

Interdisciplinary Research (IDR) Origination Awards

Project Title

Toward an integrated model for sustainable action: Articulating the symbiotic connections between natural, human/social and built environments

Principal Investigator(s) (full-time faculty)

Name (PI listed first)	Department	College
Brett Hashimoto	Linguistics	Humanities
Andrew South	Civil and Construction Engineering	Engineering
Robert Christensen	Romney Institute of Public Service & Ethics	Marriott School
Clifton Farnsworth	Civil and Construction Engineering	Engineering

Track: Track Two

Abstract: *Sustainability* is now a nearly ubiquitous goal and motivator for purposeful action. We observe, however, that sustainability remains relatively atomized – focused on specific applications or individual domains (e.g., climate, corporate action, governance, infrastructure and the built environment) – without identifying their interconnectedness. Repeated calls—from both scholars and practitioners—for integrated approaches have gone unanswered. Globally, we still lack unifying methods to consistently engage and coordinate sustainable actions across disparate groups of stakeholders.

This IDR proposal seeks to develop an actionable, integrated approach to remedy our fragmented understanding of sustainability. We have recently completed part 1 of this research, a corpus linguistics study to understand the construct “sustainability” in a cross-section of academic literature, mapping areas of divergence and congruence, and developing an initial sustainability application framework. This proposal seeks to expand upon that work by broadening our understanding of the interdisciplinary nature of sustainability amongst a variety of academic disciplines. This research proposal includes part 2 of our research plan, including establishing a set of interdisciplinary expert panels (Delphi technique) to unpack deeper meanings of ‘sustainability’ from various perspectives and calibrating the framework and developing a more complete integrated model of sustainability. Our initial findings will be published in leading sustainability, public policy, and linguistics journals. The IDR funds will support a graduate student leading the study components, and 5+ undergraduate researchers. Other outcomes include development of a living laboratory model for sustainability on campus and an interdisciplinary course on sustainable community development.

Summary of Plans for External Funding: Sustainability is a topic that currently receives much attention from both national and private research funding agencies and organizations [1]–[3]. The interdisciplinary approach proposed in this research is unique and will appropriately prepare us to be highly competitive in obtaining further externally funded research. A specific output of this research is the development of four externally funded research grant proposals, targeting research calls through the National Endowment for the Humanities, the National Science Foundation, and the Environmental Protection Agency. Work performed under this IDR project will develop a transformational approach for applying interdisciplinary sustainability thinking within community development and built environment processes and practice, thus making further interdisciplinary sustainability research within this realm realistic, desirable, and advantageous.

Project Narrative

1 - Problem Statement

‘Sustainability’ is widely cited as both an important goal and a motivator for human development and global stewardship. An emphasis on ‘sustainability’ is found across public and private sectors, and throughout academic discourse. One example of this focus is highlighted in global governance and the United Nations’ 2014 expansion of the eight Millennium Development Goals (MDGs) for social improvement of developing economies, into the broad encompassing 17 Sustainable Development Goals (SDGs) addressing social, economic, and environmental issues for the world [4], [5]. However, the scope of ‘sustainability’ is poorly understood between academic disciplines and across public-private domains, with multiple definitions and primary focal elements [6]. This leads to incomplete and oftentimes non-sustainable actions as policies and planning objectives fail to balance human development needs with global resources and natural earth systems.

As an example, a renewable hydro-electric power generation dam that provides electric power to a marginalized population may be championed as a “sustainable” infrastructure project. However, questions related to the negative impacts of downstream water and sediment/nutrient flow required for food production (human development) and ecosystem sustenance (earth systems performance) are often not fully considered. The societal cost of incomplete sustainability (or worse, non-sustainable actions touted as sustainable) is the perpetuation of poverty, food insecurity, high rates of preventable mortality, and low standards of living. At the same time disrupting earth systems performance through unbalanced natural resource consumption [7], [8]. Since the 1970’s global resource consumption per person is out pacing the Earth’s ability to replenish resources, and the gap has been widening. These costs speak directly to the current generation’s challenges; but with current trajectories the costs are disproportionately accruing for future generations (see Figure 1).

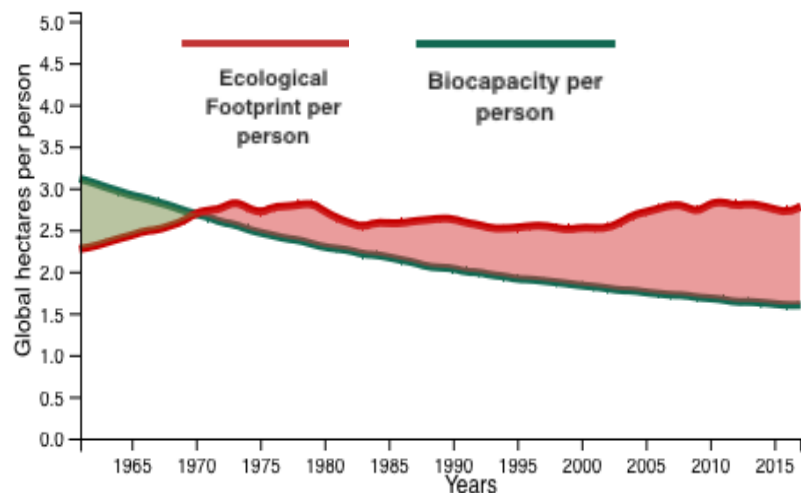


Figure 1: Ecological footprint & biocapacity, from National Footprint and Biocapacity Accounts 2021 [7]

The global community is aware of this imbalance. The UN’s 2020 Human Development Report finds that almost no countries occupy the global sustainable development quadrant (where quality of life and human development are achieved through appropriate resource consumption) [7]. It is widely known that highly developed countries categorically fail to live within the means of global resources and use as much as eight times per capita the rate that earth systems can sustain [9], while countries within sustainable resource bounds are generally not achieving high levels of human development (see Figure 2). Recent experiences (like pursuit of the SDGs) show that there is strong appetite for global society to rebalance [5]; however, a holistic framework for stakeholders to engage with one another to coordinate individual, organizational, local and national governmental actions does not exist. We clearly lack an integrated, multifaceted framework to approach (measure and coordinate) sustainability across the symbiotic natural, human/social and built environments. Without an integrated framework and model for sustainability, we continue to evaluate problems, projects, programs, and practices incompletely. Transportation infrastructure may be built using “sustainable materials and methods,” but functionally fail marginalized populations if access and housing development are misaligned. Community planners may incorporate and enforce “sustainability-motivated” agricultural land-use protections, but unintentionally support archaic zoning approaches in driving development that further stratify socio-economic classes. This lack of an

integrated sustainability framework also causes continued narrow scoping of education and training. For example, civil engineering students are encouraged/required to achieve high technical proficiency for designing and constructing the built environment, but lack training for a wider view of how the built environment interacts with the social environment. This limits their performance in central leadership roles for building society and community.

This research begins to address the missing, coherent, integrated model of sustainability, necessary for addressing today's complex and interdisciplinary development problems and practices. This IDR proposal is the second part of a two-part study approach. In part one, a corpus linguistic analysis (just now in the final stages by the research team) was initiated to help understand the contours of a sustainability definition and application framework. This second step uses a Delphi technique of gathering and applying expert feedback to develop an integrated model of sustainability. The principal motivation behind this research is to develop a framework for interdisciplinary sustainability research that can be used to guide future interdisciplinary research efforts. Published papers that demonstrate a broader definition and understanding of the need and opportunity for interdisciplinary approaches to solving real world sustainability issues are a key output. However, the principal outputs from this

project are the external grant proposals. The big picture outcomes for the research team also ultimately include applying this framework to: create an interdisciplinary course for SDC - sustainable community development; produce a policy publication for local and regional development agencies; bring developers, engineers, and planning professionals together to apply more robust sustainability practices in the built environment; and develop a small scale living laboratory experience at BYU.

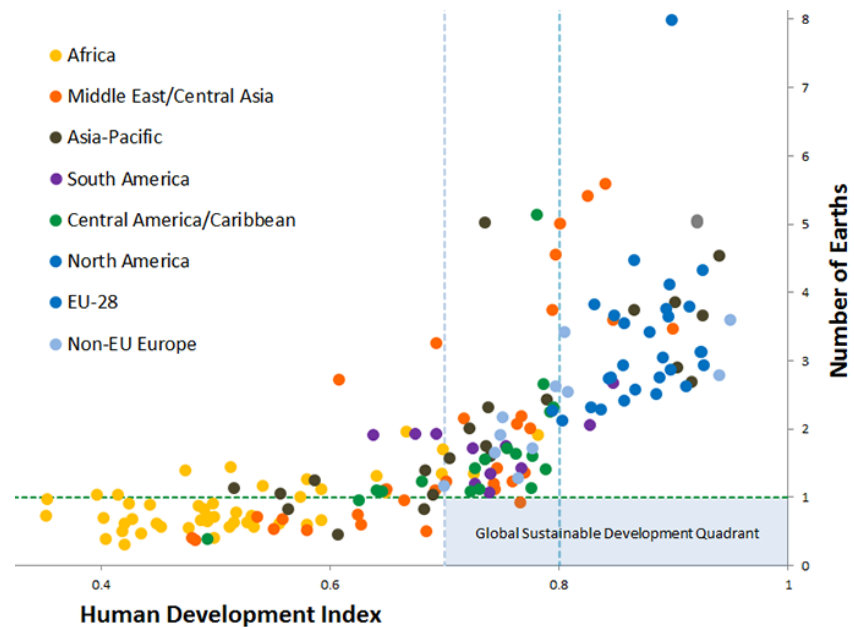


Figure 2: Proportional global resource consumption by nation (in Number of Earths), compared to national human development (HDI - life expectancy, education, avg. gross income) [7]

2 - Diverse interdisciplinary research partnerships with clear team member contributions

Research Approach / Objectives

To accomplish the outcomes of this project, an interdisciplinary team will carry out the second part of a two-part study. Part 1 was recently completed, and included a systematic analysis of the collective academic discourse. The clear lack of an integrated model of sustainability is perplexing, given its ubiquitous presence across the discourse. If policy makers, practitioners, and academics are consistently and regularly calling for “sustainable” action, why is there no equally ubiquitous framework for coordinating that action? To understand this question, we conducted a comparative corpus linguistics analysis from a sample dataset spanning the last 25 years, comparing sustainability in the academic literature. We produced an initial typology of how industry, government, and the academy define and understand ‘sustainability,’ including motivations, objectives, and actions. This typology further allowed us to construct an initial integrated framework of sustainability. In this research, Part 2 of the study, we propose to follow the NSF-sponsored SESYNC (National Socio-Environmental Synthesis Center) model

for facilitating interdisciplinary research [10], and incorporating the Delphi method [11]. The Delphi technique is a systematic research process for achieving consensus amongst a panel of experts. In this qualitative approach, a question set regarding application of the integrated framework to various cases will be posited to the experts. Results from the initial round of questions are analyzed, compiled, and synthesized to develop additional questions to go back to the expert panel. This will be repeated for three rounds in each of the two panel sets.

Study Part 1 - Linguistics Analysis and Preliminary Findings

We have begun the development of a framework outlining the nature of sustainability in academia by conducting a linguistic analysis within a massive database of peer-reviewed research articles totalling approximately 120 million words. The method is known as collocation analysis, a bottom-up, statistically-driven analysis, which identifies words that occur together greater than chance. In linguistics, it is commonly understood that words are cognitively learned and understood from the contexts in which they are used. Using these co-occurring words (or collocates), we can summarize the discourse on a topic within a specific context [12], [13]. The results of this analysis revealed 116 critical words that together define how sustainability is being talked about within academia. Iterative qualitative analysis of these words using Grounded Theory [14] revealed which disciplines are most critical in the sustainability discourse within academia (environmental science, engineering, education, policy, and business), what specific topics and areas of research are most frequently discussed in academic articles, and the relationships, interactions, and overlaps between disciplines in sustainability research. This has become our preliminary framework of sustainability discourse in academia. Based on our data, it appears there are three major areas of concern in sustainability: financial, human, and natural. Engineering governance and policy stand at the intersection of all three major areas, and further interact through the fields of ecology, public health, business, agriculture, and others (see Figure 3). The first step in the proposed research is to finalize the linguistics portion of the study.

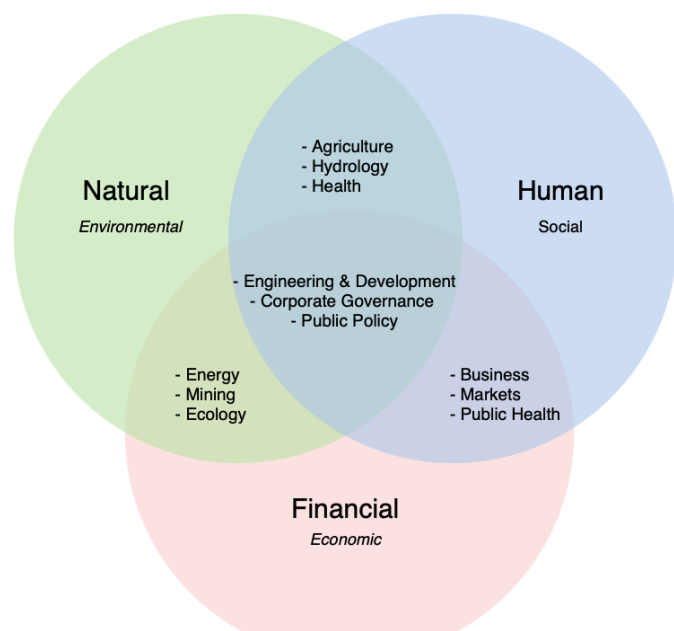


Figure 3: Venn diagram of preliminary findings

Brett Hashimoto, Assistant Professor in Linguistics, led the analytical portion of study part 1. Corpus linguistics is a highly technical subfield that requires a combination of linguistic, computing, and statistical training to perform analysis on massive datasets, in our cases, hundreds of millions of words. Hashimoto also has specialized knowledge of natural language processing (NLP) and machine learning, which can further enhance the analysis of large text-based datasets as well as experience with highly formalized qualitative methods, such as Grounded Theory, which are useful for corpus analysis because of the large amount of full text data involved. The results from our Part 1 linguistics analysis will serve as the groundwork and continue to be an integral part of establishing the makeup and execution of the Part 2 Delphi study.

Study Part 2 - Interdisciplinary Delphi Panels

This research project will build upon the results of the linguistics analysis to evaluate and refine the proposed integrated sustainability framework using the Delphi technique, a multi-round iterative approach of repetitive question and information synthesis that allows expert panels to converge upon real solutions for various cases [11], [15]. The purpose of the interactive Delphi panels is to capture a holistic set of theoretical and practical perspectives of the integrated sustainability framework (from Study Part 1), to build an actionable model for sustainability. Clifton Farnsworth, associate professor in Civil and

Construction Engineering, will set up and oversee the Delphi studies. Farnsworth practiced civil engineering professionally for ten years prior to joining the BYU faculty. He has performed multiple successful Delphi studies and is experienced in the data gathering processes and analysis procedures associated with this research approach. He is a co-director of the BYU CCE Sustainability Lab, with a research focus on sustainable motivations, implementation, and built environment processes.

Academic Panel - During the 2021-22 academic year, a preliminary Delphi panel was assembled through the BYU Interdisciplinary Sustainability Forum (BISF). The BISF was a cross-campus roundtable series to understand the perspectives, motivations, objectives and actions of an interdisciplinary set of academics. This preliminary Delphi panel drew from the collection of 35 BISF participants. In this research, the academic Delphi panel will be revisited, this time with the specific notion of testing the validity of the integrated sustainability framework. Andrew South, Assistant Professor in Civil and Construction Engineering, facilitated the BISF and will continue to coordinate the academic panel as part of this study. South is an expert in large complex engineering and development projects. Professionally he has 20 years of experience in various national and international housing, food security, energy production, and community resiliency projects. He is a Stanford Interdisciplinary Graduate Fellow, and has conducted research through expert panels of national government advisors, engineering consultants, and public infrastructure developers.

Practitioner & Policy Maker Panel - In this research, a second Delphi panel will be composed of regional practitioners and policy makers. In particular, we'll focus on local government, nonprofit and business leaders as well as state- and federal-policy makers in Utah (some of these participants are already contributing to related studies in the CCE Sustainability Lab). Findings from the academic panel will inform this second Delphi panel. Robert Christensen, professor of public management in the Romney Institute of Public Service and Ethics at BYU's Marriott School, will help coordinate this part of the study with Andrew South. Christensen is an expert in public law and public policy and past recipient of NSF funding (law and courts). His research focuses on prosocial motivations and attitudes like pro-environmental behaviors, in the public and nonprofit sectors. Christensen is a research fellow at Arizona State University's Center for Organization Research & Design and a co-researcher at Seoul National University's Center for Government Competitiveness.

3 - Potential to produce significant scientific, cultural, creative, and/or societal impacts

Project Objectives

The purpose of this research is to develop an integrated sustainability model that can reliably be used across different disciplines. This model will facilitate discussion, collaboration, and coordination toward proactive steps in implementing comprehensive sustainable actions, satisfying differing stakeholder objectives towards collective human development now and for generations into the future. To achieve this, the research project includes the following objectives within four key areas:

1. **Scholarship** - Four pivotal publications will be produced during this research, each providing a unique interdisciplinary contribution to the body of knowledge: 1) a theoretical paper detailing the development of the integrated model of interdisciplinary sustainability - target journal is Nature Sustainability. A draft of this paper has already been developed through the preliminary research performed thus far; 2) a methodological paper presenting the results of the corpus linguistics and comparative corpora portion of the study - target journal is Applied Linguistics; 3) a public policy and governance paper demonstrating application of the integrated model within public planning and decision making - target journal is Public Management Review; and 4) an adaptive educational paper presenting a transformational interdisciplinary approach for teaching sustainability and performing scholarly research within higher education - target journal is International Journal of Sustainability in Higher Education.
2. **Curricular Development** - Although many campus disciplines incorporate aspects of sustainability within their curriculum, this research will develop a more holistic interdisciplinary approach for teaching sustainability principles and practice. This will be accomplished by: 1) connecting existing sustainability curriculum across campus and developing an interdisciplinary sustainability course

centered around the framework for interdisciplinary thinking and decision making; and 2) producing a small scale living laboratory experience for student learning through integrated experiential learning and application of sustainability principles within the campus community (this action has been informally initiated and is supported by the BYU Sustainability Office).

3. **Community and Practice** - This research has the potential to provide tangible and meaningful broader impacts within public policy, community planning and development, and design and construction practice. Part two of this research will generate significant involvement from practitioners and policy makers. Although, beyond the initial scope of this proposal, these results can be distributed through potential follow on actions, which may include: 1) development of a policy publication outlining recommendations and detailed interdisciplinary governance principles; and 2) a practitioner workshop including application examples for effective interdisciplinary sustainable actions. These additional elements can be pursued as part of the external funding proposals.
4. **External Funding** - A key motivator and objective for this research is the development and submission of four externally funded research grant proposals that build on the groundwork established through this IDR project. We anticipate the results and corresponding outputs from this research will enable these externally funded proposals to be highly competitive. See *Plans for External Funding* for additional explanation regarding these proposals. As a truly multidisciplinary project, the results of this research will provide each contributing faculty member the opportunity to expand upon the work in an interdisciplinary manner within their individual disciplinary context.

4 - Identified measures of success and achievable milestones

Success in this project is achievable as research activities support multiple outputs: student experiential learning opportunities, grant proposals, papers, curricular activities, and broader impact activities. The segmented nature of this project allows for various outputs to be produced in stages as the research progresses. The primary research achievement for this project is the development of an integrated sustainability model. Figure 4 shows the major tasks and deliverables, faculty and student involvement, and the general flow and milestones for the project. A total of 6 students (5 undergraduate students and a graduate student) will participate as a team of research assistants on this project. A graduate student will contribute to the technical parts of both the research study and writing outputs coinciding with their graduate work. As shown in the figure, each of the four principal investigators will take the lead in producing a technical journal article and an externally funded grant proposal. At the conclusion of the final study components, the curricular and other outputs will be produced with additional mentored undergraduate research experiences.

		2023		2024				2025	
Research Study	PI Lead	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
Finalize Linguistics Study	Brett								
Initial Framework Development	Clifton								
Delphi - Academic Panel	Andrew								
Delphi - Practitioner / Policy Maker Panel	Rob								
Integrated Sustainability Model	Andrew								
Grand Proposals									
NEH - Collaborative Research Grant	Brett								
NIH - Research Infrastructure (STRIDES)	Rob								
NSF - Science and Technology Studies	Andrew								
NSF - Civil Infrastructure Systems	Clifton								
Papers - Outputs									
Applied Linguistics - Methodological Contribution	Brett								
Public Management Review - Governance Contribution	Rob								
Sustainability in Higher Education - Education Contribution	Clifton								
Nature Sustainability - Theoretical Contribution	Andrew								

Figure 4: Project Milestones and Timeline

Budget Narrative

The following budget outlines the projected use of funds during the project. Budget categories can be divided into two categories:

1. mentored student research experiences / inspiring learning,
2. Delphi panel sessions.

75%+ of requested funds will support graduate and undergraduate students. A primary outcome of this proposal is the conscious and consistent incorporation of student inspiring learning experiences across the research flow (see Figure 5).

This project is ideal for attracting students with diverse interests and provides a spectrum of unique opportunities (linguistics study, conceptual modeling, Delphi studies, writing, community workshop, and curriculum development). As indicated in the project timeline, graduate and undergraduate students will be involved in nearly every step of the project. The remainder of funds will go directly to supplies/support activities to accomplish the research and broader impacts.

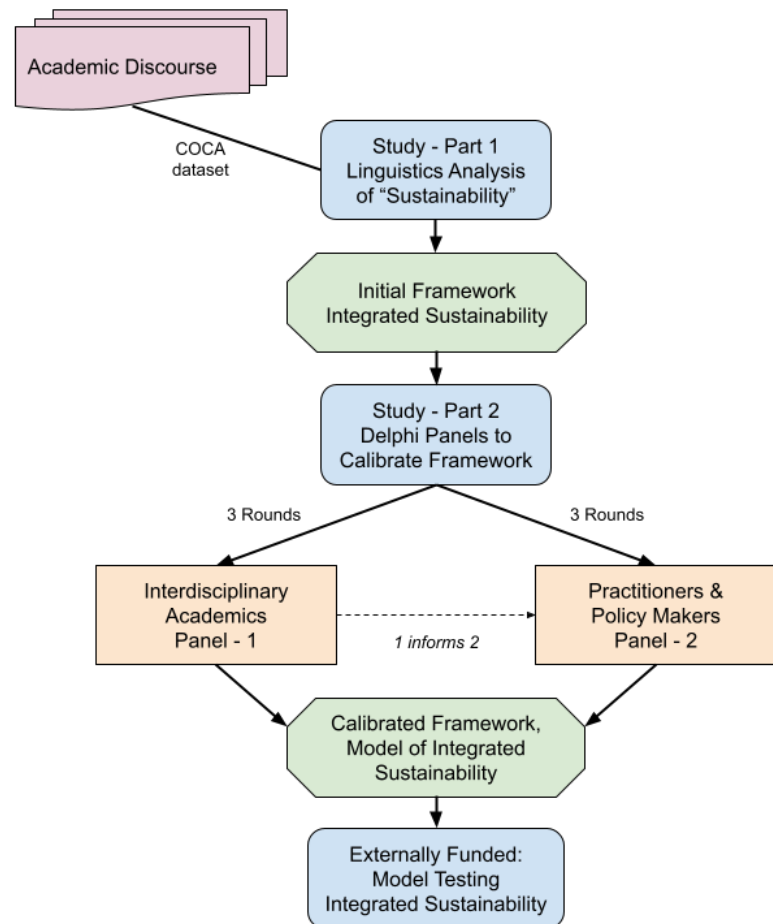


Figure 5: Research steps and flow

Item	Description	Qty	Units	\$ / Unit	Cost
Study					
Graduate Support	Tuition & Salary	2	Student-Semesters	\$5,000	\$10,000
Undergrad Support	RA Wages	5	Student-Semesters	\$3,500	\$17,500
Facilitator	Delphi Panels	1	Service Contract	\$2,000	\$2,000
Venue & Supplies	Delphi Panels	6	Panel Sessions	\$1,250	\$7,500
Other					
Student Travel	Conference	2	Typ. Travel Costs	\$1,500	\$3,000
Total					\$40,000

References

- [1] R. E. Almond, M. Grooten, and T. Peterson, *Living Planet Report 2020-Bending the curve of biodiversity loss*. World Wildlife Fund, 2020.
- [2] E. National Academies of Sciences and Medicine, *Strengthening sustainability programs and curricula at the undergraduate and graduate levels*. National Academies Press, 2020.
- [3] N. A. of Engineering, “Frontiers of Engineering: Reports on Leading-Edge Engineering from the 2018 Symposium,” 2019.
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- [13] J. R. Firth, ““A Synopsis of Linguistic Theory, 1930-55.” *Studies in Linguistic Analysis*. (Special Volume of the Philological Society),” *Sel. Pap. JR Firth 1952-59*, pp. 168–205, 1957.
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Plans for External Funding

One of the key purposes of this research proposal is to sufficiently push the boundaries of current sustainability related research in such a way to make a compelling pretext for meaningful and competitive interdisciplinary externally funded grant proposals. The central element of this strategy is application of the developed model for solving large scale sustainability related issues. Multiple program solicitations have been targeted and four externally funded research proposals will be submitted in connection with the IDR project to the following:

1. National Endowment for the Humanities: The National Endowment for the Humanities supports research, education, preservation, and public programs in the humanities. The interdisciplinary model generated from the IDR award will provide the collaborative context necessary to effectively develop an interdisciplinary model for teaching sustainability within university curriculum.
2. National Science Foundation: The Civil Infrastructure Systems (CIS) program supports fundamental and innovative research in the design, operation, and management of civil infrastructure that contributes to creating smart, sustainable and resilient communities. The interdisciplinary model generated from the IDR award will serve as a framework for transforming typical sustainable research practices into broader more impactful interdisciplinary research communities.
3. National Science Foundation: The Science and Technology Studies (STS) program supports research that uses historical, philosophical, and social scientific methods to investigate the intellectual, material, and social facets of the STEM disciplines. This specifically includes interdisciplinary studies of ethics, equity, governance, and policy issues that are closely related to STEM disciplines. The IDR project will provide a stronger context for further exploring the underlying ethical motivations for corporate social responsibility and environmental, social, and governance related issues within large corporations. The research framework generated from the IDR will further provide an interdisciplinary context for generating measurement and transparency standards for facility management and other built environment processes.
4. Environmental Protection Agency: Environmental Education (EE) grant program provides financial support for projects that design, demonstrate, and/or disseminate environmental education practices, methods, or techniques. The IDR project results will prepare the team to further map the interrelationships of sustainability across the natural, built, and human domains within higher education. This will provide the appropriate context to transform the currently siloed approach of teaching sustainability into an interdependent and synergistic manner.

Grant Program	Proposal Title	Request Amount	Planned Submission	Lead PI
NEH: Collaborative Research	An integrated framework for sustainability: Toward a university curriculum for sustainability	\$250,000	Oct 2023	Hashimoto
NSF: Civil Infrastructure Systems	Aligning sustainable community development and infrastructure asset management within an interdisciplinary context	\$600,000	Sep 2024	Farnsworth
NSF: Science and Technology Studies	Measuring corporate social responsibility and environmental, social, governance (ESG) factors in organizations affecting built environment processes	\$375,000	Sep 2024	South
EPA: Environmental Education Grants	Mapping sustainability across natural, built and human/social domains in higher education	\$150,000	Dec 2023	Christensen

Biographical Sketch

Brett J. Hashimoto
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1) Professional Preparation

Northern Arizona University (Flagstaff, AZ)	Applied Linguistics	Ph.D.	2020
Brigham Young University (Provo, UT)	Linguistics	M.A.	2016
University of Utah (Salt Lake City, UT)	Linguistics	B.A.	2013

2) Professional Appointments

Assistant Professor	Brigham Young University	2020-Present
Research Fellow	Brigham Young University	2019-2020

3) Publications

- **Hashimoto, B.** (forthcoming). Corpus of Founding Era American English: Designing a corpus for interpreting the United States Constitution. *Corpora*.
- **Hashimoto, B. J.** (2021). Is frequency enough?: The Frequency Model in vocabulary size testing. *Language Assessment Quarterly*, 18(2), 171-187.
- Jarvis, S., & **Hashimoto, B. J.** (2021). Comparing operationalizations of a word in lexical diversity measures. *International Journal of Learner Corpus Research*, 7(1), 163-194.
- Youn, S. J., & **Hashimoto, B. J.** (2021). Methods and data bases for investigating pragmatics in EIL. In Z. Tajeddin & M. Alemi (Eds.), *Pragmatics Pedagogy in English as an International Language*. New York, NY, USA: Routledge.
- **Hashimoto, B. J.**, & Nelson, K. (2020). Using a corpus in creating and evaluating a DCT. *Applied Pragmatics*, 2(1), 80-120.
- **Hashimoto, B.**, Keller, D., Sudina, E., Yaw, K., Egbert, J., & Plonsky, L. (2020). Research in Progress: Applied Linguistics at Northern Arizona University, USA. *Language Teaching*, 53, 227-232. <https://doi.org/10.1017/S0261444819000491>
- **Hashimoto, B. J.**, & Egbert, J. (2019). More than frequency?: Exploring predictors of word difficulty for English language learners. *Language Learning*, 69(4), 839-872.

4) Peer reviewed presentations

- Lambert, Z., Mecham, S., **Hashimoto B.**, Eckstein, G. (2022). Increasing students' phrasal complexity in timed ESL writing. Paper presented at TESOL International Convention 2022, Pittsburgh, PA, USA.
- Nelson, K., & **Hashimoto, B.** (2022). A methodological synthesis of corpora used in corpus linguistics journals. Paper presented at the annual conference of the American Association for Applied Linguistics, Pittsburgh, PA, USA.
- Woods, K. **Hashimoto, B.**, & Brown, E. K. (2022). Predicting writing proficiency using various lexical diversity measures. Paper presented at the annual conference of the American Association for Applied Linguistics, Pittsburgh, PA, USA.
- Lambert, Z., Mecham, S., Knecht, H., Poggemann, S., **Hashimoto, B.**, & Eckstein, G. (2021). Academic writing made easy with phrasal complexity and compression. Paper presented at Intermountain TESOL 2021 Fall Conference, Ephraim, UT, USA.
- **Hashimoto, B. J.** (2021). Evaluating the linguistic representativeness of a corpus of historical English. Paper presented at the International Corpus Linguistics Conference CL 2021, Limerick, Ireland.
- **Hashimoto, B. J.**, Repo, L., & Laippala, V. (2021). Modeling registers in a corpus of historical English. Paper presented at the International Corpus Linguistics Conference CL 2021, Limerick, Ireland.

- Nelson, K., & **Hashimoto, B. J.** (2021). Current practices in corpus linguistics research reporting: A methodological synthesis. Paper presented at the International Corpus Linguistics Conference CL 2021, Limerick, Ireland.
- Hashimoto, B. J. (2021). A situational description of the language experience of university students. Paper presented at the annual conference of the American Association for Applied Linguistics, Virtual Conference.
- **Hashimoto, B. J.**, Heilpern, J., & Wilder, T. (2021). Legislative history as a corpus. Paper presented at the 6th Annual Law & Corpus Linguistics Conference, Virtual Conference.
- Keller, D. R., **Hashimoto, B. J.**, & Fahy, M. (2020). Lexical alignment predicts collaboration in L2 oral interactive tasks. Paper presented at the annual conference of the American Association for Applied Linguistics, Denver, CO, USA. (Conference canceled)
- **Hashimoto, B. J.**, & Jarvis, S. (2020). Effects of different operationalizations of word types on three prominent measures of lexical diversity. Paper presented at the annual conference of the American Association for Applied Linguistics, Denver, CO, USA. (Conference canceled)
- **Hashimoto, B. J.**, & Jarvis, S. (2020). Evaluating operationalizations of a 'word type' in automated measures of English L2 lexical diversity. Paper presented at the Language Assessment Research Conference, Provo, UT, USA. (Conference canceled)
- Hoffman, A., Wood, M., Lee, T. R., Egbert, J., & **Hashimoto, B. J.** (2020). Linguistics and the canons: Series qualifier v. rule of the last antecedent. Paper presented at the 5th Annual Law & Corpus Linguistics Conference, Provo, UT, USA.
- **Hashimoto, B. J.** (2019). Toward a proportionally representative written corpus of general university student language. Paper presented at the International Corpus Linguistics Conference CL 2019, Cardiff, Wales, UK.
- Egbert, J., **Hashimoto, B. J.**, & Pinchbeck, G. (2019). Toward a new measure of text readability. Paper presented at the annual conference of the American Association for Applied Linguistics, Atlanta, GA, USA.
- McAndrews, M., Keller, D., & **Hashimoto, B. J.**, (2019). Identifying semantically formulaic sequences for L2 teaching and curriculum: A corpus-driven approach using the UCREL Semantic Analysis System. Paper presented at annual conference of the American Association for Applied Linguistics, Atlanta, GA, USA.
- Keller, D., **Hashimoto, B. J.**, & McAndrews, M. (2018). The main purpose of this study was to determine...: A probabilistic method for identifying and comparing lexical bundles of arbitrary length. Paper presented at the Arizona Corpus Linguistics Conference 2018, Flagstaff, AZ, USA.
- Youn, S. J., & **Hashimoto, B. J.** (2018). Developing an L2 pragmatic listening test of implied meaning using corpus linguistics and conversation analysis. Paper presented at the Arizona Corpus Linguistics Conference 2018, Flagstaff, AZ, USA.
- Nelson, K., & **Hashimoto, B. J.** (2018). Using corpora for improving the discourse completion task. Paper presented at the 14th American Association for Corpus Linguistics (AACL) Conference, Atlanta, GA, USA.
- **Hashimoto, B. J.** (2018). Vocabulary size testing and the Frequency Model. Paper presented at the annual conference of the American Association for Applied Linguistics, Chicago, IL, USA.
- **Hashimoto, B. J.** (2016). Linguistic relativity in Korean possessives. Paper presented at the annual conference for the Rocky Mountain Modern Languages Association 2016, Salt Lake City, UT, USA.

5) Professional Memberships

American Association for Applied Linguistics (AAAL)	2017 – Present
Teachers of English to Speakers of Other Languages (TESOL)	2017 – Present
Arizona Teachers of English to Speakers of Other Languages (AZTESOL)	2017 – 2020
Graduate Student Association of Applied Linguistics (GSAAL)	2016 – 2020
Rocky Mountain Modern Languages Association (RMMLA)	2016 – 2017

Biographical Sketch

Clifton B. Farnsworth
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1) Professional Preparation

University of Utah (Salt Lake City, UT)	Civil Engineering	Ph.D.	2008
Brigham Young University (Provo, UT)	Civil Engineering	M.S.	2000
Brigham Young University (Provo, UT)	Civil Engineering	B.S.	1999

2) Professional Appointments

Associate Professor	Brigham Young University	2017-Present
Assistant Professor	Brigham Young University	2011-2017
Assistant Professor	University of Texas at Tyler	2008-2011

3) Publications

- Bingham, E.D., Whitaker, D., **Farnsworth, C.B.**, and Smith, J.P. (2022). Evidence-Based Design in Hospital Renovation Projects – A Study of Design Implementation for Patient Privacy and Comfort: ASCE Journal of Architectural Engineering, 28(2), DOI 10.1061/(ASCE)AE.1943-5568.0000530.
- Patterson, D.A., **Farnsworth, C.B.**, Hutchings, M.D., Eggett, D.L., and Weidman, J.E. (2021). Comparing Cost, Schedule, and Quality of CM/GC and DBB Project Delivery for Repetitive Commercial Construction: International Journal of Construction Education and Research. DOI: 10.1080/15578771.2021.2013998.
- Christoffersen, D., **Farnsworth, C.B.**, Smith, J.P., and Bingham, E.D. (2021), Considerations for Creating Library Learning Spaces Within a Hierarchy of Learning Space Attributes: The Journal of Academic Librarianship, 47(6), 102458.
- Petrinovich, C.A., **Farnsworth, C.B.**, Weidman, J.E., Smith, J.P., and Bingham, E.D. (2021). Roof System Suitability for IT Mission-Critical Facilities: Journal of Facility Management Education and Research, 5(1).
- Bingham, E.D., **Farnsworth, C.B.**, Warr, R.O., and Smith, J.P. (2020). Identifying Challenges to Project Outcomes from a Transportation Project Owner Perspective: The Professional Constructor: Journal of the American Institute of Constructors, 45(2), 59-71.
- **Farnsworth, C.B.**, Smith, J.P., and Bingham, E.D. (2020). A Cross-Sectional Study Exploring IJCER Impact in Construction Scholarship: International Journal of Construction Education and Research, DOI: 10.1080/15578771.2020.1867259.
- Warr, R.O., **Farnsworth, C.B.**, and Weidman, J.E. (2017). Advantages and Disadvantages of CM/GC Project Delivery in Transportation Construction: The Professional Constructor: Journal of the American Institute of Constructors, 42(2), 49-60.
- Childs, B.R., Weidman, J.E., **Farnsworth, C.B.**, Christofferson, J.P. (2017). Use of Personality Profile Assessments in the U.S. Commercial Construction Industry: International Journal of Construction Education and Research, 13(4), 267-283.
- Danforth, E.M., Weidman, J.E., and **Farnsworth, C.B.** (2017). Strategies Employed and Lessons Learned by Commercial Construction Companies during Economic Recession and Recovery: ASCE Journal of Construction Engineering and Management, 143(7), 04017027.
- Williams, G.R., **Farnsworth, C.B.**, Miller, K.R., Weidman, J.E., and Eggett, D. (2016). Responding to the Approaching Mass Departure of Building Code Professionals in Utah: ASCE Journal of Professional Issues in Engineering Education and Practice, 142(4), 04016009.
- Danforth, E., Weidman, J.E., and **Farnsworth, C.B.** (2016). Measuring Organizational Learning Success in Commercial Construction during Economic Recession: The Professional Constructor: Journal of the American Institute of Constructors, 40(1), 5-14.

- **Farnsworth, C.B.**, Warr, R.O., Weidman, J.E., and Hutchings, D.M. (2016). Effects of CM/GC Project Delivery on Managing Process Risk in Transportation Construction: ASCE Journal of Construction Engineering and Management, 142(3), 04015091.
- **Farnsworth, C.B.**, Ozer, T.A., Bartlett, S.F., and Lawton, E.C. (2015). Comparison of Methodologies for Establishing Design Properties of Horizontal Drainage in Soft Cohesive Soils: Transportation Research Record: Journal of the Transportation Research Board, No. 2511, Soil Mechanics.
- **Farnsworth, C.B.**, Beveridge, S., Miller, K.R., and Christofferson, J. (2015). Application, Advantages, and Methods Associated with Using BIM in Commercial Construction: International Journal of Construction Education and Research, 11(3), 218-236.

4) Peer reviewed presentations

- **Farnsworth, C.B.**, Design and Student Perceptions of a Graduate Course on Managing Risk in Construction: ASC Annual Conference, Virtual Conference, August 2020
- **Farnsworth, C.B.**, Hashem Mehany, M., and Bingham, E.D., Assessing the Need for Infrastructure Education within Construction Related Curriculum: ASCE Construction Research Congress, Tempe, AZ, March 2020
- **Farnsworth, C.B.**, Bridging the Gap in Construction Education: ASCE Civil Engineering Education Summit, Dallas, TX, May 2019
- Williams, G.R. and **Farnsworth, C.B.**, Understanding the Impacts of the Aging Population of Code Professionals in Utah: ASC Annual Conference, Denver, CO, April 2019
- **Farnsworth, C.B.** Construction Monitoring Strategies for Problematic or Abnormal Cases: UDOT Embankment Surcharge Design Training, Salt Lake City, UT, January 2019
- **Farnsworth, C.B.** Overview of Geotechnologies to Reduce Settlement at Bridges and the Relative Performance: UDOT Embankment Surcharge Design Training, Salt Lake City, UT, January 2019
- **Farnsworth, C.B.** Evaluation of Curve Fitting Techniques for Estimating Time of Surcharge Release in Embankment Construction over Soft Soils: ASCE Construction Research Congress, New Orleans, LA, April 2018
- **Farnsworth, C.B.**, Ziegenfuss, D., and Roberts, M., A Model Workshop for Helping New Faculty Engage Students in the STEM Classroom: ASEE National Conference, Columbus, OH, June 2017
- **Farnsworth, C.B.**, Miller, K.R., and Kent, B.J., BIM Practices of Commercial MEP Contractors: ASC Annual Conference, Seattle, WA, April 2017
- **Farnsworth, C.B.**, Bartlett, S.F., and Lawton, E.C., Development and Testing of a Multiflow In Situ Permeameter: ASCE Geo-Chicago - Sustainability, Energy, and the Geoenvironment, Chicago, IL, August 2016
- **Farnsworth, C.B.**, Challenges with Managing Risk when Using the Observational Method of Construction with Design-Bid-Build Delivery: ASCE Construction Research Congress, San Juan, Puerto Rico, June 2016
- Warr, R.O. and **Farnsworth, C.B.**, Perceptions of Historic Projects in the Construction Industry: ASCE Construction Research Congress, San Juan, Puerto Rico, June 2016

5) Professional Memberships

Professional Engineer, State of Utah	2003 – Present
Associated Schools of Construction (ASC)	2011 – Present
American Society for Engineering Education (ASEE)	2008 – Present
American Society of Civil Engineers (ASCE)	2003 – Present

Biographical Sketch

Robert K. Christensen
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1) Professional Preparation

Indiana University (Bloomington, IN)	Public Affairs & Policy	Ph.D.	2007
Brigham Young University (Provo, UT)	Law & Public Mgt	JD/MPA	2000
Brigham Young University (Provo, UT)	Russian	B.S.	1997

2) Professional Appointments

Professor	Brigham Young University	2019-Present
Associate Professor	University of Georgia, Brigham Young University	2013-2019
Assistant Professor	University of North Carolina Charlotte, Univ of GA	2006-2013

3) Selected Publications (** = work with a graduate student)

- Choi, Hemin, Greta Nasi, Maria Cucciniello and Robert K. **Christensen**. (2022). A Systematic Literature Review of City Competitiveness: A 30-year Assessment and Future Agenda for Public Administration. *Public Management Review*.
- Porumbescu, Greg, Robert K. **Christensen** and Tobin Im (2022). Softening Performance's Pitfalls by Integrating Context and Capacity: A Government Competitiveness Framework." *Public Administration Review*.
- Witesman, Eva and Robert K. **Christensen**. (2022). Elevating Public Service Motivation Research and Practice. *International Public Management Journal*.
- ** Li, Danyao, Sean Nicholson-Crotty, Jill Nicholson-Crotty and Robert K. **Christensen**. (2021). Exploring the Conditionality of Public Service Motivation: Evidence from a Priming Experiment. *Asia Pacific Journal of Public Administration*.
- Reichert, Patrick, Marek Hudon, Ariane Szafarz and Robert K. **Christensen**. (2021). Crowding-in or Crowding-out? How Subsidies Signal the Path to Financial Independence of Social Enterprises. *Perspectives on Public Management and Governance*, 4(3), 291-308.
- **Christensen**, Robert K., Kuk-Kyoung Moon and Andrew Whitford. (2021). Genetics and Sector of Employment. *International Public Management Journal*, 24(5), 585-595.
- ** Osorio, Andrew, Sarah Nielsen and Robert K. Christensen. (2021). Systematically Reviewing American Law and Public Administration: A Call for Dialogue & Theory Building. *Perspectives on Public Management and Governance*, 4(2), 100-117. Preprint
- Wright, Bradley and Robert K. **Christensen**. (Accepted). Additional intervention evidence on the relationship between public service motivation and ethical behavior. *Journal of Behavioral Public Administration*, 4(1), 1-10.
- ** Wightman, Breck, Robert K. **Christensen** and Paula Sanford. (2020). Exploring the Perceived Barriers to Intergovernmental Collaboration: Schools and Local Governments in Georgia. *Public Performance and Management Review*, 43(6), 1318-1341
- **Haslam, Alyson, Robert K. **Christensen**, and Rebecca Nesbit. (2019). The Dynamic Impact of Nonprofit Organizations: Are Health-Related Nonprofit Organizations Associated with Improvements in Obesity at the Community Level? *Nonprofit Policy Forum*, 10(3), 1-12.
- Ryu, Sangyub and Robert K. **Christensen**. (2019). Student Performance in Turbulent Environments: The Contingent Role of Administrative Intensity in Hurricane Rita. *American Review of Public Administration*, 49(5), 519-531.
- **Christensen**, Robert K., Rebecca Nesbit, Justin Stritch. (2018) The role of employee public service motives and organizational commitment in workplace giving campaigns. *American Review of Public Administration*, 48(7), 644-658.

- **Christensen**, Robert K. and Bradley E. Wright. (2018). Public Service Motivation and Ethical Behavior: Evidence from Three Experiments. *Journal of Behavioral Public Administration*, 1(1), 1-8.
- Thompson, Jeffrey and Robert K. **Christensen**. (2018). Bridging the Public Service Motivation and Calling Literatures. *Public Administration Review*, 78(3), 444-456.
- Pearl, Drew and Robert K. **Christensen**. (2017). First-Year Student Motivations for Service-Learning: An Exploratory Investigation of Minority Student Perceptions. *Journal of Higher Education Outreach and Engagement*, 21(4), 117-138.
- **Christensen**, Robert K., Laurie Paarlberg, James Perry. (2017). Public Service Motivation Research: Lessons for Practice. *Public Administration Review*, 77(4): 529-542. Preprint
- ** Pearl, Drew and Robert K. **Christensen**. (2017). First-year student motivations for service-learning: An application of the Volunteer Functions Inventory. *Michigan Journal of Community Service Learning*, Spring: 66-82.
- Wright, Bradley E., Shahidul Hassan, Robert K. **Christensen**. (2017). Observational Analyses of Job Choice and Performance: Revisiting Core Assumptions about Public Service Motivation. *International Public Management Journal*, 20(1): 108-131.
- ** Tsai, Chin-Chang, Justin Stritch and Robert K. **Christensen**. (2016). Eco-helping and Eco-Civic Engagement in the Public Workplace. *Public Performance and Management Review*, 40(2): 336-360.
- Bushouse, Brenda, Brent Never, Robert K. **Christensen**. (2016). Elinor Ostrom's Contribution to Nonprofit and Voluntary Action Studies. *Nonprofit and Voluntary Sector Quarterly*, 45(4): 7s-26s.
- Stritch, Justin M. and Robert K. **Christensen**. (2016). Going green in public organizations: Exploring Eco-Initiative in Public Employees. *American Review of Public Administration*, 46(3): 337-355.

4) Selected External Funding

- Moyer, Laura; Susan Haire; John Szmer and Robert K. **Christensen**. "Collaborative Research: Judicial Diversity and Appellate Decision Making." Amount: \$35,000. **National Science Foundation** (NSF), Law and Social Science (LSS). Status: Accepted, Award #1654559. January 2017.
- Im, Tobin (PI), Robert K. **Christensen** (co-PI), Milena Neshkova (co-PI), Yijia Jing (co-PI), Jesse Campbell (co-PI). Amount: \$600,000, 2014-present. Project on Government. Competitiveness. **Korean Research Foundation**. Status: Awarded Fall, 2014. NRF-2014S1A3A2044898.

Biographical Sketch

Andrew South
Civil and Construction Engineering
Brigham Young University, Provo, UT 84602
andrew_south@byu.edu, 801-422-6489

1) Professional Preparation

Stanford University (Stanford, CA)	Civil and Environmental Engineering	PhD.	2019
Stanford University (Stanford, CA)	Sociology	M.A.	2014
Brigham Young University (Provo, UT)	Construction Management	M.S.	2011
Brigham Young University (Provo, UT)	Construction Management	B.S.	2003

2) Professional Appointments

Assistant Professor	Brigham Young University	2021-Present
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3) Selected Publications (= work with a graduate student)**

- **South, A.**, Cassidy, C., Contractual and Relational Governance in Public-Private Partnership (PPP) Stakeholder Networks, International Journal of Project Management, SUBMITTED November 2021
- ****Monk, H.**, Levitt, R., Garvin, M., **South, A.**, Carollo, G. (2019) Public-private partnerships for infrastructure delivery, Book Chapter - Public-Private Partnerships for Infrastructure Delivery: Finance, Stakeholder Alignment, Governance
- **South, A.**, Dewulf, G. (2019) Stakeholder network dynamics in public-private partnerships, Book Chapter - Public-Private Partnerships for Infrastructure Delivery: Finance, Stakeholder Alignment, Governance
- **South, A.**, Eriksson, K., & Levitt, R. (2018). How Infrastructure Public-Private Partnership Projects Change Over Project Development Phases. Project Management Journal, 49(4), 62–80.
- **South, A.** & Dewulf, G. (2017) “An interdisciplinary Approach to Understanding ‘Stakeholders,’” Proceedings of the Engineering Project Organization Conference – Managing Complex Adaptive Systems, Lake Tahoe, CA.
- Levitt, R & **South A.** (2017) Toward an Integrated Lifecycle Governance Framework for Delivering Sustainable Infrastructure Systems: Analyzing Public-Private Partnerships, Annual Review of Social Partnerships, 10
- **South, A.**, Levitt, R., & Dewulf, G., (2016) “Dynamic Stakeholder Networks and the Governance of PPPs. Proceedings of the 2nd International Conference on Public-Private Partnerships, Austin, Texas. ASCE Transportation & Development Institute. BEST PAPER AWARD
- **South, A.**, & Zweifel, Z. (2014) “Disaster Survivability of Thin-Shell Concrete Dome Structures: Experience and Practice,” Proceedings of the IASS-SLTE 2014 Symposia
- **South, A.** & Hutchings, M., (2012) “Unintended Social and Economic Consequences of New Construction Technology Implementation in the Developing World, International Journal of Social Sustainability in Economic, Social, and Cultural Context

4) Other Scholarly Activities

- “Opportunities for Change in US Federal Infrastructure Policy”, presentation at 14th annual Engineering Project Organizations Conference (2017), Lake Tahoe, CA
- “Stakeholder Networks,” presentation to the College of Engineering Technology, University of Twente, (2016), Netherlands

- Research lead for the Stanford GPC and Wharton collaborative large infrastructure database project – engaging 20+ universities globally in compiling a quantitative and qualitative case-based data set (2014-2016)
- Assistant grant writer and senior research associate for Stanford’s Global Project Center - NSF funded proposal #1334292 to the Civil Infrastructure Systems and Science of Organizations groups. Collaborative Research: Toward an Integrated, Lifecycle Governance Framework for Delivering Civil Infrastructure Systems.(Award period 2013 – 2016)
- “Concrete Dome Structures and Extreme Wind Loads: The Design of Community Shelters,” presentation at IASS – Shells, Membranes and Spatial Structures (2014), Brasilia, Brazil
- “Stakeholder Engagement & Management in Public-Private Partnerships,” presentation at the 10th annual Engineering Project Organizations Conference (2013), Devil’s Thumb Colorado
- “Balancing Culture and Innovation: managing unintended consequences in development” (2011). Universitas Gadjah Mada, Yogyakarta, Indonesia, Department of Engineering and Architecture

Current and Pending Support

Clifton Farnsworth

\$40,000 from Hussein Ethics Endowment (BYU College of Engineering) for Civil and Construction Engineering Sustainability Lab projects. Co-Director of CCE Sustainability Lab, January 2022 - December 2022.

\$10,000 from Clyde Fellowship (BYU College of Engineering) for Heavy/Civil Construction (infrastructure) related research. (\$10,000 / year for 3 years.) September 2021 - August 2024.

\$12,000 from BYU College of Engineering for ‘Understanding the Role of ESG in Promoting Sustainability Practice within the Built Environment.’ July 2022 - June 2023.

\$5,000 from Charles Redd Center for Western Research for ‘Comparison of Infrastructure Asset Management Processes for Rural and Urban Populations in Utah.’ September 2022 - August 2023.

Andrew South

\$40,000 from Hussein Ethics Endowment (BYU College of Engineering) for Civil and Construction Engineering Sustainability Lab projects. Co-Director of CCE Sustainability Lab, January 2022 - December 2022.

\$13,000 from Sant Foundation for ‘Identifying Applications of the United Nations’ Sustainable Development Goals to Reduce Air Pollution Concentrations in Brick Kilns in Nepal’ - January 2023 - January 2024