A Strategic Resource-Based View of Higher Education Institutions' Resources

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Abstract

Strategic management of organizations such as institutions of higher education involves leveraging resources to achieve objectives. The strategic role of organizational resources has received increased attention in empirical research in recent years. Nevertheless, the literature on higher education lacks reviews of the diverse measures of institutional resources researchers have employed. This article reviews the measures of organizational resources reported in a decade of published empirical studies. Ten representative articles reporting sufficient data on the measurement of institutional resources were included. The reviewed studies commonly drew data from government databases (especially the U.S. Department of Education) and other secondary data sources. Some resource variables were qualitative, but the majority captured size or quantity of resources. Aside from resource amounts, future research should attempt to explicate the ways in which valuable, rare, inimitable and non-substitutable resources can be leveraged for competitive advantage, and address how resources are integrated to form organizational capabilities.

Keywords: Resource-based view, Strategic management, Higher education

1. Introduction

Institutional resources are vital to all varieties of organizations; and colleges and universities are no exception. Strategic management of organizations involves the leveraging of resources to achieve objectives (Barney, 1991; Kong and Prior, 2008). As colleges and universities strive to accomplish their various goals, resources are sought, acquired and exploited in countless ways. Examples include the acquisition and development of human resources, which enables the delivery of services (Srivastava, Fahey and Christensen, 2001). Accordingly, many empirical studies of post-secondary institutions have included measures of institutional resources. Frequently studies have used organizational resource measures as independent variables that explain outcomes of interest such as graduation rates (Anstine, 2013) and school rankings (Schlesselman and Coleman, 2013). Other studies have used organizational resources as a control variable in order to focus on, for instance, university operating efficiencies in producing student success (Sav, 2013). Research on higher education can also look at how organizations accumulate resources such as gifts to the university (Humphreys and Mondello, 2007) or invest in resources such as hiring faculty (Becker, Greene and Siegfried, 2011), thereby treating resources as a dependent variable.

Despite the centrality of resources to the field of organizational strategic management, the literature on higher education lacks reviews of the diverse measures of institutional resources that researchers have employed. Identification of valid and practical measures of constructs is necessary for advancing empirical research, and reviews of institutional resource measures can assist in this regard. Naturally there is no single, best measure of institutional resources for all studies. Some resource measures, such as years in existence (Schlesselman and Coleman, 2013), are global and indirect indicators of an institution's resource endowments, and the data is easily obtained. In contrast, other measures such as the number of economics faculty members (Becker, Greene and Siegfried, 2011) are pertinent to specific resource uses, but their narrowness may limit their content validity as operationalizations of organizational-level resources and thus not be appropriate for certain studies. The content validity of measures can have profound consequences for research findings.

Furthermore, measures of resources such as research expenditures (Lowry, 2004) are relevant and feasibly attainable for a broad range of institutions, while measures such as publication rates of the pharmacy faculty (Schlesselman and Coleman, 2013) are more challenging to obtain and of relevance to a limited range of institutions; this raises concerns about (a) the generalizability of the findings of the studies that employed the measures, and (b) sample size and statistical power constraints.

The purpose of this article is to review the diverse measures of organizational resources reported in a decade of published empirical studies on post-secondary institutions.

A search of electronic databases of research articles was conducted for empirical studies that were published between January 2004 and December 2013. The literature on the resource-based view (RBV) of organizations defines resources as any organizational characteristics that can be a strength or weakness (Wernerfetlt, 1984), particularly if the resource is valuable, rare, inimitable and nonsubsitutable as such resources can be the source of sustained competitive advantage (Barney, 1991). Ten empirical studies using and providing descriptions of at least one measure of institutional resources were located. Some articles included multiple measures of resources. After describing how the articles were identified and selected for this review, brief summaries of each of the articles are presented with emphasis on the organizational resource variables. Then an integrated discussion of the findings is presented. The article concludes with several implications of the findings for future empirical research bearing on post-secondary institutions' resources.

2. Identification and Selection of Studies for this Review

Search tools from Google and EBSCO Information Services were used to locate articles on institutional resources that were used in published empirical studies of colleges and universities. The EBSCO search tools used were Academic Search Complete and Business Source Complete. Searches with the EBSCO tools were complemented with a search of Google Scholar. Searches were limited to articles with publication dates ranging from January 1, 2004 to December 31, 2013. The search terms used are listed in Table 1. The complete set of search terms was used with each of the three tools. The articles identified with these searches were initially screened by reading the articles' titles and abstracts. The searches and initial screening yielded 56 articles worth further evaluation (Google Scholar searches produced only one of the 56 articles that was not also produced by the EBSCO tools).

Table 1: Search terms used in Academic Source Complete, Business Source Complete, and Google

College/University Resources
College/University Predict Performance
College/University Success
College/University Graduate
College/University Predict Funds
College/University Funds
College/University Factors
College/University Ranking
College/University Spending
College/University Asset Allocation
College/University Competitive Advantage
College/University Endorsement
College/University Donations
College/University factors influence students
Predict College/University Ranking
Predict College/University Fund
Predict College/University Success
Predict Graduation
Predict College/University Size
Predict Academic
Predict Academic Success
Predict Academic Graduate
Predict College/University Tutor
Predict College/University Endorsement
Predict Athletic Success
Predict Athletic Performance
Affect College/University Fund
Affect College/University Graduate
Fund Impact
Fund Influence
Resource Impact
Student Support
Student Resource
Student Success
Student Fund
Student Graduate
Athletic Ranking
Athletic Success
Athletic Performance
Impact Athletic Success
Impact Athletic Performance
Impact Governmental Funding
Impact Endorsement
Institutional Ranking
Institutional Success
Institutional Performance

The 56 articles produced through searching and screening were then read to determine whether they contained empirical data on measures of college or university resources. To be included in this review, the articles needed to report a majority of the following types of information about some form of post-secondary institutional resources: (a) the source of the data, (b) the number of institutions for which data was reported, (c) descriptive statistics, and (d) statistical associations with other variables (including significant and nonsignificant results).

To resolve definitional challenges, the framework of the resource-based view (RBV) of strategic management of organizations is employed (e.g., Barney, 1991; Wernerfelt, 1984). The RBV posits organizations acquire, develop and exploit resources in order to compete. The RBV is applicable to for-profit and not-for-profit organizations (Kong and Prior, 2008). Although the behavioral assumption of profit maximization is not well suited to all universities, the behavioral assumption of cost minimization does fit institutions of higher education given their goals of efficiency and effectiveness in resource usage and output production (Worthington & Higgs, 2011). Moreover, universities compete for students, and have differentiated offerings on the basis of factors such as their academic reputations, the degree programs they offer and their locations (Rothschild and White, 1993).

Resources are defined as anything that can be thought of as a strength or weakness of an organization (Wernerfelt, 1984). Taken liberally, that definition can encompass an unwieldy range of favorable and unfavorable issues pertaining to an organization, many of them transitory and of little strategic consequence. Boundaries have to be put around the concept of resources. Clearly the RBV indicates that any assets and capabilities that an institution could possess that are valuable, rare, inimitable and nonsubstitutable must be included in a review of resources since they can be the basis of sustainable competitive advantage (Barney, 2001). If an organization that has valuable and rare resources can have its resource base imitated or duplicated by its competitors, then any competitive advantage from those resources would likely be temporary. Similarly, if competitors do not duplicate the resources that have served as the basis for competitive advantage, but instead achieve the same ends with a different type of resource, then it is said that substitution of resources has limited the sustainability of the competitive advantage. Both tangible resources (e.g., facilities, infrastructure, and libraries) and intangible resources (e.g., reputations, brands and knowledge) are relevant.

Given that organizational resources are exploited through activities to produce desired outcomes, definitional boundaries are needed between resources and activities, and also between resources and outcomes. This is particularly challenging where the resources are directly linked to the performance of personnel, and where resources are exploited to create products and services offered to customers or other stakeholders.

With regard to personnel, organizational talent pools are strategically important resources; however, activities such as human resource management practices are typically not considered resources with the potential to yield a competitive advantage since such practices can be imitated (Wright, McMahan, and McWilliams, 1994; Wright, Dunford, and Snell, 2001). The exceptions are human resource practices that involve causal ambiguity, social complexity, or historically evolved processes such as learning, cooperation, and innovation that can be difficult for competitors to imitate. In such cases it is appropriate to view the practices as strategically relevant organizational resources (Boxall, 1996).

Similarly, the organizational processes through which assets are leveraged to produce goods or services are not automatically considered strategically important resources since they may be occurrences rather than enduring traits of the organization, or may not be rare or difficult for competitors to imitate. Examples include product development activities, supply chain management, and customer interactions (Srivastava, et al., 2001). However, if these processes reflect learning, cooperation and tacit knowledge possessed by the organization, they can be useful for measuring organizational resources.

Even in circumstances when processes should not be labeled as resources, they might be useful proxies for measuring the resources that underlie them (Collis and Montgomery, 1995). Processes and practices could be useful in a study of institutional resources to the extent that such deployments demonstrate an organization's possession of resources, or reveal an institution's cultural values and priorities. As explained in the following section, Lowry (2004) treated institutions' class sizes and research spending as indicators of their values and priorities. Cultural values can be strategically important organizational resources (Wright, et al., 2001).

Regarding the boundary between resources and outcomes, a sales transaction (e.g., a student's enrollment and tuition payment) should not normally be considered an organizational resource in the RBV; however, institutional size and scale (e.g., total enrollments) can be measures of resources.

Size can serve as a proxy for an institution's operational capabilities (e.g., ability to deliver instruction, and ability to conduct research) and marketing capabilities (e.g., ability to attract students). Institutions can also benefit strategically from scale economies (Worthington and Higgs, 2011).

Another type of resource that is near the boundary of its definition is relationships an organization can have with customers and similar external parties (Srivastava, et al., 2001). An organization's relationships with such stakeholders are external rather than possessed by the organization, but participation in such relationships is a unique organizational characteristic that can be a competitive strength or weakness. Relationships can reflect enduring patterns in the way an organization interfaces with customers and other stakeholders, and relationships can be leveraged for the organization's benefit.

In summary, organizational resources in higher education are any institutional characteristics that can be either a source of competitive strength or weakness, particularly if they are valuable and rare, and not easily imitated by competitors. Measures of phenomena that are not resources can also be useful if they are indicators of, or proxies for, institutional resources.

3. Literature Review: Measures of Institutional Resources

As noted above, ten articles published from the years 2004 through 2013 were identified that reported empirical studies using at least one measure of post-secondary institutions' resources. Information on the articles and the measures they contain follow, listed in alphabetical order by authors' names and summarized in Table 2.

Table 2. Institutional Resource-Related Measures

Article	Measure	Key Findings
Anstine (2013)	**Average faculty salaries**, obtained from the American Association of University Professors (AAUP). Average faculty salaries were a continuous variable and had a mean of $69,400, a minimum of $35,460 and a maximum of $130,000. Average salary data was available for 935 institutions. **Learning communities**, obtained from the U.S. Department of Education. Learning communities was a nominal and binary variable in the study. Eighteen percent of the institutions had learning communities. Data was available for 1347 institutions. **Teaching/learning centers**, obtained from Hoftstra University. Teaching/learning centers was a nominal and binary variable in the study. Nineteen percent of the institutions had learning communities. Data was available for 1347 institutions.	Graduation rates at 935 U.S. colleges and universities were regressed on nine control variables and six independent variables. All data was collected for a single year, 2009. Neither teaching/learning centers nor learning communities were positively associated with graduation rates. Faculty salaries had a small but statistically significant positive effect on graduation rates. Among the regression results, neither teaching/learning centers nor learning communities were positively associated with graduation rates. Faculty salaries had a small but statistically significant positive effect on graduation rates.
Becker, Greene & Siegfried (2011)	**Size of the economics faculty**, obtained from the authors' survey of 18 bachelor degree granting institutions (mean of 6.61, std. dev. of 3.21, and range 2-14) and 24 Ph.D. granting institutions (mean of 23.2, std. dev. of 10.44, and range of 8-56). Economics faculty size was a continuous, ratio variable that was positively skewed.	The study used panel data on economics departments of 42 institutions in the U.S. over fourteen academic years (1990/1991 through 2005/2006, except 1998/1999). The regression analysis found that Ph.D. graduates, but not bachelors graduates, were positively associated with faculty size.
Humphreys &Mondello (2007)	**Unrestricted gifts to public universities**, obtained from the U.S. Department of Education's Integrated Postsecondary Educational Database (IPEDS). The measure	The study looked for effects of an institution's athletic success on gifts to the school from 1976 to 1996 for 320 NCAA Division I institutions. The

	was a continuous variable with a mean of $1,408,553, std. dev. of $4,134,322, a range of $0 – 95,000,000, and was skewed and heteroskedastic. **Unrestricted gifts to private universities**, obtained from IPEDS. The measure was a continuous variable with a mean of $7,269,683, std. dev. of $21,700,000, a range of $0-328,000,000, and was skewed and heteroskedastic. **Restricted gifts to public universities**, obtained from IPEDS. The measure was a continuous variable with a mean of $9,746,579, std. dev. of $18,000,000, a range of $0 – 183,000,000, and was skewed and heteroskedastic. **Restricted gifts to private universities**, obtained from IPEDS. The measure was a continuous variable with a mean of $9,794,354, std. dev. of $22,400,000, a range of $0 – 209,000,000, and was skewed and heteroskedastic.	reduced-form econometric model found that restricted donations were positively associated with athletic success measures, but unrestricted donations were not. Public universities benefitted in the form of gifts from both football and basketball success, but private universities only benefitted from basketball success.
Li, Shankar & Tang (2011)	**The number of universities each country had within the Shanghai Jiaotong University's Academic Ranking of World Universities (ARWU)**. For the university unit of analysis, ARWU would be an ordinal variable from 1 – 500. In this study, country is the unit of analysis is unit of analysis, and the total number of universities appearing in the ranking is a ratio variable. The distribution is left-skewed with the U.S. having 159 of the Top 500 universities (years 2003-2008).	A Poisson distribution model regressing the number of Top 500 universities in a country (years 2003-2008) on a vector of independent variables found that the U.S.'s dominance of the rankings was due to large population, economic size, R&D expenditures and the predominant language being English.
Lowry (2004)	**Undergraduate enrollment**, obtained from IPEDS. Full-time equivalent undergraduate enrollment in 1994-1995 was used. The mean was 6,272.529. **Small class size**, obtained from US News & World Report's annual guide to America's Best Colleges for 1996-1997. The percentage of classes with fewer than 20 students minus the percentage of classes with 50 or more students in 1996-1997 was used. The mean was 44.2%. **Research spending**, obtained from IPEDS. Research spending was a highly skewed ratio variable with a mean of $28.6M in 1994-1995.	The study included 570 public and private comprehensive universities in the U.S. with graduate programs. Results found that public universities that face little competition and universities that rely heavily on direct government subsidies relative to the revenue they obtain in tuition and fees have higher undergraduate enrollments and have higher research budgets. Private universities and universities that rely heavily on student tuition and fees as a percentage of their revenue have smaller class sizes. Additionally, small class sizes were most common at universities that were either very selective or very unselective with regard to applicants' SAT or ACT scores.

Muscio, Quaglione&Vallanti (2013)[1]	**Research funding** from the European Community, MIUR, the university, and other governmental bodies in each of the five years 2005-2009 by academic dept. These were ratio variables. **Staffing levels** in each of the four years 2006-2009 by academic department. These were ratio variables. **University size** in each of the four years 2006-2009. Universities were categorized by size of their respective enrollments (small, medium, large or mega) to create ordinal variables. **Polytechnic status**; whether the institution was one of Italy's four polytechnic universities. This was a dummy variable with a mean of 0.06, std. dev. of 0.24, and range from 0.00 to 1.00. **Patenting office**; whether the university had an office to manage European patenting. This was a dummy variable with a mean of 0.86, std. dev. of 0.35, and range from 0.00 to 1.00. **Research rating** by academic department from MIUR. This was an ordinal variable with a mean of 0.79, std. dev. of 0.08, and range from 0.20 to 1.00.	Tobit and probit regression analyses assessed various departmental and university characteristics' effects on levels of funding received. A lagged measure of public funding was positively associated with public funding. Staffing levels, research ratings, and polytechnic status were positively associated with private funding. Medium-size universities were less efficient at securing private funding than larger and smaller universities. Possessing a patent office was unrelated to private funding.
Ovseiko, Oancea& Buchan (2012)	**Income from research grants and contracts in clinical medicine**, obtained from Higher Education Information Database for Institutions (HEIDI) from the UK's Higher Education Statistics Agency. Income was £1,346.9 for all health education institutions in the UK during the 2008-2009 year.	The study did not test hypotheses. It assessed the feasibility of collecting indicators of research impact that could be used to evaluate health education institutions in the UK and influence future decisions such as grants, allocation of research contracts and allocation of other resources. Twenty-nine health education institutions were represented in the authors' survey, but the number of health education institutions covered by HEIDI was not reported.
Sav (2012)	**Undergraduate enrollment**, obtained from IPEDS. The mean was 8,758, and the std. dev. was 5,409. **Student service expenditures** per undergraduate student, obtained from IPEDS. The mean was $1,253, and the std. dev. was 538. **Total faculty employment**, obtained from IPEDS. The mean was 349, and the std. dev. was 183.	The study used a balanced panel of 199 public universities for the four academic years 2005-09. Each institution was classified by the Carnegie Foundation as "Master's Colleges and Universities," and awarded at least 50 master's degrees annually. "Research and Doctoral" classified universities were not included.

[1] All data was obtained from Ministerodell'Istruzionedell'Università e dellaRicerca(MIUR)except for whether the university was a polytechnic university (obtained from the universities' websites). Means, standard deviations and ranges for the ratio variables were reported but too numerous to list here.

	Faculty academic salary, obtained from IPEDS. The mean was $64,146, and the std. dev. was $9,754. **Proportion of total expenditures allocated to research**, obtained from IPEDS; mean was 2.09%, and std. dev. 2.98%. **Percentage female faculty**, obtained from IPEDS. This variable was further divided into tenured (mean 37.4%, std. dev. 6.2%), tenure-track (mean 49.2%, std. dev. 7.9%) and nontenured/nontenure-track (mean 56.9%, std. dev. 12.4%). **Percentage female administrators**, which was a proxy using tenured faculty on 12-month contracts, obtained from IPEDS. The mean was 15.5%, and the std. dev. was 16.3%.	Enrollment and research were negatively associated with both male and female student graduation rates. Services, faculty, and the percentage of female administrators were positively associated with both male and female graduation rates. There were no statistically significant effects for salaries. The results for the percentage of female faculty were mixed.
Sav (2013)	**Undergraduate enrollment**, obtained from IPEDS. The mean was 8,610, and the standard deviation was 5,511. **Total faculty employment**, obtained from IPEDS. The mean was 342, and the standard deviation was 186. **Student service expenditures per undergraduate student**, obtained from IPEDS. The mean was $1,403, and the std. dev. was 591. **Expenditures on instruction per student**, obtained from IPEDS. The mean was $35.94, and the std. dev. was $6.40.	The study involved 227 Carnegie classified master's level universities during the four academic years 2005-2009. Universities' operating efficiencies in producing student success given inputs such as the resources listed here were assessed using stochastic frontier analysis (SFA) estimated in a four-stage data envelopment analysis. Undergraduate enrollment and total faculty employment were inputs that fit the SFA estimates and had statistically significant adjusted R-squares, while student service expenditures and expenditures on instruction did not.
Schlesselman& Coleman (2013)	**Research funding**; the grand total of funding from the National Institutes of Health (NIH), non-NIH federal agencies, and the institution's foundation/association was obtained from American Association of Colleges of Pharmacy (AACP). **Affiliation with an academic health center**, from the Carnegie Foundation for the Advancement of Teaching's web site. **Years in existence**, from each school's web site. **Student/faculty ratio**, obtained from AACP. **Publication rates**, obtained by searching Web of Science and PubMed using the faculty rosters obtained from AACP. **Ratio of full to junior professors**, obtained from AACP. **Research intensiveness**, from the Carnegie Foundation for the Advancement of Teaching on their Web site	The 2008 *US News and World Report* mean ranking scores for 78 U.S. colleges and schools of pharmacy were regressed on school characteristics. A multivariate mixed linear regression model was used. Research funding, affiliation with an academic health center, years in existence, student/faculty ratio, and publication rates were associated with the rankings. Univariate analysis also found the ratio of senior faculty to junior faculty and research intensiveness to be associated with the rankings, but the multivariate regression model did not. Grant funding was the strongest predictor of rankings.

Number of professors holding PhD and PharmD degrees, obtained from AACP.

Faculty awards, obtained from the AACP Roster of Faculty and Professional Staff 2007/2008.

3.1 Anstine, 2013

In a study published in the journal *Business Education & Accreditation*, Anstine (2013) used measures of institutional resources as potential predictors of graduation rates. Graduation rates were regressed on nine control variables and six independent variables.

The measures in the study most closely associated with institutional resources were faculty salaries, learning communities and teaching/learning centers. Faculty salaries are best viewed as proxies for institutional resources. Although salaries are an expense in accounting terms rather than an asset valuation, high salaries can be used to attract, incentivize and retain highly talented faculty. Additionally, the ability to pay higher salaries can be an indicator of institutional wealth. Teaching/learning centers represent a bundling and integration of tangible and intangible assets organized to promote faculty skill development. Learning communities can be construed as an organizational routine. Learning communities are formed by co-registering or block-scheduling students such that they take courses together, often in consecutive time slots (Tinto, 2003). Learning communities can also include practices such as formally organizing student discussion groups.

Data on faculty salaries was obtained from the American Association of University Professors (AAUP). Hofstra University was the source of data on teaching/learning centers. The U.S. Department of Education was the source of data on learning communities. Data was collected for a single year, 2009. Nine hundred thirty-five observations were available for average faculty salaries. Data was available for 1347 institutions for both the teaching/learning center variable and the learning community variable.

Average faculty salaries wasa continuous variable and had a mean of $69,400, a minimum of $35,460 and a maximum of $130,000. Both the teaching/learning center variable and the learning community variable were nominal and binary. Two hundred and fifty-six institutions had teaching/learning centers (19%) and 243 institutions had learning communities (18%).

Among the regression results, neither teaching/learning centers nor learning communities were positively associated with graduation rates. Faculty salaries had a small but statistically significant positive effect on graduation rates.

3.2 Becker, Greene & Siegfried, 2011

In a study published in *The American Economist*, Becker, Greene and Siegfried (2011) looked at whether an institution's number of undergraduate economics graduates or Ph.D. graduates was most closely associated with the size of the economics faculty. In this study, faculty can be viewed as a resource in which the institution invests in response to demand (student enrollment). The research methodology involved regression analysis using panel data for 42 institutions over 14 years.

The authors obtained data on undergraduate degrees awarded from the annual survey collected by the American Economic Association's Universal Academic Questionnaire, which is published in the Summer issue of the *Journal of Economic Education*. The number of Ph.D. degrees awarded was obtained from the Survey of Earned Doctorates sponsored by six agencies of the U.S. Federal Government. The number of faculty was obtained from surveys.

Data was obtained for each school year from 1990-1991 to 2005-2006 with the exception of 1998-1999 (Ph.D.s awarded in 1999 were not available from the Survey of Earned Doctorates). Data on faculty size was obtained from 18 bachelor degree granting institutions (mean of 6.61, standard deviation of 3.21, and range 2-14) and 24 Ph.D. granting institutions (mean of 23.2, standard deviation of 10.44, and range of 8-56). Economics faculty size was a continuous, ratio variable that was positively skewed.

The study found that Ph.D. graduates were positively associated with faculty size. Bachelors graduates were not associated with faculty size.

3.3 Humphreys & Mondello, 2007

In a study in *Journal of Sports Management*, Humphreys and Mondello (2007) investigated whether athletic success increased gifts to colleges and universities. Gifts to an institution are a resource, and some are given for use without restriction while other gifts are earmarked for specific purposes. The study employed a reduced-form econometric model of the determination of donations to an institution.

Data on finances at colleges and universities during the period of 1976–1996 was obtained from the Integrated Postsecondary Educational Database (IPEDS) via the U.S. Department of Education and the National Center for Educational Statistics. As the authors note, IPEDS consists of annual censuses of financial, enrollment, and other data for U.S. colleges and universities since the mid-1970s. The study used data from 1976 to 1996 on 320 NCAA Division I institutions.

At public institutions, data was obtained for real unrestricted gifts (mean of $1,408,553, standard deviation of $4,134,322, and range of $0-95,000,000) and restricted gifts (mean of $9,746,579, standard deviation of $18,000,000, and range of $0-183,000,000). At private institutions, data was obtained for real unrestricted gifts (mean of $7,269,683, standard deviation of $21,700,000, and range of $0-328,000,000) and restricted gifts (mean of $9,794,354, standard deviation of $22,400,000, and range of $0-209,000,000). Heteroskedasticity due to variations in institution sizes was addressed with the White-Huber sandwich correction. Skewedness of the dependent variables was addressed by reestimating the regression equation with the dependent variable expressed in logs, which demonstrated that skewedness had no effect on the general pattern of significance and thus did not drive the results.

The analyses found that restricted donations were positively associated with athletic success measures, but unrestricted donations were not. Public universities benefitted in the form of gifts from both football and basketball success, but private universities only benefitted from basketball success.

3.4 Li, Shankar & Tang, 2011

In a 2011 article published in *Studies in Higher Education*, Li, Shankar and Tang (2011) attempted to discover why the U.S. dominates worldwide rankings of universities. The authors contend that a university's ranking is a proxy for its stock of academic talent. Superior academic talent leads to superior research and publication performance, which in turn leads to higher rankings. Accordingly, university rankings were an institutional resource-related measure in their study that was regressed on various national-level independent variables. Shanghai Jiaotong University's Academic Ranking of World Universities (ARWU) was argued to be an indicator of university excellence. ARWU was therefore a proxy for university resources.

Although the authors suggest that a university's resources are a determinant of its ranking, universities were not the unit of analysis—country was the unit of analysis in their study. The study utilized a Poisson distribution model regressing the number of Top 500 universities in a country on a vector of independent variables. Independent variables were the log of population size, log of income, research and development spending as a percentage of gross domestic product, and a dummy variable for English as the native language. The years considered were 2003 through 2008.

For the university unit of analysis, ARWU would be an ordinal variable from 1 – 500. But in this study, with country being the unit of analysis, the total number of universities appearing in the ranking is a ratio variable. The distribution is left-skewed with the U.S. having 159 of the Top 500 universities. The study found that U.S.A.'s dominance of the rankings was due to its large national population, economic size, R&D expenditures and its predominant language being English.

3.5 Lowry, 2004

Lowry's (2004) article in *Economics of Governance,* contrasted the priorities of universities that were oriented to supply-side subsidies with universities that were market driven. The study's resource-related measures were undergraduate enrollment, small class size and research spending. The premise of the study was that observable differences in universities' resource accumulations and deployments revealed differences in the respective universities' priorities. Differences in institutional mission, governance and strategic orientations affect resource acquisition and deployment.

State universities that have a policy of offering discounted tuition to in-state students most closely compete with other state schools. Private universities and others that do not offer in-state discounts on tuition are in close competition with a larger number of universities and are therefore more market driven as a consequence. Additionally, some universities rely more heavily on government subsidies relative to tuition revenue than other institutions do.

In this study, undergraduate enrollment can be viewed as a resource acquired by post-secondary institutions. While a single, ordinary transaction between an institution and a student (e.g. enrollment and payment of tuition) does not constitute a characteristic of the institution worthy of note in RBV, patterns in transactions over time certainly can; hence total enrollment can be viewed as a resource for a variety of reasons. First, the quality of organizations' interactions with and knowledge of their customer bases can constitute relational assets that can serve as a basis for competitive advantage (Srivastava, et al., 2001), and by close analogy post-secondary institutions' relationships with current students, alumni and communities can be strategically important assets. Second—and pertaining to Lowry (2004)—the volume of students enrolled is an indicator of strategically important institutional characteristics. For instance, above average enrollment is an indicator of a university's ability to achieve economies of scale (Worthington and Higgs, 2011). Third, enrollment is an indicator of the magnitude of an institutions' stream of revenue.

Class size, while not a resource per se, is an indicator of institutional resources. Class size is a consequence of resource commitments. With this study, Lowry (2004) contends that smaller class size is a commitment of resources that reveals the priorities of universities. He suggests that universities that are more market driven are inclined to have smaller classes in order to promote the quality of undergraduate education. The institutional priorities Lowry discusses are akin to organizational cultural values, and an organizational culture can be a source of competitive advantage. To an extent, class size is a trait of an institution that is not easily changed term-to-term, year-to-year. Therefore, class size is not easily imitated. Decisions about class sizes reflect commitments to staffing levels, faculty workloads, and classroom facilities.

Research spending in the study was defined as separately budgeted research. It reflects a combination of resources obtained from external funders and deployments of internal resources.

The study included 570 public and private comprehensive universities in the U.S. with graduate programs. Data on undergraduate enrollments 1994-1995 and research spending 1994-1995 was obtained from annual surveys conducted by the Department of Education and maintained as the Integrated Postsecondary Education Data System. Data on class size was obtained from *U.S. News & World Report's* annual guide to *America's Best Colleges* for 1996-1997, which was the first year for which the guide reported the data.

The author implies that IPEDS data and data from the Higher Education General Information Survey that preceded it are reliable when contrasting that data with older, "historical" data: "[R]eliable historical data on variables such as graduation rates and class sizes are more difficult to come by" (p. 48). No further discussion of reliability was provided though.

Public universities that face little competition (due to discounted tuition for in-state students) and universities that rely heavily on direct government subsidies relative to the revenue they obtain in tuition and fees were found to have higher undergraduate enrollments and have higher research budgets. Private universities and universities that rely heavily on student tuition and fees as a percentage of their revenue were found to have smaller class sizes.

3.6 Muscio, Quaglione&Vallanti, 2013

In an article appearing in *Research Policy*, Muscio, Quaglione and Vallanti (2013) examine the relationship between government funding and academic departments' ability to secure private funding.

The authors used tobit and probit regression analyses to assess various departmental and university characteristics' effects on levels of private funding received. The predictors of interest were departments' public funding levels, and departmental university characteristics were controls. Academic departments were the unit of analysis.

Measures pertaining to institutional characteristics included public research funding for each department (2005-2009), departmental staffing levels (2006-2009), departmental research ratings (a 2007 rating based on research performed 2001-2003), university enrollment, whether the university had an office to manage European patenting, and whether the institution was polytechnic.

Being a polytechnic university is an indicator of resources inasmuch as it suggests an institution's resource commitments emphasize applied arts and sciences rather than academic fields. Nearly all of the data pertaining to resource-related measures was obtained from Italy's Ministry of Education, Universities and Research (Ministerodell'Istruzionedell'Università e dellaRicerca, MIUR). However, data on a university's status as one of Italy's polytechnic universities was obtained from its website.

As the authors hypothesized, a lagged measure of public funding to academic departments was positively associated with its public funding. Also, larger academic departments received more private funding. Research ratings were positively associated with private funding as well. Medium-size universities were less efficient at securing private funding than small and large universities. Possessing an office for European patenting was not associated with private funding levels. Finally, polytechnic universities received significantly more private funding.

3.7 Ovseiko, Oancea & Buchan, 2012

In an article appearing in *BMC Health Services Research*, Ovseiko, Oancea, and Buchan (2012) report a study of indicators of health research impact. The authors' primary goal was to assess the feasibility of collecting indicators of research impact that could potentially be used to evaluate health education institutions in the United Kingdom and influence future decisions such as grants, allocation of research contracts and allocation of other resources. The authors did not test hypotheses. Moreover, their intent was not to measure a post-secondary institution's resources. However, one of the health research impact measures is also a potentially useful measure of resources—income from research grants and contracts in clinical medicine.

Although some of the data in the article was obtained from the authors' survey that included responses from 29 health education institutions in the United Kingdom, the data on income from research grants and contracts was obtained from the Higher Education Information Database for Institutions (HEIDI) from the UK's Higher Education Statistics Agency. The research funding data for the 2008-2009 year was subdivided by funding source (e.g., type of government entity, type of charity, and home country of the industry funder) and by university. Income at Oxford University was £173.6 million, and was £1,346.9 for all health education institutions in the UK. No other descriptive statistics were reported.

The authors note that among measures of impact, income from research grants and contracts in clinical medicine is relatively easy to obtain. Their interest was in the measure as an indicator of impact, however, and they note that its reliability and validity for that purpose deserves further examination.

3.8 Sav, 2012

In an article appearing in the *International Journal of Business Management and Economic Research*, Sav (2012) investigated the potential efficiency gains associated with female faculty employment in producing university student graduation rates. The measures pertinent to institutional resources were undergraduate enrollment, student service expenditures per undergraduate student, total faculty employment, average faculty academic salary, proportion of total expenditures allocated to research, percentage female faculty and percentage female administrators.

The study employed stochastic frontier analysis and a university production function in which output was students' graduation rate. "At the university level, the graduation rate serves as the overall measure of success and depends upon student and university inputs. Inputs include, for example, student academic preparation and finances and university size, support services, faculty, and the allocation of resources devoted to non-undergraduate education production."

Data was obtained from the U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS) for a balanced panel of 199 public universities for the four academic years 2005-2009. For the sake of comparability, the institutions included were each Carnegie classified Master's Colleges and Universities that awarded at least 50 master's degrees annually. Research and doctoral classified universities were omitted. Reliability of the measures was not discussed.

Results for female faculty were mixed. Higher female employment in tenure track positions offered efficiency gains for improving graduation rates for both male and female students. However, higher proportions of tenured females produced the opposing effects, while non-tenure track appointments had nonsignificant effects for male graduation rates and negative effects for females.

With regard to institutional resource-related variables, enrollment and research expenditures were negatively associated with both male and female student graduation rates. Student services expenditures, total faculty and the percentage of female administrators were positively associated with both male and female graduation rates.

3.9 Sav, 2013

In Sav's (2013) article entitled "Four-Stage DEA Efficiency Evaluations: Financial Reforms in Public University Funding," appearing in *International Journal of Economics and Finance*, Tom Sav examined the efficiency with which universities produced graduation rates. As the author notes, universities are increasingly being evaluated on the basis of their graduation rates, and there are implications for the financial support they receive: "Using graduation rates to evaluate university performance, however, fails to account for the efficiency with which universities produce student success. That efficiency depends upon the quantity and quality of university resources and internal managerial performance in the allocation of those resources."

Graduation rate for undergraduate students was the output variable in the study's stochastic frontier analysis (SFA) estimated in a four-stage data envelopment analysis (DEA) model. The input variables were undergraduate enrollment, Scholastic Aptitude Test (SAT) scores, the percentage of low-income federal government, post-baccalaureate enrollment at the university, the number of teaching faculty, expenditures on student services, and expenditures on instruction. Environmental variables, operationalized at the state level rather than the institution level, were used to adjust for environmental effects. They included governmental financial support per student, the concentration of high school students with high scores on either the SAT or ACT (American College Testing) tests, and the number of college freshman imported from other states relative to the number of resident freshman attending colleges out-of-state. Institution-level data was obtained for 227 Carnegie classified master's-level universities for the four academic years 2005-2009 from the U.S. National Center for Educational Statistics, Integrated Postsecondary Data System (IPEDS). Environmental data was obtained from the National Center for Higher Education Management Systems (NCHEMS) data base. Reliability of the measures was not discussed.
The analyses demonstrated that accounting for good and bad fortune and external environmental effects improved the accuracy of assessments of universities' efficiency. With regard to resource-related measures, undergraduate enrollment and total faculty employment were inputs that fit the SFA estimates and had statistically significant adjusted R-squares, while student service expenditures and expenditures on instruction did not.

3.10 Schlesselman & Coleman, 2013

In an article published in *American Journal of Pharmaceutical Education*, Schlesselman and Coleman (2013) explored the associations among characteristics of colleges of pharmacy and their *US News and World Report* rankings.

US News and World Report mean ranking scores for 78 US colleges and schools of pharmacy for 2008 (based on the 2007 survey of pharmacy school administrators) were regressed on various school characteristics in a multivariate mixed linear regression model. Nine resource-related measures were included: affiliation with an academic health center, years in existence, student/faculty ratio, number of professors holding PhD and PharmD degrees, ratio of full professors to junior professors, faculty publication rates, Carnegie Foundation classification, faculty awards and grant funding.

Data was obtained from several sources. Research funding was operationalized as the grand total of funding from the National Institutes of Health (NIH), non-NIH federal agencies, and the institution's foundation/association (which was obtained from the American Association of Colleges of Pharmacy, AACP). Data on research intensiveness and affiliation with an academic health center was obtained from the website of the Carnegie Foundation for the Advancement of Teaching. Each school's years in existence was obtained from its web site. Data on student/faculty ratio, ratio of full to junior professors, number of professors holding PhD and PharmD degrees, and faculty awards were obtained from AACP. Data on publication rates was obtained by searching Web of Science and PubMed using the faculty rosters obtained from AACP. Reliability of the measures was not discussed.

In the multivariate linear regression model, research funding, affiliation with an academic health center, years in existence, student/faculty ratio, and publication rates were associated with the rankings. Univariate analysis also found the ratio of senior faculty to junior faculty and research intensiveness to be associated with the rankings, but the multivariate regression model did not. Grant funding was the strongest predictor of rankings.

4. Discussion of the Findings

As a group, the studies reviewed in the prior section rely heavily on secondary data sources. IPEDS is a commonly used database.

The study by Ovseiko, Oancea and Buchan (2012) demonstrates that the United Kingdom and perhaps other nations have government databases that are comparable to IPEDS. *U.S. News & World Report* surveys and that publication's guide to *America's Best Colleges* were also used. Several studies included data from the Carnegie Foundation. Discipline-specific institutional variables were measured with data obtained from discipline-specific associations such as the American Economic Association and the American Association of Colleges of Pharmacy.

The studies generally did not discuss reliability of the measures. There is commonly a presumption of reliability and objectivity of the quantitative data derived from organizational records. However, it is worth remembering that such data is subject to inter-organizational differences in recordkeeping and reporting practices (Richard, Devinney, Yip, and Johnson, 2009). IPEDS data is self-reported by institutions.

The limitations of secondary data sources need to be addressed in studies of post-secondary institutional resources. Limitations in the original data collection become limitations in the focal study. (Information about IPEDS data is available at Broyles [1995].) Humphreys and Mondello (2007) noted limitations to the specificity of certain IPEDS measures. Lowry (2004) laments the reliability of historical data on graduation rates, but does so without providing many details, and without specifically addressing any reliability questions pertaining to IPEDS data. Sav (2012, 2013) noted that more detailed data in realms such as teaching quality would enhance his analyses. Anstine (2013) is an example of a study that drew data from multiple sources, but without estimating any variable with data from more than one source.

Reliability and validity of subjective secondary data should be critically evaluated. Rankings of institutions that have been used as secondary sources often include subjective measures, such as reputations for the quality of research (e.g., Muscio, et al., 2013).

Many of the measures have skewed, kurtotic and/or heteroskedastic distributions (e.g., Becker, et al., 2011; Humphreys &Mondello, 2007; Li, et al., 2011; Lowry, 2004). This is problematic for models assuming normally distributed variables. Transformations can be performed, but transformations complicate the interpretation of findings.

While a few of the variables addressed institutional rankings and reputations, the majority of the resource measures included in the studies reviewed here involved assessments of quantity or size. As explained in the following section, application of the RBV framework indicates the need to look at integration of resources in a way that permits them to be leveraged.

5. Implications for Future Research

The goal of the literature search for this article was to obtain a useful sample of recently published articles to provide a sense of the type and range of measures of institutional resources that have been used. The RBV framework was used to delimit the review.

In many spheres and with diverse approaches, colleges and universities compete for scarce resources. Inter-organizational competition explicitly or implicitly underpins the research that links organizational resources with variables such as *US News & World Report* rankings (e.g., Lowry 2004; Schlesselman& Coleman, 2013).The resource-based view of the firm posits that sustainable competitive advantage can be derived from resources that are valuable, rare, inimitable, and non-substitutable. That represents a richer conceptualization of resources than merely quantification. This literature review found heavy reliance on variables that pertain to the size or magnitude of resources. Beyond the size or magnitude of a certain type of resource possessed by an institution (e.g., research funding, faculty headcount) there is a need to look at the nature of the resources as they pertain to the ability to achieve a competitive advantage.

Future research on institutional resources in higher education would benefit from additional attention to how tangible and intangible resources can be bundled and integrated to form organizational capabilities. An asset alone is unlikely to confer advantages. Complementary capabilities are generally required to obtain the potential benefits of an asset (Teece, 1986).

Investigation of the strategic role of resources is advanced by measuring and modeling assets, processes and capabilities (Barney, 1997). Asset are organizational attributes than an institution can acquire, develop, nurture and leverage for use internally and/or externally (Barney, 1991; Srivastava, et al, 2001). Acquisition, development, nurturing and leveraging are processes and are worthy of investigation.

Even in the domain of RBV research, there has been less attention to the processes through which resources are leveraged to create value for external stakeholders. There is ample opportunity for research contributions in this field.

As noted above, the Anstine (2013) study is an example of an approach that implicitly addresses the role of resource integration and routines. Resource deployments rather than the magnitude of resources such as budgets and staffs were used. Anstine (2013) employs teaching/learning centers and institutions' learning communities to predict graduation rates. The creation of a teaching/learning center likely represents an allocation of budgetary and personnel resources, and those resources must be effectively integrated in order to promote faculty skill development. Similarly, learning communities represent organizational routines, which utilize knowledge assets possessed by personnel. The study did not merely look at effects of the size of an institutions' budget or the size of its workforce. Similarly, Sav (2012) explicitly mentions resource allocations, and Lowry (2004) contends resource deployments reveal institutions' priorities.

Finally, research in this field would benefit from closer examination of the reliability of the measures obtained from sources such as the U.S. Department of Education. On the one hand, disclosures to Department of Education that are auditable are generally assumed to be sufficiently reliable. On the other hand, research on publicly traded companies whose disclosures are auditable have on occasion been found to be deficient in reliability (Richard, et al., 2009). Unreliability of measures could lead to some of the null findings in the published studies reviewed above, and may have caused other studies to have resulted in null findings and thereby prevented them from being published.

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