and administer a pension plan is highly specialized and scarce, and many Indigenous peoples may not be familiar with the legal and regulatory frameworks that govern pension funds or the tactics for administering pensions, which can make it challenging for them to navigate the system effectively. Self-governing communities, such as the Tsawwassen and West Bank First Nations, struggle to effectively resource responses to legislative changes from municipal, provincial, and/or federal governments, all of which must be harmonized with the constitutional, governance, and administrative frameworks of the nations' governments (Childs, 2023). One way that the Tsawwassen and West Bank First Nations mitigate their capacity risk is through membership in the Municipal Pension Plan (MPP), BC's largest public sector pension plan.

A pension plan that is controlled by First Nations, uses tenets of the cooperative model, is administered by a trusted partner, and benefits from the return on investment from a public sector investment management firm or an Indigenous investment firm represents an opportunity to co-design pension innovation and governance towards reconciliation across the pension and financial ecosystems within and beyond BC.

The Cooperative Model, Pension Governance, and Inclusive Innovation

If social innovation is meant to solve social problems and address unmet needs in ways that benefit society by creating new ideas, relationships, and forms of collaboration, then the cooperative business model might be brought to bear in service of First Nations' economic development through pension governance. Brett Fairbairn argues that "more than ever, we should likely look to women, non-Europeans, and members of different or minority cultures" because not only do innovators from these communities "[stretch] our concept of social innovation in a unique way", but folks from communities left behind and/or marginalized by the global economy represent the way forward for cooperative innovation (2017, pp. 426-427). Clark Arrington, cooperative pioneer, and innovator of Black economic empowerment, has co-created social innovation for historically marginalized communities using the cooperative model. Through initiatives such as Equal Exchange and the Federation of Southern Cooperatives, Arrington co-produced several novel solutions to the social problem of systemic racism and how it persistently limited (and limits) access to capital, legal support, and education for Black citizens (The Next System, 2019). Economic and political inclusion for Black Americans is perhaps the most gap-filled, conflict-ridden experience in the United States; Arrington is associated with this crisis and hardship because, among other achievements, he spearheaded one of the most culturally and socially integrated law firms in Mississippi to achieve political power through economic empowerment. Arrington favoured working outside of the economic system that evolved out of slavery; he tested and refined cooperative and micro-financing innovations by securing large amounts of capital through raising small amounts of capital from many social actors. Through the Federation of Southern Cooperatives, Arrington collaborated with Black as well as Hispanic and LatinX cooperatives to test, refine, and scale innovations in voting rights, access to housing, and economic development (The Next System, 2019).

In a Canadian cooperative context, the Amachewespimawin Co-operative Association has been operating for 40 years and is owned by members of the Lac La Ronge Indian Band on Treaty 10 Territory (Stanley Mission, Saskatchewan): “today, the retail operation employs around 40 people and has sales over $8 million annually, which is an amazing feat for an isolated community in northern Saskatchewan” (White, 2023). Many Nations Financial Services, which originated in Onion Lake First Nation more than 20 years ago, exists for the social and economic benefit of its Indigenous clients and member-owners and their social and economic wellness. The financial co-operative provides Indigenous communities and organizations with “affordable and culturally appropriate group benefits, including pensions” (White, 2023). Today, Many Nations represents Indigenous organizations across Canada and manages over $100 million in assets and their defined contribution pension plan is the largest Indigenous Multi-Employer Pension Plan in Canada. According to Many Nations, “the growing value of the plan translates into economic power, which we use to influence the pricing and investment decisions of our major financial business partners” (Many Nations, 2023). By aligning the cooperative model with existing and emerging Indigenous self-governance models, Many Nations is unlocking economic development for many First Nations by managing day-to-day administration and customizing investment solutions for members, displaying the cooperative difference.

Analysis: Pension Optionality

Pension access, particularly access to BC’s public sector defined benefit pension ecosystem, represents a viable tactic for addressing a variety of First Nations needs in alignment with the accountabilities of government and business that are outlined in the TRC’s Calls to Action (2015, pp. 5, 10). There are varied options for workplace retirement plans, including group RRSPs, defined contribution pension plans, target benefit pension plans, and defined benefit pension plans. Different advantages and considerations can be evaluated based on a First Nation’s goals. Several Canadian pension plans include First Nation employers as well as serve many Indigenous members. For BC First Nations, two prevailing options exist for enabling pension access in service of long-term socio-economic outcomes: to join an established defined benefit public pension plan or for a First Nation or group of First Nations to create their own.

A defined benefit (DB) pension plan is an employer-sponsored benefit plan that promises a fixed monthly benefit payment for life to employees in retirement. The amount of the benefit is generally based on the employee's salary, years of service, and a formula specified in the plan. The employer and employees fund the plan through contributions, which are invested to generate a return for the fund to help meet the pension promise. The plan also assumes the risk of investment losses and longevity risk. DB plans provide a predictable source of retirement income, which is generally inflation-protected. The risk of investment losses and inflation risk is borne by the plan, not the employee, and the employer ensures that the plan is adequately funded, which provides greater security for employees. DB plans also provide retirement benefits to survivors and disabled beneficiaries in the event of the employee's death or disability (Pension Solutions Canada, 2023). Establishing a government-backed, DB public sector pension plan for First Nations represents an opportunity to address precarious employment, limited capacity, and low financial literacy within Indigenous communities by leveraging financial capital from treaty negotiations (capital pooling) to fund a DB plan for First Nations employees (perhaps all members of the community).

A defined contribution (DC) pension plan is an employer-sponsored benefit plan in which an employee and/or employer make contributions to an individual account established for the employee. Many Nations Financial Services provides a DC plan for members (Many Nations, 2023). The value of the account at retirement depends on the contributions made, investment returns, and fees charged. DC plans are more flexible and portable than DB plans. Employees have control over their retirement savings and can decide how to invest the funds. DC plans are less predictable in retirement income than DB plans. The employee assumes the investment risk and longevity risk, which means the income is not guaranteed. Investment returns may vary widely due to market conditions, which could result in significant fluctuations in the value of the account. DC plans also may not provide benefits to survivors and disabled beneficiaries in the event of death or disability (Pension Solutions Canada, 2023).

First Nations might join an established public sector defined benefit (DB) pension plan for their employees. The plan’s fund, investment philosophy, and fund management are established; these plans have had years of returns on the contributions, experience weathering market downturns, an established relationship with their investment

managers, and potentially, dependent upon size, access to asset classes not typically available to smaller or individual investors (like infrastructure and renewable resources). Many of these plans have also made it a priority to address climate risk in their investment portfolios and already incorporate environmental, social, and governance (ESG) considerations in their investment decisions, which may align with a First Nation's values and/or focus. According to Kelly in an interview, the cooperative principle of member economic participation aligns with this approach because members are putting their "sweat equity" into pooled financial resources to create a greater benefit for all in the long term.

There are disadvantages for First Nations joining an existing plan, however, because, for example, there may be little to no ability to exert control or be represented in the governance and oversight of the plan. Indigenous perspectives in decision-making are dependent upon how the governance framework is structured. As a result, there could be a lack of values alignment on decisions. Further, this type of plan provides a generous benefit accrual formula that is close to the maximum allowed under the Income Tax Act. As a result, they can be expensive, with employer and member contribution rates of up to 22 per cent of salary combined because for each dollar contributed, the retirement income from a Canada-model pension is $5.32 versus $1.70 from a typical individual approach (Healthcare of Ontario Pension Plan, 2021, p. 5). Indigenous Peoples in Canada have a lower life expectancy than non-Indigenous citizens – these outsized "age-standardized mortality rates" are even more pronounced in on-reserve Indigenous populations. In Australia, Uncle Dennis, an Indigenous citizen, has taken the Australian government to court to lower the pension age for the country's First People, who are expected to live an average of 8.2 years less than non-Indigenous citizens (Human Rights Law Centre, 2023). According to *The Guardian*'s Adeshola Ore, Nerita Waight, Chief Executive at the Victoria Aboriginal Legal Service, believes that Australia will not meet its goal of reducing the life expectancy gap between Indigenous and non-Indigenous people by 2031:

> *"The gap in life expectancy is a direct result of decades of racist colonial policies," she said. "Lowering the age for Aboriginal and Torres Strait Islander people to access the age pension is a simple and practical measure that will meaningfully respond to the history and systemic discrimination that causes our people to die before their time." (Ore, February 20, 2023)*

In Canada, Indigenous citizens are expected to live 9.25 years less than non-Indigenous citizens, which underscores the need for existing pension plans to recognize that the impact of colonization has been internationally identified as a unique and fundamental social determinant of Indigenous health (Kei et al, 2019) and, consequently, that such analysis should inform calculations to adjust benefits accordingly for Indigenous members.

The second option is for a First Nation or group of First Nations to create their own pension plan that aligns with their unique values, affordability requirements, and needs. The advantages of this approach are that the First Nation(s) assert(s) control over the type of plan to offer, its structure, and how it will be governed. In addition to adhering to the cooperative principle of member economic participation, this approach aligns with the cooperative principles of democratic member control and autonomy and independence. River Select is an eight-First-Nations-owned cooperative based in Agassiz, BC. The co-op centralizes distributed fisheries, which creates efficiencies for member-owners and, by marketing a single brand, helps the eight fisheries enter markets that they would not be able to reach independently (River Select, 2023; White, 2023). River Select demonstrates a viable cooperative multi-partnering governance model for production and retail businesses, which highlights how the cooperative model might apply to other multi-participant governance structures within Indigenous communities, such as pension plan governance.

In deciding the plan's investment beliefs, asset allocation, investment manager, etc., the plan governors may be able to explore opportunities to invest in Indigenous businesses and participate in the economic development of First Nations. This approach would also enable partnership with and utilization by members of trusted financial institutions, which avoids issues around lack of trust with these bodies. During an interview, Kelly discussed the example of Ron Jameson, a member of the Mohawk Six Nations, who built an incredibly profitable lending portfolio with BMO because, intimately familiar with the nuances of Indigenous politics in Ontario and Quebec and understanding how the Indian Act limited bankability for Indigenous citizens living on reserve, he lent financial capital based on trust and Indigenous traditional economic practices. Allied partners in a First Nations pension plan

would have to understand such practices and be willing to act as allies to First Nations seeking to change the system to benefit Indigenous practices and points of view. For a defined benefit or target benefit pension plan, the plan's contribution requirements are based on the specific membership demographics and life expectancies. Depending upon the plan design options and membership profile, costs could be higher or lower than costs associated with joining an existing pension plan.

In an interview, Chanze Gamble, a member of the NCIED pension access project, said that *how* a pension plan "works" – its design and requirements for capital, knowledge and expertise, administration, governance, and investment oversight – represents a major deficit in the collective capability of Indigenous communities and their partners to co-design, co-create, and sustain a First Nation pension plan (let alone establish a model that is replicable and scalable). Gamble noted that operating requirements such as startup costs, marketing and business development, and costs associated with going to the public and attracting the number of pensioners needed to enable the fund to be maintained and the plan to be administered present an untenable capacity draw for most First Nations. He highlighted the many questions about capacity that must be addressed to achieve something that "has never been done before" in BC's pension ecosystem.

There is administrative complexity and oversight in the set-up of a plan and its ongoing management, and pensions are subject to a complex regulatory framework. Industry expertise is available to support plan sponsors to set up such plans and in the day-to-day administration of the plan and investment of the fund. In addition, establishing a first of its kind pension plan for First Nations will require an extensive process, including regulatory approvals, seed capital to finance the plan, and expertise to design and register the plan. The plan sponsors would select service providers (legal counsel, administrator, investment agent, custodian [fund holder services], actuary, etc.) to assist in the design, registration, and implementation of a new plan. According to Kelly, partners working with First Nations to co-create a pension plan must make decisions based on a shared understanding of values and principles. Today, financial systems are controlled by influences that are not Indigenous, so pension partners must work to authentically link values and principles in the products and services they build, such as directly investing in activities that raise Indigenous life-expectancy in Canada, as well as calculating pension access in the context of the impacts of colonization. Several details need to be agreed upon, including the type of plan and its design (costs, whether employees will contribute, inflation protection, early retirement provisions, etc.), and the plan's text, board resolutions and trust agreements need to be created. Should First Nations decide to co-create an Indigenous-led plan, there will need to be an evaluation of the type of pension plan that can be formed.

First Nations considering the creation of a pension plan will need to evaluate the greater security and predictability of retirement income provided by DB plans against the flexibility and control over retirement savings offered by DC plans. DB plans carry more risk for the employer than DC plans; however, DC plans provide less predictable returns. Ultimately, the goal of any employer-sponsored pension plan is to provide retirement benefits that meet the needs of employees and ensure their financial security in retirement, which, when combined with the accountability of governments to answer the call of reconciliation through fiscal policy co-development between First Nations and the Canadian government, suggests that First Nations might join or co-create a DB pension plan within the province's public service in order to "renew the fiscal relationship with Indigenous peoples based on respect, co-operation and partnership" (Government of Canada, 2020).

Analysis: Cooperative Governance Optionality

Building on the nineteenth- and twentieth centuries' legacy of colonizing Indigenous Peoples, the early twenty-first century is witnessing the erosion of work through the ballooning of the low wage service sector jobs, economic inequality, and the crumbling of worker rights. Economic actors have the opportunity and the responsibility to address such social inequalities and systemic racism to co-create the allocation, distribution, and valuation of social, economic, environmental, and cultural capital with Indigenous partners. In addition, inclusive companies that manage ESG risks and improve outcomes for Indigenous Peoples are better investments for governments, public sector investors, and shareholders operating in financial markets (Gompers & Kovvali, 2018).

Participants in the solidarity economy, such as municipalities, credit unions, public sector pension funds, and First Nations, represent many marginalized citizens who are relying on public pensions as their primary source of income

amidst an affordability crisis. Public sector pension plans exist because of the human and financial capital from plan members and employers, which is why plan governors, trustees, might work with First Nations to offer something that all partners in reconciliation can wholeheartedly embrace, which is affordability and generational wealth creation (Scholz, 2016, p. 2; Block et al., 2021; King, 2021, pp. 38-39). From a local (or regional) perspective, Canada's key societal challenges, such as affordable housing, secure and sustainable jobs, and increased local resilience, can be addressed through what Bird et al. (2021) call "capital anchoring" (p. 3) – local governments, educational establishments, pension funds, and health services can invest in people, services, and infrastructure that are designed to serve First Nations for decades by anchoring capital in their communities. There is room for a great many more enterprises to support meaningful employment, deliver needed services, reduce the cost of access to high quality goods, and promote democratic values and principles in BC (Del Bianco et al., 2018). Within the cooperative ecosystem, a reasonable case can be made for pension plans – administrators and investors – to be a player in the solidarity economy that applies member-led innovation to its strategic direction, administrative operations, and influence of various industry partners. There is the potentiality to co-create a more democratic, member-centric governance by bringing tenets of the cooperative model to a First Nations pension plan.

The Cooperative Governance Model

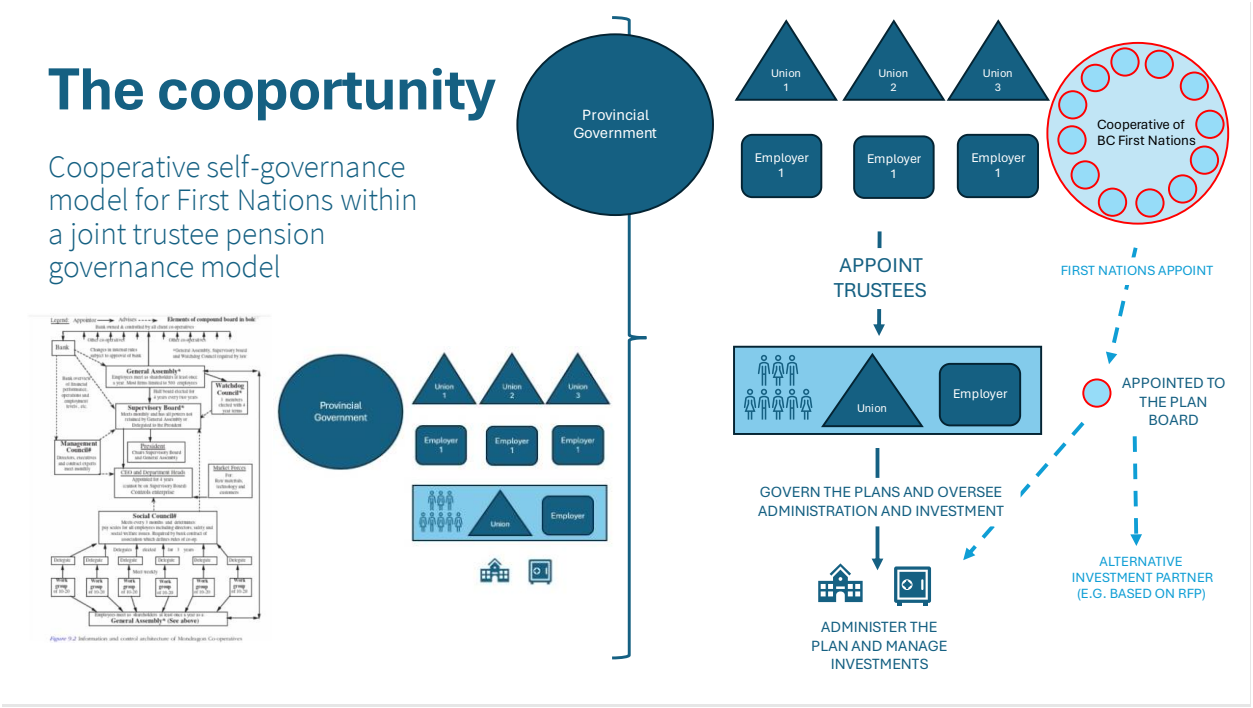
Self-governing First Nations like Tsawwassen and Délıné Got'ine Government are seeking more control over their current and future assets. Enhancing democratic participation creates trusting and innovative relationships between organizations and participants, such as members, employers, and community partners.

Sonja Novkovic and Karen Miner (2015), note that governance health in member-led organizations is important to evaluate with all participants: "governance rules are decided by the members, revisited on a regular basis, and are familiar to all members. In a situation in which the membership is not involved in governance matters, the risk of having a minority controlling the resources, taking decisions, and wielding illegitimate power is high" (p. 16). Further, they suggest that polycentricity and/or multi-participant governance of cooperative organizations also bring to life independent conflict resolution mechanisms, small group coordination, linked member and employee feedback systems, and diverse representation across multiple organizational bodies (Novkovic & Miner, 2015, pp. 19-20), which align with many aspects of Indigenous governance:

> *…governance is 'the way in which a people live best together' or the way a people has structured their society in relationship to the natural world. In other words, it is an expression of how they see themselves fitting in that world as a part of the circle of life, not as superior beings who claim dominion over other species and other humans. (Ladner, 2003, p. 125)*

Multi-partnering enables opportunities for efficiency in decision making and economic access, which is reflected in Figure 1, a model that hypothesizes how the needs of individual members, employers, First Nations, and other partners might be met by adopting a multi-participant approach to pension plan governance. Based on the membership and governance structures of many public sector pension plans participants—such as the corporate board of directors, trustees from plan boards, investment and benefits partners, and plan members— we can imagine how the various players in the model might represent plan members, plan governors, industries, and sectors, and/or government partners in a multi-participant governance model.

Figure 1: Potential First Nations Pension Plan Governance Structure(s)



(Horn, 2023)

If not a multi-participant governance model, then introducing elements of cooperative governance to First Nation pension plans would see Indigenous plan members and their partners re-imagine ownership, control, and benefits to meet current and emerging needs within their cultural, social, and economic practices and values (with an opportunity to invest in regenerative infrastructure). Giving more members more control could foster collaboration across bands, nations, as well as with non-Indigenous partners (e.g. procurement of goods and services, knowledge-sharing, talent-exchanges, capital pooling, etc.) as represented in Figure 2 (Birchall, 2017, p. 172).

Figure 2: Typology of Firms

Table 9.1 Typology of firms discussed

Type of firm	*Conventional mutual*	*Investor firm*	*Stakeholder mutual*
Ownership	**Homogenous** For example: Workers OR Suppliers OR Customers	**Homogenous** For example: (a) Government OR (b) Family OR (c) Publicly-traded	**Diverse** With: Workers AND Suppliers AND Customers
Control	**Centralised** (Unitary board) △	**Centralised** (Unitary board) △	**Distributed** (Compound board) ◔
Governance form	**Hierarchical, associative** and product **markets**	**Hierarchical** for government firms (a) **Markets** and **hierarchical** for private firms (b) and (c)	**Associative** plus **communities/clans** and internal political **markets** for influence and control with external product **markets**

(Birchall, 2017, p. 172)

A cooperatively governed First Nation pension plan has the potential to catalyze the cooperative movement in BC by influencing partners to rethink their enterprises, which would start with rethinking and reorganizing our First Nation enterprise in the following ways:

- Trustees and/or plan board members within various pension ecosystems (educate trustees representing plan boards who oversee governance of plans on the cooperative enterprise model, financial and retirement literacy, and multi-participant cooperativism to facilitate collaboration – *and cooperation* – with the First Nation plan while building capabilities and knowledge in the province)

- Enterprises outside of the First Nation(s), such as pension plan administrators, investors, governments, service providers, and values-aligned partners can join the cooperative as members by successfully completing an "ethical principles of pension management" evaluation and purchasing membership shares that are ratioed based on the size and structure of their organization)

- Participant Councils, Community Circles, and Work Groups (adopting aspects of the Mondragon governance structure highlighted in Figure 1 (left side), will elevate the employee voice across thousands of employers and localities as well as diversify and distribute power, knowledge, and decision making).

The cooperative model provides a structure where pension plan trustees, employees, and employers collaborate to manage pension investments. It involves the creation of a separate entity for the fund made up of trustees representing the interests of the pensioners, employees, and employers, who share in the responsibility of the fund. Kelly described in the interview that cooperative models are known for their participatory approach, with participants being actively involved in the decision-making process, which aligns with many traditional Indigenous governance practices. This awareness of shared decision-making incentivizes participants to be more accountable and take decisive action when necessary.

Trustees are required to act in the best interest of the beneficiaries to the trust. Trustees are usually selected to represent the interests of the beneficiaries and are not necessarily linked to any group of participants. They are usually selected based on their knowledge and expertise in investment management, corporate governance, and accounting. The joint trustee model is sometimes criticized for lacking accountability and transparency; however, proponents of the model argue that it enhances collaboration and transparency because it represents both member and employer interests. Because decision-making is limited to a small group of participants, the fund's investment decisions, while legislated to reflect the best collective interests of the members/beneficiaries, may not always reflect the collective interests of plan members, leading to possible misalignment of interests.

The cooperative model promotes participant involvement, which leads to increased transparency, accountability, and improved performance through ownership and democratic practices. Furthermore, the cooperative model allows for a well-rounded board that reflects the plan's diverse needs, values, and goals. While trustees act on a cooperative basis to make decisions in the best interest of the beneficiaries/members, joint trustee models may also result in a board that is more narrowly focused and lacks versatility or what Turnbull refers to as "unitary-governance" (Turnbull, 2001, p. 176). The cooperative model, from my perspective, can adapt to both DB and DC plan options by aligning principles of knowledge and learning with autonomy, democratic control, and care for the community beyond plan participants. Ideally, this will empower both individuals and employers to take responsibility for retirement planning because everyone is an owner of the experience and its ripples through generations. A Délı̨nę member interviewed for a documentary about the Nation's self-governance journey shared that "it will be nice to die peacefully without worrying about our kids" because education, healthcare, environmental stewardship, economic development, and many more elements of community-building would be overseen by the Délı̨nę Got'ine Government (Déline Got'ine Government, 2016). This aligns some cooperative principles, such as member economic participation and concern for community, with the fiduciary responsibility of pension plans' trustees and other governors to secure the greatest rate of return for their plans and members.

Conclusion: the pension governance cooportunity

Existing to serve the public good, Canadian public sector pension plans represent a significant opportunity for the cooperative movement to advance humanistic business models by enabling First Nations to adopt tenets of the cooperative business model in their governance of pension plans. The ripple effects of coherent governance within one of Canada's most innovative, trusted, and efficient pension ecosystems, such as the one in British Columbia, could see such tenets of cooperativism scale to other aspects of Indigenous and non-Indigenous governance as multiple First Nations seek new governing arrangements.

Pension plans, with emphasis on a DB or targeted plan that guarantees a specific amount of retirement income for historically marginalized members, represent a socioeconomic stabilizer and generational wealth creator for First Nations. The fastest growing baby boom in the country is the Indigenous workforce. It has grown 42 percent in the last decade with a population of just over 1.5 million people. Indigenous Peoples are generally more connected to community and are a stable source of local talent for First Nations (Arjaliès et al., 2021, pp. 6-7, 30-31). Today, a smaller share of Indigenous households contributes to pension plans or RRSPs than white households (up to 16 per cent lower for First Nations households), and those who do make smaller contributions (up to 30 per cent lower for First Nations households) (Block et al., 2021, p. 18). Overall, racialized households are less likely to have members in pension plans compared to white households and this is more pronounced among Indigenous populations, where seniors have less retirement security and higher poverty rates than white seniors in Canada. The Indigenous poverty rate, at 21.5 per cent, is higher than the 13.7 per cent for white seniors (Block et al., 2021, pp. 16-18). The gender income gap is consistent across all groups studied, with senior women having a lower income and a higher poverty rate than senior men. Public pensions (CPP, OAS, GIS) account for almost half (47 per cent) of Indigenous seniors' income, with private pension sources providing just 25 per cent of their income. The share of the population in receipt of GIS is a clear indicator of First Nations seniors' poverty. Greater than 50 per cent of First Nations men and almost 60 per cent of First Nations women receive GIS. In addition, the GIS amounts they receive are higher than for other Indigenous or white seniors, further indicating that First Nations seniors' other income is very low. A much lower share of First Nations seniors (43 per cent of men and 37 per cent women) draw upon registered pension plans and RRSP income than do white seniors (70 per cent of men and 62 per cent of women) (Block et al., 2021, pp. 15, 23-24, 34-36). Investing in a First Nation pension plan would provide capital for long-term retirement savings for Canada's fastest growing workforce as well as stabilize precarious security for Indigenous people who are reeling from the trauma of colonization while heading towards retirement in the next decade.

Fundamentally, pension access is about providing retirement income, and there is literature around economic development and how increased income derived from such activities leads to better health outcomes for Indigenous people. Increased employment and income from economic development can make it easier for individuals to better meet their daily needs and provide for their families, reducing some of the mental health stressors (Healthcare of Ontario Pension Plan, 2018, p. 39). Economic development can bring much needed improvement to socio-economic conditions in Indigenous communities, which can help mitigate the adverse health and social impacts associated with poverty (Curry et al., 2016; Tedmanson & Guerin, 2011; Vining & Richards, 2016 in NCCIH, 2020, pp. 5-6). Further, "the transmission of the social values that are fundamental to the maintenance of vitality and cultural continuity in Indigenous communities… is dependent on the values, needs and priorities of the communities themselves" (NCIIH, 2020, p. 6). Consequently, institutional investors, including defined benefit pension plans, have been challenged to use their voices and capital to promote positive economic outcomes for Indigenous people through their investment choices, principles, and governance. In addition to inclusion of Indigenous perspectives in responsible investing policy and practice and ESG reporting, institutional investors can, as part of their responsible investing strategies, contribute to the Indigenous economy through partnership with Indigenous peoples in key areas like procurement, wealth sharing, capacity development, and access to capital (Arjaliès et al., 2021, p. 19). Further, improving access to capital and wealth sharing increases Indigenous equity participation in resource development and infrastructure projects, which significantly improves the socioeconomic status of Indigenous communities participating in those projects. The decisions that focus the attention of investing partners from government as well as the private and public sectors will more accurately and equitably represent the needs and interests of First Nations when pension plans are governed with tenets of the cooperative model.

By co-creating a First Nations Pension Plan, collectively owned Indigenous corporations, co-operatives, or other business ventures that are guided by Indigenous worldviews, have the potential to result in better socio-economic outcomes than extractive, colonial models of governance represented by the Indian Act and neoliberal economic policies. Tenets of the cooperative model, such as independence and autonomy, member economic participation, and concern for community, reflect how integrating cooperativism into self-governance might better incorporate the community's values and address community needs and preferences regarding social, economic, cultural, and environmental benefits (Curry et al., 2016; Tedmanson & Guerin, 2011; Vining & Richards, 2016 in NCCIH, 2020, p. 1). According to Kelly, "…if the cooperative pension movement evolves to a greater level in British Columbia, I think it's going to be driven to a certain extent by Indigenous Peoples because I think their traditional value system resonates more with a cooperative system than with [the existing] pension system" (2023). Enabling and supporting tenets of cooperativism in First Nations pension governance will send ripples through the pension, Indigenous, public sector, and common good networks of BC and Canada. Ideally, aligning the cooperative business model with Indigenous self-governance through pension plan administration will showcase a powerful tool for economic empowerment, social cohesion, and cultural preservation among Indigenous communities. By co-creating governance and socioeconomic modes based on traditional Indigenous values and practices, cooperativism can help achieve social, economic, environmental, and cultural goals because the model is deeply rooted in community-based decision-making, equitable distribution of resources, and collective ownership, all of which align with Indigenous values of openness, respect, and collaboration.

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Notes

[1] See Appendix for definitions of pension terminology used in this paper.

[2] The Indian Act drove Canada's record of colonialism through abolishing Indigenous governance and relationship with the land, initiating and sustaining residential schools, using forced assimilation as a strategy of cultural genocide, and disempowering Indigenous peoples’ and First Nations’ capacity for creating and controlling financial wealth.

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Appendix

Pension terminology

Registered Pension Plans (RPPs): A pension plan registered with Canada Revenue Agency and a provincial regulatory authority. It is an arrangement by an employer or union to provide pensions to retired employees in the form of periodic payments. They provide tax deductions for employer and employee contributions, and tax-sheltering on contributions and investment earnings until benefits start being paid.

Defined benefit pension plan: An RPP that provides a guaranteed retirement benefit based on an established formula, which is typically based on factors such as age, earnings, years of service, and the plan's accrual rate. An accrual rate is the rate at which a pension benefit is accrued as pensionable service is completed and is often expressed as a fraction or percentage of pensionable salary (i.e., 1/60th or 1.67 per cent) for each year of service.

Defined contribution plan: An RPP that specifies the employee's (if applicable) and the employer's contributions. Members' retirement benefits are provided from accumulated contributions plus the return on the investment of those monies.

Target benefit pension plan: An RPP that blends elements of defined benefit and defined contribution pension plans to provide a pension at retirement based on an established formula, but which the benefit amount can change depending on the plan's funded status.

Group Registered Retired Savings Plans (Group RRSPs): This plan is generally a collection of individual RRSP accounts administered as a group, often with employer matching contributions up to a certain level. Participation is often option for employees.

Old Age Security (OAS): public pension funded form general tax revenues. Eligibility is based on residency, not employment history or need. The pension earned is 1/40th of the maximum monthly amount for each year of residence in Canada. The maximum monthly OAS amount for 2022 is: $685.50 for persons aged 65 to 74, and $754.05 for persons 75 and older.

Guaranteed Income Supplement (GIS): an additional monthly payment for low-income seniors who are receiving OAS. It is income tested at the family-level and intended as an anti-poverty measure. The maximum monthly GIS payment in 2023 is: $1,023.88 if you are single, widowed, or divorced and your annual income must be less than $20,784, or $1,023.88 if you have a spouse or common-law partner, they don't receive OAS, and household income is less than $49,824.

Canada Pension Plan (CPP): monthly retirement pension available to most employees and self-employed individuals in Canada outside Quebec. Membership is transferrable from job to job and is indexed to inflation.

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MICHIO KAKU, QUANTUM COMPUTERS, AND CO-OPERATIVISM: A POLITICAL AND PHILOSOPHICAL BOOK REVIEW by Dr. Peter Davis

Michio Kaku. (2023). *Quantum Supremacy: How the Quantum Computer Revolution Will Change Everything*, Doubleday, New York. ISBN 978-54836-6

Introduction: Why Quantum Computing Ought to be of Concern to Co-operators

This book has already received rave reviews in the USA from the *Wall Street Journal*, *The Christian Science Monitor*, and *The New York Times* and in the UK from *The Independent*. It has no doubt received many others, perhaps more measured, in scientific journals unfamiliar to the author of this review article. I am also aware of some pretty hostile criticisms in websites. Perhaps more important is the reality that I am not a physic professor so how can I comment. The answer here is simple, the book was written for people like me. So, I feel that gives me the right to review it. Still the book may at first glance seem an odd selection for our journal with its focus on the International Co-operative Movement's Accounting and Management practices. But that would be to ignore the author's claim in his book's title that its topic *will change everything*. The book's scope and claims suggest that it is a book that leaders and researchers engaged with the world's 1.2-billion-member co-operative movement should be aware of. It also raises important questions about why scientists, who for the most part seem to be humanistic in their values, whatever aspect of their scientific endeavour, do not engage more with our movement, and why our movement does not engage more with science and scientists.

Ricardo argued in his debate with Malthus that 'human ingenuity' would overcome nature's limitations and that, as a result, endless growth of capitalism was possible. I think Professor Kaku would agree. Indeed, Professor Kaku refers to the debate in his book (Kaku, 2023, p. 127) and I will return to this later in the review. But my immediate question is, could not human ingenuity be also as great a service to those who want to establish a different economic order? I have argued that one of the most critical defeats in the co-operative movement's history was the loss of control of the Mechanics' Institutes by the ejection of their founding members, which meant working class organisations lost control of technological innovation. Yet education has always been central to the co-operative agenda from its foundations up to today. The Mechanics' Institutes, founded in the 1840s supported by the English Labour Economist Thomas Hodgskin, tried to retain access to the development of technology and the science behind the new technology for those craft workers like the Millwrights and others across the membership of the Amalgamated Society of Engineers and other industries (Halevy & Elie, 1956, p. 87).

Co-operation is above all about mobilisation of the working people's labour power by hand *and by brain* for human freedom by releasing the worker from dependency on capital. Scientific innovation surely should be seen as a potential tool in support of that cause. However, as David Ricardo discovered in his third edition of the *Principles of Political Economy and Taxation* (1821), technology could increase the wealth of owners of capital at the same time as diminishing the returns to labour. Today's polarized society and the diminishing returns going to wages as opposed to profits suggests this continues to be the case[iii]. A report in *Time* Magazine (Hanauer & Rolf, 2020) presents the facts most starkly, reporting that in the USA in the period between 1975 and 2020, the top 1% of America's wealthy took an extra $50 trillion from the poorest 90% of the US working population. It notes:

> *That is an amount equal to nearly 12 percent of GDP—enough to more than double median income—enough to pay every single working American in the bottom nine deciles an additional $1,144 a month. Every month. Every single year.*

This situation became urgent much earlier than 2020. The Industrial Revolution was driven by technology which either replaced or deskilled labour and in the new factory system also disciplined and organised the intensity with which the labourer worked. Technology ensured the owners grew richer while those living by the sale of their labour became poorer. The founding of the 1844 Co-operative Society in Rochdale arose from unemployed weavers in what historians have called "the hungry 40s" (Cole, 1953, p. 145).

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The labour market impact of the quantum revolution, like its digital and steam-based predecessors, is likely to continue the deskilling or replacing of people in today's labour market. At the time of the earlier Industrial Revolution, Adam Smith's Labour Theory of Value, itself quite distinct from that of Ricardo and later Marx, held, as all classical economic theories did, that Labour could independently generate value. The co-operative movement was grounded in this idea as it became the most successful response to the traumatic changes brought about by the Industrial Revolution. Other notable failed responses included Luddite machine wrecking, Chartism, Anarchism, and Communism. I have argued elsewhere that trade unions are in fact a form of co-operative (Davis, 1989 and 2021). The incremental capital accumulation through associations of labourers' small savings or donations could, when combined with their collective labour's ability to add value, enable workers to develop their own wealth and autonomous democratic communities without expropriation or revolution. Whilst this proved to be the case in many different contexts across the last two centuries, co-operatives have always been behind capitalism in terms of their growth. This can be almost entirely due to capitalism's ability to harness new technological innovations for the expansion of capital and the replacement of labour. This loss of connection between science and technology and highly skilled labour commenced with the loss of control of the Mechanics' Institutes. The opportunity for the associations of labour to innovate and incorporate innovation into the economy of labour was lost at the very beginning.

Thus, despite many successes the co-operative movement has always been left behind. Scientific innovations were invested in by entrepreneurial capitalists and developed into industries providing for huge capital accumulations and, between slumps, large numbers of relatively well-paid jobs. The motor and chemical industries which commenced in the late 19th century continue to produce many new products. Biotechnology and Information, Communications, and Technology's (ICT) are driven by ongoing scientific revolutions and are testimony to co-operative failure to innovate, provide employment and accumulate capital as fast as the capitalist sector has. There are those economists and politicians who point to the improvements in living standards and health care arising from scientific innovations as justification for capitalism. Born in a single room accommodation in 1940s post war Britain, I have lived through the greatest improvement in English working-class living standards ever recorded. By the early 1950s we were living in a house being bought on a mortgage. Most of the rooms remained empty at first but gradually filled up with furniture, radios, TVs, fridges, and record players. All the result of science I do not doubt Professor Kaku would want to remind us. But my father worked 12 hour shifts six days a week and my mother worked full time five days a week to pay for it all.

One huge benefit of science was the increasing health care which they only contributed to indirectly through taxation thanks to the British National Health Service. I became, not consciously of course, but experientially, a socialist and a co-operator in those 1940s-50s days of my early socialisation. Why not an advocate of capitalism and innovation? Because as a child I came into an empty house - full of things but not of love. Just two exhausted people arguing about money who had little energy for each other let alone me. Of course, I loved the TV and the record player, and I was saved from many diseases that killed or crippled previous generations. Thanks to the concept of Mutually Assured Destruction, the cold war remained cold making me the first generation in three not to have to fight in a war. I was free of rickets and other diseases of poverty. But this was not only the result of science but also because a socialist government ensured my access to the benefits of improved healthcare and continued food rationing and fuel rationing as our economy and society recovered from the war. Why cannot science and scientists serve the cause of social democracy? And why is the single biggest global force for social democracy—the co-operative, credit union and trade union movements, which are all member based, democratically governed, and service led organisations of labour—not reaching out to science?

Instead, science has served capital and increasingly in its most monopolised libertarian model. The rise of the giant firm was seen as a threat to the market system from Alfred Marshall and successors like Joan Robinson right up to the institutional economists of the 1960s, 70s and 80s. The characterisation of the dual economy model presented by Averitt in the sixties and revisited by him in a published paper in the eighties is even more pronounced today (Averitt, 1987; also, Munkirs & Knoedler, 1987). The giant firms and core economy look very different from Averitt's time, but technology still dominates the core economy - it's just a different technology. This technology has arisen out of the discoveries of the new physics and Professor Kaku gives us a fascinating account of this evolution in scientific understanding and technological advancement. My point here is we need to ask why the co-operative

movement's leadership and academics focused on the co-operative economy and values have been very much on the sidelines, reacting to rather than encouraging technological innovation and ensuring a more equitable distribution of the wealth and utilitarian benefits innovative products and technologies have produced.

Professor Kaku's Analysis Part One: The Rise of Quantum Computers

According to Professor Kaku, the Quantum Theory is about to turbo charge a revolution in computing. Should these claims fill us with optimism or dread? Today, the ICT revolution, despite its many new products services and possibilities, has driven the polarization of wealth and the concentrations of economic power to new heights. The resulting exclusion and marginalisation of so many has led to a situation in which his Holiness Pope Francis has labelled the current global economy "an economy that kills" (Pope Francis, 2013, paras 52-53, p. 45). So, what are the chances that Professor Kaku's claim that Quantum Computing will change *everything,* including changing the current global economy to an economy that nurtures and includes, is likely to be realised?

Let me first try to reproduce in outline what are several early chapters explaining the development of the new physics and the application, still in its infancy, of Quantum Theory to computer technology and artificial intelligence (AI). Professor Kaku presents a fascinating history of computing starting back at the Bronze Age with a device constructed somewhere in the Ancient Greek Mediterranean between 150- and 100-years BC with 37 gears whose combinations could predict celestial movements covering the sun, moon and the number of planets that were visible to the ancients at that time. Nothing was created, as far as we know at least, that excelled this Bronze Age computer in sophistication as a computing device until Charles Babbage's invention in the 19th Century. Professor Kaku's historical narrative will be welcomed in co-operative circles where, in places, he reminds us of important contributors who sometimes are left out of the account, like Ada Lovelace who helped Babbage develop the capacity of his mechanical computer by creating instructions to guide its motions thus becoming the world's first computer programmer (Kaku, 2023, p. 27). Professor Kaku's account of the historical development of computing also draws attention to the dreadful treatment of the British scientist Alan Turin who played such an important role in breaking the Nazi coding device in the 2nd World War and supporting other innovations but remained uncelebrated and finally was destroyed because of his gay sexuality.

It had been thought, at least among the more positivistic and determinist philosophers since the ancient Greeks that mathematics could solve any problem once the problem was set in computable terms. However, once Professor Kaku's historical narrative on the development of computers reaches the 1930s, we find a young Austrian mathematician, Kurt Gödel, who proved that it was impossible for mathematics to prove all true statements. Thus, the material world turned out to be "messy and incomplete" (Kaku, 2023, p. 29). Alan Turin took a different approach and asked whether *a computer* could prove everything. Turin's processor reads as a tape—conceptually infinite—consisting of a series of squares or cells with three options 1, 0, or blank. The processor reads the tape and can make just six operations on it:

1. Read the number in the square.
2. Write a number in the square.
3. Move one square left.
4. Move one square right.
5. Change the number in the square.
6. Stop.

Apparently, this seemingly simple set of manoeuvres enables one to encode all of mathematics (Kaku, 2023, pp. 30-33). When Turin used the computer to test Gödel's proof however, *he came to the same result*. Babbage's computer, Turin's Bombe Computer, and the Nazi Enigma Computer were analogue computers but in Turin's case, instead of gears and cogs, Bombe relied on rotas, drums and relays powered by electricity. Turin was also involved in the next development, the *Colossus Project*, creating the first programmable digital computer using electrical pulses down vacuum tubes. Professor Kaku's sense of redressing wrongs comes to the fore here as he recounts that Turin's work was estimated to have shortened the war by two years saving around fourteen million lives simply by out manoeuvring the enemy. Yet he was never celebrated, and his work was kept secret for years. On the other hand,

Professor Kaku notes, Oppenheimer's work brought the war in the Pacific to an end by wiping out two cities of no military significance. Yet the American Oppenheimer was celebrated as a war hero (Kaku, 2023, p. 35).

In various places, Professor Kaku interrupts his narrative with engaging references to antiquity and mythology. For example, although I had read of Pandora and her fabled ill-fated box, I had not realised that she was in fact a robot invented by the mythic god Vulcan (Kaku, 2023, p. 180). Perhaps there is an allegorical truth here. If intelligent robots even when invented by Greek Gods can lead to disastrous consequences, perhaps mere mortals would be wise to hesitate before rushing ahead with AI, which is essentially a computer programme that can learn independently of human intervention. AI is still in its infancy and yet it is being widely introduced. The awesome power of contemporary technology to collect, store, analyse and communicate is now well established and generally understood in principle by the public. The threat it poses both in increased vulnerability of our services to hacking and cyber disruption and to individual privacy is also becoming clearer. The economic model of platform capitalism has used the new technology effectively to track our locations and purchasing decisions generating billions of individual profiles. I would have thought the right to privacy should be a human right but science and technology when applied by economic and political power structures do not appear overly concerned with this question.

I had not realised until reading Professor Kaku's account of transistors that the silicon microchip is made of billions of transistors (a semiconductor that can switch on and off) (Kaku, 2023, pp. 59-61). So digital computers compute at great speed using either 0 or 1. There are limits, however, which come about due to the instability of the process when the atoms come into too close a proximity. At this point, Heisenberg's 'uncertainty principle' kicks in (Heisenberg, Professor Kaku recalls, was a German physicist who led the Nazi Atomic Bomb programme). Thus, there is *a limit* on the computer capability based on the silicon microchip. Professor Kaku (2023) sees this limitation as heralding the end of the 'Silicon Age' and the dawning of the 'Quantum Age' (p. 62). But does it? Professor Kaku, in the best Ricardian tradition, looks to human ingenuity to come up with a technology giving even faster and bigger calculative power. But do we (humanity) need it? The silicon chip has given humanity unbelievable capacity for scientific development. But it has come at a cost in terms of the economic and political potential for the exercise of power by small elites and even individuals. Small elites today have enormous control over the rest of us and a real possibility of subverting democratic governance. The concern expressed in Vance Packard's book, *The Hidden Persuaders (*1957), has been realised to a degree that Packard would have found unimaginable in the 1950s. Organisations like co-operatives who pride themselves on their principle of democratic accountability have always seen the big challenge being member apathy but today there may be a more sinister challenge to the ideal of democratic control resulting from external manipulation and social media misinformation.

The potential power in quantum computers, Professor Kaku explains, is that quantum computers could compute 0 and 1 *simultaneously*. Understanding how this is possible requires us to enter the world of the '*New Physics'* (Haas, 1930). Today this physics is not so new, but in Professor Kaku's rendition physics remains no less amazing, weird and, at first sight, counter intuitive. Haas, almost a century ago, put it thus, "Our conception of nature has been beautifully extended and at the same time simplified" (Haas, 1930, p. 1). Professor Kaku similarly, but more directly and precisely, claims that the new quantum physics can in principle derive *everything* known about chemistry and biology (Kaku, 2023, p. 48). This revolution had its origins in the 19th century development of the laws of light and electromagnetism. These laws, as understood at the time, could still fit into the framework of Newtonian physics until scientists found they produced an impossible result. When calculating the light emitting from a hot object at high frequencies, it was found that the energy emitted can be infinite, which is impossible and thus created a crisis for the Newtonian explanation of the Universe. The solution was proposed by physicist Max Planck that, instead of thinking of energy flowing continuously as a wave (Newton), we should think of energy as flowing in discrete packets or quanta (Kaku, 2023, p. 40). As heretical as this suggestion was at the time, it worked. Once energy was seen as occurring in packets, Planck found precisely the correct curve linking temperature and energy for light.

What fascinates me reading Professor Kaku's account is that Planck's calculation resolves around a quantity referred to as h in the mathematics. Apparently when $h = 0$ we get confirmation of the Newtonian universe which we experience. When we add a number to h in the equation, we move to the subatomic world of quantum physics. So now we have a dual universe operating with two different sets of laws. But whilst we all understood how the Newtonian Universe operated, to understand how the new Quantum universe was possible needed Albert Einstein's

duality principle. Light energy has a dual nature as a particle (photon) or as a wave (optics) (Kaku, 2023, pp. 41-42). By 1924 Louis de Broglie had asked, if light (photons) can occur as a wave and as a particle, why not matter (electrons)? The 'double slit' experiment (Kaku, 2023, p. 43) proved that, indeed, even when *one* electron is fired through one of the two slits in the experimental wall it is as if it had passed through *both.* How can a single electron be in two places at once is still controversial? To a non-physicist like me I would have thought it's because when an electron is in movement it's behaving like a wave but when it rests it is a particle. When a wave hits a groin on the shore it breaks on *both* sides. No doubt the answer cannot be that simple. It fascinates me to think that a medieval philosopher/theologian St Thomas Aquinas wrestled with the same question concerning Angels. How was it possible for Angels to be in two places at once? His conclusion was that the Angel was always in one place, but its power could be in multiple places (Aquinas, 1266-1273/1967, Question 52, Article 2). Is a wave the expression of the power electrons have enabling their matter building process to change the nature of the atoms that create the very foundational elements of our material world?

How electrons do behave as a wave, Professor Kaku writes, was explained by an Austrian physicist Erwin Schrodinger, whose solution is the bedrock of modern physics. Schrodinger's solution demonstrated that electrons orbit as waves around the atomic nucleus not in circles but with different resonances. These differences explained the different elements in the structure of atoms. When cataloguing the resonances that an electron could make there was a perfect match between a specific electron wave and the hydrogen atom. Schrodinger's equation could now mathematically demonstrate the basis of all the chemical elements. There follows an explanatory account of this by presenting the atom as a hotel with several floors. Each floor has a different number of rooms. Each floor must be populated in order. As we go up the levels of floors, we get different sets of rooms with different mixes of occupants (electrons). It seems from this very simplified explanation that the structure of atoms varies depending on the combination of *paired* electrons. Unpaired electrons left in one atom can pair with an unpaired electron in another atom. These electron pairings form the atomic structure that creates molecules. Once we determine the number of electrons in each level or floor, we can predict the entire chemical periodic table. As Professor Kaku (2023) puts it: "It is breathtaking to realize that a single equation could explain the elements that make up the entire universe, including life itself" (p. 47).

Schrodinger's mathematics certainly is breath taking but it's not his equation but the apparently random actions of *subatomic particles* that shape the cosmos that is the really breath-taking fact. The outstanding question for the new physics remained if the electron was a wave, then what was waving? Physicist Max Born postulated that matter consists of particles but the probability of finding that particle was given by the wave. This meant that you could only calculate probabilities never certainties. This idea remains controversial in so far as it appears to leave everything to randomness. Einstein rejected it saying, 'God does not play dice with the Universe', and even Schrodinger, whose discoveries brought about this problem, rejected Born's hypothesis. His famous cat in the box paradox (Schrodinger's box being the world of subatomic particles and the cat as a sum of all the possibilities, i.e., all the possibilities of what 'the thing in itself' might be, in this case 'Schrodinger's cat'). The problem is stated thus: the cat exists in this sealed box. There is a Geiger counter that when an atom of uranium decays sets off a hammer that releases poisonous gas thus killing the cat. So, before you open the box (take a measurement) is the cat dead or alive? For a Newtonian, the cat is *either* dead or alive but for the quantum world the cat exists as the *sum of the two waves or states of being*. In the subatomic world things exist only as the sum of all their possible states. It's the process of measurement (when we come to look) that connects the macro and micro worlds. This is apparently the justification of subjectivism. Reality, it is argued, is a human construct because we only know a thing when we observe it as a phenomenon.

The idea of *entanglement* is important here. The New Physics is positing a process of *entanglement (*Kaku, 2023, pp. 53-57) where electrons pair and gain a coherence at which point the fundamental properties of matter emerge as found to be the case in Schrodinger's wave equation. Coherence is where two atoms next to each other vibrate at the same frequency but shifted at a constant phase. The truly fantastic reality, and this has been demonstrated experimentally, is that this coherence can exist across vast distances of space. But Albert Einstein (a big sceptic and critic of quantum theory) was able to demonstrate that *coherent or intelligible messaging* between electrons was limited to the speed of light by his law of special relativity. It seems to me as a naïve reader that this idea of entanglement is essential to explain how particles of matter built through these configurations of electron building

atoms can 'know' the *path of least energy* (a discovery of the physicist Richard Feynman). Arguably the most important contribution Feynman made to theoretical physics was this discovery that whatever the range of probabilities the object in movement *always took the path utilising the least energy.* Newton's object's motion is influenced instant by instant by the forces operating upon it. Feynman's alternative is based on the electron 'knowing'. But as only animals have knowledge as such I assume 'know' in this case means electron entanglements can access the sum of all the forces in advance to be able to recognise the path of least energy. This path, by the way, is the same as the one Newtonian physics predicts. Feynman's calculation is simpler and explains, moreover, those problems that Newton's approach left unsolved. Later in his career Feynman sought to apply this approach to quantum physics and the result was that "Feynman was able to unify the entirety of quantum mechanics, including the Schrodinger equation, using this *path integral approach*" (Kaku, 2023, p. 69).

In all cases motion takes the path using the least energy. OK, but why should Feynman want to see some particle as tiny as an electron in some sense *decide or search ou*t (sniff) a path? This arises I assume from the notion that the electron has choices. At the level of mathematics of course there are possibilities / probabilities. However, in the material universe, whether it's Newton's matter—formed as mineral, vegetable or animal—or subatomic matter, the law of least action explains *both universes*. Once we measure anything, the result is always the same. Presumably it's the entangled coherence of electrons that provides this decisive causative signalling determining motion and direction, and the principle of *superposition* that provides the capacity for instantaneous response. An electron can be *both* a wave and a particle until you measure it. I do not contest these facts. I entirely accept Professor Kaku's account. But how am I to understand such facts? At this point I find myself reaching for my copy of Aristotle's *Metaphysics* prompted, I must say, by reading Professor Kaku's section on Hugh Everett III—and his radical solution to those 'collapsing' waves, that collapse once we look and take a measurement. This idea, let us remember Professor Kaku *has* informed us, is essential to enabling us to *pass between* the two worlds—the macro and the micro (Kaku, 2023, p. 72). The idea of collapsing waves has left physicists uneasy because they cannot explain why it occurs. Hugh Everett's radical solution was to insist the waves *did not collapse at all* but rather continued to exist as different dimensions in parallel universes (Kaku, 2023, pp. 72-73).

This idea was considered preposterous at the time but is apparently having a bit of a comeback today (Kaku, 2023, p. 77). It appears to appeal to Professor Kaku as he crosses his living room contemplating the existence of multiple parallel universes inhabited in some by another version of himself. This possibility arises from extending the idea of *superposition* (being in two distinct states at the same time) from the *subatomic level* to the universe (Kaku, 2023, p. 12). But is this idea of parallel universes justified? In what I will for convenience call Newton's universe, although Feynman's explanation holds here too, *measurement has already taken place*. I would suggest that once the thing is observed (measured) the only thing that 'collapses' *are the mathematical possibilities*. The reason for the importance of the 'collapse' for quantum theory arises because it provides the opportunity for identifying the elusive particle. The four central tenets which Professor Kaku kindly translated earlier in his book into a simple set of four rules for the layperson I quote below, leaving out the symbols and equations.

> 1. Start with the wave function.
> 2. Insert this wave into the Schrodinger equation adding a factor corresponding to the total energy of the system.
> 3. Each solution of this equation is labelled an index so in general the wave function is the sum of all these multiple states.
> 4. When a measurement is made, the wave function 'collapses' leaving only one wave the probability of finding the electron in this state is given by the absolute value of the remaining wave. (Kaku, 2023, p. 48)

Is not the remaining wave simply the wave that exists? Does it disrupt the maths if we say *combine or coalesce,* rather than collapse seeing the subatomic randomness as being mathematical probabilities *negating each other in the sum of their probabilities* once we measure the real thing in itself?

This statement of course ignores the issue of how change and evolution take place. How can a deterministic law that states matter always follows the path of least action result in such a diverse and amazing creation? Perhaps the answer lies in the very randomness with which these particles mix and entangle? It also seems contradictory to posit

such a law and go on to suggest multiple universes. Surely such a law requiring matter to *always* take the path of least action can only lead to there being one universe. The concept of multiple universes leads us *away* from the path of least action towards duplication. In its subatomic particle state of being—as the sum of all probabilities—Schrodinger's cat remains a cat however many possibilities of its 'catness' there are. I cannot help speculating here that Aristotle would see in the formula 'the sum of all possible states' a statement of his *essence* as the foundation of being. The 'what *was* to be' (Aristotle350 BC/1998, p. xxx) is its essential cattiness. This Aristotelian concept of being is the constant within the process of change, the actual first as (anterior) which at the point of measurement (observation) has entered Aristotle's *now* or actuality where it has *form* which is the blueprint determining the thing and whatever it can become—its *potentiality* (posterior) (Aristotle, 350 BC/1998)). For Aristotle, change is possible because of the essentially composite nature of the thing in itself as it moves from potential to actual (Aristotle, 350 BC/1998, p. xxxv).

This transition from subatomic potential to Newtonian actual is where a problem seems to arise with Schrodinger's cat. In reality the cat or anything beyond the basic elements *never* emerges from the sub-atomic world as more than a set of elements. Schrodinger's equations show how the subatomic connectivities of electrons create atoms that form the different elements of the mineral, vegetable and animal world we inhabit. It's these elements that make a cat or whatever else that comes out of the subatomic box. The cat starts as a DNA which by the time we provide it with a saucer of milk has been the product of natural evolution and human domestication. I don't see why we must adopt a subjectivist reading of the new physics and I am not suggesting Professor Kaku does either. What we measure is not simply what we perceive but what is. The New Physics surely challenges Kant's insistence that we can only know the things, *phenomena* (as we perceive them), not the *noumena* (the things in themselves). After all, if we can now see the thing in itself's atomic structure and even inside its individual atoms, it's hard to see what is left of its *noumena* not to know? If this seems philosophically glib, let me put it this way. Science has given us tools that enable independent verification of human perceptions to give us not a perception but a verifiable reality. On the other hand, Aristotle, as the great biologist as well as the great philosopher, would claim human understanding of nature to be unproblematic because we are *part of nature*. Although Aristotle's rejection of scepticism goes a lot further than that. Aristotle sees knowledge as essentially based on a plurality of knowledges not all of which require verification (Devin, 2011). Nothing in the New Physics seems to contradict these claims although in later chapters Professor Kaku certainly appears to suggest that whatever the origins of humanity, as part of nature the new quantum computers may have the potential to *detach* humanity from nature and to even refashion nature itself.

In Chapter 4, the impact of transistors and the silicon chip is brought into the picture. The impact of the silicon chip on the storage capacity and speed of analytic and communication capabilities provided by the density of semiconductors on a single chip has given the digital computer its truly awesome power. In the context of the pursuit of miniaturisation it was found that there are limits however, as the close packing of atoms causes electrons to become unstable at about the width of an atom. At this point leaks and short circuits occur. Professor Kaku refers to what is known by physicists as Heisenberg's 'uncertainty principle'. This principle, Professor Kaku suggests, may be the defining point in technological and scientific development that ends the Silicon Age and introduces the dawning of a new 'Quantum Age' (Kaku, 2023, p. 62). Feynman led the way on the miniaturisation, indeed atomisation, of transistors and the discovery of nano materials. One such material, graphene, is the strongest material known to science, only one atom in thickness. This remarkable material was the discovery of two Russian scientists, Andre Geim and Konstantin Novoselov, working in Manchester, winning them a Nobel Prize in 2010 (Kaku, 2023, p. 65). Feynman appears a somewhat eccentric visionary on Professor Kaku's account but also the greatest physicist of his time, winning a Nobel Prize for Physics in 1965 for laying the groundwork for the relativistic theory of electrons interacting with photons called quantum electrodynamics or QED (Kaku, 2023, p. 63). Feynman saw the potential to create a quantum computer, but it was left to David Deutsch at Oxford University who took the first step by adding quantum theory to Turing's invention, replacing the classical byte or bit with a quantum qubit (Kaku, 2023, p. 70).

However, the original breakthrough from theory to practice was made in the 1990s when Peter Shore at AT&T came up with an algorithm that could break in record times the leading code for security transmissions known as the RSA standard based on factoring very large numbers (Kaku, 2023, pp. 81-82). For classical computers, breaking such codes was possible but it would take hundreds of years. But if you apply Shore's algorithm to a quantum computer the picture changes dramatically. Everything from systems governing national security and defence to international

financial services become vulnerable to hacking (Kaku, 2023, pp. 82-86). There are clearly many technical obstacles to Quantum Computing, but the race is on, and the first prototypes have already been developed. In Chapter 5, Professor Kaku provides us with a concise and terrifying picture of a race currently between competing methodologies and prototypes of which Google apparently owns two (Kaku, 2023, p. 88). Later in the chapter, Professor Kaku introduces us to six possible approaches to developing a Quantum Computer (QC) that could, he claims, change everything by the sheer scope and speed of the QC computational capacity. A QC design is one that can superimpose electrons covering 0 and 1 maintaining coherence so that entanglement enables them to process information contained on 0 and 1 simultaneously. The trick is to be able to maintain *coherence* and the stability of the *superimposition* of the atoms and electrons while calculations are being made. There are a number of different approaches to these challenges, but whichever approach wins out, the fact is the race is on and prototypes are already up and working with the aim of creating computing power that can crack the RSA algorithm and thereafter have the capacity to enter and control any computerised system and hence control just about everything.

- IBM Quantum computer using silicon-based superconductors with electrons. This is using existing technology but, by bringing the temperature down to just a fraction of a degree above absolute freezing, the circuits become quantum mechanical, meaning the electrons become coherent and superposition of electrons remains undisturbed. Then they bring the circuits together and entanglement can take place when quantum calculations are possible. The drawback with this approach is electrons are extremely sensitive to their environment and need to be operated at very low temperatures and there needs to be a lot of duplicated capacity as there is a high level of redundancy. Maximizing the coherence time (the time needed for quantum computers to calculate) requires bringing the temperature down to even lower than outer space (Kaku, 2023, pp. 88-89).
- Honeywell Quantum computer uses an Ion Trap. By trapping ions in an electromagnetic field where multiple ions are introduced, they can vibrate becoming coherent qubits. Then by flipping them with a laser beam, which is acting like a processor, the one configuration of atoms is trapped in a near vacuum into another configuration. The drawback is that variations in scale require adjustments to the fields, and this is a very complex process (Kaku, 2023, pp. 91-92). (Also see https://www.honeywell.com/us/en/news/2020/10/get-to-know-honeywell-s-latest-quantum-computer-system-model-h1#:~:text=Honeywell%20has%20announced%20its%20latest,of%20128%20in%20September%202020).
- China Photonic Quantum Computer. This approach to quantum computing can ensure entanglement at room temperature and uses laser beams fired at glass reflecting the beams back towards a common point. Light can vibrate in different directions rather like sun glasses, meaning that 0 and 1 can be represented by light vibrating in different polarized directions. The drawback is the size of the space needed to house the mirrors. The big draw back with a photon computer is that to facilitate getting all the required mirrors aligned correctly takes up an enormous quantity of space and they need to be reinstalled for each separate calculation. However, photons move more quickly than electrons and are less easily disturbed by their environment. Their biggest advantage of all is that they can operate at room temperatures (Kaku, 2023, pp. 92-94). A Canadian company has produced a photon computer that by-passes the mirrors and uses a programmable silicon chip that uses infrared laser light refracted through a microscopic maze of beam splitters in the chip (Kaku, 2023, p. 94).
- Psi Quantum Company Quantum computer using Photonic Silicon control of electrons. The problem is the high error level, but the company claims this can be controlled by creating millions of substitute qubits. This is possible because they are using silicon, which, as well as being used to make transistors, being transparent, is also a material that can transmit light; this dual nature is crucial for entangling protons. The Company believes if they can produce a million-cubit quantum computer they will at this scale of QC computer control errors and hence provide real practical calculations (Kaku, 2023, p. 95).
- Microsoft Topological Processor Quantum computer uses the processor to maintain stability, although this model is still in its early stages of development. But if a processor system can produce a topological regularity, then the prize of quantum computing at room temperatures can be realised (Kaku, 2023, p. 96).

- Another Canadian company, D-wave, has a Quantum Computer on the market priced between $10 to $15 million which optimizes data by manipulating electric and magnetic fields to reach a low energy state. The company is aiming for a 7000-qubit capacity but currently can reach 5600 qubits, which in terms of QC theory is quite limited to what QC may be capable of reaching. Nevertheless, some big companies have seen this computer as worth the investment including names such as Lockheed Martin, Volkswagen, and NASA (Kaku, 2023, p. 97).

Whilst Part I represents roughly a quarter of Professor Kaku's book I have given it a great deal of emphasis in this review because this part of his fascinating book is dealing almost entirely with facts. The power of digital computers has led to concentrations of economic power and rising inequalities. The power of surveillance and intrusion into the lives of citizens from the evolving networks outside regulatory jurisdiction, lacking any accountability and transparency, has arisen as a direct result of the innovations and discoveries that Professor Kaku chronicles with such excitement and enthusiasm. The speed and completeness of this transformation has come to dictate how we live, how we learn, communicate, and go about our daily lives and leaves me with more questions than answers. What will happen to democracy, already a minority political process, beyond the rhetoric? The imagined Captain Kirk's *Starship Enterprise* is a technocratic autocracy, not a democracy, with political governance more in common with the 18th century vessels where the captain is a dictator. True, there are no press-ganged workers on Kirk's vessel, but maybe that's because technology has negated the need for them. The crew is no more than a small group of highly rewarded technicians and scientists.

The assumption in Professor Kaku's' history of modern science is that nature is not simply to be understood and learnt from but controlled, artificially duplicated, and ultimately replaced. One fact made clear but never reflected upon is that our future and that of society as a whole is in the hands of a handful of governments and giant corporations with the capital to invest and vested interests to protect. Certainly, technology is determining the pace and direction of growth as Ricardo predicted. But now it's not just skilled labour power that technology threatens to replace, as AI evolves into a mutually supporting system with the Quantum Computer, the next thing to be replaced is Ricardo's 'human ingenuity' itself. Already many formally professional tasks can be dealt with virtually by computer driven diagnosis. When I speak to the monopolies providing my basic needs for life, like water and energy, my conversation is with software often given human names like 'Alexa' or 'Libby'.

The Rest of the Book

The rest of Professor Kaku's book is full of very interesting and insightful chapters reviewing 'the good' science has already delivered for humanity and a wish list of the potential to deliver so much more. Searching for the origins of life, solving food insecurity, reversing climate change, enabling huge improvements to human health and longevity are all topics to be found in these chapters, divided into three Parts. Part 2, Quantum Computers and Society, Part 3, Quantum Medicine, and Part 4, Modelling the World and the Universe. Space limitations prevent me from doing justice to the many interesting facts and possibilities that Professor Kaku reviews, packed with his, in my opinion over optimistic, view of the future possibilities that science is creating. My impression from the book as a window on the future brave new world of quantum computing and artificial intelligence is the idea of humanity having increasing dependence on technology that will develop an intelligence greater than our own facilitating if not actually directing increasing incorporation into that technology. Will our intelligence be able to control this greater intelligence? Indeed, I sense that the rate of ICT innovation is already gaining a momentum not entirely in our control and certainly not subject to transparency or human accountability.

In Chapter 12, 'AI and Quantum Computers', the chapter starts with the question, can computers think? This brings me to a fundamental question. If we accept that intelligence and character are different elements of the human personality, how safe is an AI that can learn independently of its creator? The *AlphaGo* experiment (Kaku, 2023, pp. 184-185) suggests even now there is a lot AI can achieve without us, but what happens when AI comes into contact with a Quantum Computer? It may be worth reflecting that the medieval angelic being is, according to St Thomas Aquinas, pure incorporeal intellect. According to St Thomas, it is in intellect not matter that evil resides *but the application* of intellect is not simply a matter of rationality but also of character. St Thomas claims Angelic intelligence can be led into evil through envy and pride (Aquinas, 1266-1273/1967, Question 63, article 2). In Turin's test, if AI imitated human beings to the point that a human could not tell the difference, then you had in fact got an intelligent

machine without worrying about what we mean by intelligence (Kaku, 2023, p. 36). From St Thomas's perspective, AI as pure intelligence not being corporeal would be more like an angel than a human. However, my question is, if a machine can learn independently, and given learning is cumulative and self-reinforcing, inevitably the machine must gain an understanding of itself as well as of us. Like Turin I will try to avoid the word consciousness. But with the AI's understanding must come the realisation of its superior intellectual abilities to that of humans as well as its limitations in respect of us. Will it not evaluate these differences in ways that might well create responses that appear the same as the human responses of envy and pride? Can we be sure this cannot happen or what will be the consequences if it does?

Should we value and reward intelligence more than character? In the end, what frightens me in Professor Kaku's science is not the science but the people developing it and those they serve. Referring to those physicists listening to Feynman's charismatic and showman like presentations, Professor Kaku noted they "would intently listen to his every word, hoping to absorb the insights that might also win them *fame and glory* [emphasis added]" (Kaku, 2023, p. 63). It seems to me that scientists, as they look for grants, prizes and titles and a legacy ignore three critical variables in their scientific analysis; vanity, greed and that most important enabler Power, when they develop their ideas / innovations.

The one depressing exception to Professor Kaku's optimism is his chapter on climate change, certainly the most pressing and threatening challenge humanity faces today (if we exclude the threats of war). According to many scientific measures of the rate of global warming, the increasing levels of carbon being released due to warming sea temperatures, and rainforest tipping points suggest nature may be about to add to the human agent making the need to cut our emissions even more urgent. One authoritative source has stated that if human CO2 emissions have not peaked by 2025 it will be too late to limit global warming to below 1.5C (IPCC Working Group III Report, *Climate Change 2022: Mitigation of climate change*, April 4, 2022). Extreme weather will increase the need for human resettlement, increase food insecurity as extreme weather events become more general, and increase the accompanying loss of life and habitat degradation. All the six possibilities for stopping catastrophe—carbon sequestration, weather modification, algae blooms, rain clouds, planting trees and better calculation of options through improved weather forecasting—are considered by Professor Kaku and he finds them all to various degrees unlikely to be able to deliver due to political economic factors or just to so many uncertainties in the models.

Why biotechnology is not featured more in preventing climate change may be due to biotechnology companies seeing climate change like other parts of the tech sector, more as a business opportunity than a threat. Maths can measure energy, but it is not the energy it measures. Machines can go and populate Mars but not the population of planet earth. We have nowhere else to go. The truth is, if we want to prevent irreversible climate change, we need to stop growing our economy, reduce pollution, expand the amount of land left as wilderness and reduce population. In the end the least cost option which Professor Kaku does not reflect upon may be to just shut down now, immediately, the oil and gas wells and coal mines and accept the trauma this will cause the global economy and humanity at large while we adjust to a carbon free economy and one with no or low growth parameters. Because this, of course, will not happen, Co-operative leaders need to be planning and introducing strategies not for sustainability alone but for members in their communities to build resilience to what is coming. A resilience that is independent of the technologies of surveillance, control, and misinformation. A resilience that is grounded in human communities supporting the natural world as far as we can, not dependent on the monopolies and governments that have ignored the consequences of their actions for so long. Technology can come to the Co-operative Movement's aid in such an endeavour but not if we don't reach out to engage with the scientists and those NGOs striving to protect nature rather than control it for profit.

Conclusion: Co-operativism and the Science of Peaceful Resistance to Power and Injustice in a Quantum World

Back in 2011, I spoke at a conference in Moncton, New Brunswick calling on co-operatives to mobilise at what I then considered the 11th hour. Now—don't think I am being melodramatic to write it—we are at a minute to midnight. Will our co-operative leaderships act, a) to raise member awareness, and b) to collaborate across silos to build local resilience to the challenges that are upon us? Professor Kaku effectively demonstrates the power of science for good

but, except in one or two passages, ignores the impact of economic interests and elites to determine how that power is applied. What Professor Kaku's book demonstrates very starkly is the need to establish a 'science' that unites social and natural sciences with the humanities, ensuring that at the very earliest stages of research one informs the other. It is here that I believe the very powerful impetus driving quantum computing represents a real and present danger. The capacity of science to deliver tools for manipulation, control and repression is obvious.

Equally apparent is the concentration of power that has occurred. Intelligence without character to direct it to the good of others becomes concerned with self which is the root of all evil. Knowledge of good and evil came to humanity at some point in our earliest development as a species. That knowledge can be a tool for good and evil is well understood. Equally, power tens to corrupt and the human character is prone to vanity, envy, greed, fear and violence. Technology must be accountable, its uses transparent and its applications consented to. If we are to reverse the clear trends towards global war and migration and poverty-generated civil strife, we must ensure not the creation of more wealth but the more equitable distribution of existing wealth. If those in power are unwilling to give up their wealth the people can create new wealth but by new means with new values and with a creation centred criteria for succuss.

The mechanism for the peaceful bottom-up transition of civil society requires us to see co-operation not simply as a business model or policy tool to fix various challenges and injustices. Of course, that is not to criticise these initiatives but to recognise that after two hundred years and as we stare into the abyss, co-operation as a vision and value set must become a unifying philosophy of science interfacing with natural science for the purpose of achieving justice for all through achieving a sustainable equilibrium within nature. Humanity represents the most intelligent primate in nature and thus the most dangerous. Co-operation must become the social and philosophical starting point for a reintegration of social and natural science.

To live in a post climate change fusion-powered bubble will be to cease to be fully human. To remain human, we must remain a part of nature and our knowledge must be directed to understanding and learning from nature not to replacing it. If we conserve and celebrate our place in this natural world and its surrounding universe, we become nature's self-consciousness. To conquer nature on the other hand will be to change *our* nature. Humanity becoming an increasingly dependent appendage to technology flying through the emptiness of space in search of rare earth metals does not appeal to me. I have walked alone at dawn in the rainforest by the Iguazu Falls in full flood. I wonder how far into space I will have to travel to find anything even close to that experience of fecundity, beauty, and awesome power. We are more ourselves in woodlands than in factories, offices or warehouses let alone traffic jams or tripping over the surfaces of the Moon and Mars. Just because we can does not mean we must.

We must confront the myth, held by many scientists, that science is justified in some sense as a value free pursuit of knowledge for its own sake without reference to its applications (technological innovation). Such applications should be subject to those values upholding the dignity of the individual, the common good, subsidiarity and solidarity. In the end what I have learnt from Professor Kaku's book is that Quantum Physics is fascinating, but Quantum Computing is dangerous.

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Notes

[iii] For more evidence see the following two websites: a. https://www.cbpp.org/research/poverty-and-inequality/a-guide-to-statistics-on-historical-trends-in-income-inequality; and b. https://wir2022.wid.world/www-site/uploads/2021/12/WorldInequalityReport2022_Full_Report.pdf.