Movement Building and Cooperation to Transform the Construction Industry

Andrew Gansenberg, Masters of Co-operatives and Credit Unions, Saint Mary’s University, Canada

**Abstract**: The intent of this paper is to assess the ability of cooperatives to facilitate a shift in the construction industry, changing it from a major source of climate change into a source of climate regeneration. The research question was whether cooperative business models can support a rapid increase in understanding and adoption of low embodied carbon and carbon storing materials and building techniques in residential and low-rise commercial construction. The research followed an emergent approach, allowing the findings to unfold and uncover a path forward. Secondary research was used to examine the greenhouse gas impacts coming from the built environment, the current state of the building industry and its supply chains, and strategies for supply chain management in the construction industry. These challenges were compared with various cooperative models and research on movement building. The secondary research was supplemented by informal conversational interviews with professionals in cooperatives, supply chains, and construction. The paper concludes that the industry needs to be transformed, which requires action throughout the supply chain and that cooperatives have the adaptability to be implemented at all levels of the supply chain and to bring stakeholders together under one umbrella. It recommends a broad cooperative strategy using a multi-pronged approach to increase the use of low embodied carbon and carbon storing materials. If this approach is to be realized, it will require industry participants coming together and refining the proposal into something that works for them all.

Andrew Gansenberg is a Project Manager at New Frameworks, a worker-owned cooperative committed to a kinder sort of building, in Waterbury, Vermont and a graduate of the Masters of Co-operatives and Credit Unions program at Saint Mary’s University in Halifax, Nova Scotia, Canada.

**Keywords: Construction industry, climate change, climate regeneration, cooperatives, supply chain management**

### Introduction

The intent of this paper is to assess the ability of cooperatives to facilitate a shift in the construction industry, changing it from a major source of climate change into a source of climate regeneration. While the arguments revolve around climate change, there are significant interdependent ecological and social challenges the industry faces. The paper concludes that the industry needs to be transformed, which requires action throughout the supply chain.

After describing the climatic impacts and potential of the construction industry, the paper looks at difficulties this industry in particular faces in integrating and collaborating throughout the supply chain. Understanding the shape of the industry and what kind of change is needed then informs a review of cooperatives to see if they could be appropriate vehicles for this change. The paper looks at cooperatives generally and argues that they are a better fit to address the challenges in the industry than other forms of business. Since cooperatives themselves come in many forms, it also looks for what type of cooperative or cooperative strategy is best suited to the current situation. A multi-pronged approach is recommended. If this approach is to be realized, it will require industry participants coming together and refining the proposal into something that works for them all.

The immediate significance of this research is its potential to address the climate crisis. It is important to recognize the crisis not only as an ecological issue, but as having deeper social impacts. It is also important to understand that climate impacts are not the only issue within the construction industry but are a symptom of oppression and a deeply entrenched extractive culture. The dominant demographics and culture in the industry are defined by heterosexual, able-bodied, white men. Even most attempts to implement diversity and equality practices in the industry expect minority groups to assimilate to a hegemonic image of masculinity. This culture can lead to significant harassment, oppression, and exploitation of minority groups encompassing gender, race, age, sexuality, and ability (Powell and Sang, 2013). These issues undoubtedly exacerbate challenges in hiring, retention, job satisfaction, and the topics of this study - inter-firm collaboration and socially and ecologically driven building practices. While this study focuses on the clear and direct links between supply chain, materials, and climate change, a cooperative strategy focused only on environmental or ecological symptoms cannot be transformative. It will be critical for success that industry stakeholders who take up this work approach it with an intersectional and inclusive perspective.

### Methodology

With very clear goals for the outcome of the research, an inductive approach was taken, allowing the research to guide the shape of the final proposal. The research question was:

Can cooperative business models support a rapid increase in understanding and adoption of low embodied carbon and carbon storing materials and building techniques in residential and low-rise commercial construction?

An exploratory approach was used to understand the impacts and issues in the industry and make the case that the industry needs transformation. An explanatory approach was then used to show how cooperatives can address those challenges.

#### Methods

The research relied heavily on secondary sources to understand the climate impact of the industry, supply chain management (SCM) - particularly as it relates to the construction industry - and potential cooperative solutions. The secondary research was supplemented with conversational interviews with cooperative experts and industry leaders, and the author’s own experience. In total, seven interviews were conducted; all the interviewees are involved with cooperatives, five work within the construction industry, two are cooperative developers, and four are involved in supply chain and procurement including three who work with purchasing cooperatives.

#### Rationale

There is a significant amount of existing research in most of the areas relevant to this work but they have not been brought together, as they are here, with the topics of climate change, construction SCM, and cooperatives. The author’s experience and networks within the cooperative movement and the construction industry provided strong leads on where to find less common secondary research such as that around embodied carbon in construction as well as access to extremely knowledgeable professionals with expertise in both the construction industry and cooperatives. The interviews were a valuable source of supplementary knowledge of cooperatives and the construction industry as well as feedback on the author’s emerging thinking throughout the process. They were conducted intermittently throughout, helping identify subsequent areas of secondary research. Though similar ideas came from multiple interviews, these interviews were not intended for thematic or other analytical purposes. For this reason and due to the targeted expertise of the interviewees, a small sample size was sufficient.

### Climate Change and the Built Environment

Recognizing that the industry has major effects on all areas of the natural environment, this paper will focus on the industry’s greenhouse gas (GHG) emissions and sequestration due to the urgency of the climate crisis. Climate warming has wide-ranging effects including increased risks around “water scarcity, ill-health, food insecurity, flood and drought, extreme heat, tropical cyclones, biodiversity loss, and sea level rise” (Ivanovich, 2018). These impacts are disproportionately felt by disadvantaged groups within countries as well as between countries. This includes groups disadvantaged due to income, age, race, ethnicity, and gender (Islam & Winkel, 2017, p. 2).

The International Panel on Climate Change (IPCC) identifies the goal to slow and reverse the emissions of GHGs measured as carbon dioxide equivalents (CO2e) to avoid increasing warming above 1.5oC from pre-industrial levels. They suggest that to do this, we must make “emissions decline by about 45% from 2010 levels by 2030 … reaching net zero around 2050” (IPCC, 2018, p. 12).

#### Operational and Embodied Carbon

Improving building energy performance and use of renewable energies have become well-developed areas of focus to reduce some of the impacts of a warming climate. The industry only recently has begun to look closely at the emissions of the materials used in the construction process. Operational emissions (oCO2e) can be reduced by improving building energy performance, while embodied emissions (eCO2e) come from the entire life cycle of the materials’ resource management, extraction or harvest, manufacturing, transportation, construction, deconstruction, and degradation. Whole building life cycle assessment (WBLCA)[[1]](#endnote-2) tools are quickly improving and should be able to be integrated into the operationalization of the proposed strategy.

Looking at global GHG emissions by sector, 28% come from oCO2e in the construction industry and 11% come from eCO2e in the construction industry (International Energy Agency, & United Nations Environment Programme, 2018, p. 11). At first glance, oCO2e seems like the bigger problem and the obvious place to focus our attention; however, eCO2e has a nearly immediate impact while oCO2e are slowly released over time. Only a small percentage of the emissions reductions from a performance retrofit today will be realized by the IPCC’s 2030 and 2050 deadlines while all of a building’s upfront eCO2e will be released by the time the building construction is complete. With the short timeline humanity has to reverse the climate crisis, it is imperative that there is a rapid improvement in the upfront eCO2e emissions from the construction industry and fortunately, this can be done while simultaneously building high-performance buildings that also reduce oCO2e.

#### Construction as Climate Regeneration

There are five natural carbon sinks which can store CO2e. These are the ocean, fossil fuels, pedologic (soils), atmospheric, and biotic (living things) (Lal, 2010, p. 709). While currently, “buildings generate nearly 40% of annual global GHG emissions” (Architecture 2030, 2019), the building industry has the potential to be a sixth major carbon sink - or maybe more accurately, to enhance the capacity of the pedologic and biotic sinks - actively reducing atmospheric CO2e.

Biogenic materials[[2]](#endnote-3) can sequester atmospheric carbon during their lives and Guest et al. (2013) show that delaying the period between carbon capture in plant material and carbon-emissions at the plant’s end of life can have significant climate impacts. The period in which this carbon would be stored in a building as structure, insulation, finishes, or other construction materials therefore can play a major role in climate change mitigation. Along with storing carbon in the plants, resource management practices during the growth of these biogenic materials can capture carbon by building soil.

For the construction industry to become a sixth major carbon sink, the amount of carbon sequestered in the soil and building materials needs to be greater than the amount released during the rest of the life-cycle processes. Recognizing the various stakeholders throughout the supply chain that play a role in determining materials’ eCO2e highlights an obvious need to understand construction supply chains and supply chain management.

### Supply Chains in the Construction Industry

In many industries, supply chain integration (SCI)[[3]](#endnote-4) has proven to bring value to participants throughout the supply chain. Key benefits include organizational learning for all stakeholders, faster, more accurate, and reliable flows of products and information, better responsiveness to markets, improved customer service, and lower costs. Challenges to implementing SCI in the construction industry, specifically short-term relationships, a lack of transparent communication, and a lack of trust, have significantly hindered its adoption.

By looking at research on collaborative supply chains including Whipple and Russell’s typology of collaborative approaches - “collaborative transaction management; collaborative event management; and collaborative process management” (2007) - and construction specific procurement strategies such as Khalfan et al. (2008) among other relevant literature, it is possible to identify widely agreed on keys to SCI. This literature has been reviewed here through a cooperative lens, to identify if and how cooperative models and collaborative approaches to SCI among ecologically and socially concerned partners can address the challenges the industry faces. This includes improving communication, building trust and long-term relationships, and allowing these companies and their clients to reap the benefits while simultaneously increasing the use of low embodied carbon (EC) and carbon storing materials.

#### Collaboration

SCI has been an extremely successful tool for firms in many industries, “noteably [*sic*] in vehicle manufacture and the retail trade” (Akintoye, 2000, p. 159). Despite calls for greater SCI in the construction industry, there has not been a significant move in that direction (Akintoye, 2000). Much of this can be attributed to the fragmented nature of the industry and short-term relationships that can breed distrust and opportunism (Briscoe and Dainty, 2005; Cheung et al., 2011).

The industry is fragmented largely due to the uniqueness and complexity of each building project as well as the unpredictability of work (Broft et al., 2016). Contractors often need different types of expertise from one project to the next, discouraging the internal development of expertise and instead they partner with specialist subcontractors for each project. These short-term relationships and specialized knowledge sets can result in a lack of transparent communication and distrust. Furthermore, specialists are generally looking to accomplish their portion of the work without concern for the outcome of the project as a whole.

#### Low Embodied Carbon and Carbon Storing Materials

The work of Chris Magwood (2019) illustrates the importance of changes in materials selection. He applies common construction approaches for North America to two types of low-rise residential buildings, a small single unit and a four story eight-unit building. He classifies four categories of materials selection and corresponding EC data as shown in Table 1. The data is all pulled from standardized Environmental Product Declarations (EPDs).

**Table 1: Four Categories of EC Materials**

|  |  |
| --- | --- |
| **Category** | **Description** |
| High EC | "commonly used materials that are the highest emitters in each material category" (Magwood, 2019, p. 24) |
| Typical EC | the most commonly used materials |
| Best Conventional EC | materials with the best EC “that are commercially available through typical building supply chains” (Magwood, 2019, p. 25). |
| Best EC | the best EC materials including those that are either not commonly used or are not commonly available |

Magwood’s comparisons show that changes in materials selection and only minor changes in building practices (Best Conventional EC) can move the upfront EC impacts of the low-rise construction industry from a major source of emissions (when using High and Typical EC) to a small source of net carbon storage. More significant changes to building practices and availability of Best EC materials would result in these buildings becoming a major source of net carbon storage. This shows how working to change purchase behavior and building practices, as well as improving production and access to Best EC materials are all necessary to transform the industry from a major contributor to climate change to a big part of the solution.

### Why a Cooperative Approach?

The above discussion shows the immensity of the challenge that needs to be addressed. Building practices need to change, meaning designers need to understand what materials are most appropriate in different circumstances and how to integrate embodied carbon calculations into their selections and design specifications. Builders need to understand how to work with these materials and where to source them from. Suppliers need to offer these materials. There needs to be a greater volume and localization of manufacturing. Finally, shifting to these materials will require an increase in production of the biogenic raw materials by resource managers using regenerative land-use management practices that build carbon-storing soil. The scale of this transformation is massive as should be expected when trying to change an industry from the world’s largest contributor of CO2e emissions to an industry that actively reduces atmospheric CO2e. It calls for industry wide collaboration and the cooperative business model has characteristics to meet the challenge. Cooperatives have incredible variety in type, industry, and size offering an adaptable structure for the changes necessary at all levels of the construction supply chain.

While a structure can be a good fit for something, it is how that structure is used which truly matters. Novkovich describes two types of cooperatives; Type 1 are those used to address "economic injustice, or a lack of access to markets" (Novkovich, 2018, p. 37), Type 2 are inspired by social and environmental justice and "are entering the market to change the economic paradigm" (Novkovich, 2018, p. 37). The discussions in this paper presume an intent to combat climate change and therefore are squarely situated in Type 2 cooperatives.

#### The Adaptability of Cooperatives

The many forms of cooperatives are all based around shared principles and values[[4]](#endnote-5), and have adapted their structures, processes, and business models to fit different market conditions and serve the needs of various types of members. Members - as users - own, control, and benefit from the organization (Frederick, 1997) and, depending on the kind of cooperative, their use takes the form of workers, consumers, suppliers, or residents.

While the ownership aspect can vary in terms of what democratic control processes are set up and how a surplus is distributed, the various types of cooperatives are often distinguished by who the members are and how they use the cooperative. An internet search of cooperative types will find many reputable sources all giving slightly different answers to the questions: how many types of cooperatives are there and what are the common forms? Adding to the complexity, within each category there are variations to fit particular industries or markets. A pretty inclusive, but not entirely comprehensive list of the types includes consumer cooperatives, worker cooperatives, producer/marketing cooperatives, purchasing/shared services cooperatives, financial cooperatives, and housing cooperatives. There are also multi-stakeholder cooperatives that include more than one type of member. Finally, in the spirit of the sixth cooperative principle - cooperation among cooperatives - the organizations themselves can become members of secondary, tertiary, or further levels of cooperatives, creating complex networks. Table 2 briefly describes each type of cooperative and gives an example of its potential applicability to this research.

**Table 2: Cooperative Types**

| **Cooperative Type** | **User-Owners** | **Applicability for Transforming the Construction Industry** |
| --- | --- | --- |
| Consumer Cooperative | Members buy from the cooperative. | Multi-project clients as member-owners could purchase project management services from a cooperative they collectively govern. |
| Worker Cooperative | Members have a job within the cooperative. | Worker cooperatives are extremely adaptable to various scenarios and especially common in labor intensive industries. Product development, manufacturing, and construction companies would all be natural fits for worker cooperatives. |
| Producer Cooperative | Members sell their goods to the cooperative. | Farmers and foresters growing the biogenic materials for construction products could form a producer cooperative similar to the common farmer-owned producer cooperatives in the food industry. |
| Purchasing (or shared services) Cooperative | Members collectively buy products or support services through the cooperative. | Collectively purchasing carbon-storing materials and consulting on these materials are needs that designers and builders could meet by forming a purchasing cooperative. |
| Financial Cooperative | A financial cooperative can take various forms such as a cooperative bank, a credit union, or a cooperative development fund. They are most often a type of consumer cooperative. | Most construction projects and business growth require financing. Any cooperative project needing financing would be better served by a financial institution that understands their business structure. Cooperative banks and credit unions have in the past been key to the growth of the cooperative movement and could be again. |
| Housing Cooperative | Members live in the cooperative. | Housing cooperatives could be clients that create demand for building maintenance and construction done with carbon storing materials. |
| Multi-stakeholder | There are multiple types of members such as consumers and workers. | Resource managers selling their raw materials to a manufacturer and the workers in manufacturing could come together to form a multi-stakeholder cooperative. |
| Federations | Members are cooperative organizations and the federation can support them and coordinate among them in various ways. | Cooperatives throughout the supply chain may form a federation to serve any shared need such as advocating for policy change in building codes, financing the development of new complementary businesses and materials, or providing testing for those new materials. |

Table 2 should clearly illustrate the ability of cooperatives to be used in all parts of the supply chain but the question remains, why should they be used?

#### Bringing People into the Economy

Businesses today are commonly thought of from the dominant neoclassical economics perspective. On one side, they provide jobs that exchange money for labor. On the other, they sell goods and services in exchange for money. Their goal is to create profit; in neoclassical economics “the social, health, and environmental impacts of markets are not regulated by markets but external to them” (Norcia, 2012). It is no wonder, then, that economic activities focusing so narrowly on profit have degraded social, health, and environmental conditions. It is in this realm outside of the view of neoclassical economics where communities exist. To address the destruction that has been caused by the short-sighted neoclassical approach, there is a need to reframe our thinking with more inclusive economic models. Humanistic economics prioritizes human well-being rather than financial gain (Lutz, 1999) and Kate Raworth’s ‘Doughnut Economics’ provides a framework for meeting human needs without destroying environmental resources (Raworth, 2020). These approaches are more appropriate for organizations interested in going beyond the economic realm, looking at other bottom lines, and taking a holistic perspective on their impacts. Cooperatives integrate economic aspects as part of rather than apart from human concerns, prioritizing member needs and community wellbeing while relegating profit to a necessary tool rather than an ultimate goal.

#### Associative Practices and the Industry’s Hurdles to SCI

In all cooperative forms, members benefit from their use as well as from sharing in the financial surplus (and loss) of the co-op. When cooperatives successfully follow the guidance of the cooperative principles, there are additional positive externalities such as individuals developing personally and professionally and communities strengthening through increased networks and civic engagement. Success in a cooperative requires engagement on both sides - as a user and owner - resulting in a unique relationship between members and the organization.

With their unique relationships, cooperatives can build long-term partnerships, transparency, trust, solidarity, and reciprocity. In practice, management, leadership, and the culture of an organization ultimately determine levels of transparency, trust, and communication. Cooperatives inherently create a platform that is easier to build these traits upon, but there must be organizational commitment to the guiding cooperative values and principles. Two of the seven cooperative principles - Democratic Member Control and Education, Training, and Information - point directly to associative practices. These associative practices can be broken down into four categories - Information, Education, Consultation, and Decision Making (Côté, 2019, p. 52). The first two flow from the cooperative to the members (and often beyond) while the other two flow from the membership or broader community into the cooperative.

Information directly addresses transparency, ensuring that the membership knows what is happening with their cooperative, and can take forms like open-book accounting and managers defending their decisions to the membership. Cooperatives are also expected to provide education and training for all members so that they can understand the information they are receiving as well as become qualified to serve in leadership positions such as on the board or in committees. Consultation is an invitation for members (and often extended to wider communities) to give input for managers, board members, and other leaders to consider when making decisions. With this consultation, transparency, and member oversight, cooperatives can still empower managers to make day-to-day operational decisions that would be inefficient to discuss among larger membership bodies. Other decisions, including policy, strategic direction, and overseeing management are commonly taken by the board who are democratically elected by and primarily from the membership. Some major decisions will even be put to a vote directly with the entire membership. These associative practices have a long history of strengthening and perpetuating the relationships among members and directly address the major hurdles the construction industry faces to implementing SCI strategies.

#### Cooperative Coherence

Embedding an inclusive and holistic perspective into their structure, cooperatives have broad-based ownership and democratic control among their users ensuring the voices of the members define the priorities of the organization. To successfully bring this human focus into a market context, cooperatives need to create alignment at three different levels, what Côté calls ‘Cooperative Coherence’ (2019, p. 47). This includes:

* Alignment of shared needs and values among the members.
* Alignment of the products and services of the cooperative with the needs and values of the members.
* Alignment of the business model with its market environment to be competitive.

With these concepts as a cooperative lens, it is informative to look at a definition of supply chain management. Stadtler defines it as “the task of integrating organizational units along a SC and coordinating materials, information and financial flows in order to fulfil (ultimate) customer demands with the aim of improving competitiveness of the SC as a whole” (2005). This definition clearly focuses on providing value to the organizations in the supply chain and making them more competitive in the market. If these organizations were members of a cooperative, this would only address the second and third levels of cohesion. Thus, to look at supply chain management from a cooperative perspective, one needs to expand the view to ensure there are shared needs and values amongst the members. Working back from the mission of this research - to transform the construction industry from one of the greatest contributors to the climate crisis into a large source of climate regeneration and stabilization - and remembering the earlier discussion of the deeply intertwined social and ecological dynamics of climate change, a picture of potential members begins to form. They would have to value ecological and human wellbeing as equal to or greater than profit and understand the importance of climate action done in a way that considers the wellbeing of every client, worker, and other stakeholder engaged in or impacted by the transformation.

### Cooperation in the Supply Chain

In the North American economy, designed for and dominated by capitalist businesses, cooperatives are subject to the pressures of institutional isomorphism[[5]](#endnote-6), often moving away from their unique characteristics and conforming to the practices of the dominant business logic. As capitalist organizations are the dominant model, legislation is designed for them, business education programs teach managers how to work in them, and the majority of support service specialists like lawyers, accountants, and bankers are focused on them. Cooperatives are forced to respond to the competitive market forces of these businesses; they are often managed by people who do not fully understand the unique advantages of the model, and they take the advice of support service specialists who likely understand even less of the cooperative difference. It is easy to see how cooperatives end up trying to compete by mimicking the strategies of for-profit businesses such as incessant growth. Côté analyzes cooperatives that have struggled, sometimes to the point of demutualization[[6]](#endnote-7) as well as cooperatives that have found prolonged success. He shows that cooperatives who denaturalized[[7]](#endnote-8) were the most likely to struggle and fully or partially demutualize. Cooperatives who embrace the unique differences of the model can overcome market pressures and leverage their difference into competitive advantages. Côté refers to this cooperative character in increasingly competitive markets as The New Cooperative Paradigm (NCP) (2019, p. 30). While it is heartening to see that embracing the cooperative identity can lead to success, it still happens in spite of an environment designed for the cooperative’s competitors.

A major feature of large successful cooperative economies is the previously mentioned Principle Six, Cooperation Among Cooperatives. Unlike the hyper-competitive individualism of profit-driven businesses, cooperatives are strongest when they work together. In an economy with a much greater density of cooperatives, and hence legislation written with an understanding of cooperatives, managers who appreciate the cooperative character, and financing and other support services appropriately designed for cooperatives, they can much more easily thrive. Naturally, cooperatives have developed uniquely appropriate growth models that can work to change the environment around them. Though some individual cooperatives do grow quite large, many grow through deeper integration with the cooperative movement. That can be through incubating and spinning off complementary cooperatives, partnering, associations, and federations of cooperatives.

#### Multi-Stakeholding

Not only do cooperatives encourage collaboration among one another but they can also bring various stakeholders together within a cooperative. Multi-stakeholder cooperatives are hybrids of other types. As the name suggests, they have more than one type of member. Voting rights, seats on the board, surplus allocation, and other ownership structures can be designed differently for the different member classes. They should of course be designed in alignment with cooperative values including equality. As all businesses have workers and the workers have an inherent stake in the success of their company, integrating a worker class of members with other types such as consumers is a logical approach to the growing movement of multi-stakeholder cooperatives. Giving multiple stakeholders an interest in one another’s success can help to align their goals, strengthen collaboration, and bring more diverse sets of knowledge and perspectives to the table. This has its challenges, but with a strong shared mission, well designed governance, and an engaged membership, multi-stakeholding can offer incredible advantages.

Due to the importance of carbon-storing in soil and biogenic materials there is a necessary focus on farmers and foresters. Wood products from the forests are the most common materials used in low-rise construction and straw and other materials from farmers’ fields will be increasingly important with the shift to carbon storing materials. A producer cooperative (as highlighted in Table 2) can give resource managers who otherwise have very little bargaining power the ability to set fair prices and have a more stable and predictable market for their goods. Producer cooperatives can play an important role in a values-led supply chain and are often a core part of fair-trade arrangements. The producer cooperative generally purchases raw materials from the resource managers and offers some value-added process before reselling them. This points to the purchasing cooperative playing the role of manufacturer. Table 2 also shows that product development and manufacturing are appropriate areas for worker-ownership. This could lead to creation of a multi-stakeholder cooperative in which producers (farmers and foresters) supply raw materials and the product development and manufacturing workers lead innovation and processing of those materials into valuable products for the construction industry. Collaboration could result in significant business benefits such as guaranteed supply/purchasing and better communication for planning quantities and quality control. They may even be able to co-locate to reduce shipping, logistics, and overhead and increase social ties.

#### Spin-offs and Second Tier Cooperatives

There are differing opinions on the ability of individual cooperatives to function at larger scales. Cooperatives, as democratic organizations, truly thrive when their members engage with the cooperative. Engaging the membership and serving their needs becomes more challenging as the membership grows and diversifies. Despite these challenges, some cooperatives have successfully grown quite large and maintained their cooperative character but that is not the best approach for all cooperatives. Often, as a cooperative recognizes a need, whether in the market or their community, instead of expanding their company to fill this need, they incubate and spin off a new business. These businesses are generally complementary and become business partners with strong social and contractual ties.

Whether through spin-offs or independent development, when there is a significant density of cooperatives (generally in an industry or a region), they may recognize shared needs that could be most efficiently served by another business. At this point, the cooperatives themselves may form a second-tier cooperative (a federation) in which the cooperative businesses themselves are the members who own and democratically control the business.

The idea of federations as a SCI strategy has been around for a while and is “emerging as key to global competition” (Handfield, 2016). The federations’ role has been as a central governing body that implements shared policies, procedures, and guidelines to create an integrated system of SCM for its participants. This all rings true for our study. However, the version of supply chain federation in mainstream literature is smaller supply firms integrated around a larger firm; Handfield uses the examples of Honda, John Deere, and Intel. These large businesses have integrated many small suppliers into a federated structure to support the primary business but they are not cooperative federations. Handfield describes the large firm as having “a strong, paternal relationship” (2016); the federations have hierarchical control with the large firm dictating the terms and reaping the benefits rather than democratic governance and shared surplus. In the fragmented construction industry, few individual contractors could play such a role highlighting the failure of traditional SCI strategies in the industry. In contrast, Lonngren et al. (2010) describe a case study of Baufairbund, a cooperative federation comprising 15 businesses which perform complementary trades. Together, these businesses are able to provide everything to a client “from the original consultation through to the planning and realisation of the building project up to and including subsequent services surrounding financing and facility management” (Lonngren et al., 2010, p. 408).

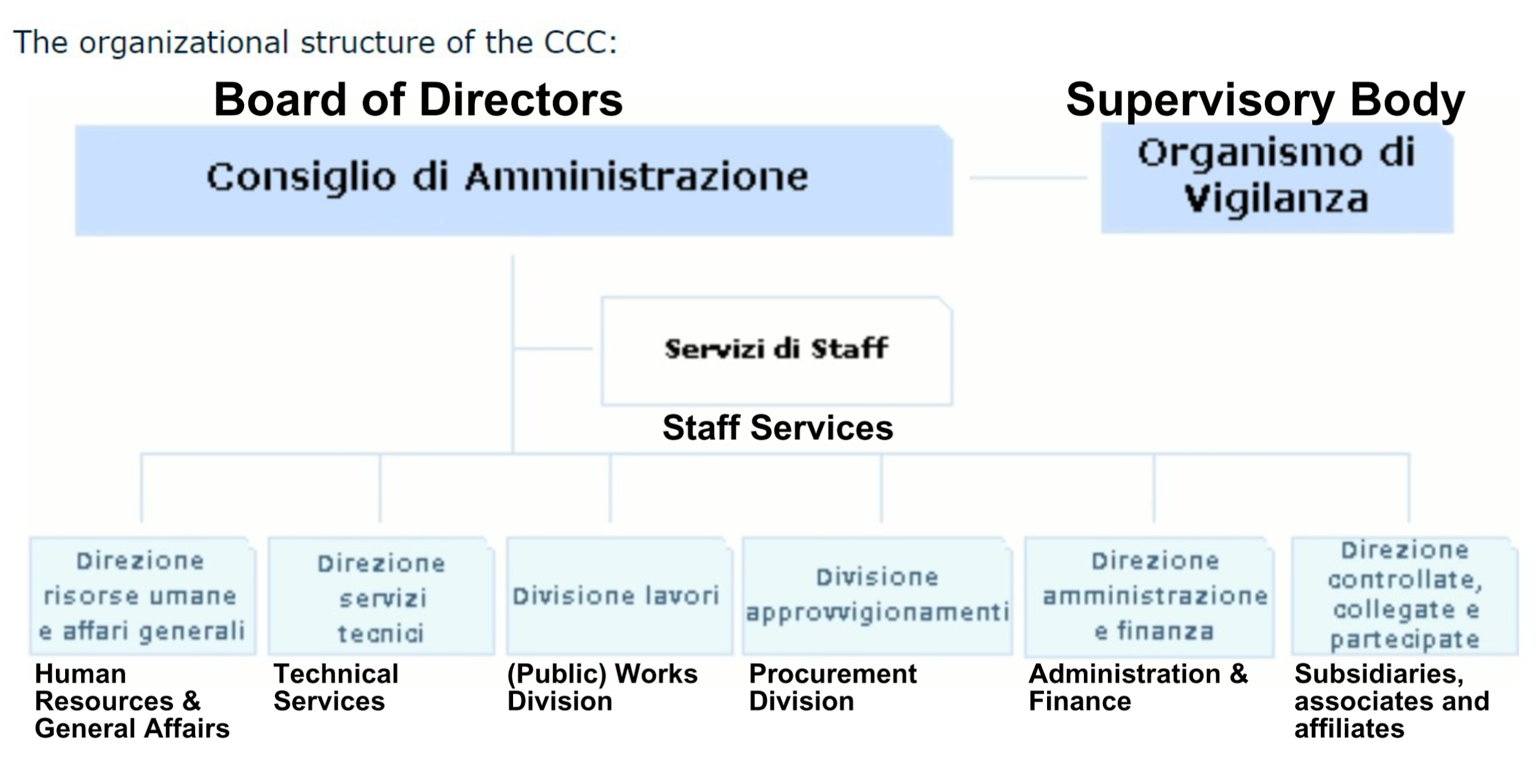
Table 2 noted that housing cooperatives could become clients that demand their projects be done with embodied carbon in mind. A small housing cooperative on its own may struggle to find the designers, builders, and materials to create a carbon storing building. An association of housing cooperatives that come together for maintenance, remodels, and new construction, on the other hand, may be able to leverage their buying power to incentivize the supply chain to provide these services.

Table 2 also suggested that a purchasing cooperative could support designers and builders in using more carbon storing materials. As the purchasing cooperative builds a strong foundation, it may find that suppliers are not providing the materials, information, timeliness, quality, or communication that they need and look to connect directly with manufacturers focused on producing carbon storing materials. The solution to this could be to create a new supply company to serve the members of the purchasing cooperative and other designers and builders looking for similar services. The new supplier could take many forms. Multiple regional purchasing cooperatives may expand vertically, incubating a second-tier consumer owned carbon focused supply company. Another path could be one or more purchasing cooperatives incubating and spinning off a worker owned supply company. Alternatively, multiple manufacturing cooperatives may be the ones to identify the need for a new supply company. Traditional suppliers may not be interested in selling their materials or the manufacturers may simply decide that a carbon-focused supplier that offers all their materials in one place will improve their visibility and make it easier to sell their products. They could create a supply company in the form of a producer cooperative owned by the manufacturers or a multi-stakeholder cooperative owned by the manufacturers and workers at the supply company.

#### A Cooperative Ecosystem

An association of housing cooperatives or a supply company owned by manufacturing cooperatives are examples of second-tier cooperatives but this same approach to creating federations to serve shared needs can continue. It is not hard to imagine the many forms of cooperatives briefly touched upon in this paper and similar movements in other regions coming together into regional and national federations. A well-developed example is in Italy where the Consorzio Cooperative Construzioni (CCC) has brought together the regional cooperative organizations in the construction industry. The process began in the early 20th century as regional consortia were set up for cooperatives in the construction industry. One of these was CCC which was “formed by eight cooperatives … to bid for public works” contracts (Ammirato, 2018). Over the 1900s CCC merged with other regional consortia and near the end of the century incorporated the National Consortium of Building Supplies Cooperatives (ACAM) to bring construction support service cooperatives together with builders, engineers, and designers (Zamagni, 2006). Figure 1 shows the organizational structure of CCC. The CCC in turn is a part of LegaCoop, one of Italy’s three primary cooperative apex federations that bring together all industries and economic sectors.

**Figure 1: The Structure of CCC**



(Retrieved from: <http://www.ccc-acam.it/azienda/organizzazione.php> July 2020. English annotations added by the author with guidance from Google Translate)

At this point, it is clear how cooperative economies can grow through integration and development of multiple tiers of cooperatives that provide for the shared needs of stakeholders with shared values and goals. Each tier benefits and is controlled by its members, creating a complex bottom-up hierarchy. Eventually, the system can move towards a voluntary and democratic federated structure that develops strategy and services for its members on an industry scale or even for an entire cooperative economy or society. Within these apex federations, there are incubators, consultants, cooperative banks, development funds, and many cooperative businesses buying one another’s products and services and sharing information. It is by taking a step back and looking beyond the individual cooperative to a cooperative ecosystem that one can see the fit of a cooperative approach to transforming an entire industry.

#### Movement Building

Transforming the construction industry in its essence is ecological and social activism. It will take political will and legislative change, it will take an increase in demand for this work from clients, and it will require growth and education among builders, suppliers, manufacturers, and all other industry stakeholders. The goal and the process of this transformation is not simply an entrepreneurial notion of success for an organization, it is the building and strengthening of a movement.

Like the construction industry, scholars looking at social movements highlight fragmentation as a major barrier or starting place of movements (Grassroots Policy Project, 2013; Funke, 2014; Pastor and Ortiz, 2009). While it is true that movements need “different kinds of groups that have different kinds of strengths [they also] need networks and alliances that are flexible, not rigid, in which roles, divisions of labor, approaches, tactics and strategies are regularly negotiated” (Grassroots Policy Project, 2013, p. 2). Cooperatives can offer these structures. They will not be the only players as there are non-cooperative organizations[[8]](#endnote-9) doing this work and there will need to be legislation and political action as well. This work should also not be looked at in isolation but as part of a larger intersectional global movement of anti-oppression, empowerment, regeneration, and health. Cooperatives’ ability to bring people together, create decision-making structures, bottom-up hierarchies, and extend across economic and social realms positions them as a structural nexus to work around.

The cooperative advantage can be boiled down to its strengths in bringing together, amplifying, and leveraging human capital in contrast to capitalist organizations that excel in leveraging financial capital. Cooperatives have been able to compete in the economic realm by developing systems, strategies, and processes that parallel movement building. Much like Côté’s discussion leading to the NCP, many cooperative scholars argue that to meet modernity’s challenges, cooperatives need to lean more deeply into their unique characteristics. Other scholars and practitioners have developed cooperative managerial and governance strategies to operationalize networking, partnerships, and movement building (Davis 2004; Novkovic & Miner, 2015).

Seeing innumerable potential ways cooperatives could play roles in transforming the supply chain is as exciting as it is daunting. Who are the people who are going to take on all this work, how can one expect so much to happen across the industry in such a short window and will individual businesses collaborate with one another? Here, the work of Funke (2014) who looks at movement building as a continuum is inspiring. Building on Fox’ (2004) categorization of types of transnational cooperation, he draws the continuum from very loose collaboration that prioritizes autonomy and individuality to the development of shared identity, processes, and organizations that can displace current dominant systems. The focus of his work is describing how one type can lead to another and build through the continuum. A cooperative economy can follow a similar path with secondary and apex federations acting to bring actors together with a shared purpose and identity while allowing them to retain their autonomy and independence. To move through the continuum, "activists, groups or networks, as well as particular protests, forums or occupations, can be thought of as operating as a sort of catalyst or amplifier for generating group connections, linkages or cooperation that could spread across space and time" (Funke, 2014, p. 32). In order to transform the entire industry, this research has looked for a tangible step that can act as such a catalyst, one leverage point in the supply chain that when transformed can trigger autonomous nodes of change throughout. These nodes can then find their commonalities with one another and build coalitions, networks, and federations.

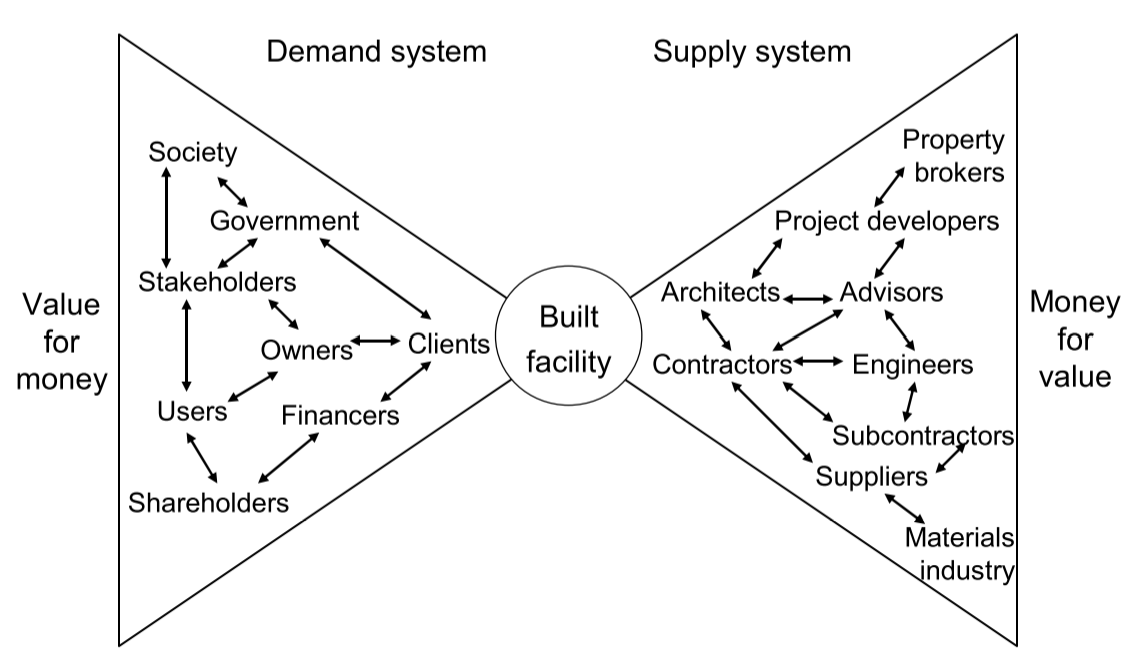
#### Identifying a Catalyst

Returning to the notion of movement building, real structural change will come not from one source but from multiple like-minded groups working on the same problem from many angles. Those various nodes can then come together to feed off and reinforce one another. Funke (2014) describes “a continuum of increasing movement building and thus describes higher stages of commonalities, shared understandings and identities, mobilizations and strategies” (p. 29). Recognizing the embryonic stage of transformation the construction industry is in, identifying a catalyst that can trigger the development of cooperative strategies throughout the supply chain is an important step in moving towards industry wide transformation.

#### Narrowing in on One Strategy

To narrow in on what could be an effective catalyst to spur transformation in the industry takes a return to industry research and what SCI strategies are being proposed. De Ridder and Vrijhoef have provided a useful graphic (Figure 2) showing the relationships among stakeholders in the industry. On one side there are the stakeholders creating demand for a building project. These stakeholders want the most value for their money. On the other side are all the stakeholders working to create the building and they would be expected to want the most money for the value they are providing.

**Figure 2: Industry Stakeholders**



De Ridder and Vrijhoef, 2005

This graphic helps us to understand the value chain including the demand for the building and the supply chain that creates the building. It is important to note how the demand side funnels to the clients while the supply side funnels to architects/designers and general contractors. These stakeholders are the final touchpoints that all other stakeholders directly or indirectly work through. Therefore, SCI strategies generally revolve around architects/designers and general contractors as the keystone stakeholders to coordinate all others.

Most literature on SCI in the construction industry focuses on the demand side (client driven strategies). In many ways this makes sense as clients are the ones specifying what they want built, paying for it, selecting who designs and builds it, and they can even specify who they want further into the supply side such as materials suppliers and subcontractors. This shows the importance of significant buying power to dictate the collaboration and communication of manufacturers, suppliers, and builders. It can increase the efficiency and accuracy of materials procurement as well as bring the materials expertise of manufacturers and suppliers into the design process (Khalfan et. al, 2008). However, building the relationships and communication structures among various stakeholders takes a lot of work up front. Client driven SCI is only worthwhile if the client has a huge project or is a multi-project client such as a government or developer. Returning to the focus of this study - low-rise construction - many clients creating the demand are going to be individuals, families, and small businesses looking to renovate or build specifically to their needs. These are not huge construction projects and the clients are generally not multi-project clients. An exception would be an organization like a housing developer. For the rest of the single project clients, a more natural fit is a supply side driven strategy revolving around designers and/or general contractors.

#### What Needs to Change?

Understanding what unmet services could be valuable to designers and/or general contractors while also triggering change elsewhere in the supply chain begins to shape more concretely who the target participants are and what form the organization should take. The work of Chris Magwood helps better understand this. As noted above, he describes ‘Best Conventional EC’ materials that are commonly available and that, when selected, can bring buildings just below carbon neutral (Magwood, 2019). It is clear, given the impacts that are attributed to the built environment that though these materials are available, they are not being used consistently. Reasons for this could include cost, a lack of understanding of their benefits or an inability to communicate those benefits to clients. If all these areas can be addressed, it seems likely that there would be a significant increase in the use of these common materials and the building industry may move closer to carbon neutrality. Even that is not the ultimate goal. The climate research discussed above shows the need to dramatically decrease atmospheric greenhouse gases and that buildings can be a sixth major carbon sink. To accomplish this, it is necessary to go beyond these commonly available materials. Magwood explains that these materials are either not readily available through most building suppliers, or not well enough understood to be adopted by the industry.

#### What are the Services and Who are the Members?

While construction is approached differently depending on the project, the local building codes, and many other factors, there is generally a designer who specifies construction details and the major categories of materials going into a project. This shows an immediate leverage point in which a service offered to designers could fill the knowledge gaps. Keeping in mind the earlier presumption that all participants would be aligned with the mission (to combat climate change), working with them in the design process to ensure that low embodied carbon and carbon storing materials are integrated into the design would be a valuable service. So long as the market also has clients that believe in combating climate change, providing the ability to measure and communicate the impacts of embodied carbon adds a business case for the value provided. While some of these materials are common, others are hard to find or contractors may not know how to build with them. This is where the services begin to shift from working with designers to working with the general contractor. Services could initially include:

* Holding expertise in cost, availability, and ecological impact of materials
  + Supporting design teams in materials specifications
  + Supporting the estimating process
  + Providing carbon calculations to guide the design and communicate with clients
* Coordinating materials purchasing
  + Negotiating discounts and rebates for members on common materials
  + Sourcing less common materials
  + Coordinating purchase and delivery logistics
* Facilitating member to member communication & education
  + Managing a member updated best practice database
  + Hosting workshops and other member events

Based on the author’s personal experience in the industry, the interviews with industry stakeholders, and secondary research, these services address the primary gaps in skill and knowledge holding designers and builders back from further adoption of carbon storing materials. Members themselves will want to refine services as this work moves forward.

Having now identified the key leverage points on the supply side of the supply chain and the services that can be offered, it is clear that services should be targeted at both design companies and general contractors. However, the services and value propositions are significantly different for the two types of stakeholders. Fortunately, there has been a trend towards integration in the industry on many fronts, incidentally providing hope for more success in supply chain integration. This is exemplified by firms that offer both design and general contracting services - design/build companies - which are now “the most widely used project delivery method in the United States” (Brown, 2018). It is these companies that profile as the ideal members for this cooperative and could be joined by workers forming a multi-stakeholder cooperative.

### Another Look at Purchasing Cooperatives

In the interviews with cooperative, supply chain, and industry experts the author framed the conversation based on an understanding of designers and contractors as the ideal leverage point in the supply chain and outlined the services identified. It became clear that offering these services to design/build companies aligned very well with a purchasing/shared services cooperative model.

Purchasing cooperatives generally negotiate discounts and rebates on primary products, i.e., construction materials or auxiliary services such as credit card processing fees. Along with negotiating for better prices, purchasing cooperatives commonly provide their members with training, networking, and shared marketing. A less common, but in this case important service purchasing cooperatives can provide is sourcing inputs that are hard to find or access.

The horizontal nature of purchasing and shared services cooperatives for design/build firms shows great promise. They are one link in the supply chain, but as seen in Figure 2, have immense leverage. With a large membership (or multiple purchasing cooperatives), it is possible to impact many projects broadly across the industry. Purchasing cooperatives are already reasonably common in the construction industry and that familiarity may make potential members more comfortable pursuing this strategy. An example is Blue Hawk Cooperative whose members are independent Heating, Ventilation, Air Conditioning and Refrigeration distributors. They formed a cooperative to stay competitive in the face of “the relentless expansion of manufacturer owned distributor networks and large corporation-owned distributor chains” (Blue Hawk).

With a purchasing cooperative identified as a potential catalyst, questions that naturally follow are, what is a viable scale at which to provide these services, are there enough companies that fit the member profile and are interested in participating in this strategy, and what suppliers could be appropriate partners? Design/build companies interested in these services and embodied carbon experts interested in offering them will need to ask those questions themselves while developing a purchasing cooperative or other solution. The following analysis is a starting point.

#### What is the Right Scale?

Having narrowed in on design/build firms as the ideal members, it is important to also decide the geographic boundaries. Should the scale be local, regional, national, or even international? Because building techniques and material characteristics vary in different climatic areas, and due to the ecological impacts of shipping, it is unlikely that a national or international strategy will be appropriate. The potential exception would be geographically and climatically similar areas such as Southeastern Canada and Northeastern United States. Focusing on local or regional scales as a starting point, a good next step will be to run some financial projections. The author is located in Vermont, United States and his networks and interviews primarily revolve around the Northeast of the United States so that is the initial focus. To assess the viability at these scales, the following data will help:

* Assessing the number of design/build firms in those markets and how many of them can be expected to join (looking at the Northeast Sustainable Energy Association’s member directory is a good starting point).
* Identifying what materials are commonly available and have enough suppliers to be able to negotiate discounts and rebates from.
* Understanding the annual dollar amount these companies spend on commonly available materials that could be purchased through the cooperative (conducting a further round of interviews with companies that fit the member profile will help to understand this amount).
* Estimating the percentage of those materials that the member would buy through the purchasing cooperative (based on interviews with professionals in construction industry purchasing cooperatives, 30% recommended).
* Multiplying that dollar amount by the expected percentage of rebates and discounts (based on the same interviews, 4-6% recommended).
* Considering how much of that revenue would be passed on to members to be valuable enough to encourage participation and how much can go towards the cooperative’s expenses.
* Adding any additional revenue sources such as member dues or fee for service for services beyond purchasing commonly available materials.
* Assessing the annual expenses of the cooperative and if these sources of revenue can cover them.

#### Management and Governance

The leaders in purchasing cooperatives who were interviewed confirmed that purchasing cooperatives often do not strongly embrace cooperative values and have less participatory democratic processes. It will be important to ensure that is not the case here. Earlier in this paper, trust was identified as one of the major barriers to SCI in the construction industry. Trust can be built in multiple ways including through democracy, transparency, and consistent social interaction. Because cooperatives can provide these, Sabatini et al. show that “unlike any other type of enterprise, cooperatives have a particular ability to foster the development of social trust” (2013). In talking about a new partnership of companies interested in transforming an industry and the massive goal of combating climate change, there are undoubtedly significant risks. Trusting that the other members of the cooperative as well as supply chain partners are competent, well aligned, and looking out for one another allows members to recognize that the risk is not solely on their shoulders but spread across a strong community. The U.S. Overseas Cooperative Development Council reinforces this by explaining that “trust entails a willingness to take risks in a social context. Individuals act, based on confidence that others will respond as expected and will act in mutually supportive ways” (Cooperatives, 2007 p. 21).

In this research on SCI, it was clear that providing digital platforms for member-to-member communication is incredibly important. With a view to moving further along the continuum towards a deeply interconnected carbon-conscious supply chain, facilitating communication among the various stakeholders will be increasingly important both for business purposes, i.e., efficient supply chain logistics, and for movement building purposes and building social capital. In the interviews it also became clear that occasional in person events have a huge impact in building relationships and collaboration.

While the primary services and foci are around business processes, cooperative principle 4 - Education, Training, and Information – can extend to personal development and individual empowerment and responsibility. These are valuable processes in their own right but also have significant positive externalities in building stronger communities, improving societal communication and understanding, and taking care of shared resources among others. Without the development of the individuals, it is hard to imagine the successful growth of a movement.

#### Next Steps

The next steps need to be focused on developing some initial financial projections to confirm the viability of the cooperative and the appropriate scale at which to start it. With a better understanding of the geographical boundaries that are feasible, it will be important to engage potential members more deeply. The author hopes to conduct some of that work and identify a development team of leaders in design/build firms by distributing this paper, networking, and potentially through presentations. The team’s insights and leadership will be crucial in many respects from refining the understanding of their needs, tailoring the organizational structure, management, and democratic processes to fit those needs, and building the social capital among members that allows for strong associative practices. Discussions on these topics will help the development team write the bylaws or operating agreement. One of the areas of member needs that should be a focus is identifying which materials and suppliers will be the best fit for the cooperative. This can be done by matching member needs to the cooperative’s services as well as looking at how the cooperative’s services position it in a competitive market. Additional outside support will likely be necessary in various areas depending on the skill sets, capacity, and level of engagement among the founding members and development team. Technical support may be necessary to identify the most effective digital platforms to both facilitate the members’ business with the cooperative and mutual support among the members. Workers will need to be hired at some point and may start off as part of the development team. The number of workers will be dependent on the final scale but important roles will include general strategic management, member relations, and supplier relations.

#### Opportunities for Future Development

The purchasing cooperative described above with its focus on embodied carbon sets a scope that is manageable, impactful, and immediately needed. However, there are many opportunities for this cooperative to grow. With that in mind and knowing that the members are users who control, own, and benefit from the organization, below is a list of some of the areas the cooperative could move into once it has a stable footing:

* Policy and building code advocacy and development to create a more fertile environment for both cooperatives and carbon conscious construction.
* Tracking of other environmental and social metrics beyond embodied carbon and guidance to improve these impacts.
* Vertical integration with other areas of the supply chain.
* Incubation and spin-offs such as product and materials development, testing, manufacturing, and supply.
* Marketing, project management, contracts procurement and project financing.
* Federation, association, partnerships, or other increased connectivity with the cooperative movement.

Many of these services would benefit not only the members of the purchasing cooperative - design/build companies (and potentially workers) - but all industry participants. When shared needs and values are recognized throughout the supply chain, greater integration can happen and instead of the purchasing cooperative growing on its own, it may be appropriate to create an industry-wide federation such as Italy’s CCC discussed above.

### Conclusion and a Call to Action

The causes of, impacts from, and solutions to climate change are inextricably linked to other social inequities and any work on climate change should be considered as part of larger movements towards a more kind, just, and democratic society. The built environment is the largest contributor to global greenhouse gas emissions but through transformation at all levels of the supply chain, the industry can help the world change its trajectory and begin drawing down the levels of atmospheric CO2e. To do so, the construction industry must continue improving on operational CO2e emissions while simultaneously shifting the materials and building techniques used to address embodied CO2e. This change will take efforts from every level of the supply chain.

Industry wide transformation can be looked at through the lens of movement building rather than changing business models and practices. The adaptability and characteristics of cooperatives can offer a structure for the individuals and organizations working independently towards shared goals and for them to come together as a movement. The leverage that designers and builders can have based on their position in the supply chain and the opportunity to provide valuable services to them suggests that a purchasing cooperative of design/build firms may be able to act as a catalyst for change throughout the supply chain.

This research is only a starting point upon which values and mission aligned individuals and companies can build. It has suggested some ways in which a cooperative approach could be used in different areas of the supply chain and which stakeholders could be members but those decisions will ultimately need to be made together by the parties interested in forming cooperatives and transforming the construction industry. Anyone interested in putting in the work to further develop or adapt what is outlined in this paper and bring this strategy to life in the Northeast or any other region are encouraged to reach out to the author or simply dive in.

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### Notes

### Appendix: List of Abbreviations

|  |  |
| --- | --- |
| **Abbreviation** | **Full Name** |
| ACAM | Consorzio Nazionale Cooperative Approvvigionamenti |
| CCC | Consorzio Cooperative Costruzioni |
| CO2e | Atmospheric Carbon Dioxide Equivalents |
| EC | Embodied Carbon |
| EC3 | Embodied Carbon in Construction Calculator |
| eCO2e | Embodied Atmospheric Carbon Dioxide Equivalents |
| EPD | Environmental Product Declaration |
| GHG | GreenHouse Gases |
| IPCC | International Panel on Climate Change |
| NESEA | Northeast Sustainable Energy Association |
| NCP | New Cooperative Paradigm |
| oCO2e | Operational Atmospheric Carbon Dioxide Equivalents |
| SCI | Supply Chain Integration |
| SCM | Supply Chain Management |
| WBLCA | Whole Building Life-Cycle Assessment |

1. WBLCA “is a tool that allows architects and other building professionals to understand the energy use and other environmental impacts associated with all life cycle phases of the building: raw material procurement, manufacturing, construction, operation and decommissioning” (Singh, A., 2017). [↑](#endnote-ref-2)
2. Materials originating from living organisms such as plants or fungi. [↑](#endnote-ref-3)
3. Collaboration among organizations throughout a supply chain leading to integrated systems and logistics. [↑](#endnote-ref-4)
4. The most common expression of these comes from the International Cooperative Alliance’s *Statement on the Cooperative Identity* (Macpherson, 1995). Some cooperative movements such as Mondragon have developed their own closely related set. [↑](#endnote-ref-5)
5. Dimaggio and Powell (1983) define three types of institutional isomorphism. 1) “Coercive isomorphism results from both formal and informal pressures exerted on organizations by other organizations upon which they are dependent and by cultural expectations” (p. 150). This includes conforming to political legislation. 2) Mimetic isomorphism comes in situations of uncertainty when organizations look to model themselves after other organizations. 3) Normative isomorphism “stems primarily from professionalization” (p. 152) often shaped by university education, and professional networks and training. [↑](#endnote-ref-6)
6. Demutualization is when a cooperative or other mutual organization transitions to another organizational structure (commonly by selling into an investor-owned firm) or liquidates. [↑](#endnote-ref-7)
7. Denaturalization is when a cooperative drifts away from their cooperative identity (Côté, 2019). [↑](#endnote-ref-8)
8. There are already organizations pushing to focus on embodied carbon in construction or more broadly focus on ecological impacts in construction that could be important partners such as the Northeast Sustainable Energy Association (NESEA), Builders for Climate Action, Architecture 2030 and the Carbon Leadership Forum. [↑](#endnote-ref-9)