Exploring the Role of Ethics and Sustainability in the Decision Making of Engineering and Construction Professionals: Toward Developing Sustainable Cities and Communities

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Abstract

The built environment is the backbone of sustainable cities and human settlements. Thus, engineering and construction (EC) professionals have a direct impact on achieving goal 11 of the United Nations' Sustainable Development Goals (SDGs) through designing, building, and operating sustainable cities and communities. However, the built environment is also heavily connected to many of the other SDGs. This research reports the exploration of EC professionals' approaches to sustainable development, and the extent to which ethics and aspects of sustainability motivate their decision making. Semi-structured interviews with a range of EC professionals demonstrate how various decisions are professionally evaluated as touching each of the 'three pillars of sustainability' (economic, social, and environmental). Economic motivations are embedded in virtually all decision making, while social and environmental aspects of sustainability are more varied in their implementation. Social aspects comprise a broad array of motivating factors, while environmental aspects are heavily influenced by regulation. Most surprising is the extent to which some EC professionals decouple ethics from sustainability-related decisions, placing responsibility fully upon the shoulders of their clients to make sustainable decisions and act appropriately. The ASCE statement on sustainability suggests that engineers should "do the right project" (2021b). However, practice seems to indicate that often EC professionals inform their clients about what may be "right," but take no responsibility to insist on any sustainable action beyond regulatory minimums. EC professionals have an opportunity to take greater leadership roles in directly and indirectly supporting the SDGs via professional work in the built environment.

Keywords: Ethics, Sustainability, Decision Making, Civil Engineering, Construction

Introduction

Background/Motivation

The United Nations' Sustainable Development Goals are compelling calls to action. At the macro, national policy level, many countries are making changes towards a more sustainable future. However, at the meso-organizational and micro-individual levels (the implementation levels) these changes are happening more sporadically. Organizations developing, designing, building, and operating/maintaining the built environment--engineering and construction (EC) firms--have

an immediate impact on the development of sustainable cities and communities (SDG goal 11). EC professionals are also directly involved in:

- the development of systems for providing clean water and sanitation services (SDG goal 6)
- producing affordable and clean energy (SDG goal 7)
- facilitating decent work and economic growth (SDG goal 8)
- supporting industry, innovation, and infrastructure (SDG goal 9)

Additionally, EC professionals indirectly participate in other SDGs, for example:

- transportation networks and food cultivation & distribution systems - zero hunger (SGD goal 2)
- medical care facilities - good health and well-being (SDG goal 3)
- primary, secondary and higher education facilities - quality education (SDG goal 4)
- resources for building materials - responsible consumption and production (SDG goal 12)
- energy consumption from structures - climate action (SDG goal 13)

While national policies are enacted to shape the built environment, which in turn leads to improvements among the above-mentioned SDGs, EC organizations play a significant role in the implementation of those policies. However, EC organizations have the potential to do much more to promote sustainability than what is required by policy. This research sought to explore how sustainability and ethics are connected to the professional decision making of EC professionals. We frame it in the role EC professionals have in developing sustainable cities and communities (though as previously illustrated, EC professionals and the built environment encompass many of the SDGs). First, we review the relevant literature on sustainability in engineering, ethics in engineering, and professional decision making by EC professionals. We then outline our research approach, in which a group of EC professionals participated in semi-structured interviews which informed us as to how economic, social, and environmental aspects of sustainability, and ethical motivations, are considered by EC professionals. We present our findings and provide discussion relating to SDG 11 and other SDGs centered in the built environment. While the EC industry has an embedded role in many of the SDGs, for the purpose of this paper we focus on SDG 11 - *make cities and human settlements inclusive, safe, resilient and sustainable* and its targets.

Literature Review

Sustainability in Engineering and Construction

In June of 1992 the United Nations' Conference on Environment and Development (1992) outlined 27 principles that influenced the creation of the Millenium Development Goals (Sachs, 2012), which served as precursors to the SDGs (United Nations General Assembly, 2015). Today's unifying SDGs recognize social, ecological, and economic sustainability needs. The SDGs address multiple domains of interest directly related to the EC professions, including the efficient use of natural resources, waste reduction, pollution prevention and integrated environmental systems management. The promotion of human rights development, global social equity, environmental justice, and the elimination of world poverty are indirectly related. Looking across the globe, the distribution of these "goods" (e.g. wealth, natural resources, food, housing, technology) and "bads" (e.g. pollution, resource depletion, poverty, industrial disease) associated with the built environment "raises major issues about justice, equity, human rights, and opportunity for health and prosperity" (Manion, 2002).

In business literature these social, ecological, and economic needs are connected with the concept of the triple bottom line (TBL). The TBL identifies three distinct areas to measure organizational impact--people, planet, profits, though the appropriateness of this notion has been questioned (Norman and MacDonald, 2004). Others debate how the three areas should be evaluated, with some arguing that they should be taken together, as the TBL "is explicitly based on the *integration* of the social, environmental, and economic lines" (Alhaddi, 2015). Independent or collectively, these three areas are also considered the oft-noted 'three-pillars' of sustainability. Despite their frequent use it has been argued that these pillars lack a theoretical basis (Purvis et al., 2019). Regardless of these debates, the construct 'sustainability' is increasingly raised throughout academic discourse and the popular press. The fact that there is significant attention paid to the concept of sustainability, without a clear consensus of meaning, suggests that there are many opportunities for further academic research in this domain (Martins et al., 2019). For the purposes of this paper, we acknowledge the various debates of origins, theory, and application, and proceed with the construct of sustainability in a conventional form, as both a motivator and a goal for purposive efforts that seek to improve and even harmonize interactions within what we term the total environment -- the natural, social and built environments.

The EC industry has a significant impact on the total environment. In 2018, researchers suggested the EC industry "consumes 50% of natural material resources, 40% of energy, and is responsible for 50% of total waste" (Khodeir and Othman, 2018). With such an outsized impact on the planetary ecosystem, there is perhaps no more important domain for sustainability research than the EC industry.

Ethics in Engineering and Construction

In the widely-cited work *Ethics in Engineering Practice and Research*, emphasis is brought to bear on the "difficult ethical problems engineers encounter in their practice and in research"

(Whitbeck, 2011). Whitbeck further stated that "in many ways, these problems are like design problems: they are complex, and often ill defined; resolving them involves an iterative process of analysis and synthesis; and there can be more than one acceptable solution." The notion of complexity and challenge in ethical engineering decision making is perhaps not surprising, but that there is no closed-form solution or definitive model leaves much to individuals and the profession to guide how decisions should be approached.

An alternative generalized view of ethics suggests that "there's no such thing as engineering ethics," but rather universal guiding principles applied to the engineering domain (Veach, 2006). Veach's argument is based on John Maxwell's argument that "there is no such thing as business ethics—there's only ethics…Ethics is ethics. If you desire to be ethical, you live by one standard across the board" (2007). This conceptualization of ethics speaks beyond a requirement for specific contextualized ethics frames and focuses more on personal belief systems, culture, and deeper meanings about moral appropriateness, which in turn can be applied to specific domains (e.g. the EC industry).

While interesting, the framing of ethics in engineering is not the primary thrust of this research, but rather how ethics frame EC professionals' decision making toward sustainability-centered actions. We take from the aforementioned perspectives that the application of ethics in engineering is difficult and culturally bounded, but suggest it is fundamental to some of the more challenging issues that SDG 11 presents.

Connecting Ethics and Sustainability

Sustainable decision making requires ethical thinking. While the study of ethics is broader than the idea of sustainability, the application of ethical ideals is central to effective sustainable design and construction. Sustainable decision making cannot be made without the application of numerous ethical considerations, because "virtue, rightness, consequence, and context are all ethically important in navigating sustainability" (Jennings, 2016). Ethically-based decision making is necessary to accomplish SDG 11 and its targets. For example, target 11.2 includes a component for "improving road safety." Jurisdictional safety requirements exist, which new and retrofitted road infrastructure systems must adhere to, but is adhering to existing regulations an improvement when data suggests greater factors of safety for certain circumstances are warranted? Similarly, target 11.5 aims to "substantially decrease the direct economic losses relative to global gross domestic product caused by disasters…" However, existing regulations exist in the forms of building standards, codes, and design guidance based on historical data. Yet these regulations may fail to consider the dynamics of current and future conditions brought on by aspects such as climate change. Is it therefore ethical to design to existing standards in areas which are at risk of greater frequencies of disaster? It is the ethical character of the professional that must adopt a more proactive-cautionary stance or build additional resilience into a system when not required and at a potentially higher cost.

Unfortunately, development of and care of the built environment currently includes many unsustainable practices. Society is increasingly acknowledging this, resulting in expectations that new engineering and construction projects be designed and built in a sustainable manner. This

transformation in behavior requires the direct application of ethical thinking. Ethical concerns are implicit in the term sustainability, as “sustainability means taking into account not just utility (that is, the usefulness of something), but also moral values and goals.” It is far too common that the “ethical aspects of sustainability [...] remain implicit, since most analyses focus on economic, social, environmental, and technical issues” (Kibert et al., 2012). There is a tremendous need to make the ethical dimensions of sustainability more explicit, which are in fact central to sustainable development.

The idea that sustainability and ethical decision making are intertwined has also been integrated into engineering education. The American Society for Engineering Education’s (ASEE) statement for sustainable development education indicates that “engineering students should learn about sustainable development and sustainability,” further noting that “studies of economics and ethics are necessary to understand the need to use sustainable engineering techniques” (1999). Similarly, professional codes of ethics promote ideals of sustainable development within the built environment. The National Society of Professional Engineers (NSPE) code of ethics states that “engineers are encouraged to adhere to the principles of sustainable development in order to protect the environment for future generations” (2019). This professional code of ethics further defines sustainable development as the “challenge of meeting human needs for natural resources, industrial products, energy, food, transportation, shelter, and effective waste management while conserving and protecting environmental quality and the natural resource base essential for future development.” Interestingly, the code provides a definition for sustainable development, yet sustainable development cannot occur without the application of the ethical code. Finally, the American Society of Civil Engineers (ASCE) code of ethics states that “engineers adhere to the principles of sustainable development; consider and balance societal, environmental, and economic impacts, along with opportunities for improvement, in their work; mitigate adverse societal, environmental, and economic effects; and use resources wisely while minimizing resource depletion” (2021b).

It is clear that sustainability should be a key component in the day-to-day ethical considerations and decisions of EC professionals. What is not clear in the literature is how and to what extent EC professionals’ decision making frames include ethically motivated sustainable thinking.

Professional Decision Making in Engineering and Construction

Researchers have investigated how large-scale, major strategic decisions take place in the EC industry. Hansen and Tatum came to the conclusion that “strategic decisions spring from many sources external to a formal planning process and that the strategy formation process is not linear.” Their research was conducted on the premise that “conventional methods of viewing strategy formation do not reflect the importance of dynamic elements (clients, champions, technical competence, etc.) in making strategic decisions.” Rather, motivation, risk, timelines and technology frame decision making (1996). Kam and Fischer contribute to the idea that dynamic variables are present and important, and suggested technology-based tools such as virtual design and construction (VDC) for use as a decision dashboard for “clear and flexible evaluation, and quick re-formulation of AEC [Architecture-Engineering-Construction] alternatives” (2004). Other technological tools have been suggested for decision making such as building information

modeling (BIM) and a “single bond VR real-time synchronization system” to enhance collaborative decision making (Du et al., 2018).

In addition to dynamic elements and technological solutions, scholars suggest that “significant decisions in construction projects are reliant on heuristic processes where assumptions are developed from past experience” (Sujan et al., 2019). It is unsurprising that past experience provides a baseline for future decisions, but the range of dynamic variables makes it unlikely that the same combination of variables, and the same levels of intensity, would be present for repeated decision points. In sustainable development projects, a multidisciplinary framework has been proposed, which may help solve the issue of different disciplines involved in a project using a variety of frameworks that cannot easily be compared in the decision making process (Xue et al., 2022).

A review of this literature gives a glimpse into the scope of professional decision making for EC companies by including technological tools, and dynamic multidisciplinary frameworks, which can incorporate sustainability related aspects. However, it is both obvious and surprising that ethical considerations are not a conscious focal element, despite such strongly and prominently positioned language of professional associations championing ethics and sustainability. This suggests a need for continued research in this domain and underscores the importance of this exploratory study.

Research Approach

This research employed a qualitative exploratory approach to understand how ethics and sustainability are connected in the professional decision making processes of EC professionals. To provide perspectives of ethics and sustainability in decision making within the built environment, EC professionals were invited to participate in semi-structured interviews. Semi-structured interviews are somewhat informal, allowing a researcher to ask questions about specific topics while remaining flexible as to the flow of informants’ responses and then asking appropriate follow-up questions (Longhurst, 2003). An informant-interview protocol was developed to provide clear and consistent initial guidelines for researchers, including primary open-ended question prompts and optional sets of follow-up question prompts.

For this study, 15 informants participated through individual interviews lasting an average of 46 minutes. Informants were selected from small/mid-sized for-profit companies in the Intermountain West. Informants were purposefully sampled across three organizational levels -- executive, management, and production (see Table 1). Each interview was conducted via video conferencing, recorded and later transcribed. The 645 minutes of interview transcripts were “open coded” to identify key concepts (Corbin and Strauss, 2008). These concepts were then thematically coded (Gibbs, 2007), and assembled into a register of the informants’ engineering and construction decisions and actions related to sustainability. This register was categorized by each action's connection to one of the three pillars for sustainability: economic, social, environmental. Acknowledging the ubiquity and flexible application of the three pillars conception (Purvis et al., 2019), this research uses the sustainability pillars as a useful heuristic for thematic

organization. The transcripts were also thematically coded for decisions and actions along ethical dimensions.

Respondent	Field	Level
Informant 1	Construction	Management
Informant 2	Construction	Production
Informant 3	Engineering	Executive
Informant 4	Construction	Management
Informant 5	Engineering	Marketing
Informant 6	Engineering	Production
Informant 7	Engineering	Executive
Informant 8	Engineering	Executive
Informant 9	Construction	Production
Informant 10	Engineering	Production
Informant 11	Engineering	Executive
Informant 12	Engineering	Production
Informant 13	Engineering	Executive
Informant 14	Engineering	Management
Informant 15	Engineering	Executive

Table 1 - Categorization of Informants, (Neil, 2022)

Findings

Through the lens of sustainability's three pillars (economic, social, and environmental), this research into EC professionals' ethical and sustainable decision making produced four key findings. First, economic considerations are embedded in virtually all decisions. Second, social decisions are seldom regulated or prescribed. Third, environmental decisions are highly regulated. Perhaps most surprising was the finding that, with respect to ethical decision making, there is conscious and non-conscious decoupling of ethics from EC professionals' decision making. As this research was decidedly exploratory and inductive, we draw extensively from the thoughts, concepts, and context presented by the informants, some of which are quoted (italicized) throughout the remainder of this paper.

Embedded Economics of Sustainability

As the concept of economics was presented generally to informants, we found overwhelming evidence that economics is a primary driver of professional decision making related to sustainable action. As informants shared their perspectives on sustainability, it was often prefaced with the theme of 'economics first'. One executive-level engineer said, *"I don't know if it's kosher to say it like this, but we value money and profits… We don't do work when we don't think it is going to be profitable; we just… there's no reason to do that."* In addition to EC professionals' own

organizational motivations, EC professionals shared similar sentiments when speaking of project owner's motivations. Another executive-level engineer explained, *"If the economics prove that we could build this facility to handle a product, and they can turn a profit, the project will go, it will execute. And if it's shown that the risk is too high for that to happen, then they won't do it."* In a capitalistic market this particular finding was perhaps unsurprising, but it was surprising to see the degree this focus was conscious and solely egocentric. Informants in this research seemed to indicate that the secondary impacts of economics were not regularly considered, that is how EC actions economically affected non-project participants. Meaning many private sector organizations prioritize financial return first for their organization (and to some extent their project team), a necessary condition, but are indifferent towards the economic sustainability of other stakeholders.

EC professionals stated that they wanted to act sustainably, but it is clear that if the economics within a project did not work, then EC professionals were unlikely to recommend or pursue such actions. For this reason, we consider economic sustainability (on the part of the EC professionals and the organizations for whom they are agents) as embedded in professional decision making. A management-level construction professional summarized this concept of economic embeddedness: *"In a lot of ways the economic, social, and environmental factors do work together. It's not a perfect world, they don't always align. Sometimes the costs don't justify it, and even though you would like to be a little more involved with some of those things, it's not financially feasible for the project."*

Non-Regulated Social Elements of Sustainability

Considering the 'social' pillar of sustainability, EC professionals regularly provided insights within three different categories: employees/co-workers, clients, and the public/community. One executive-level engineer commented, *"The founders of the company were very good from the beginning about instilling their same values in employees, and they put a high premium on giving a lot of responsibility and a lot of reward to employees who earn it, from a very young age even. They always made it a priority to put our clients and our employees first [and to] make sure people are treated well.* This "interest" or "priority" on people seemed to be motivated intrinsically. In contrast to the embedded nature of economic elements driving sustainable decision making, social elements tended to be voluntary, and of a normative or cultural nature.

Employees

Informants' comments regarding social sustainability factors in EC organizations frequently highlighted employees. One management-level construction professional said,

So when I hear 'social' related to a job, the first thing that I always think of is our staff and our subcontractors and making sure that it's a project that we can do successfully without putting undue stress or strain on our staff or our subcontracting staff…making sure that we only take projects that we can be successful on and that our subcontractors can be successful on and that we're respectful of our staff and the work life balance that needs to be maintained there.

This normative consideration of employees and subcontractors demonstrates some moral and ethical motivation for non-required or non-regulated social sustainability actions. As there was no direct economic or regulatory motivation in these situations, it may suggest there is an ethical connection to social sustainability for employee and subcontractor treatment. These indirect motivations to retain employees and subcontractor options may also point to embedded economics, simply with a longer-term time horizon.

Clients

A client-focused aspect of social sustainability, motivated by core organization values, was also discovered. One executive-level engineer shared: "*We've actually done some post-surveys about people, what they think of our company and those core values, … the ability to get things done and being responsive is one of the things that I think our clients really appreciate about our company, that we were responsive to their needs, we listen. And sometimes social factors will be important to a client."* It may be that the desire to uphold a company's reputation will encourage sustainable action on the social front. However, another executive-level engineer explained, *"So our first focus is always to make sure our clients are happy. The easier we make their job, the happier they are with us, and the more likely they are to hire us again."* This line of reasoning re-emphasizes the finding of embedded economics.

It was surprising how often informants spoke to the theme of client-focus. There were different ways to approach it, but for the majority of EC professionals, it was a primary priority. A production-level construction professional shared, *"Owner relationship is super important, so our owners come first. We want to make sure that they're happy and they're treated well. We don't believe in doing claims; we don't ever claim our owner. So, top priority is to make sure that our owners are happy."* In these instances, the economic and social motivations became fuzzy and difficult to disentangle, reaffirming that the relationships between the pillars of sustainability are complex and integrated, requiring them to be taken together.

Public

The public was also identified by informants when it came to professional actions regarding social sustainability. Although, EC professionals at times defer to their clients for direct engagement of public stakeholders. One executive-level engineer explained, *"Public outreach is an important component of the decision making process, and maybe even keeping the public informed through construction as things progress. Those are all generally driven by the owner."* Many EC firms displayed an aspiration or intent for their professionals to strike a balance of understanding, considering, and informing the client of their impact to the community, but ultimately putting decision making in the client's court. Another engineer commented: "*We're not necessarily in charge of all the decision making because our clients are paying for it. We typically try to put the decision in their court, it's their job to weigh things like social versus monetary and then long-term value for the municipality."*

In other cases stakeholder engagement (as a public-facing social sustainability strategy) seemed to be motivated by factors, such as the desire to add value and minimize costs to people. One executive-level engineer shared:

…these projects, [they] impact people's monthly water and sewer bill, and so the lower on the economic scale a household is, the harder it is to be able to pay for that monthly bill. So on the social side, certainly, we try to be as efficient as possible with the budget that we have and deliver not necessarily the cheapest project, but what we think is the right blend of value without spending money for something that's not going to provide value to the municipality.

This awareness leads to a desire for a positive impact on people, which we find to be in-line with SDG 11- targets 11.1, 11.2 (11.1 - ensure access for all to adequate, safe and affordable housing and basic services & 11.2 - provide access to safe, affordable, accessible and sustainable transport systems for all). These EC professionals understood or perceived an expanded role and responsibility in the industry and were trying their best to act sustainably in the ways they felt were possible for them. Some EC professionals really take their work to heart; they want people to benefit from the work that they do. One engineer mentioned, *"For my particular work people drink the water that we produce and so for me, making sure that public health is protected is one of the key social parts of my work."*

In some instances, EC professionals were explicit about motives being mixed, at least partially financially motivated for socially beneficial decisions and actions. Once again, the complexity of social and economic considerations is a fuzzy puzzle to unpack. One production-level construction professional said, *"I mean, at the end of the day, it probably is driven by finances because we're thinking about future jobs and future relationships. But also, I think a lot of the time it's more than just that. We're thinking about the people in these communities."* These sentiments should motivate future research to understand questions related to the interconnectedness of the pillars of sustainability as well as an exploration of additional motivators driving socially conscious actions.

Regulated Natural Environmental Considerations of Sustainability

Regulations were found to be the focal driver for decisions regarding environmental sustainability. An executive-level engineer summarized, *"First of all, what's required by law? And then also a consideration of the client's long-term concerns."* This response was indicative of most respondents' approaches. Regulators' efforts to guide organizational decisions regarding environmental sustainability appear to be successful. Additionally, there is evidence suggesting that EC professionals are making decisions beyond regulatory minimums. One management-level construction professional said:

So [the] environment recently has become much more important to contractors and to owners. In the last few years, I think we've really realized that there's a lot of improvements that we can make in construction related to our environmental impacts. Every contractor has to comply with basic environmental laws, you know there's wastewater contamination, there's dust control, there's a

number of things that just everyone has to do, regardless. And you have to put plans together and show how you're going to comply with those things, but the good contractors nowadays are taking it a step above that and figuring, “what can I do to minimize even above and beyond what's required of me?”

This provides an encouraging picture for succeeding with environmentally sustainable actions, beyond what is required by regulation. It also demonstrates a general feeling in the industry that there is a shift towards more environmentally conscious work and attitudes.

While environmental regulations do seem to be a driving aspect of sustainability decisions, yet again economics were shown to be closely intertwined. One construction professional noted: “*A lot of times you'll have sustainability consultants on projects that can help you figure out, ‘what are the best ways to design your project to make it more sustainable?’ [A]nd a lot of times there's a lot of benefit to the owner with that as well, because it might create a cost up-front for [the owner], but the life-cycle costs on the building will justify some of those initial costs.”* Additional efforts to demonstrate to stakeholders long-term economic benefits of social and environmentally positive actions may provide a more certain way to increase sustainable community development.

Risk mitigation, largely an economic factor for environmentally focused decisions, is also intertwined beyond purely regulatory compliance. A management-level construction professional shared, *“Before we start any project, any lender is going to require an environmental study for any piece of ground and they're going to lend on. That's pretty standard industry practice, to make sure that land is not tainted and that you're not going to have liability before you acquire land or before you develop on it.”* Understanding the importance of risk management and its relationship with the SDGs may provide a compelling reason for many EC professionals and owners to act sustainably. A production-level construction professional further shared:

It just depends on the job and the location and what is sensitive, environmentally, in that area….There are usually laws and we already know about them going into the projects. A lot of times it's already written into the projects because of the existing laws. We also get environmental consultants involved that are more well-versed in those areas. They help us with those plans to make sure that we know what we're doing and we're not putting ourselves in a place to get fines because environmental fines can be pretty damaging to projects… Any fines you get are going to affect your bottom line so we avoid those at all costs.

This supports continued broad public influence in determining what is environmentally sensitive and producing laws to require continued environmentally sustainable decision making. It may be possible to take the successes of regulatory requirements for environmentally sustainable decisions and broaden them to include an expanded set of socially sustainable requirements.

Summarizing the Three Pillars of Sustainability for Decision Making

To summarize how EC professionals’ decisions are influenced by sustainability elements, our informants provided multiple examples of economic and social actions, which were almost

completely voluntary, and environmental actions that were predominantly regulated (see Table 2). However, a more nuanced view of voluntary economic and social actions suggests that while economic actions are voluntary, they are embedded in almost all other decisions. That is to say, the economic effect of a sustainability-centered decision appears to always be evaluated with another aspect of the decision (social or environmental), whereas social elements may not be consciously considered in economic or environmentally centric decisions.

	Economic		Social		Environmental	
Respondent	**Regulatory**	**Voluntary**	**Regulatory**	**Voluntary**	**Regulatory**	**Voluntary**
Informant 1	-	2	-	3	-	1
Informant 2	-	1	-	3	5	-
Informant 3	-	4	-	8	-	-
Informant 4	-	8	-	5	2	4
Informant 5	-	1	-	3	-	-
Informant 6	-	2	-	4	-	2
Informant 7	-	-	-	4	1	3
Informant 8	-	3	1	6	3	3
Informant 9	-	1	2	1	1	-
Informant 10	-	1	-	-	1	-
Informant 11	-	6	-	4	2	1
Informant 12	-	3	-	3	-	-
Informant 13	-	1	-	1	2	1
Informant 14	-	4	-	4	2	1
Informant 15	-	4	-	4	-	-
Total	**0**	**41**	**3**	**53**	**19**	**16**

Table 2: Regulatory vs voluntary drivers of EC professionals decisions regarding sustainability actions, (Neil, 2022)

The Decoupled Ethics of Sustainability

The most surprising finding from this study was a lack of conscious ethical responsibility for decisions related to sustainability. EC professionals appear to have decoupled their ethics from the outcomes of sustainability decisions. One informant, an executive-level engineer, said, *"We're not necessarily in charge of all the decision making because our clients are paying for it. We typically try to put the decision in their court. It's their job to weigh things like social versus monetary and then long-term value for the municipality."* It seems clear that EC professionals have an ethically motivated perspective in sustainability-framed decisions but bound their responsibility to the evaluation and communication of potential outcomes, not in the outcomes themselves. One engineer explained:

I think that the ethical part of it is for me to be aware of it, and then also to bring it up to my client in a transparent way, and then to frame it for them so that they can make a decision based on their value system. But ultimately, because I'm an engineering consultant, and the owner makes decisions about elective things, such as what you're talking about – [the] balance between social,

environmental and budget and money. It really is, I feel that it's up to them. And I think the ethical part is recognizing that we all, because we have impact on those items, that we need to be abreast of it and the considerations behind it and then it's incumbent on us to talk about it. And then for the client to ultimately decide what is the right balance between those items for their community.

This helps explain the conscious thinking of some EC professionals who feel that they have a duty to inform their clients with regards to sustainability while not forcing action in a certain way.

Other informants further distanced themselves from an ethical imperative to act sustainably. An executive-level engineer shared, "*because we're the consultants and we're hired by these entities…we just respond to what they're concerned about. We're not trying to push them in any particular direction. We just give them information so that they can make their own decisions."* Another executive-level engineer completely separated himself from the ethical duty to act sustainably. He said, *"Honestly, it's not a topic that I think very much about in my job. I understand the concepts, but again as a professional service industry, I think most of this is out of our hands, out of our control. At least while on the job, I have little influence on sustainability."* A total surrender to the idea that civil infrastructure will be designed and built by professionals without conscious regard to sustainability-centered thinking is unsettling. If this sentiment is widespread, it may be very difficult for EC professionals to justify turning down projects that counter the related SDGs and their targets.

One management-level construction professional did however provide a more hopeful outlook regarding the intertwining of ethical motivations for sustainable decision making.

I feel like we have an ethical responsibility to be responsible environmentally as builders. We're in an industry that has a large environmental impact, and we are getting better and figuring out ways to do it and minimize those impacts.…what impact is that going to have down the road, on my company, on this building for the owner, and on the environment for my kids?…I don't think that all environmental pursuits are justified, I think sometimes people get a little carried away with it, but I do believe that we have the responsibility as a contractor to be conscientious of what effect we have and do what we can to help minimize those impacts.

While there was little additional evidence from our informants to support this broad ethically motivated way of sustainable thinking, it offers a positive notion that ethical motivations within EC professionals can lead to conscious sustainability decisions. Still, the lack of this sentiment more frequently presented throughout the study is troubling.

Discussion

Within the built environment there are a host of stakeholders, but none are more central than EC professionals. EC professionals are involved in early project- and program-shaping phases, planning, design, construction, and operations. EC professionals are present at each step of built asset life cycles. EC professionals are well-trained, with professional associations to guide certification, continued education, and even standards governance. Given the

organizational/structural position of EC professionals within the built environment, and their high degree of responsibility in developing the built environment, who better to act as stewards of processes that lead to sustainable communities and cities?

The findings of this research pointed to several ways that EC professionals can contribute further to SDG 11 and the other SDGs. If sustainable actions make economic sense for owners or EC professionals, they will become standard in the industry because capitalistic markets incentivize positive financial returns. Regulations and the desires of the owner are powerful drivers in efforts to make cities and settlements more sustainable. The desires of the public often create regulation and/or influence owners to want what the public desires. There are also some EC professionals that will act sustainably because of intrinsic motivations, including ethics. For example, even if ensuring access to safe and affordable housing and basic services for all (SDG Target 11.1) may not be the most profitable for EC professionals to begin with, government funding can cause their design and construction to make economic sense; regulation can require EC professionals to design and build new infrastructure according to that goal, or EC professionals, owners and the public can be taught their ethical imperative to help all people have access to basic human rights. Thus, the findings of this research can be similarly applied to the other targets of SDG 11 as well as SDGs 7, 9, 12, and 13.

Ethical intrinsic motivation can lead to great results in many of the SDGs through EC professionals. A good example is SDG 11.2; instead of merely providing transportation services that perform their proper function, EC professionals committed to sustainability ethics will take a step back to see if their actions will help those in need or if there is a better way to do it. For SDG 11.3.2, participation of citizens in the planning and management of their communities will increase as ethically motivated EC professionals seek out the advice of those who will permanently live with what is being designed and constructed. For SDG 11.4, rather than regulation and public pressure driving the protection of natural and cultural heritage, EC professionals will feel a personal responsibility to care for the natural and cultural environment where they are designing and building infrastructure. For SDG 11.5.1, EC professionals will ask themselves if they are building resilient infrastructure whether it is required of them or not, which will decrease the number of deaths and affected persons from disasters.

The findings of this research may be used to enact change towards more sustainable development in other ways as well. For SDG 11.5.2, if those who fund infrastructure projects and the public at large can be shown the money they will lose because of inaction (economic loss due to disasters), economic drivers can help build more resilient infrastructure even though it will have a greater upfront cost. For SDG 11.5.3, disruptions to basic services could be seen as both a social and an economic factor. People and businesses could get behind funding projects that will help them prosper socially or economically if they know it will really help them. Both targets of SDG 11.6 could be heavily influenced by regulation since they are environmental factors; these changes could be driven by the public or EC professionals wanting to make a difference. The targets of SDG 11.7, while more on the social side, are measurable, and therefore could potentially be enforced through regulation or encouraged through economic incentives. SDG 11.a speaks of plans and policies. EC professionals are knowledgeable in their fields, and if they feel

an ethical responsibility to these things, they will be more likely to get involved and use their expertise to make a difference in their jobs. Also, as citizens they will be more likely to be active in their local government. SDG 11.b.2 similarly speaks of action at the local government level regarding disaster risk reduction. If there is an ethical alignment with these needs, construction and engineering professionals could use their expertise to make a lot of good happen. SDG 11.c mentions using local materials. Although there may be a habit of using imported materials, EC professionals can step into the role of advising owners to use local materials to build sustainable and resilient buildings.

Our findings also align strongly with SDGs 7, 9, 12, and 13. EC professionals touch many aspects of society through their work. With regards to SDG 7, ensuring equitable access to energy can be accelerated as the public is educated on this front and EC professionals connect with their intrinsic motivating factors regarding the people their projects are affecting. Some EC professionals really care about their end-users. If that care can be replicated by a greater number of EC professionals, this goal may be attainable at a faster pace. Our findings suggest that SDG 9, as it relates to building resilient infrastructure, will be changed quickest through regulation and social drivers such as the desires of the public or the owner. What is required or desired will be designed and built. More specifically, SDG 9.4 could be achieved through economic incentives and regulation in each country as it relates to upgrading infrastructure and adopting more sustainable technologies and processes. Construction consumes many resources, so achievement of SDG 12 will be heavily influenced by the degree to which EC professionals either decide to act sustainably or are compelled to. For instance, SDG 12.2 speaks to sustainable management of natural resources; this can be realized if there is intrinsic motivation, or if it is required by regulation, or desired by owners or the public. If the public desires it (enough), the owner will either elect to use it, or it will become regulated. SDG 12.8 speaks to people being educated on the front of sustainable development; this could be met by EC professionals understanding their responsibility to teach their clients and the public about sustainability as understood through the lens of their professions. Similar to SDG 12, SDG 13 is heavily influenced by the engineering and construction industry because of the emissions that are produced in the building and operation of infrastructure. The findings of this research can be employed to target specific ways to influence change in the industry, including helping EC professionals understand their ethical duty to minimize their impact on the environment and helping the public understand how they can influence change on this front.

Conclusion

The American Society for Civil Engineers has outlined four priorities for changing engineering practice toward more sustainable development, including “doing the right project” (priority 1), and “doing the project right” (priority 2) (2021a). This research highlights the need to advance these priorities by:

1. encouraging EC professionals to move beyond strictly economic foundations for sustainable decision making,

2. expanding training for EC professionals in the scope of social sustainability actions, such as the specific targets for SDG 11

3. working with regulators to enlarge appropriate actions to meet sustainability goals and objectives

4. and train and empower EC professionals to *re*-couple their ethical motivations to sustainable project goals and objectives.

Moving beyond economic foundations of project decision making will require institutional efforts to enhance the role and position of EC professionals. EC professionals are central in project identification, design, construction and operations, yet they lack a degree of autonomy for decision making toward sustainable outcomes. This suggests more policy interventions, education and new professional mentoring, and institutional work to change the culture of EC professionals' roles and services from advising, to responsibility for project decision making.

This research also indicates that social sustainability objectives are the least consistent in EC professionals' decision making. Providing additional training, beyond technical design and analysis, will enable engineers to be more conscious of their decision outcomes on various internal and external stakeholder groups. This is an area where a dearth of information is found, leading EC professionals to continue to emphasize technical solution finding at the expense of broader social progress.

It is clear from this study that regulatory constraints for environmental sustainability actions have been successful. EC professionals successfully incorporate regulatory imperatives as project 'design requirements,' which fits well with EC professionals' technical decision framework. This begs the question, should social sustainability requirements be expanded, and would EC professionals be able to incorporate such 'social design parameters' successfully into projects?

Lastly, this research suggests that ethics, as it relates to sustainable decisions, is overwhelmingly decoupled from EC professionals' decision making paradigm regarding sustainable actions. EC professionals view themselves as service providers, and either consciously or unconsciously decouple their personal and organizational ethics frames from sustainability-related project decisions. However, if EC professionals are societally positioned as stewards of the built environment, with follow-on responsibility for impacts to the natural and social environments, then more tightly connecting their ethical motivations to decision making authority is an imperative.

This research supports efforts in training individuals and organizations on their role in ethical and sustainable decision making. Further, it suggests that there is much institutional work to do in empowering EC professionals to leverage their ethical motivations to developing sustainable cities and communities. One informant illustrated this momentous challenge: "*I heard a lot more about sustainability in school than I've heard about it in the industry. You get into industry and you want to do the right things, but there is 100 years of tradition and weight behind the way that the industry is already doing things. You throw yourself up against that and you try to make*

incremental changes where you can, but it's difficult." This research acknowledges and embraces the gravity of this challenge, and calls for educators, professional governing bodies, and policy makers to encourage and support capacity-building efforts for EC professionals in consciously connecting ethical motivations to sustainability-centered decision making.

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