Locally-sourced architecture

Alejandra Cervantes[1], Amy Douma[1], Jim Moore[1], Jacob Mans[2]

[1]HGA, Minneapolis, MN
[2]University of Minnesota, Minneapolis, MN

ABSTRACT: Architectural projects contribute to economic development through many channels, including the specifying of materials and building systems. As specification systems become more standardized, relying on familiar manufacturers or product lines, architects inadvertently contribute to concentrations of opportunity – and potentially resulting wealth – along established supply chain channels. With increased globalization of product manufacturers and supply chains, those who benefit from this system are frequently distant from the community in which the project resides. This research identifies an interdisciplinary process to help refocus the economic benefits of material choices through repositioning the design professional within the ecosystem of those decisions. This process leverages architectural services to enhance local economies through social and material capital. Developed through a national research consortium connecting academia and architectural practice, the research is led by a HGA Architects & Engineers and the University of Minnesota who teamed to explore these questions beginning in 2016. Preliminary outcomes of the research identified ways architecture projects could embed data-driven processes within an effective economic development strategy, in turn opening possibilities for architects to impart positive change in a project's local economy and improve their agency in the systems of material and social currency that enable local economic growth. Through this research a 'locally-sourced' design process was developed in which embedding the data of local economic experts within the process of material and systems selections could maximize targeted impact, and architects would be able to track the benefits of these selections for ultimate sustainment. This research not only offers architects an opportunity for expanded architectural services, it also posits an equitable design and construction process with the potential to enhance client relationships, increase supplier partnerships, and benefit local communities.

KEYWORDS: local economy, partnerships, stakeholders, agency, process engineering

INTRODUCTION

Architectural design and construction projects contribute to economic growth through numerous channels. Frequently local tradespeople are engaged in building assembly, and occasionally architecture itself becomes an economy-fueling attraction, demonstrated by the well-documented regeneration of Bilbao (Franklin 2016). Sourcing of construction materials and building systems is another potential economic driver, but – due to competing project forces such as budget, schedule pressures and even habit – its ability to propel targeted economic growth is frequently underexploited. Few practitioners have a clear understanding of the economic impact of their choices on regional and global wealth distribution.

With increased globalization of product manufacturers and supply chains, architectural materials are now frequently sourced from locations distant from the community in which the project resides. Without rigorous research into – and even creative repurposing of – local resources, architects may inadvertently contribute to concentrations of opportunity and wealth along established supply chain channels, potentially to the detriment of local community economic health.

This research explores the opportunities for architects to redirect the financial benefit of material choices to targeted locations in support of robust local and regional economies. The project began in 2016 and is co-led by HGA Architects & Engineers and the University of Minnesota through a national research consortium connecting academia and architectural

practice. The research probes the following questions:

1) 49Do current architectural material procurement processes reinforce existing wealth distribution, thereby rewarding global supply chains at the expense of local networks? What are the potential roles for the architect in reinforcing or reshaping this trend?
2) What are the economic drivers that privilege non-local sourcing, and how can they be disrupted?
3) How do traditional design and documentation processes contribute to these trends? How could these processes evolve to re-center the investment benefit?

The following pages will outline the research context, findings and conclusions, and speculate on the state of practice and its place in navigating global and local economic dynamics.

1.0 MATERIAL ECONOMIES

A material's life-cycle influences an entire ecosystem of economic impact throughout its stages of extraction, production, use, and end of life. With varying degrees of wealth distribution, the labor and logistics involved at each stage can be traced to a single locality or individual. Two examples illustrating the relationship between declining material production and community economic health are described below.

1.1 Shifts in U.S. aluminium production and economic impact

The decline of aluminum production in the U.S. and its impact on employment has gained significant national attention over the past decade. Several decades ago, over 30 primary unwrought aluminum[1] smelters operated in the U.S. As recently as 2011, there were 13 smelters nationwide; by 2017, only 5 remained in full operation while 2 continued with limited production (Tsuji and Torsekar 2017). New York Times correspondent Binyamin Appelbaum analyzed the causes of this decline and revealed the beneficiaries of the industry's national exodus in a story published in 2017. Appelbaum describes the impact of decisions made by Alcoa, an American-owned aluminum production company, formerly known as Aluminum Company of America, which has closed plants in the U.S. and is now primarily operating in Iceland.

While the decline of domestic aluminum production is frequently attributed to Chinese competition, the high cost of U.S. electricity has also played a role, along with the age and inefficiency of U.S. plants. Iceland's unique geography enables the island to harness melting glacial water to create inexpensive electricity, attracting industries like Alcoa with heavy energy demand; already low energy prices were further subsidized to entice development.

As a result, Reydarfjordur, located on Iceland's eastern coast, has experienced a remarkable revitalization of its community, economy, and population since 2007 due to the influx of new jobs created by the burgeoning aluminum industry.

> This is precisely the kind of globalization that economists have long told us is beneficial. Iceland gets jobs. Alcoa shareholders get higher profits. Shoppers in the United States get lower prices. Of course, there is also a hefty cost: factories closed, jobs gone, communities torn apart (…) (Appelbaum 2017)

One of these communities is Wenatchee, Washington, whose Alcoa plant closed in 2016. In addition to the 428 jobs provided by the plant itself, Alcoa was estimated to drive $60 million annually into the local economy according to Eastern Washington University's Institute for Public Policy and Economic Analysis. The plant closure has left the community scrambling to replace the revenue source, and an effort to reopen the plant has been ineffective. Facing a similar fate, the state of New York agreed to pay Alcoa $73 million in public funds to maintain plant operations in struggling upstate Massena for 3.5 years. That agreement expires in March of this year.

1.2 Community decline and the wood industry in Oregon

The U.S. wood product industry has been subject to economic fluctuations, most recently during the Great Recession of 2008 which devastated home builders and the construction

sector (Peralta-Alva 2011). A key driver of wood product demand, U.S. construction was more sharply impacted than other countries; through 2013, the industry remained stagnant and before slowly and steadily recovering (Prestemon, Wear, and Foster 2015).

While the Great Recession precipitated a steep drop in wood production nationwide, the Pacific Northwest has seen steady decline since the 1990s due to environmental protection regulations, changes in land use policies, and technological innovations. This area's rural regions were profoundly affected, as the wood products industry "has played an important role in rural employment for decades and few other skilled labor jobs are available" (Gale et al. 2012). Towns that were once reliant on logging as the main source of economic revenue and jobs suffered exponentially with the gradual disappearance of an industry.

Sweet Home, located in West-Central Oregon's Linn County, still experiences economic instability and high unemployment resulting from the regional deterioration of the wood-based economy. Classified in the American Communities Project as "Graying America" – defined by low diversity and a large senior population (Chinni 2016) – the community faces increasing homelessness, low wages and a poverty rate over 20%.

> The food bank has a more secure future than remaining industrial jobs, and the town is full of people looking for second or third acts without much of a script to guide them. (Johnson 2014)

As logging jobs have disappeared, so has the young adult population, leaving behind an aging community struggling to adapt and attract new industries. Despite an elevated unemployment rate, nearby Roseburg has lost major employers to nearby regions due to frustration with the ability to attract quality workers (Matassa Flores 2015).

Sweet Home is working to grow its economy through a community trail network "to draw more hikers and cyclists." (Johnson 2014) Successful economic rebranding in the region is not without precedent; Bend, another former Oregon logging town has reinvented itself as a tourist destination. Such change is complex and slow to evolve, however, and at this time the path to economic stability for Sweet Home is unclear.

2.0 CONSTRUCTION MATERIAL SOURCING AND ECONOMIC AND ECOLOGICAL TRENDS

While the U.S. continues to see rapid growth in many non-manufacturing industries, such as healthcare, more than half of the twenty most rapidly declining industries are from the manufacturing sector (Bureau of Labor Statistics 2017). Several of these declining industries are closely connected to construction, such as logging, iron and steel, and machinery manufacturing[2]. As major manufacturing industries that supply the construction industry deteriorate, the sourcing of materials by necessity shifts elsewhere, exacerbating the rate of decline. As the examples in Section 2 illustrate, the results can be disastrous for communities.

> Industrial flight has a dramatic impact on everyone. Depleted industrial centers endure the long term effects of unemployment and diminished public services. The declining tax base means less money for schools, roadways, and public safety. (Alliance for American Manufacturing 2016)

Shifts in architectural material sourcing have ecological, as well as economic, impact. Next to food production, the construction industry is the largest consumer of raw materials (Berge 2009). Architects can act as indirect – and unintentional – enablers of unsustainable consumption through the specification of building systems and materials. For example, Brazilian exports of ipê increased by 500 percent between 1998 and 2004 in response to classification of mahogany as an endangered species, and wood products treated with chromated copper arsenate as a preservative were determined to be unsafe. A very dense material resulting from a slow growth rate, ipê's sudden popularity led to unsustainable harvesting practices in Brazil; soon ecologists began branding ipê as the "next mahogany" (Hutton 2016).

Understanding the economic and ecological impacts of material sourcing can be challenging for practitioners. Architectural practice is often confined to a well-established scope of services

that limits the time and resources available to research these topics in depth (AIA 2017). Further, these two issues do not necessarily align as one may expect. Architects have become accustomed to the distances defining “local” in LEED and other sustainability guidelines, but interviews with economic experts revealed that “local” capital flows and geographic distance may be only loosely related. Economic regions can easily be impacted by topography, resource distribution, as well as financial and social networks, making an accurate definition of “local benefit” challenging to articulate.

Finally, while sustainability principles encourage local materials and system sourcing, economic and ecological agendas may occasionally be at odds, particularly in communities based on legacy manufacturing industries. Navigating these issues requires a deeper understanding of economic and ecological forces than most practitioners currently possess.

3.0 FACTORS DRIVING MATERIAL SELECTIONS

In order to understand how the priorities governing materials sourcing can be augmented, it is useful to analyze the factors that frequently drive selection decisions, as well as the process limitations that reinforce current practices.

Through this research project, the team assessed the priorities frequently driving material choices within the sponsoring firm. Deciding factors included local conditions such as constructability or availability (often within tight timeframes) and project constraints such as budget or construction type. Other considerations included warranty, reliability, production capacity and client preferences or standards. Ecological impact was often considered, but frequently clients prioritized cost or schedule over less calculable benefits, particularly as project budgets became strained. Several projects explored local material sourcing to build community favor and benefit local industry, particularly in smaller or rural communities, but these examples were generally limited in measurable economic impact. Ultimately the research team did not uncover a standard process for the selection of materials, but rather a carefully studied list of priorities, which frequently shifted as projects developed.

Our research into the materials selection process also reinforced the limitations of time and project fee on material and system choices. Driven by the need for efficiency and consistency, the sponsoring firm relies on a robust set of standard specifications to establish system quality levels and avoid unexpected problems during or following construction. Interview teams frequently relied on these standards for many material and system choices, reinforcing existing procurement systems.

Given the pressures already faced by practitioners, as documented through the research, the time required to develop deep knowledge of local material availability – and its economic impact – would require an offsetting benefit or service line opportunity to be financially viable. Alternatively, incentivizing manufacturers to document and publish economic relationships and regional impact could shift much of the considerable time investment to supply chain partners. This will be explored further in Section 7.

4.0 CHALLENGING NORMS AND UNCOVERING ROADBLOCKS: PILOT PROJECT

As illustrated above, the local economic impact of materials selection is typically a lower priority for architectural projects – if it is a consideration at all. However, what if a project team – architect, client and contractor – deliberately prioritized this issue? To what degree would “standard” material selections be altered, and could the local economic benefit be quantified? These are the questions the research team explored through a pilot project in 2017.

The pilot was tied to a live project at the sponsoring firm – a small, rural hospital located in a coastal community in the Pacific Northwest. This project was selected due to its potential alignment with the goals of the research and the interest on the part of the client; the community had experienced declining local industry, and 49% of households earned less than the basic

cost of living for the state. The project was also a useful case study, as the broader healthcare system providing oversight had recently identified system-wide material standards it planned to implement on all future projects. Project stakeholders wondered whether local economic benefit derived from alternative material choices could encourage reconsideration of the system standards.

In collaboration with local economists and industrial ecologist partners, an initial economic analysis revealed systemic gaps and potential opportunities to deliver local economic benefits through strategic material selection. In particular, the availability of wood products, local masonry production and stone quarrying showed promise.

Success in implementation, however, was mixed. Given stringent budgetary challenges and fire code restrictions, locally-sourced interior wood was eventually replaced by standardized product systems provided by nationally-recognized manufacturers. The specific geographic sources for the wood products comprising these systems were not well-documented by the manufacturer, so assessing regional relationships and potential economic benefit was challenging. Exterior wood cladding wasn't considered, as the extremes of the coastal environment would require significant maintenance or unpalatable treatment expense. Stone and masonry choices proved more successful; in particular, a locally-quarried stone was selected to replace the system-wide standard product, which was sourced from China (the local client and healthcare system did not previously know the origin of this material and appreciated that a local alternative was identified). Locally-sourced masonry products were selected to complement the stone cladding. In addition, regional site materials, such as hazelnut shells and seashells for mulch, raised some intriguing sourcing ideas.

Challenges to fully implement large-scale impact included the following:
1) A relatively small number of materials that could be locally sourced. Given the stringent requirements of the hospital environment (including infection control and maintenance), many healthcare-tested interior products lacked a viable local alternative. In addition, major building components – such as the structure and HVAC system – simply couldn't be provided by local fabricators.
2) Difficulty in quantifying the ROI. The client was prepared to spend marginally more for local products in return for community good-will and partnership-building. However, their resolve was tested when the contractor – required to deliver the building for an established cost – questioned the quantifiable value of local choices. Calculating the tangible economic impact proved challenging, as it required a detailed understanding of local capital flows beyond the capacity of the team; quantifying the intangible benefits was even more difficult.

The pilot identified several gaps in industry processes and typical design team expertise needed to leverage material selections to impact the local economy in a meaningful way. The research team used these findings, as well as previous research regarding typical material decision drivers, to formulate a potential framework that aspires to enact change more consistently and at a larger scale.

5.0 TURNING THE TIDE WITH A SPECULATIVE FRAMEWORK

Fueled by the unique convergence of academic research and research in architectural practice, this project posits that the challenges of material procurement standards are aligned with the consequences of volatile global economic trends. Both the construction industry and the architectural profession are enablers to deeply embedded economic networks benefiting global development with limited attention to the local impact. The processes in place for material selections, however organic, could – and ultimately need to – aid building projects beyond the limited ecosystem of the building site, thereby expanding scale and yielding a prolonged growth in a segment of the local economy. By reverse engineering the typical outcomes of building projects, the team developed a speculative framework that could augment current processes to disrupt the inertia behind traditional material selections.
As demonstrated by the pilot project, partnering with economists and other experts to better propose avenues for impacting the local economy is essential to make informed specification

decisions. While many traditional design team consultants contribute to these decisions, the scale of their roles and agencies remains tactical, limited to introspection within the project site and building. This research calls for the need to partner with experts skilled in realizing the benefits of connecting with broader ecosystems that specifically look towards economic development. Ideally, an economist would have a significant impact to early design phases when site analysis and preliminary assessment of building systems takes place by uncovering that segment(s) of the project area's economy that could be impacted by material selections or other strategies.

With an expert guiding some of the early decisions in the project, such decisions could deliver a degree of sustained local economic impact in the project area extending beyond the duration of the project. To track and properly assess this type of outcome, an integrated process informed by robust evaluative tools would be needed within the design and construction process. Establishing direct links between material selection and metrics such as jobs created, or even quantitative indirect impacts on the economy, could help the design team refocus and reprioritize the critical factors informing material selection. Precedents for other broader community benefits already exist in construction, such as zoning ordinances, fire codes and energy codes.

Engaging an expert and the development of a tracking tool are two practical strategies uncovered by the literature review and the challenges faced in the pilot project. A third component is establishing the ROI of sourcing locally to impact economic growth both for project teams and the client. For project teams, it would likely involve a series of synchronized projects to demonstrate significant impact and a defined period of time to reflect on the economic impacts of the decisions made.

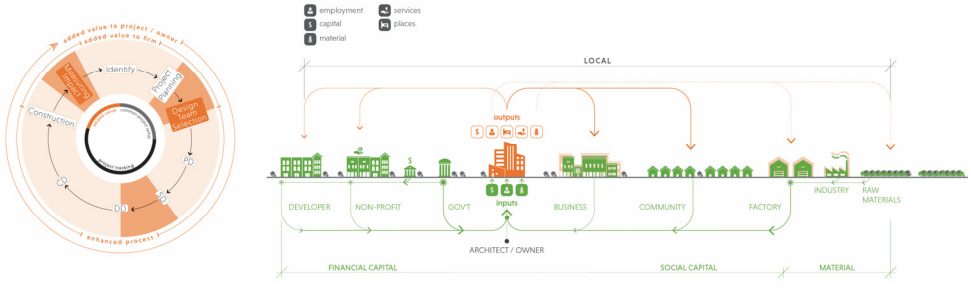

Figure 1. Implications to the design process. Source: (Cervantes 2017)

6.0 PROJECTION

The findings of the research led to broader questions seemingly remote from construction yet suggesting interesting parallels regarding patterns in material procurement and specification. The local food and small business movement are key precedents to consider in this regard. Once considered highly costly and unsustainable, farmers, local food producers and supporters were able to raise awareness around food production – and the ecological and economic benefits of buying local – inspiring a dramatic shift in national consumption habits (Walker, Keane, and Burke 2010). Similarly, small businesses and pop-up shops represent a slow but promising movement supporting local makers, craftspeople, and inventors demonstrating social, cultural, and economic value (Hallsworth, Ntounis, Parker, and Quinn 2015).

A local material movement may face similar obstacles before ultimately earning support from policy makers, economists and construction material "consumers." Clients, contractors, manufacturers and architects will need to embrace long-term return and even some risk in the face of immediate budgetary and schedule pressures. Benefits to clients offsetting potential challenges may include a strengthened and sustained economic base for services or products provided, a skilled labor force, and the community richness engendered by a thriving economy.

Architects, in turn, may see reward in the form of expanded value-based services, enhanced interdisciplinary partnerships and a deep understanding of local resources that could beget additional business. Moreover, by engaging economic challenges and the complexity of potential solutions, architects have the opportunity to recalibrate their professional and societal value, elevated to generators of economic development versus casualties of cyclical downturns.

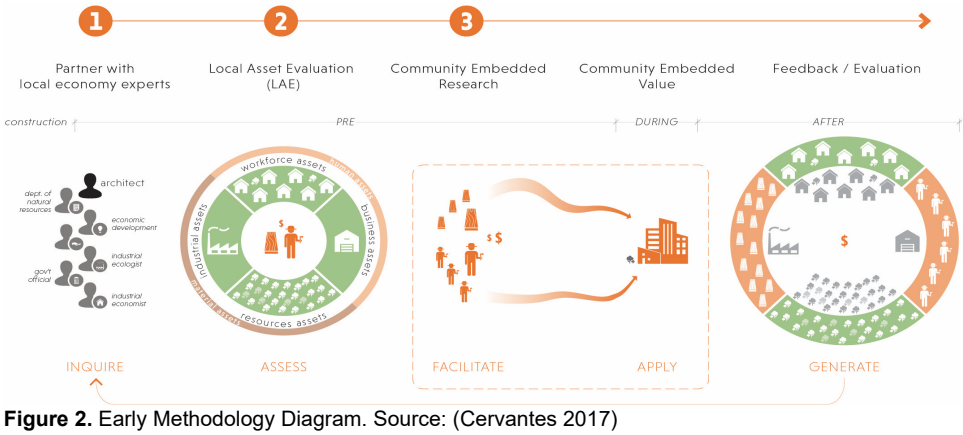

Figure 2. Early Methodology Diagram. Source: (Cervantes 2017)

One potential avenue to integrate this initiative into a broader movement is by appending an existing framework such as LEED or another sustainability guideline. LEED's credit for materials manufactured within a given radius could be expanded to acknowledge local economic development (USGBC 2017). By extension, this could catalyze a greater movement enabling more concentrated economic impact. A second opportunity to build a local materials movement could take the form of direct economic policy including incentivization programs such as tax relief.

In closing, we must note that this research and the approaches promoted do not represent rejection of global development or partnership. It rather challenges the notion that the forces underpinning current trends in economic benefit distribution are of such a scale that they cannot be redirected or reshaped by informed stakeholders. Further, it has been demonstrated that global and regional resources can produce synergies that do not benefit one locale at the direct expense of another. As noted by Katz and Nowak in their work The New Localism:

> Globalization not only creates a hyperconnected world, it also opens up new means for expressing local identity and new possibilities for local development strategies. The importance of local capacities and action is augmented by global and technological change (Katz and Nowak 2017, 47).

This paper acknowledges the daunting complexities of creating new economic policies, but the reward structure and beneficiaries are not unlike those represented by recently established movements that have reshaped the architecture industry. Given the rapid rise of income inequality, propelled in part by the evolving economic forces described in this paper – and the potential to reposition architects as drivers of economic value – this topic warrants consideration and further exploration by the industry.

7.0 RELATED TRENDS IN ARCHITECTURAL PRACTICE

Climate change, energy consumption, and pollution are only some of the wicked problems facing the planet, and the architecture industry is evolving to provide leadership in the face of these changing conditions (Cramer 2017). Recent interest in alternative practice models has propelled architecture practices worldwide to challenge the architect's traditional scope of work through partnerships, pro-bono services, joint ventures, and other clever collaborations (Kim et al. 2007).

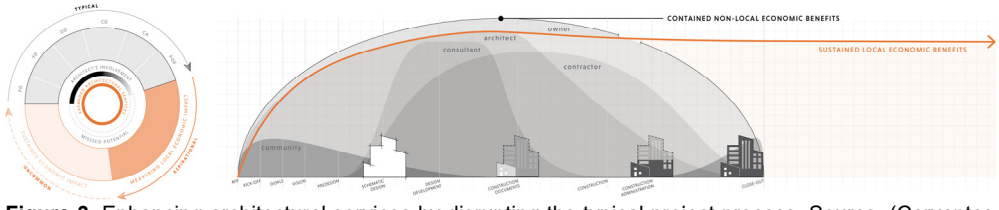

Figure 3. Enhancing architectural services by disrupting the typical project process. Source: (Cervantes 2019)

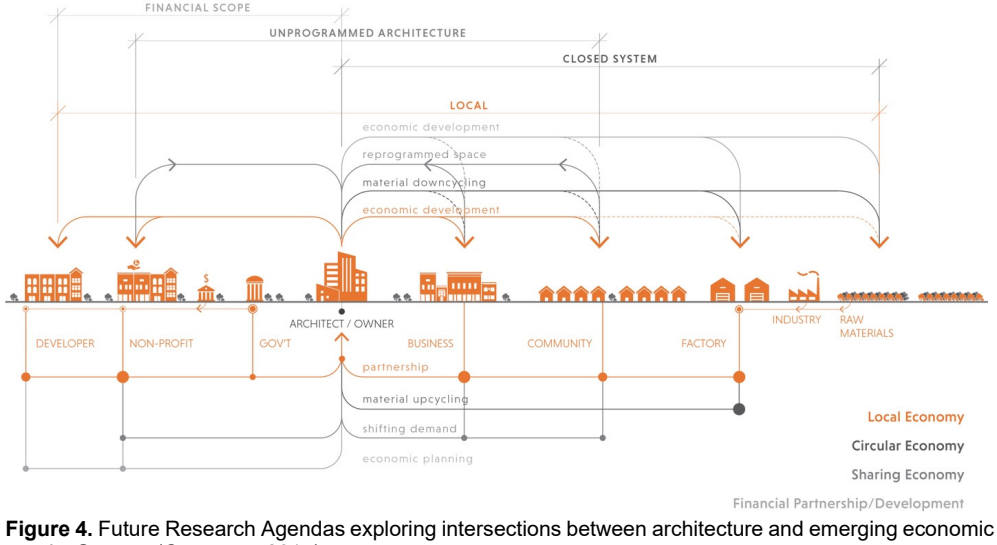

Figure 4. Future Research Agendas exploring intersections between architecture and emerging economic trends. Source: (Cervantes 2017)

In addition to the work described above, this research project also analyzed for-profit practices representing an array of cross-disciplinary collaborations related to aspects of economic development. These case studies demonstrated the value of applying architects' skills in systems-based thinking to complex problem-solving, connecting otherwise disparate systems and foreseeing opportunities of improvement.

In addition to the "local economy" framework described within this paper, this case study analysis identified trends in architectural practice that intersect other emerging economic models: the circular economy, the sharing economy, and financial partnership. In each model, the architect's scope of services produces economic value for the community in different forms. The local economic growth approach encourages distributed, targeted financial benefit through thoughtful material sourcing. A circular economy approach involves regenerative material systems deployed within the community. A sharing economy approach suggests unprogrammed spaces that shift function over time. The financial partnership serves as a funding model through financial institution collaboration to grow economic development.

While the majority of this research project addressed the local economy research agenda, relevant literature and a proposed framework for the remaining three agendas was developed to propel future research that could expand the architect's role and agency in solving complex economic problems.

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ENDNOTES

[1] Primary Unwrought Aluminum production involves the mining and processing of raw materials such as bauxite ore, which is smelted to create aluminum. Unwrought aluminum production employs mechanical processes, such as rolling, extruding, drawing, or forging to make wrought aluminum products from primary or secondary aluminum. (Tsuji and Torsekar 2017)

[2] According to the Standard Occupation Classifying system, Architecture and Engineering Occupations are a major group of the iron and steel mills manufacturing sector; the logging subsector includes the harvesting of timber; machinery manufacturing includes the Agriculture, Construction, and Mining Machinery Manufacturing industry groups (Bureau Labor of Statistics 2017).