

Creating and Validating a Stewardship of Place Index for Appalachia

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Abstract

Quantitative analyses of the social and economic roles of higher education institutions are limited by the lack of an institutional-level measure of regional engagement. One way to conceptualize regional engagement is through stewardship of place, or the technologies and work by postsecondary institutions that contribute to regional economic and community development. This study creates a measure of stewardship of place, the Stewardship of Place Index, that relies entirely upon publicly available data. The final index comprises three dimensions: Education, Research, and Regional Needs. We validate the index through a series of qualitative and quantitative steps. The instrument can be used by institutions for benchmarking, assessment, and communicating work to stakeholders, and it can be used by researchers to analyze the role of postsecondary institutions in regional development. Additional findings highlight data limitations and major shortcomings of the Carnegie Community Engagement classification.

Keywords: stewardship of place, community engagement, economic development, community development



Higher education institutions (HEIs) in the United States shape and are responsible for the spaces they inhabit, fostering a sustainable and equitable future for all stakeholders involved. They serve as engines of opportunity and economic prosperity for students, families, and communities. In essence, they must be stewards of place. *Stewardship of place* is a concept that orients higher education community engagement as inherently place-based, implying HEIs have a moral obligation to be involved in their region's community and economic development (Orphan & McClure, 2022; Saltmarsh et al., 2014). We define stewardship of place as the technologies and work by postsecondary institutions that contribute to regional economic and community development. The phrase arose in the higher education community in 2002 as part of a movement initiated by the American Association of State Colleges and Universities (AASCU). Whereas flagship, land-grant, and community and

technical colleges tended to have more clearly defined missions beyond the academic functions of their institutions, AASCU set out to delineate and communicate the importance of local engagement in the mission and vision of regional public colleges and their effects on the communities they serve.

Much has changed in the political and fiscal environments in higher education over the past two decades. Among the most impactful are (1) steadily declining state resources to public higher education and more institutional reliance on tuition and fees, and (2) increasing pressure from state and local leaders to meet local workforce demand and serve as economic engines in meeting broader community, regional, and statewide needs. In order to make their case to policymakers and stakeholders, or even to secure future existence for some, it has become imperative for many colleges and universities to be locally engaged and to be able to effectively communicate the regional impact of the institution on students' lives

and the workforce, economy, and health of the community.

Quantitative analyses of the social and economic roles of HEIs in regional development are notoriously limited, however, largely because there is no clear, identifiable treatment variable. Consider the three broadly accepted missions of HEIs: education, research, and community engagement. Research on the relationship between the educational mission of HEIs and economic development is the most well-developed, with a rich history of literature on wage premiums of a postsecondary degree (Arteaga, 2018; Ost et al., 2018; Psacharopoulos, 1991). The research mission's relationship to development is less clear, focused mainly on patent generation near research universities (Andersson et al., 2009; Kantor & Whalley, 2014), and quantitative literature on the effects of community engagement is scant. As interest grows for HEIs to be engaged in their regional economies and good stewards of place for their communities, being able to measure an HEI's contribution will be an essential part of the conversation.

In order to develop sound strategies and to obtain and provide stakeholders comparative information, higher education professionals need better quantitative data, measures, and indices. These data and metrics are particularly essential for regions with relatively low incomes, poor health outcomes, and/or low educational attainment, as HEIs in these regions look for ways to solve local problems. The Appalachian Mountains, as defined by the Appalachian Regional Commission (ARC), is such a region and will serve as the bounds for this initial validation project.

This study aims to develop and validate an organizational-level measure of stewardship of place, comprised of several data elements and measures, that can then be used both by HEIs to evaluate their own regional engagement and by researchers to estimate the relationships between HEIs and regional development. The objectives of this project are thus (1) to design an index measuring stewardship of place at an organizational level using publicly available data and (2) to validate and revise the index through a combination of qualitative and quantitative tests. This article contributes to the study of university-community engagement by offering a transparent, replicable quantitative measure that can supplement other initiatives to capture and communicate the work of HEIs.

Literature Review

There is growing demonstrated interest in HEIs as stewards of place in their regions. This interest is associated with declining public trust in higher education. HEI leaders seek ways to demonstrate the value of colleges to legislators and families, with community engagement often positioned as a solution (Fischer, 2023). AASCU has also reinvigorated the stewardship of place conversation recently, having published a series of reports on stewardship of place meant to update the concept for the middle of the 21st century (McClure & Orphan, 2023; McClure & Vaidya, 2023; Orphan & McClure, 2022).

Much literature around postsecondary institutions and local development uses the conceptual frame of anchor institutions (Garton, 2023; Porter, 2016). This frame begins with the assumption that certain types of organizations, almost always universities and hospitals, are incredibly unlikely to move locations and thus are reliable sources of regional economic stability. Anchor research then analyzes the economic contributions of institutions from their day-to-day operation. Colleges and universities act as anchors in their communities not necessarily because of anything unique about their mission or contributions to society, but because they employ large numbers of people, spend large amounts of money, and bring foot traffic to specific areas (Garton, 2021). Being an anchor institution does not necessarily imply any intentionality on the part of the institution—purely through its existence, the institution will shape the local economy.

Stewardship of place differs from the anchor framework in two main ways. First, stewardship of place goes even further than assuming intentionality, to the point of conceptualizing local engagement as a moral obligation. Second, the anchor literature is largely focused around urban development, and with good reason given the hyperlocal nature of projects like real estate development. Stewardship of place, however, allows for broader geographical applications, particularly important for the largely rural Appalachian setting of this study.

Stewardship of place conceptualizes local engagement and development as a moral obligation, not just a footnote to an HEI's mission or a strategy to generate goodwill. This obligation originates in an ontological lens of existence, freedom, and vocation as

being fundamentally contingent upon place and community (Sweeden, 2023). If place is so central to the very media through which we experience our lives, then there must be some degree of investment in shaping place. When HEI and community partners commit to place, the involved individuals tend to develop moral perspectives tied to place (Ryan et al., 2023). The social construction of place is no longer purely local, involving larger cultural dynamics informed by forces like globalization (Dymnicka, 2010). In the case of Appalachia, communities formed identities in a history of exploitation and collective action, the economic downturn of deindustrialization from globalization, and a general respect for natural settings (Reid, 2005).

Within this context of stewardship of place as a core moral obligation for institutions and of place as an evolving concept that extends beyond our immediate surroundings, HEIs in rural settings are well poised to use stewardship of place as a guiding frame. HEIs engaging in such an approach can support multiple organizations across rural regions like P-12 schools, small businesses, and other local civic organizations (Johnson et al., 2009). Rural HEIs also serve as anchor institutions, often being among the largest employers and offering valuable services that are otherwise inaccessible in rural regions (Orphan & McClure, 2019). Aspects of HEIs that scholars have analyzed using the lens of stewardship of place include publicly accessible libraries (Stover, 2016), education geared toward tackling local problems (Doordan, 2015), and education to provide income stability as well as social mobility in local spaces independently of global economic conditions (Oleksiyenko, 2013).

Measuring Stewardship of Place

Despite the enormous interest in the topic, stewardship of place is difficult to measure in a way that can be easily scaled to a large number of HEIs. One flawed approach would be to use public service expenditures from the Integrated Postsecondary Education Data System (IPEDS), which reduces the concept to activities not already captured within instructional and research expenses. Assuming community engagement is conceptualized as cutting across teaching and research (Fitzgerald et al., 2012), relying solely on public service expenditures would miss perhaps even most of the engaged work performed by an HEI. For example, any credit-bearing courses meant to fill regional

needs would be captured under teaching expenditures, not public service. Public service expenditures are thus only part of the story.

Another potential way to quantitatively measure stewardship of place is with a binary variable: Either the HEI is an engaged institution, or it is not. This approach is essentially how the Carnegie Classification for Community Engagement measures engaged institutions, distilling long, qualitative applications into a yes/no measure. The issue with a binary indicator is that it loses vast amounts of information around dosage. A deeply engaged HEI devoting millions of dollars to regional problems may be placed in the same category as a small, cloistered college doing good but limited outreach. A continuous measure would be able to distinguish among magnitudes.

A third way researchers have attempted to capture HEI contributions to regional development is with economic impact reports. These reports use a variety of methods, like estimating wage premiums for graduates; amount of money students, faculty, and staff spend at local businesses during the school year; and operational expenses of the organization that contributed to the local economy. The results of such reports are of dubious quality. First, the estimates of wage premiums are rough, and regional impact is usually estimated by adding a multiplier, which may be untethered from any meaningful local context. Second, the focus on operational expenses conflates expenditures with impact, offering little to no consideration for who made the initial payments. Especially in the tuition-dependent environment of higher education today, high expenditures do not necessarily equate to equitable regional development.

Therefore, given the growing interest in stewardship of place and the current shortcomings of quantitative measurements, the fields of higher education and the scholarship of engagement stand to benefit greatly from a methodologically rigorous, quantitative measure of stewardship of place. Such a measure will be useful to HEIs as they look for ways to demonstrate their worth to legislators and families, establishing the institutions as working toward the public good. The measure will be invaluable for scholarly analysis to understand the relationship between HEIs and regional development, as it can be used as an independent variable to predict different regional outcome variables like income, population growth, and health

indicators. Finally, by using publicly available data to construct the measure, it can be scaled cheaply across a large number of HEIs beyond just the ARC service area analyzed in this study. Staff at interested HEIs will not need to launch expensive surveys to apply the measure to their own campuses, and researchers can easily shift the population of interest without new, costly data collection beyond any contextual revisions.

Methods

The project progressed through three successive stages: (1) Create the initial stewardship of place index following Wilson's (2005) four building blocks approach to construct modeling, (2) evaluate construct validity of the index through a focus group with community engagement leaders and an interview with a faculty expert, and (3) evaluate criterion validity and reliability through quantitative tests.

Sample Selection

We limited our sample to HEIs within the ARC service area for three methodological reasons. First, the ARC service area is large and diverse though with well-defined boundaries, encompassing parts of 13 different states (ARC, 2015). See Figure 1 for a map of all counties within the ARC service area. This wide coverage across so many legislative jurisdictions ensures our sample includes institutions with different missions, sizes, and funding models. Second, despite the geographic diversity of the region, it also shares a cohesive cultural and economic context of similar industries and community challenges (Pollard et al., 2023). Stewardship of place in one cultural and economic setting might look very different than in another. This initial validation project avoids introducing too much variation by focusing on one context, albeit a large and diverse context. Third, focusing on the ARC service area allowed us to test and refine the index in a region without major spatial confounders of dense populations and economic activity. Global megacities like those in southern California, or New York City, could disproportionately influence the index due to their size, number of HEIs, and economic complexity. Limiting our sample to the ARC service area thus provides a diverse yet cohesive setting in which to develop the index. Finally, from a pragmatic standpoint, Appalachia's workforce needs and historical education attainment deficits

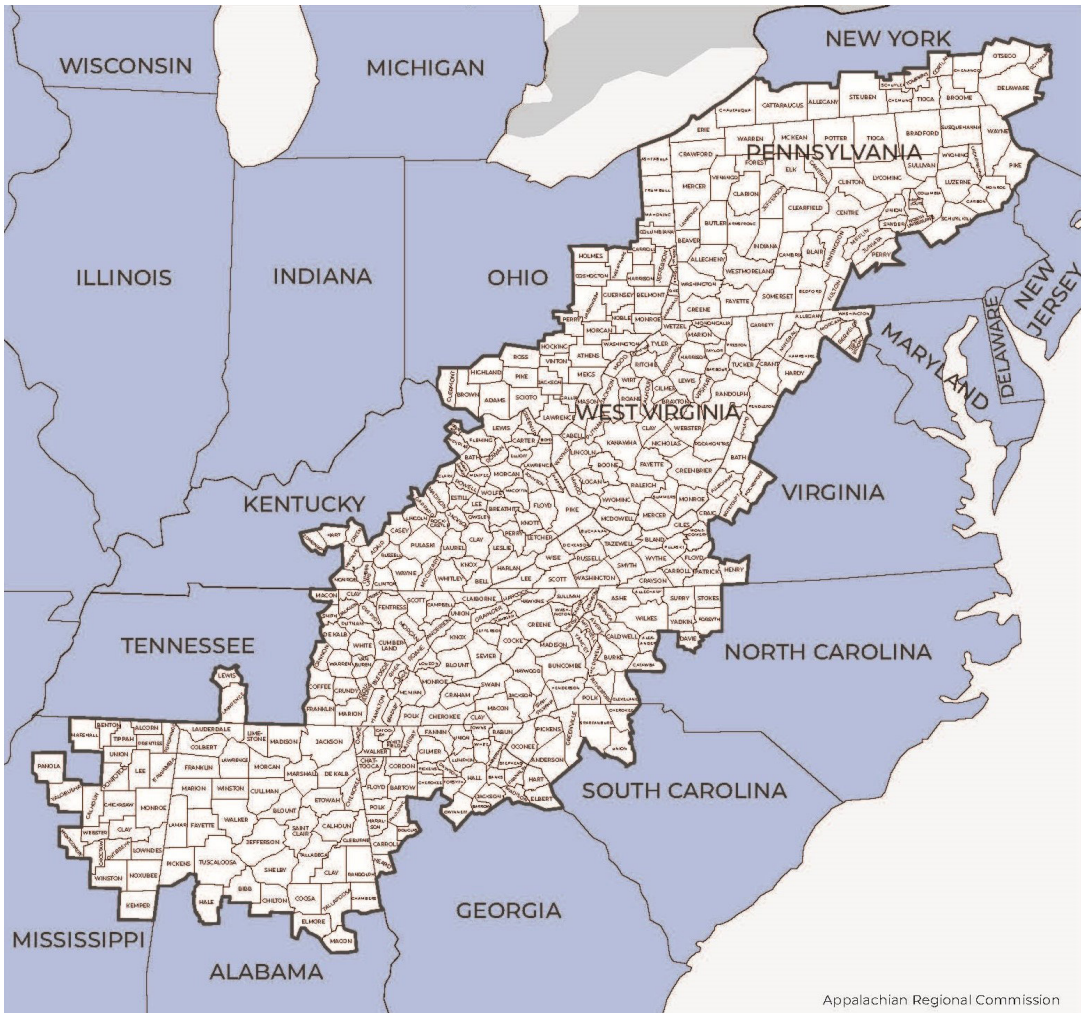
(Pollard et al., 2023) necessitate new ways of thinking about higher education and measuring inputs, outcomes, and work. By focusing on the Appalachian region in the validation phase, the tool will be more likely to be useful to HEIs in Appalachia.

The final sample size included 559 institutions: 238 were 4-year institutions, 174 were 2-year institutions, and 147 were less-than-2-year institutions; 246 were public institutions, 167 were private not-for-profit, and 146 were private for-profit. Of these institutions, 29 were in New York, 154 in Pennsylvania, 53 in Ohio, 72 in West Virginia, five in Maryland, 24 in Kentucky, 19 in Virginia, 56 in Tennessee, 37 in North Carolina, 23 in South Carolina, 11 in Mississippi, 45 in Alabama, and 31 in Georgia.

Construct Modeling

Wilson (2005) recommended a four-step process in construct modeling. First, create the construct map. A construct map identifies the different dimensions of the construct, the opposing extremes of each dimension along continuous scales, and qualitative levels within each continuous scale. This stage is drawn from theory. Second, create the items. The third step, the outcome space, is the process through which the items are converted into scores. Finally, the measurement model step is the process through which all the scores are combined into the final measure.

To build the construct map, we relied heavily upon the stewardship of place reports from AASCU, literature on place-based community engagement and economic development, and the literature on the scholarship of engagement. As our point of departure, we used Orphan and McClure's (2022) summary and Doberneck et al.'s (2010) typology to guide our identification of the dimensions. Both Orphan and McClure and Doberneck et al. organized their discussions along the lines of education, research, and community engagement, so those were the three dimensions we used as our starting point. Although different HEIs and academic disciplines use a variety of terms to refer to this third dimension (e.g., public scholarship, outreach, societal impact), we follow Doberneck et al.'s approach of using the word "engagement" as a catchall term for activities involving community partners to tackle societal problems. Based on the construct map, we identified publicly available data through IPEDS (National Center

Figure 1. Map of ARC Service Area

Note. ARC service area by county. From *Appalachian Region*, by the Appalachian Regional Commission, 2021 (<https://www.arc.gov/wp-content/uploads/2021/11/Appalachian-County-Map-1.pdf>). Reprinted with permission.

for Education Statistics, 2026), College Scorecard (U.S. Department of Education, 2026), and the Higher Education Research and Development Survey (HERD; National Center for Science and Engineering Statistics, 2026) that serve as indicators of where the observations fall on the construct map. For example, one of the measures within teaching as stewardship of place was graduation rates weighted by the number of Pell-eligible students. Part of research was the percentage of research expenditures spent on nonbasic research, and part of service was the percentage of total expenditures spent on public service.

The outcome space step is more pertinent to psychometric style measures without inherent numeric values, so the third step related only circumstantially. For example, we

weighted graduation rates by the proportion of students that were Pell eligible, so this is the step at which we made those decisions. Most of the included variables were already numerical, however, and required no additional coding.

We standardized all the different scores and ran a principal component analysis (PCA) to identify shared variance across different dimensions. Ideally the dimensions would align conceptually with the dimensions we identified in Step 1 of Wilson's (2005) construct modeling; however, results of the PCA serve as an additional form of evidence as to what the dimensions should be. Finally, based upon the factor loadings within the dimensions that variables fit within the best, we weighted the standardized scores using the factor loadings, then combined

the weighted scores through a linear combination. This procedure results in a single continuous score that in isolation is near impossible to interpret, but in relation to the overall distribution of the Stewardship of Place Index will indicate position and dosage. Applying the index retroactively to previous years also enables longitudinal analyses, another benefit of relying solely upon publicly available data.

Validation Procedures

The next step was to convene a focus group via Zoom of four HEI community engagement leaders to evaluate the construct validity of the measure. This focus group was held in early July 2024. Participants were identified by drawing a random sample of HEIs from the population of all Title IV–eligible HEIs in the ARC service area, stratified by institution type to ensure different sectors were represented. We browsed each HEI’s website to find the chief engagement officer and contact information. If none was found, the HEI was removed from the sample. The primary goals of the focus group were to determine whether the measure captured all the dimensions of stewardship of place, whether the measure captured all the potential variation in stewardship of place, and whether the construct map resonated with the participants’ experiences and expertise (Fowler, 2014; Remler & Van Ryzin, 2021). After the focus group’s evaluation, we made reasonable recommended changes, then shared the construct map and measurement model with a faculty member with expertise in the scholarship of engagement. Our inclusion criteria for the faculty were having published at least one peer-reviewed article on HEI community engagement and being active in the field. We conducted a Zoom interview with this faculty member, with the goals of the interview being the same as those of the focus group. Following the faculty response, we again made reasonable recommended changes.

Finally, using the final measurement model, we built a data set for the Stewardship of Place Index including all Title IV–eligible HEIs in the ARC service area. We used the final data set to evaluate the criterion validity and reliability of the index through a series of quantitative tests by ensuring the index is correlated with related measures. For example, we would expect public 4-year institutions to have a higher score on the index than other sectors, assuming AASCU’s identification of stewardship of place as a

defining feature of such institutions is correct. We ran a *t*-test in which the predictor variable was whether the HEI is a public 4-year or not, and the outcome variable is the index. We tested reliability using test-retest. By using publicly available data, we can calculate index scores across multiple points in time. An HEI’s score at one point in time should be tightly correlated with its score at another point in time, the desired test-retest result. We received approval to conduct this study from the East Tennessee State University Institutional Review Board, University IRB ID# c0624.7e.

Results

The first draft of the index developed through the literature review is presented in Table 1. We made revisions and tested the validity and reliability of the index through a series of qualitative and quantitative procedures, described in detail here.

Qualitative

After developing the first draft of the index, we convened a focus group of chief engagement officials at Title IV–eligible institutions within the ARC service area. The final sample included four engagement officials (identified with pseudonyms) at four different institutions, with four different Carnegie Basic Classifications (American Council on Education, 2026) and in four different states. Our focus group members and their institutions’ classifications were Hazel at a Master’s Colleges and Universities: Medium Programs (Masters/M), Charley at a Master’s Colleges and Universities: Larger Programs (Masters/L), Mandy at a Doctoral/Professional Universities (DU), and S.G. at a Doctoral Universities: Very High Research Activity (DU/R1). Three of the represented institutions were public, and one was private not-for-profit.

Overall, the participants confirmed the face validity of the index. When asked if they saw their work and priorities reflected in the index, Charley (Masters/L) said, “I do see our work reflected” and “I think you have captured the big categories,” prompting S.G. (DU/R1) to say, “I agree, I agree.” S.G. elaborated,

I do just want to say this is absolutely much needed. It’s talked about in almost every discussion I have in various situations that we definitely need to get a better handle

Table 1. First and Second Drafts of the Stewardship of Place Index

First Draft		
Education	Research	Community engagement
Graduation rate weighted by percentage of Pell grant recipients (IPEDS)	Research/scholarly doctoral degrees awarded (IPEDS)	Carnegie Community Engagement Classification designee (American Council on Education)
Pell Grant recipient graduation rate (IPEDS)	Percentage of nonbasic R&D conducted (NSF HERD)	Public service expenditures (IPEDS)
Non-Pell Grant Direct Subsidized Loan or Stafford Loan recipient graduation rate (IPEDS)	Percentage of awards passed through to nonprofit subrecipients (NSF HERD)	Number of public service FTE staff (IPEDS)
Percentage of in-state students (IPEDS)		
Median earnings (College Scorecard)		
Selectivity weighted by competitiveness of other institutions in the region (IPEDS)		
Offers at least one program with the highest enrollments in that field in the region (IPEDS)		
Additions/Changes Following Qualitative Steps		
Percentage of students in health/education majors (IPEDS)	Professional terminal degrees awarded (IPEDS)	Public service expenditures as percentage of total (IPEDS)
Minority Serving Institution (NASA)		Public service FTE staff as a percentage of total (IPEDS)
		Publicly accessible museum (IMLS)
		Publicly accessible library (IMLS)

on how we see our institutions doing what they do and if it is directed to the community in appropriate ways using community voice. So I think this is a tool for that.

Both Charley and S.G. agreed the index appears to be measuring what it is intended to measure—the amount of work at an institution dedicated to engaging local stakeholders in community and economic development. S.G. also spoke directly here to the practical utility of the measure for practitioners, though in so doing also identified a clear limitation of the tool in itself. The measure does not incorporate perspectives of community partners. This absence results partly from a lack of data availability, and partly because the intent of the index is to capture dosage of institutional actions.

The data availability issue came up repeatedly in the focus group as participants described their priorities; however, our collaborative efforts with the participants failed to ascertain publicly available indicators. The vast majority of technologies and work described by the participants for which we were unable to identify suitable measures fell into academic community engagement activities. For example, Hazel (Masters/M) asked, “How do you capture faculty and staff involvement . . . for example, on nonprofit boards?”

Participants also discussed engaged and experiential learning as being an important source of community engagement that is not easily measured at a national level. Hazel (Masters/M) said, “Student teaching is a service to the community.” Hazel also brought up an example of engaged

scholarship conducted by a colleague that involves people in substance abuse recovery participating in a community arts ensemble. This is an incredibly pertinent project given the opioid epidemic in the part of Appalachia in which Hazel's institution is located, though it is not measured in a way that is easily scaled or publicly accessible.

Mandy (DU) also emphasized, "One of the things that we focus on a lot at our institution is our partnerships. . . . I'm pulling in . . . business partnerships and looking at how student experiences are shaped by our partnerships. . . ." Even constructs as easily quantifiable as the number of formal partnerships or the number of students involved in community-embedded internships or federal work-study are not measured clearly at a national level.

Charley (Masters/L) also brought up the economic impact of day-to-day operations along the lines of the anchor literature. Although some measures do exist that roughly estimate expenditures of all anchor institutions in metro areas, these measures do not disaggregate at the institution level and do not include areas that fall outside metro areas, thus are not as useful for rural-serving institutions. For the Stewardship of Place Index, the relative dearth of standardized data on partnerships and engagement is a clear limitation. To speak to the state of higher education data broadly, we measure what we value. If policymakers are concerned about the role of HEIs in regional development, they should seriously consider incorporating indicators of community partnerships and engaged scholarship in national surveys such as IPEDS and the HERD, or even at the state level.

Finally, participants were generally skeptical about the Carnegie Community Engagement Classification because of the resource intensity involved in the voluntary application. Mandy (DU) said,

We as an institution decided not to renew [the Carnegie classification] because we're doing the work already. . . . We put years of work into putting this application together . . . but it hasn't been a big thing on any of our grant applications or anything like that.

Charley (Masters/L) agreed and shared a similar sentiment at his institution, saying,

"We're in exactly the same boat. . . . We're so laser-focused on what actually moves the needle for students." Although participants generally agreed the self-study aspect of the classification was valuable, their institutions did not have the resources to dedicate to such an in-depth application on a regular basis, particularly since receiving the designation did not seem to be useful for enrollments or even grant applications from the engagement offices. Additionally, community colleges are dramatically underrepresented in the classification. As will be seen in the next section, the PCA supports the arguments of the participants. No component loaded on receiving the Carnegie classification in a theoretically coherent manner.

After the focus group, we conducted an interview with a faculty expert in university-community engagement, Christiana (pseudonym). Similar to the focus group, Christiana was concerned about resource disparities between institutions that would be reflected in the index, as opposed to a proportional commitment of resources to stewardship of place. The resource intensity of the engagement classification was one example. Two other variables Christiana critiqued were the public service expenditures and the public service full-time equivalent (FTE) variables. In the initial draft of the index, these variables were measured as raw frequencies. Christiana said,

With the public service expenditures, that is a very resource dependent variable. [You could make] it as a percentage of overall expenditures instead of just a whole dollar amount because . . . it gives you more of a sense of how much of an institution's budget that they're devoting. Let's say, a Florida International University, which is a huge institution, huge budget. They're going to blow all these other smaller regional publics out of the water with their public service expenditures. . . . And I would say, similar with the number of public service FTE staff maybe consider making that a percentage of overall staff.

As a result of these suggestions from Christiana, we revised the public service expenditures and public service FTE variables to be percentages of overall expenditures and overall staff.

Christiana made four other suggestions we incorporated. First, we replaced the variable that the school had the highest enrollments in at least one field in their region with a variable measuring the percentage of students who majored in health or education. As Christiana argued, “Another way to think about . . . education and workforce development could be in the health sciences and then also teacher education, because those are two major ways that they contribute to the local workforce.” Whereas the previous variable was unconcerned with workforce alignment, or at best assumed market demand from students for a major indicated workforce demand in that field, this suggestion moves toward measuring majors with concrete workforce implications, particularly in today’s environment of high demand for medical professionals and teachers.

Second, we included an additional variable measuring the number of professional terminal degrees awarded (e.g., PsyDs, MDs, or JDs), not just scholarly degrees (e.g., PhDs, EdDs) that had been considered in the first index. Christiana suggested, “Maybe [PhD students] would stay in the region, but my guess is that they’re going to go try and find an academic job or a research focused job . . . whereas if it’s a professional doctorate . . . they probably would be more likely to stay in the region.”

Third, we included a binary indicator of whether the HEI was designated as a Minority Serving Institution (MSI) using the National Aeronautics and Space Administration MSI database (NASA, 2026), and fourth, we included two binary variables indicating whether the HEI had a publicly accessible museum and/or library using data from the Institute of Museum and Library Services (IMLS, 2018) and IPEDS. Based on the recommendations from the focus group and the interview, we created the second draft of the Stewardship of Place Index. Additions and revisions from the qualitative procedures are presented in the bottom half of Table 1.

Quantitative

After creating the second draft, we built a data set including all Title IV-eligible institutions in the ARC service area, including all of the variables in Table 2, for a final sample size of $n = 559$. Data from IPEDS were collected using its Access Database (NCES, 2026). Data from NSF HERD (National Center for Science and Engineering

Statistics, 2026) were web-scraped with the Beautiful Soup Python library (Version 4; Richardson, 2007) per annum, then combined. CollegeScoreCard data were accessed via the CSC API and then combined locally (U.S. Department of Education, 2026). Data from NASA and IMLS were coded and combined locally. We used Python 3.10.6 and Stata for all data validity checks, cleaning, and wrangling.

We then standardized the variables and ran a PCA, limiting the number of components to four based on visual analysis of a scree plot (see Figure 2). For the factor loadings, see Table 2. Though our initial dimensions derived from the literature review were education, research, and community engagement, our final dimensions were determined by the different components identified in the PCA. We determined which variables to retain and which component to assign them to following a two-step process. First, we assigned each variable to the dimension with which it had the strongest correlation in absolute terms, following the prescriptions of Jolliffe (1972, 1973). Second, we evaluated each variable for conceptual coherence within that dimension in terms of both overall fit (i.e., the variable is directly measuring some aspect of the dimension) and whether the direction of the sign made conceptual sense based on expectations from the literature review. If a variable did not meet these criteria for conceptual coherence, we dropped that variable from the index. We also retained only components with at least three remaining variables at the end of this process.

Based on the results of the PCA, we made several changes to the index. First, though this does not necessarily change the final values of the index itself, we changed the construct map to reflect the new dimensions identified by the analysis. The education variables, specifically the three graduation rate variables, heavily mapped onto a single component, which we kept as Education. The number of research degrees produced and the percentage of nonbasic R&D expenditures both mapped onto a single component, but so did having a publicly accessible museum. We referred to this dimension as Research, despite shifting the museum variable over. The third component, referred to in Table 3 as Component 3, did not have at least three variables that mapped onto it in a coherent way, so we did not include this component in our final

Table 2. Factor Loadings for the Stewardship of Place Index

Variable	Research	Education	Component 3	Regional Needs
Grad rate weighted by Pell	-.07	.53 ^a	-.07	-.03
Pell grad rate	.19	.52 ^a	-.08	-.07
DSL grad rate	.18	.47 ^a	-.08	-.08
In-state	-.32	.00	.38	-.01
Median wage	.37	-.09	-.16	.08
Selectivity	-.35	-.06	.29	.07
Health & education majors	-.11	.19	.09	.31 ^a
Minority Serving Institution	.08	-.10	-.18	-.03
Research doctoral degrees	.34 ^a	.03	.25	.29
Nonbasic R&D	.31 ^a	-.02	.25	-.12
Grants passed through to nonprofits	.25	.00	.39	-.36
Professional terminal degrees	.30	.03	.30	.32 ^a
Public service expenditures	.13	.03	-.33	.05
Public service FTE	.17	-.01	.29	.44 ^a
Carnegie Engagement Classification	.10	.02	.31	-.58
Museum	.31 ^a	-.16	-.08	-.05
Publicly accessible library	.20	-.39	-.16	-.08

Note. ^aThe variable was included in the final index.

index. Component 4 included health and education majors, professional terminal degrees produced, and the public service employee variables. We named this dimension Regional Needs. All other variables were dropped from the index, as the dimension to which they were most highly correlated did not make conceptual sense. We then conducted the PCA procedure again, including only the nine final variables. This final PCA confirmed the same structure, with three components with eigenvalues greater than 1, and identical conceptual groupings under each component. See Table 3 for the final list of dimensions and variables, and see Table 4 for the final loadings. To further explain the operationalization of the index,

we summarize below how each retained indicator represents stewardship of place in the ARC context.

The three variables under the Education dimension aim to measure the social mobility aspect of postsecondary education by evaluating student success while also rewarding HEIs that serve students who are eligible for federal financial support. The index does not directly measure whether students are from the Appalachian region for two reasons. First, publicly available data do not measure student residence at the county level, only in-state or out-of-state. Second, the percentage of in-state students did not load onto any of the components in a meaningful

Figure 2. Scree Plot of Variables After Principal Component Analysis

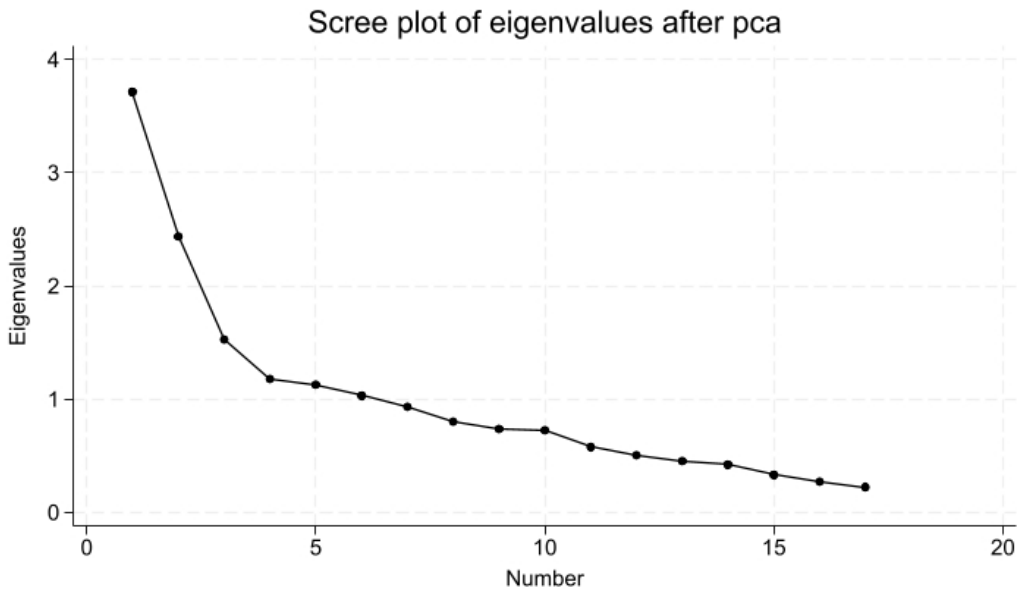


Table 3. Final Stewardship of Place Index

Education	Research	Regional Needs
Graduation rate weighted by percentage of Pell grant recipients	Research/scholarly doctoral degrees awarded	Percentage of students enrolled in health or teaching majors
Pell Grant recipient graduation rate	Percentage of nonbasic R&D conducted	Professional terminal degrees awarded
Non–Pell Grant Direct Subsidized Loan or Stafford Loan recipient graduation rate	Publicly accessible museum	Number of public service FTE staff as a percentage of all FTE staff

way. However, perhaps more important than where the students originate is where they go following graduation, and recent evidence suggests almost 70% of graduates stay within their HEI’s state, with most of those students staying in the nearest metro area (Conzelmann et al., 2023). The fairly high probability of graduates staying near the HEI, along with the well-documented connection between college attainment and regional development (Glaeser & Saiz, 2004), make these indicators an important component of stewardship of place.

The Research dimension also includes three variables. The number of research/scholarly degrees awarded serves two purposes for measuring how research can contribute to stewardship of place. First, graduate students pursuing research terminal degrees are an essential part of research

infrastructure, particularly in fields and at universities less likely to offer postdoctoral positions. Having a large pool of graduate students can support innovation gains in regional development. Second, graduates who have advanced research training and stay in the region can contribute enormously to the productivity gains from innovation beyond just the work they perform while enrolled. Most evidence on geographic mobility of doctoral graduates examines international mobility. There is evidence in Europe that PhD graduates tend to stay in the region of their HEI (Bernela et al., 2018; Waaijer, 2018) and, in the United States, somewhat dated evidence that most PhDs taking jobs in industry stay within a few hundred miles of their HEI (Stephan et al., 2005). We conducted a cursory cross-tabulation of the National Science Foundation’s Survey of Doctorate Recipients to compare the

Table 4. Final Loadings for the Stewardship of Place Index

Variable	Education	Research	Regional Needs
Grad rate weighted by Pell	.52 ^a	-.25	.06
Pell grad rate	.58 ^a	-.00	-.17
DSL grad rate	.56 ^a	-.01	-.23
Research doctoral degrees	.15	.50 ^a	.11
Nonbasic R&D	.08	.43 ^a	-.15
Museum	-.10	.41 ^a	-.28
Health & education majors	.13	-.15	.76 ^a
Professional terminal degrees	.13	.46	.29 ^a
Public service FTE employees	.07	.32	.36 ^a

Note. ^a Final assigned dimension.

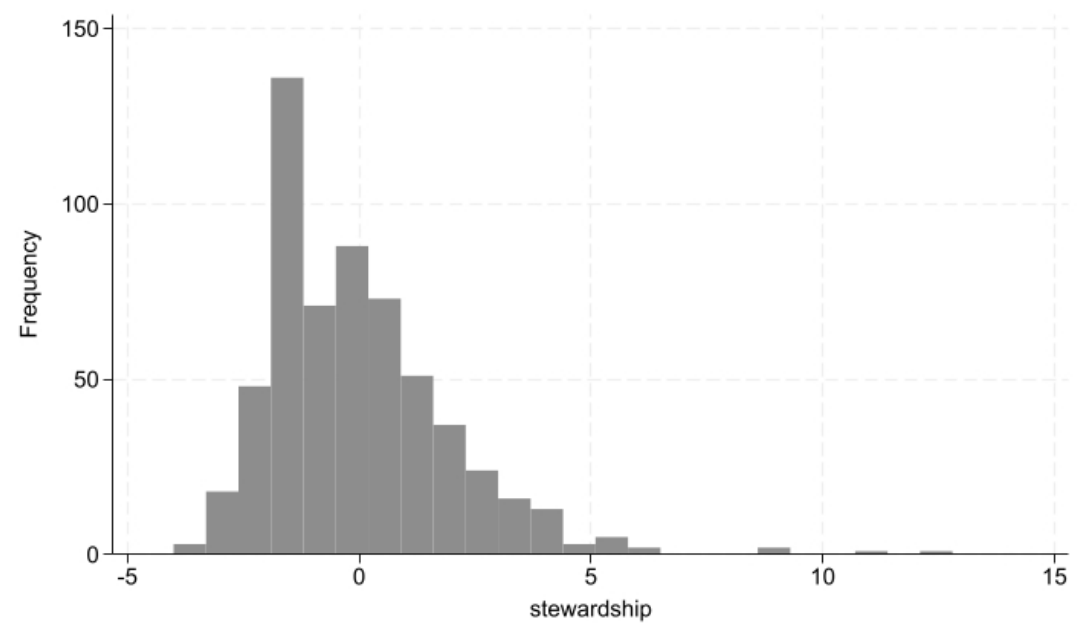
region of graduates' degree-granting institution to the region in which they are employed. Although the West region hires a disproportionately large number of graduates and the Midwest tends to export more graduates than it hires, proportionately the South and the Northeast, the regions in which Appalachia is located, tend to see stronger connections between the number of doctoral graduates and those working in the region, with 46% of doctorate recipients in the South staying there to work, and 37% of all doctorate recipients in the Northeast also staying within their region. The next variable, percentage of nonbasic research and development conducted, aggregates applied research and experimental development, which more directly map to utility for regional economies and public sectors. Higher shares therefore indicate greater institutional orientation toward locally actionable research. The final research variable, having a publicly accessible museum, recognizes research and creative activity beyond traditional conceptualizations of discovery in a format that is community facing. In our initial formulation, the museum variable was placed under the community engagement dimension at the recommendation of the faculty expert, but we revised the placement to Research based

on the loading and our belief the placement still makes conceptual sense.

The third dimension is Regional Needs. The percentage of students in health or teaching majors reflects HEIs' role in addressing the ARC region's persistent workforce needs in health care and K-12. The professional terminal degrees variable captures preparation for typically licensed professions, offering large human capital gains and advanced training in fields with clear value on the job market. Finally, the percentage of all FTE staff dedicated to public service measures institutional capacity dedicated to programs like extension, outreach, or technical assistance.

Once each variable was assigned to one dimension, we used the factor loading on the variable in that dimension to weight the standardized variable. We then added all the weighted, standardized variables together to create the Stewardship of Place Index. See Figure 3 for a histogram of the distribution of the index. The histogram provides evidence of a few nice properties of the index. First, the distribution is roughly normal, with skewness values of 1.6, though with positive kurtosis with a value of 8.5. Second, there are a very small handful of outliers in the right tail. These outliers, however,

Figure 3. Frequency Histogram of the Stewardship of Place Index



make strong intuitive and conceptual sense in terms of what the index is trying to measure. The three outliers on the right are West Virginia University, Cornell University, and University of Pittsburgh–Pittsburgh Campus, two land-grant universities and a public university with strong missions of regional development. These institutions’ outlier status reflects more than size. Strayer campuses across the region, which are part of a large for-profit education company that we would not expect to be as locally engaged, all fall well below the index median. The index is capturing the dosage of this work and acting appropriately in the way we would expect a measure of stewardship of place to act.

As a further test of criterion validity, recall that stewardship of place originated as an attempt to distinguish the role of regional public universities from other types of institutions. Stewardship has since expanded beyond regional publics, but we should still expect public 4-year institutions to have higher scores than institutions that are not public 4-years. We ran a *t*-test to determine whether the mean index value for public 4-years was significantly different from the mean index value for other sectors. Public 4-year institutions tend to score .65 points (*SE* = .23) higher than other institution types (*n* = 592, *p* ≤ .01), consistent with the conceptual origins of stewardship of place as being particularly important for regional

public universities. See Table 5 for a descriptive profile of institutions by Carnegie Basic Classification.

The Education, Research, and Regional Needs columns in Table 5 present mean scores of each dimension by Carnegie Basic Classification. The position of each mean score relative to others serves as further evidence the Stewardship of Place Index is behaving as expected. Doctoral HEIs exhibit markedly higher Research and Regional Needs scores, reflecting the research infrastructure, professional preparation pipelines, and public service activities through which these HEIs typically engage their regions. Master’s HEIs have the second highest mean on Research with relatively middling scores on Education and Regional Needs, consistent with balanced missions that support applied inquiry and some professional programming but at smaller scale. Associate’s and Baccalaureate HEIs also behave in predictable ways, with Research scores sitting below those of HEIs with graduate programs but above Special Focus and Not Applicable. Associate’s and Baccalaureate also showcase potential difficulties with graduation rates or not serving low-income families. Special Focus and Not Applicable (i.e., non-degree-granting HEIs like cosmetology schools or entry-level nursing certification programs) have the highest scores in Education and are only below Doctoral HEIs for Regional Needs.

Table 5. Profiles of ARC Service Area HEIs

Carnegie Basic	<i>n</i>	# of MSIs	Mean index score (<i>SD</i>)	Education	Research	Regional Needs
Associate's	114	6	-.90 (1.10)	-.79 (1.06)	-.03 (.30)	-.08 (.25)
Baccalaureate	83	8	-.70 (1.02)	-.52 (.85)	.08 (.36)	-.26 (.19)
Master's	69	5	-.09 (.91)	-.22 (.66)	.24 (.38)	-.11 (.26)
Doctoral	41	2	1.47 (2.10)	-.02 (.53)	.83 (.74)	.65 (1.65)
Special focus	58	0	.10 (1.22)	.27 (1.05)	-.22 (.12)	.04 (.64)
Not applicable	194	1	.55 (1.18)	.69 (1.09)	-.18 (.01)	.05 (.39)

Table 6. Correlation Matrix for Test–Retest Reliability

	2022	2021	2020	2019
2022	1.00			
2021	.81*	1.00		
2020	.79*	.86*	1.00	
2019	.79*	.83*	.87*	1.00
2018	.77*	.83*	.85*	.86*

Note. * $p \leq .001$

These programs overwhelmingly serve low-income students, which is the primary focus of the Education dimension, and both often specialize in medical education, meeting local workforce needs.

Finally, to test the reliability of the index, we leveraged the longitudinal availability of the data to use test–retest. Although we can expect changes in the index for an institution year-to-year, an institution's prior score should be tightly correlated with its current score. We used 5 years' worth of data and conducted Pearson correlations across each year (see Table 6). The correlation matrix shows each year is highly correlated with previous years, demonstrating that the index provides consistent scores across time. Additionally, the correlation is ubiquitously stronger between years that are closer together. An institution's index score in 2021 is more predictive of 2022 than the score in 2018. This is precisely what we would expect to see as the index tracks institutional change across time.

Discussion and Implications

The newly created Stewardship of Place Index has strong empirical support and can be used for future research and institutional assessment. Several additional findings pushing the literature on stewardship of place forward also emerged from this study with immediate, substantive implications for research and practice, beyond just the utility of the instrument. First, engagement officers are looking for ways to quantify their work and to communicate it to community stakeholders. Concurrently, policymakers are insisting HEIs demonstrate their economic contributions to their states and regions. The focus group participants clearly stated that quantitative measures are important. Although the index tested here is a viable path forward, additional high-quality data are necessary to more fully capture the important work being done. These measures do not need to be particularly complicated. A simple count of the number of memoranda of understanding (MOU), for example, could be used to estimate the

number of partnerships at an HEI. MOUs are not universally applicable measures of partnerships, as HEIs use them for various reasons and in different ways, but these types of administrative data are good starting points for HEIs looking for cheap, scalable ways to measure regional engagement. The number of for-credit internships would be another area of low-hanging fruit. HEIs looking to measure their roles as stewards of place have options, even if those data are not publicly available.

Second, engagement offices are grappling with the utility of the Carnegie Community Engagement Classification. The application is deeply resource intensive in terms of labor hours, and the perceived payoff may not be worth the cost for institutions. Of the four institutions represented in the focus group, two had either decided not to reapply or were not sure yet. One institution had never applied for the designation and did not intend to, likely because the engagement office had no full-time staff. Only one institution saw the process as worth the cost. Notably, that institution was the largest of the four and had the largest engagement office. The faculty expert interviewed was similarly skeptical of the classification as a measure due to the resources required to complete the application. These reservations were supported by the PCA. None of the components loaded strongly onto the Carnegie classification, despite the classification's aims of recognizing engaged institutions. We should note that this result does not detract from the Carnegie Community Engagement Classification's value in reflecting an institution's degree of engagement. Rather, it likely means the classification indicates only that certain types of institution are engaged, specifically relatively well-resourced institutions. Community colleges and 4-year institutions with tight margins remain underrepresented in the list of recipients. Across the 274 institutions with an active designation in 2021, only 10 were Associate's Colleges, 29 were Baccalaureate, 9 were Special Focus, 64 were Master's Colleges & Universities, and a relatively staggering 162 were Doctoral Universities. To put this finding into perspective, more than 20% of all HEIs in the United States are Associate's Colleges, whereas only 5% are Doctoral Universities. The Stewardship of Place Index supports the claim that Doctoral Universities are more likely to be engaged in place-based, regional development work, but the gap in the index distributions is not nearly

as large as in the Carnegie classification. Although the self-study aspect of the classification is valuable, the American Council on Education might consider reforms to the classification process to recognize HEIs that are deeply engaged in their regions but do not have the capacity to complete such an in-depth application.

Third, the distribution of the index by sector provides evidence that private not-for-profit universities and public universities are leading the way in regional development work in Appalachian higher education. This distribution highlights the significant role these institutions play in fostering economic growth and social cohesion in rural areas. The result supports the arguments from Johnson et al. (2009) and Orphan and McClure (2019) that regional universities are powerful organizations for rural development and community stability. This finding underscores the importance of continued investment and support for these universities to sustain and deepen the work they are doing. The place-based, intentional engagement of regional universities is a key component of the long-term prosperity and resilience of Appalachian communities.

Finally, limiting the analysis to the ARC region gives a glimpse into how stewardship of place manifests in largely rural settings. The final index likely privileges activities that are seen as important by engaged HEIs in Appalachia, like being accessible to low-income students, training teachers and health care workers, and serving as a cultural center. In the rural context, HEIs often act as the primary conveners and service providers in a community (Orphan & McClure, 2019). The index recognizes this work across Appalachia and offers context for HEIs looking to expand their regional engagement.

Future research using the Stewardship of Place Index should estimate relationships between stewardship and regional economic outcomes in Appalachia. Rather than relying upon the more limited measures discussed previously in this article, researchers using the Stewardship of Place Index can more accurately capture variation across institutions to better understand how these efforts contribute to topics like wages, unemployment rates, or health outcomes. Understanding these relationships will provide valuable insights into the efficacy of HEIs' contributions to economic growth and resilience in Appalachian communities. Ultimately, this line of research could inform policy

decisions and strategic investments aimed at enhancing the role of HEIs in regional development. Future research should also expand the index beyond Appalachia. This validation study was limited to HEIs within the ARC service area, so in the strictest sense the evidence provided here is applicable only to those HEIs. We believe the measure is very likely generalizable across the United States, though a cursory check of criterion validity and test–retest reliability would be warranted before leveraging the index for empirical work outside the context of Appalachia.

Practitioners can use the index in its current form by calculating their own institutions' score by first standardizing the final nine variables relative to their desired comparison institutions, applying the weights in Table 4, adding them together, then seeing where the institution falls. Roughly, scores greater than 0 are higher than average, and scores below 0 are lower than average. The index can thus be used as one measurement tool among several to convey information about an HEI's regional stewardship. Practitioners looking to expand upon the index could link the publicly available data used here to other restricted-use data sets, administrative data specific to an HEI, or original surveys to strengthen the index's utility as an assessment tool. For example, land-grant universities could add direct indicators of Cooperative Extension activities. Procurement data could be linked to include HEI expenditures to local businesses. Alumni surveys could be used to provide further evidence that graduates are staying within the HEI's service area. We encourage all to take up the work of developing quantitative, conceptually clear indicators of stewardship of place and regional engagement.

Limitations

As with any composite measure built from administrative sources, some characteristics of stewardship of place are captured only imperfectly or not at all. Our selection process was conceptually conservative, retaining only indicators that mapped most strongly to a component in a theoretically coherent way. This approach resulted in eliminating several measures that are hard to imagine as not being related to stewardship, like the percentage of in-state students. Similarly, relying solely on publicly available data may allow for scalability, but it also excludes relevant activities that lack

public measures, like the number of community partnerships, the strength of those partnerships, or community-engaged learning experiences as part of coursework. The index should therefore be interpreted as an estimate of relative position rather than an inventory of all engagement work.

Additionally, relying upon publicly available data means we surrendered some degree of control over how HEIs interpret and report data. For example, HEIs have a great deal of leeway in determining whether a staff member is coded as instruction, research, or public service. A faculty member who mentors students while working in a university health clinic might not clearly fit in a single category, and similar faculty across different HEIs doing the exact same work might be classified differently based upon the organizations' interpretations. We have no reason to attribute differences in reporting to systematic factors, including bias; however, random error has almost certainly been introduced across HEIs.

A third limitation is related to the technical generalizability of the index. This measurement model, including the weights, was estimated solely within the ARC service area. The index behaves as expected by sector within Appalachia, but we currently lack empirical evidence that a similar procedure outside Appalachia would result in the same indicators or weights. Even within Appalachia, spatial heterogeneity could result in different outcomes. The city of Pittsburgh, for example, is contextually different from rural Alabama.

Conclusion

The creation and validation of the Stewardship of Place Index marks a major step forward in measuring how HEIs contribute to regional development, especially in Appalachia. The index serves as a comprehensive, empirical tool to evaluate how effectively HEIs engage with and support their local communities. By capturing a broad spectrum of place-based development activities that cut across all aspects of an institution, the index offers valuable insights into the economic and community development work of these HEIs. Future studies can use this index to deepen our understanding of how colleges and universities affect their regions. Our intent is to leverage the index to estimate the relationship between an HEI's stewardship dosage and regional development indicators like health

outcomes, employment, and wages. This research agenda, built off the Stewardship of Place Index, will help shape policies and strategic investments aimed at promoting sustainable development and resilience.

Although we believe we have presented evidence of the index's validity and reliability, at least within the ARC service area, we also acknowledge room for improvement and further precision. We hope to continue to develop clear, quantitative measures

of stewardship and regional engagement to push the field and the work forward. However, as was made clear to us through this index development process, not all work is easily captured through quantitative measures, and the value of such work should not be diminished. This index should be seen as an important piece of information, but one among many. The index can be a vital tool for academic research and applied assessment, guiding institutions in their work to serve and uplift their regions.



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