The Top American Research Universities

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The Center for Measuring University Performance

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THE UNRECOGNIZED COMPLEXITY OF HIGHER EDUCATION

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Abstract

Most people think of higher education in terms of applying and getting accepted; taking courses, going to class, earning credits and a grade point average; interacting with faculty members who may also pursue scholarly research; and graduating, going to work, and coming back for homecoming. All these things happen, but the ways in which these activities are resourced and executed varies enormously across the 4,500 institutions of higher education in the United States, even as the structure of the higher education industry is remarkably stable over time. These differences are outlined using various sources of data. We then discuss the implications of these differences in terms of how institutions can best address fundamental change. We show how the strategic options available to different cohorts of institutions vary by resource availability, brand image, and competition.

INTRODUCTION

The plight of the ecosystem of higher education has received much recent commentary. The enormous financial impacts of the coronavirus pandemic have been outlined (Economist, 2020; Edmit, 2020; Potter, 2020). Technology has rescued teaching (Lohr, 2020; Taparia, 2020) in the short term, but rendered the bricks and mortar of academia to be, at least temporarily, of little value. These challenges are happening while the nature and priorities of students may be morphing (Chronicle, 2019; Eakins, 2020).

Although these challenges have been anticipated, the pandemic appears to have greatly accelerated their impact. Christenson (2011), DeMillo (2011). Lombardi (2013), and Rouse (2016) have outlined the challenges and opportunities. Rouse, Lombardi and Craig (2018) employed a computational model of the economics of universities to analyze several strategic options open to various types of players in the ecosystem, concluding that not all players have the same options.

This article addresses the complexity of higher education in terms of resources available, brand images, competition, organizational models, and other attributes. It portrays the enormous variety among 4,500 universities in the US; drawing upon various sources of data. We then discuss the implications of these differences for the ability of institutions to address fundamental change. We show how the strategic options available to different cohorts of institutions vary by resource availability, brand image, and other key characteristics. Finally, we consider how these findings may differentially impact the humanities, medicine, and engineering.

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THE ECOSYSTEM OF HIGHER EDUCATION

Significant challenges over the last decade, exacerbated by the pandemic of 2020, have led to a deep reappraisal of the structure and operation of the American higher education industry with the anticipation of required dramatic changes and the possibility of the closure of many small private colleges. To provide a framework for understanding these circumstances, a clear sense of the historical development and current condition of the higher education marketplace is useful.

The Higher Education Industry

America's higher education industry is remarkable for its size, variety, and stability. Over the decades since the close of World War II, institutions large and small, public and private, elite and comprehensive have proliferated. They have expanded and diversified their student populations and created multi-resourced financial models to sustain their operations. The widely varying characteristics of student populations, the emergence of a research intensive subset of universities, and the changing demands of the employment marketplace reflect in the detail of these institutions' programs and finances. However, the fundamental organization and competitive context of the institutions within this marketplace have remained remarkably stable.

As shown in Table 1, since the 1940s the higher education industry has seen student enrollments grow from 1.5 million to 19.7 million (2018, NCES, 105.30). The number of degree granting institutions serving these students has increased from 1,708 in 1940 to 4,042 today (1993, NCES, 26; 2019, NCES, 317.10). While the growth in the number of two-year institutions is higher than four-year institutions over the past 70 years, the overall distribution remains close to what it was in the 1940s at roughly 70% 4-year and 30% 2-year institutions. These data include a category of higher education institution composed of for-profit institutions, mainly offering two-year degree programs in the early years. For-profits grew from 55 in 1977 to a peak of 1,451 in 2013 but by 2019 they had declined by half and now represent 18% of the institutional marketplace, compared to 31% in 2013 and less than 2% in 1977 (2019, NCES, 317.10). Along with enrollment, degrees awarded by higher education institutions have seen tremendous growth, particularly at the graduate level (2019, NCES, 301.20 and 318.40). There is considerable variety of institutional style and operational detail among all these institutions. Many observers imagine that higher education is an industry that responds in similar ways to the challenges and opportunities of the post-secondary marketplace. This notion obscures fundamental differences in the competitive context of colleges and universities. The different types of institutions compete in many different marketplaces, and not all compete in the same marketplaces.

Table 1. Growth in Higher Education, 1940 to Present: Institutions, Students, and Degrees

	# of Degree-Granting Postsecondary Institutions				Degrees Awarded			
Approx. Year	Total	4-year	2-year	Enrollment	Associates	Bachelors[1]	Masters[2]	PhD/Prof[3]
1940	1,708	1,252	456	1,494,000		186,500	26,731	3,290
1950	1,851	1,327	524	2,659,000		432,058	58,183	6,420
1960	2,004	1,422	582	3,640,000		392,440	74,435	9,829
1970	2,525	1,639	886	8,580,887	206,023	792,316	213,589	59,486
1980	3,152	1,957	1,195	12,096,895	400,910	929,417	305,196	95,631
1990	3,535	2,127	1,408	13,818,637	455,102	1,051,344	330,152	103,508
2000	4,084	2,363	1,721	15,312,289	564,933	1,237,875	463,185	118,736
2010	4,495	2,774	1,721	21,019,438	848,856	1,649,919	693,313	158,590
2019[4]	4,042	2,703	1,339	19,645,918	1,011,487	1,980,644	820,102	184,074

Source: Digest of Education Statistics, 2018, tables 105.30 and 301.20; 2019, tables 303.25, 317.10, and 318.40. NCES 120 Years of American Education: A Statistical Portrait, table 26.

1 From 1940 to 1960, bachelor's degrees include degrees formerly classified as first-professional, such as M.D., D.D.S., and law degrees
2 Among Master's, figures for years prior to 1970 are not precisely comparable with later data.
3 Includes Ph.D., Ed.D., and comparable degrees at the doctoral level. Includes most degrees formerly classified as first-professional, such as M.D., D.D.S., and law degrees.
4 Institution counts is 2018-19; Enrollment is 2018; Degrees is 2017-18.

The Competitive Marketplaces for US Higher Education

There is considerable variety of institutional style and operational detail among these institutions, but many observers imagine that higher education institutions present a common front when faced with the challenges and opportunities of the post-secondary marketplace. This notion obscures fundamental differences in the competitive advantages of colleges and universities. The institutions compete in many different marketplaces, and while different types of institutions may compete with each other in some marketplaces (such as for student enrollment and international students), they also compete in different markets (such as for research grants and contracts and advanced graduate students and research faculty). While some institutions primarily enroll middle class and modestly prepared high school graduates, others have students drawn primarily from the upper middle class and with superior K-12 preparation.

Even so, the public approach to higher education anticipates that the marketplace, at least for undergraduate and some professional degrees, is composed of more or less interchangeable institutions, each producing two or four-year undergraduate degrees along with other credentials. The institutions of accreditation and various state and federal regulatory organizations reinforce this notion. These organizations impose standardized general criteria that the institutions must appear to meet in order to be eligible for important public funding programs. The perception of uniformity is reinforced primarily through a curricular structure that leads to a four-year degree within a relatively standardized pattern of academic programming from first through fourth years, with increasing specialization towards a major in some discipline anticipated to have a relationship to future employment or advanced educational opportunities.

In a previous study (2019, Lombardi and Craig) we reviewed the challenges of interpreting generalizations about college enrollment and focused on some characteristics that differentiate these institutions. Of the 2,345 four-year, not-for-profit institutions in 2019, 33% are public and 66% are private. These two categories of institutions have much different governance mechanisms, financial structures, and size and scope (Table 2). Eight in nine private institutions (88%) have enrollments less than 2,500 while a similar proportion of public universities and colleges (87%) have more than 30,000 students enrolled. Those with enrollments between these two extremes – 2,500 to 29,999 – are more evenly split between public and private.

Within the more than 10 million undergraduate students enrolled in 4-year non-profit institutions, nearly three in four (73%) are enrolled in public institutions and 27% are in private institutions. However, the nearly three million post-baccalaureate students in these institutions are divided much more evenly with about 53% enrolled in public institutions and 47% at private institutions.

Table 2. Fall 2018 Enrollment at Four-Year Institutions

Institutional Control	No. with Enrollment Less than 2,500	% of Total	No. with Enrollment 2,500 to 29,999	% of Total	No. with Enrollment 30,000 or More	% of Total	Under-graduate	% of Total	Post-baccalaureate	% of Total
Public	160	12%	531	58%	76	87%	7,502,622	73%	1,479,938	53%
Private	1,174	88%	392	42%	11	13%	2,776,499	27%	1,312,591	47%
Total	1,334		923		87		10,279,121		2,792,529	

Source: Digest of Education Statistics, 2019, tables 303.70, 303.80, and 317.40.

The National Center for Educational Statistics (NCES) classifies research universities into two groups based on the Carnegie Classification®, those with very high research and those with high research (Table below). Of the 219 institutions in these two NCES categories in Fall 2018, 120 (55%) had 20,000 students or more, and 65 (30%) had 30,000 or more. Public institutions make up 71% of the universities classified by NCES as having high or very high research performance. In terms of enrollment, the high to very high research universities have 5.2 million students, with the public institutions in these categories enrolling just over 4 million, or about 81%.

Table 3. Institutions with Very High or High Research Activity and Fall 2018 Enrollment

Institutional Control and Research Activity	No. of Institutions	Less than 20,000 Students	20,000 to 29,999 Students	30,000 or more Students	Total Students
Public	**155**	**50**	**46**	**59**	**4,235,722**
Very High	81	4	25	52	2,880,371
High	74	46	21	7	1,355,351
Private	**64**	**48**	**9**	**6**	**974,610**
Very High	34	22	7	5	645,546
High	30	26	2	1	329,064
All Institutions	**219**	**98**	**55**	**65**	**5,210,332**
Very High	115	26	32	57	3,525,917
High	104	72	23	8	1,684,415

Source: Digest of Education Statistics, 2019, table 317.40.

In short, these institutions differ significantly by size and type, with a smaller number of public institutions serving the largest number of students even though there are more private institutions than public institutions. As a result, it is not always helpful to over-generalize about students and institutions when the range of institutional size and their public or private character are significantly different.

Money is often an easy indicator of institutional difference. Writ large, we can look at total expenditures. A major research university like Stanford in California, with a powerful academic medical center, reports operating revenue of $6.1 billion while a small private college in Springfield, Massachusetts, American International College, reports an operating budget of $82.8 million.

A perhaps less profound reflection of the range of investments institutions can make is to review the commitments colleges and universities do make to their intercollegiate athletic programs. If we look at what appear to be equivalent institutional investments in high-level sports by the members of the Football Bowl Subdivision of the NCAA Division I (some 130 institutions), we find that highest level of expenditures on intercollegiate athletics by an institution in this division is $171.4 million while the lowest level is $14.6 million. This difference of $156.8 million highlights the wide range of resources available even among what to the public eye might appear to be equivalent university activities.

Content, Context, and Brand Competition

Over the years, the colleges and universities within the higher education industry have changed much about their internal operations in response to changes in the expectations of their principal direct consumer market among parents and prospective students and secondarily in response to the demands of the external marketplace for various skills to be acquired during the undergraduate experience. Because all these institutions respond to the same market forces, their general academic offerings tend to be similar. This content, with many variations on the margin, generally provides a core of a liberal arts education and a specialization in a major, is relatively comparable across institutions, and is reinforced by disciplines such as engineering and health care where external accreditation agencies set specific requirements for all institutions.

Since the academic content is relatively standardized, institutions often focus on differentiating themselves in the marketplace by emphasizing the context within which academic activity takes place. This context translates into a brand value for the institution designed to project a quality perception onto the more or less standardized academic content. This quality perception reflects a range of institutional attributes provided at significant cost. The institution hopes to recover this cost from various sources but especially from tuition, fees, donations, and other institutional revenue.

Among these quality attributes of the context are high visibility and high-quality student activities and a wide range of personal and academic support services that cater to the expectations of parents and students for an enriching student experience. Also significant is a high-quality physical environment of academic, residential, and recreational facilities reflecting a commitment to the comfort and effectiveness of the activities (both academic content and experiential context). Other context characteristics include multicultural support services, employment counseling, and extensive entertainment opportunities. Over the years the importance of a college credential and especially a bachelor's degree has increased. In 1940 less than 5% of individuals 25 years or older held a bachelor's degree or higher while today that number is 36% (2019, NCES, 104.10). More recently, we see that in 1970, about 26% of people 18-24 years of age were enrolled in higher education while in 2018 that percentage had increased to 41% (2019, NCES, table 302.60).

Quality faculty with stellar credentials and especially with research accomplishments serve to enhance the brand of elite institutions by offering students the potential opportunity to engage with the best and brightest minds available. Brand value, then, is one of the key elements differentiating institutions, and it is the ability to sustain the cost of delivering this brand value that sorts institutions into various competitive niches and determines their ability to recruit students and accumulate the resources needed to remain or become more competitive.

Over the years since the post WWII boom in higher education, as the proliferation of institutions increased the significance of the post-secondary educational marketplace, the intense competition for the high-quality assets that produce brand value has driven the costs of higher educational services ever higher. Over the same time period, by 2018, per capita disposable income grew from less than $8,000 to nearly $44,000 in 2012 dollars (2018, NCES, 106.60). These pressures and opportunities increased the competition among institutions to attract the most desirable students and encouraged them to invest in as much of the quality elements as their tuition and other revenue could support. Nominal or sticker prices for average tuition and required fees since the mid-1970s for all public 4-year colleges and universities rose from about $500 to about $9,000 by 2018-19. For private 4-year institutions, nominal tuition rose from about $2,000 in the mid 1970's to $35,000 by 2018-19. In constant 2018 dollars, this represents about a $5,000 increase among public institutions and a $24,000 increase among privates, in roughly 40 years (2019, NCES, 330.10).

The constant discussion of tuition costs reflects this competition. The general public press publishes many articles and analyses about the constantly rising tuition prices of public and private universities, accompanied by a strong concern about the debt accumulated by many students and families as they struggle to pay these costs. However, the competition is so strong for high-quality students (who themselves constitute one of the primary quality brand enhancers) that every college and university (elite or not) discounts the published tuition by large amounts and discounts that tuition price for financial need, academic distinction, and other desirable characteristics. That discount rate for first-time, full-time freshmen has consistently risen over the years and by the first decade of the twenty-first century even public institutions had average discount rates of about 18%. Private college and university discount rates, from a much higher sticker price base, reached a new high of 52.6% in 2018.These discount rates are a reflection of the expectation that the market will regard a high published tuition price as a prestige marker, even though average tuition actually collected is substantially lower. Also, some constituencies such as international students do pay the full sticker price (2019, College Board).

Institutions use the discount process as negotiating leverage with desirable students to construct the highest quality class with the most attractive composition of student characteristics possible. Financial need is a primary criterion for tuition discounts, but the goal here is to attract students with high potential but lower family financial resources. The purpose is always to acquire the highest quality students available, using the tuition discount to make attendance possible for high need, high-quality students and make attendance attractive for low need, high-quality students. Selective institutions with more qualified applicants than they can accept use tuition discounts to ensure that each entering class has the composition of race, class, gender, and academic credentials that will maintain brand value.

This process also includes the provision of a wide range of debt financing, much of it from federal government programs. Average debt levels on graduation are in the range of $20,000 to $30,000, which includes the debt incurred for non-tuition expenses related to housing, food, transportation, and other student activities. Four years after graduation most students have either paid off their debt or are paying on their debt, but some percentage, perhaps around 14% of those with debt, have either defaulted or stopped paying. Those pursuing higher degrees or certificates acquire significantly more debt, depending on how long their post baccalaureate programs require, but in general, those with the highest debt have lower default rates than those with lower levels of debt. The marketplace continues to signal that people believe that debt incurred in the pursuit of higher education and on into graduate and professional education is a good investment. (2017, NCES, Stats in Brief)

The successful recruitment of international students has also become a key competitive advantage, and all colleges and universities compete to acquire these students. International students tend to pay full tuition and fees and, for the most part, they have been filtered for academic preparation in their home countries. The reliance of many US institutions on international students has risen from 1-2% of student enrollment through the 1970's to 5.5% in 2018. As colleges and universities came to rely on these students for both revenue and participation in many STEM graduate programs, any changes in the international marketplace posed a significant threat to budgets and programs. However, as shown in Table 4, the largest number of international students come to doctoral granting institutions, in large part to pursue more advanced studies than available in their home countries (2019, Open Doors: Report on International Educational Exchange, Institute for International Education, New York).

Table 4. International Students by Institutional Type: AY 2018-19

Level of Institution	International Students Enrolled	% of Total
Doctorate-granting	791,777	72%
Master's	147,090	13%
Baccalaureate	35,614	3%
Associate's	86,351	8%
Special Focus	34,467	3%
Total	1,095,299	100%

Source: Open Doors: Report on International Educational Exchange, 2019, table 9.

Persistence of Preeminence

Over time, the competition for brand enhancing characteristics (whether students, faculty, programs, research activity, facilities, or support systems) has driven college and university costs higher, and only the most well-resourced institutions can sustain the cost of the highest levels of brand quality. The principal sources of funding for all institutions are tuition and fees, state and federal instructional support, private gifts and grants, and federal, state, or private research support. As the higher education industry evolved from the post WWII period until today, the differential ability of institutions to subsidize brand value, has led to clearer definition of institutional positions within the general higher education marketplace.

High brand value institutions established their preeminence early in the post war years, and the top performers continued to sustain their relative position at the top of the brand hierarchy by capturing larger shares of educational and research revenue from all sources. As a result, the hierarchy of institutions (based on research preeminence, a surrogate for brand value) has remained remarkably stable over the years, with some rearrangement among those at the top but with relatively few falling out of the competition and relatively few rising up into the high brand value group.

A review of *The Top American Research Universities* for the past 20 years, illustrates this stability well. The benchmarking project examined the performance of research universities with federal expenditures of more than $40 million annually (increased from $20 million in 2008) on nine quality measures, all of which speak to the institution's brand value. Overall, 187 different institutions have met the cutoff since the project began in 2000 and the membership in this group has remained remarkably consistent, with 80% of private institutions and 70% of public institutions remaining in *The Top American Research Universities* group every year. As noted in Table 5, there are a small number of universities competing at the highest levels nationally on a variety of quality indicators over the past two decades. For example, only 30 institutions have ranked in the top 25 nationally since 2000 on National Academy members. On another measure of faculty quality, awards given to faculty from about two dozen programs, we see more competition but even so only 48 out of the top 187 research universities were able to reach the top nationally at least once over the past twenty years. Many of the top research institutions compete successfully at a national level on several measures. Fifteen institutions have ranked in the top 10 on at least one of the nine measures every year, with more than half ranking in top 10 on more than one measure every year.

Table 5. Number of Institutions Ranking in Top 25 or 50 on Quality Measures for Past 20 Years

Top American Research Universities Quality Measures	Top 25 Nationally	Top 50 Nationally
Total Research	34	66
Federal Research	37	62
Endowment Assets	32	64
Annual Giving	42	90
National Academy Members	30	61
Faculty Awards	48	93
Doctorates Granted	41	69
Postdoctoral Associates	43	73
SAT Scores*	41	78

Source: The Center for Measuring Performance, *The Top American Research Universities*, 2000-2019

*If we limit the institutions to our group of 187 that meet the federal research cutoff, the dominance is even more apparent. Twenty-five of the top research universities rank in the Top 25 on SAT all 20 years; 39 rank in the Top 50 all 20 years.

Because the high brand value institutions set the standard for institutional excellence (by recruiting the highest ranked students and the highest performing faculty, creating the most effective administrative support structures, and providing the highest quality physical environments) other institutions seek to emulate as much of this context as possible. The competition, of course, is enhanced by endless and highly publicized ranking schemes that purport to identify the critical components of brand value, but because they all use different criteria, they tend to reinforce the general emulation of the currently regarded top performers.

Crisis and the Higher Education Marketplace

When a crisis strikes, many observers and analysts imagine that this structure of post-secondary institutions and their competitive framework will finally collapse and major structural reform will ensue. Generally, that has not been the pattern. Instead, the top performers find ways to maintain their preeminence and often enhance their brands by adopting a variety of innovative practices on top of the standard programs and activities that have always defined their high brand position. Others, however, with fewer resources and therefore more vulnerable to the transitory shocks of economic and social change, must adapt and attempt significant reconfiguration of their content models and reduce the depth of their context environment to remain competitive and financially viable.

Changes to adjust to financial crises produce innovations in instructional delivery to reduce costs, by reducing the number of high brand long-term faculty and substituting lower brand short-term contingent faculty and by adopting technological innovations such as on-line asynchronous or synchronous instruction for large numbers of students using less expensive instructional personnel. Colleges in search of financial resources seek additional marketplaces among international students, post-25 year old students, graduate or certificate students, many in populations that can be taught in content-intensive modes without the added cost of the high context services expected by traditional undergraduate residential students. They retreat from the loss leader activity of academic research, so important to the high brand value institutions, and reevaluate the context of intercollegiate athletics as a possibly too expensive loss leader for its contribution to the institutional brand.

As these issues have grown ever more intense with recurring crises that have reduced public and private support for traditional higher education institutions, the common definition of what constitutes an undergraduate educational experience becomes less and less sustainable and the differentiation of post-secondary providers grows both more visible and more acute. For the high prestige brand name colleges and universities, change will come, too, but mostly as additions to the core drivers of elite quality and prestige. As the current marketplace continues to place an increasingly high value on specific and often technical expertise, the high brand institutions focus more attention on preparing their students for post-baccalaureate specialization in many fields, giving these graduates leverage for the acquisition of high value employment and, of course, increasing the brand value of the elite institutions that prepares them. The rest of the institutions serving these marketplaces will diverge as colleges and universities with fewer resources engage in significant restructuring, that in many cases may emulate the intense top down analysis and execution models used by highly successful for-profit corporations.

In this process, the internal management models of most colleges and universities will experience significant transformations. Governing boards and public legislators, as we have seen in recent times, become less tolerant of the academic collegial model which places a high value on faculty engagement and consultation (and results in relatively slow decisions driven by academic guild values rather than the metrics of economic efficiency and effectiveness). Employees, whether faculty or staff, have and will continue to increasingly emphasize allegiance not to the institution and its values but to the corporate benefits the institution can provide, negotiated and managed not by collegial practices but by corporate/union conflict resolution systems.

Some of this will also affect the high brand value institutions, as they too suffer the consequences of economic dislocation and other environmental challenges, but their responses will be attenuated by their large investment in and support for the elements of high value brand recognition: research, faculty quality, student quality, and in many cases, high visibility sports.

The result of these changes for the structure of the American higher education industry will vary. Money always lies at the core of these issues, and the money comes from the ability of institutions to sell their products (both tangible and intangible) into a wide range of different marketplaces. Key marketplaces in addition to student tuition and fees include: philanthropy, research support from all sources, and state tax-based public funding for community colleges through to major public research universities. In addition, the hiring preferences of employers in almost every area of American life have made some college education a required token for reasonable employment, and four-year college completion a preferred entry into middle-class careers.

In the search for new markets, many institutions will continue to expand their off-campus online offerings both for traditional students for whom the cost of on-campus education may be too high but more importantly for capturing adult students who did not finish college or those who need additional certifications to improve their marketability. These additional off-campus instructional programs deliver that institution's brand to wider audiences without incurring the cost of a dramatic on-campus expansion. Moreover, many private online providers can leverage their technical expertise in exchange for the legitimizing value of major campus brands.

All colleges and universities, especially those below the top-level brand institutions, will need to approach these marketplaces with structured, organized, and data driven systems, prepared to implement the necessary actions to compete successfully. There are many constraints on rapid change in this industry, and as mentioned at the outset, some smaller private institutions will not survive because they have not prepared for institutional change sufficiently and will not be able to fund the costly investment needed to become competitive. Some significant number will arrive at the moment of need to change having already fallen too far behind to reinvent themselves for the future.

ECONOMICS OF HIGHER EDUCATION

Academic institutions typically have a variety of sources of revenue, with the highly ranked institutions often having greater amounts from each source. Nevertheless, as Derek Bok, President of Harvard, noted "Universities share one characteristic with compulsive gamblers and exiled royalty: there is never enough money to satisfy their desires" (Bok, 2003).

Tuition: In general, tuition in public universities is subsidized from all sources of revenue including state dollars. Historically state dollars have subsidized all university costs sufficiently that tuition for in-state students was relatively low while out-of-state was significantly higher. Also, historically, public universities did not seek endowments and so the endowments of private universities served to subsidize costs while tax dollars subsidized some costs for public universities. For this reason, among some others, public universities tended to be larger undergrad enterprises than private universities because the state wanted to offer instruction to as many citizens as possible.

Endowments: Use of endowment earnings can be restricted to specific uses, for example, endowed faculty chairs often have restrictions on only using earnings to support the research of the faculty member holding the chair. Unrestricted endowment earnings can be used for any purpose. Universities have different payout policies from endowments but most cluster around 5%.

Gifts: Private funding of universities includes annual giving and unrestricted giving that is not in endowments but in direct payments. Most universities' Annual Funds fit in this category.

Sponsored Research: All sponsored research with very few exceptions requires a subsidy from the institution to cover costs. Some contract research for the private sector does come with full overhead but it does not make up for the loss from Federal research, let alone the loss from state and local funding which often does not include any overhead at all. Also many foundations sponsor research but exclude indirect costs. Nevertheless, these funds are critical to the research reputation of an institution and, consequently, its brand value.

Athletics and Licensing: Division I football makes money at many, although not all, institutions. However, only about 24 or so universities break even or better on their sports programs. Most lose money. All women's sports lose money. All Olympic sports lose money. All Division III sports lose money. However, this activity is a brand enhancer of some significance.

Brand Value: Higher brand value tends to increase willingness to pay higher tuition and also enhances faculty recruitment. Brand value does translate into higher demand from everyone. Brand value has been found to correlate with faculty publications and citations of those publications, hence the importance of research funding (Rouse, Lombardi and Craig, 2018).

Institutional Cohorts

Table 6 summarizes three cohorts of institutions – termed strong, decent, and marginal. The measures used to sort universities into these cohorts were total research expenditures, federal research expenditures, endowment assets, median student SAT scores, major faculty awards, and number of members in the National Academies on Science, Engineering, and Medicine. The sorting criteria are indicated in the note below the table.

The three cohorts are starkly different in terms of the human and financial resources they can devote to addressing the future. The intellectual abilities of students differ substantially across cohorts. Differences in faculty accomplishments are enormous. The strong cohort includes a bit over 2% of all institutions, yet includes among its faculties roughly two-thirds of the members of the National Academies on Science, Engineering, and Medicine. Ten of this cohort have almost one-third of the members. These human resources consume but also generate the enormous financial resources indicated in Table 6.

These types of differences have substantial effects upon the options an institution has to address challenges. We revisit these three cohorts when we later address the possible futures for each cohort.

Table 6. Institutions by Brand Category: Performance on Key Brand Indicators

Number of Institutions in each Brand Category/Brand Indicators	Average of Each Indicator within Brand Category					
	2018 Total Research (000s)	2018 Federal Research (000s)	2018 Endowment Assets (000s)	2018 Median SAT	2018 Faculty Awards	2018 National Academy Members
Strong (6% N=98): Strong balance sheet (reflected by endowment, sponsored research success, selective student demand and preferred faculty employer) likely due to strong brand image, particularly in terms of faculty accomplishments	$526,431	$297,552	$4,162,591	1354	16	43
Decent (77% N=1194): Decent balance sheet (reflected by endowment, good sponsored research, good selective student demand, and reasonable faculty employer) likely due to middle of the road brand image, partially in terms of faculty accomplishments	$11,202	$5,626	$210,894	1148	1	0
Marginal (17% N=273): Marginal balance sheet (reflected by endowment, very low sponsored research, modest selective student demand, and tolerable faculty employer) likely due to modest brand image, with modest faculty accomplishments	361	181	27,793	1043	0	0

Note on methodology: Institutions in analysis include the 1565 Carnegie institutions excluding Bacclaureate/Associate's, Associate's and Special Focus Institutions. Institutions were then ranked on all six measures, and for each measure, divided into quartile groups based on institution counts. For each institution, determined if it fell into the top 25% or bottom 50% on four measures: 1) total research or federal research, 2) endowment assets, 3) median SAT scores, and 4) prestigious faculty awards or National Academy members.

Strong institutions (6% of total institutions) represents institutions that placed in the top 25% on all four measures.
Marginal institutions (17% of total institutions) represents institutions that placed in the bottom 50% on all four measures.
Decent institutions (77% of total institutions) represents institutions that did not place in the top 25% or bottom 50% on all four measures.

CULTURE OF HIGHER EDUCATION

The culture of higher education has slowly evolved over the past 1,000 years (Rouse, 2016). For example, the structure of the University of Bologna formulated in 1088 persists today in most institutions.

Governance: The details and distribution of power and influence varies by institution and institutional traditions. In all institutions, however, the Board of Trustees or Regents has the final authority. Shared governance (as it is called) simply codifies the bureaucratic structure that permits various constituencies (faculty, staff, students, alumni etc.) to have a voice of some kind in the process. In most places faculty de facto control the curriculum, promotion and tenure, and hiring of faculty, but some of this authority is being eroded for the sake of management efficiency and authority.

Promotion and Tenure: In the 1970s, roughly 80% of faculty members were in tenure tracks; this has fallen to 20% or so. At the same time, the "rules of the game" have tightened, e.g., a threshold number of publications in a discipline-defined small set of highly ranked journals, funding from NIH or NSF, average teaching ratings of 4 or above on a 5 point scale. There have been many discussions of replacing tenure with 5 year rolling contracts, extended by a year each year that a faculty member performs acceptably.

Student Expectations: Many expect a traditional liberal education, laced with fraternities, sororities, and sports. Others are oriented towards gaining knowledge and skills to secure well-paid employment. Of late, the balance seems steadily shifting towards vocational aspirations. Student expectations of teaching quality have increased as the Internet has enabled them to sample the best of the best.

Corporatization: The Responsibility Centered Management (RCM) model of budgeting is premised on all revenue-generating units being wholly responsible for managing their own revenues and expenditures. They pay "taxes," typically as a percent of revenues, to support non-revenue-generating units. Unit leaders often find this acceptable, perhaps even attractive, when revenues are growing. This model can be challenging when revenues are declining.

CHALLENGES

There are always challenges, particularly in organizations with many perceptive and creative people who can always think of new things to offer, often with little revenue to support them. There are several other concerns that consume the attention and time of academic institutions.

K-12 Deficiencies: Evidence of poor preparation is pervasive but especially in terms of completion rates. However, the demand that everyone who enters should graduate and get a degree disguises some of this. Institutions spend very large amounts on support services to compensate for the poor preparation of many of their students.

Increasing Demands for Services: Beyond the normal educational services, there are health services, including mental health, career counseling, placement services, dispute resolution services, managing intramurals and clubs, etc. These services require staffing, facilities, and budgets. This obviously increases costs, but seldom revenue. Consequently, tuitions and fees have to cover these costs.

Increasing Oversight and Compliance: Activities associated with university accreditation, discipline-specific accreditation, certifications of workload distributions, auditing of travel expense reports, compliance with policies and procedures, e.g., format requirements for promotion and tenure cases, and sundry other forms, signatures, etc. consume significant faculty and staff time. The worst situation is a culture of compliance laced with administrative incompetence.

Increasing Contingent Faculty: Universities' budgetary challenges have resulted in increased reliance on adjuncts and part-time faculty whose salaries are contingent on adequate enrollments in the courses they are slated to teach. Further, their salaries are substantially lower than tenure-track faculty. Consequently, 25% of adjuncts across the US are receiving some form of public assistance, typically food stamps and Medicaid. This situation has prompted unionization efforts for faculty, staff, and graduate students, which tends to undermine the collegial climate that was highly valued.

Costs-Benefits Questioned: The costs of higher education have risen much faster than incomes and the other costs of living. As a result student loan debts now exceed US credit card debts. This has caused students and parents to question the benefits of higher education. The return on investment (ROI) on an earned degree is still quite positive. However, seeing this return depends on completing the degree. It does seem that the "tuition bubble" will burst at some point (Rouse, Lombardi and Craig, 2018)

Improving Educational Technology: The pandemic has caused many to recognize that online learning is better than expected. With adequate investments, online programs can provide functions and features that are seldom available in traditional classrooms. These programs can often be hosted on platforms developed by major institutions, e.g., Coursera, edX, and Udacity. The technology enables much larger classes, e.g., 10,000 in Georgia Tech's online MS in computer science. This enables much lower tuition, e.g., $7,000 for the whole MS degree at GT.

Decreasing Foreign Students: Increasing equity of foreign institutions, immigration headaches in the US, and now pandemic worries will steadily decrease enrollments of full tuition paying foreign students, threatening almost $50 billion of revenue to US universities. Educational technology can enable recruiting students without their being in the US, but the acceptable tuitions for such offerings will likely challenge many institutions.

POSSIBLE FUTURES

The strong, decent, and marginal university cohorts defined earlier – in terms of resources available to adapt to change – do not all have the same options available. As shown in Table 7, institutions in the strong cohort have the resources – and confidence – needed to lead experimentation and evolution of innovative new business models. Institutions in the decent cohort understand change is in the offing and will be a faster follower of successes to the extent that resources allow. Institutions in the marginal cohort will struggle to sustain their current business model, which is seriously threatened.

Table 7. Strategies Versus Cohorts

Strategies	Cohorts		
	Strong	**Decent**	**Marginal**
Sustain Current Business Model	Recognizes Needs to Evolve	Priority But Will Entertain Changes	Highest Priority if Possible
Experiment, Learn Quickly and Adapt	Leads Delivery Innovations	Fast Follower of Successes	Slow Follower of Successes
Disrupt Current Business Model	Resources Available	Resources Unavailable	Resources Unavailable
Move Online With Contingent Faculty	Selectively Attractive	Increasingly Attractive	Increasingly Necessary

Disciplinary Differences

We imagine that different disciplines will address change in different ways, in part greatly dependent on the university cohort in which they are located. The disciplinary roots of the three of us are humanities (Lombardi), medicine (Johns), and engineering (Rouse), so have chosen to address these disciplines. However, we expect that schools of business and law will also face similar challenges. Nevertheless, the investments by discipline may differ significantly as shown in Table 8.

Online Education. All disciplines will necessarily have to entertain greater use of online teaching as the response to the pandemic has prompted. However, disciplines may differ in emphases. Some of these differences will be driven by the differing content employed in the curricular of these differences. Also of great importance will be the extent that face-to-face interactions are central to each discipline and the extent to which these interactions can be technologically mediated.

Interactive Technologies. Advanced technology can enable compelling interactive portrayals of phenomena ranging from chemistry and physics, to human physiology and behaviors, to social and cultural interactions. These interactive technologies can augment reality and provide profound educational experiences. The quality of these immersive portrayals has steadily improved and the costs, at least on widely available platforms, have progressively decreased. The economics of such technologies depend, however, on the number of students across which costs can be amortized.

Knowledge Management. Information access and knowledge management are challenges across disciplines, although the nature of data and knowledge artifacts differ substantially across disciplines. In particular, the technological infrastructure associated with science and technology has benefitted from enormous investments. Humanities have seen important investments and innovations but not at all on the same scale. Of particular note, the data and knowledge artifacts of the humanities were seldom originally created digitally.

Process Improvement. Process modeling and improvement initiatives are significantly affected by two factors. One is the extent to which educational processes are interwoven with operational processes. This is greatest for medicine where much of education happens during delivery of clinical services. In engineering, considerable research happens with industry and undergraduate cooperative education programs. Humanities have few similar processes and thus can be approached in a more straightforward manner.

The second factor is scale. When an undergraduate major, e.g., electrical, industrial, or mechanical engineering, has well over 1,000 students in one department, technology investments can be amortized across many students and, thereby, justify much greater investments. If such institutions are also well resourced, i.e., Cohort 1, the human and financial resources can be marshaled to undertake these investments.

Table 8. Example Investments in Innovations Versus Disciplines

Potential Investments	Discipline		
	Humanities	Medicine	Engineering
High-quality online offerings to support both virtual and in-person education, including support for group work	High-quality virtual materials from selected pre-industrial civilizations representing Asia, Africa, North and South America, Europe, and Middle East	Virtual classrooms for both lecture and small group discussion, including the "art of clinical reasoning" and actual "rounds" on patients virtually with focus on developing tactic knowledge	High-quality online offerings, with seasoned, talented instructors interspersed with demonstrations, experiments, and group discussions and work
Advanced interactive technology to support of experiences, demonstrations, experiments, etc.	Augmented reality based interactions with art, history, geography, culture, language to enable students to experience other times, places and cultures	AI-based patient simulators so students can experience any disease and morbidity despite no current patient having it, including all types of personalities and even disabilities not associated with the disease or morbidity	Computational laboratories for every engineering discipline that provide access to hardware such as robots, powertrains, electronics, integrated circuits, and manufacturing processes
Advanced technology for accessing data, information, and knowledge	Easily accessible databases of texts, material culture, artifacts. Virtual reproductions of art, music, theater, popular culture with capability for individual interaction to create virtual experiences within the cultural context of the objects to engage particular themes, values, and behaviors	Content aggregation, text analytics, and machine learning for access and interpretation of millions of published articles across the breadth of medicine and related sciences	Content aggregation, text analytics, and machine learning for access and interpretation of millions of published articles across the breadth of engineering and science
Process modeling and reengineering across every process in the institution to streamline services and decrease costs	Evaluate tradeoff between student-mentor engagement with humanistic subjects and large scale technology enabled humanistic activity	Reduce redundancy and non-relevant clinical experiences in medical school and residency training to reduce student costs and years needed to enter clinical practice	Represent student flows through each curriculum in terms of knowledge, skills and experiences gained and the costs of delivering these outcomes; focus on increasing efficiencies without losing quality

Impacts on Ecosystem of Higher Education

We expect increased enrollments due to technology-enabled easier access and potentially lower priced tuitions – see Georgia Tech example. With continuing pressures to control costs, there will be a steadily decreasing tenure-track faculty workforce, with the possible exception for institutions in the strong cohort.

Technology and outsourcing will result in steadily decreasing staff positions. Decreased investments in bricks and mortar will inevitably lead to fewer support staff. Overall university employment will decline, with possible exceptions in medicine where clinician deficits are projected, and possibly engineering with steadily increasing demands for STEM education.

Impacts on US Global Competitiveness

The overall result will be a better-educated workforce due to increased enrollments. There will be increased workforce diversity due to easier access and lower prices. This will lead to an increasingly healthy, educated, and productive workforce that is competitive in the global marketplace. With faculty positions becoming scarcer, there will be increased placement of PhD graduates in industry and government. This will lead to enhanced technology transfer and innovation due to broadened placement of research talent. Industry and government demand for professional graduate degrees will increase with easier access and lower prices.

CONCLUSIONS

The unrecognized complexity of higher education is due to several factors. Higher education is complex in terms of differing human and financial resources by cohorts. Higher education is complex due to inclinations and abilities of different disciplines to adapt to change. These differences suggest that a "one size fits all" set of higher education policies will poorly align with this complexity. Policies need to be tailored to these differences to be fully effective.

The changes portended here will require strong leadership, as this is the key to fundamental change (Rouse, 2011). Marginal leaders can muddle through great times, but tend to falter in challenging times, e.g., (Furstenberg, 2020). Great leaders are needed to address challenging times (Barsh, Mogelof and Webb, 2010; Rao and Sutton, 2020).

The anticipated changes will be challenging, in part because higher education is no longer a "sacred cow" in society. Despite the importance of higher education to prosperity, it has to adapt to the realities of change. The likely changes will likely be rather disruptive. However, the net effects will be positive.

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