Review

Complex adaptive systems: A trans-cultural undercurrent obstructing change in higher education

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It is possible that the “perfect storm” is brewing on the seas of change for higher education. This paper will address the urgent need for adaptive strategies for change within higher education institutions (HEIs) with a focus on Complex Adaptive Systems theory (CAS) as a means of explaining the disconnection between higher education and its environment. Unlike many social, economic and geopolitical issues that vary from culture to culture, higher education has a relatively uniform monocultural penchant to ignore, resist and even the war change within academe. CAS has its origin in the genome specified biological system of speciation and Darwinian evolution as discussed historically by Dennet (1995). However, it was first applied as a paradigm to address organizational evolution and change by Gell-Mann (1994). The fundamental premise for CAS is that organizations, like living organisms, are classes of complex systems that are maintained, defined and specified by replicators or schemata.

Key words: Complex adaptive systems, higher education, change, leadership.

INTRODUCTION

It is possible that the “perfect storm” is brewing on the seas of change for higher education. The enterprise of higher education may be confronting the pivotal moment when it must finally decide to chart a course and set sail with determination and vision, or drift aimlessly and rudderless in a sea of uncertainty under the yoke of crisis management. Traditional paradigms of governance, leadership and planning have been eclipsed with post-modernist philosophies. Panaceas for higher education reform come and go like clouds in the wind. Many seminal theories on governance and leadership are now considered only as historical perspective. The enterprise is confronting a new era that needs new perspectives. Higher education must revisit its mission and vision into the future in a way that offers sustainability within an environment of turbulent change. Time is short; the window will eventually close. The world is becoming increasingly complex and diversified. We are presently confronted with innumerable changes that occur at a more rapid pace than ever before. New forms of organization, values, behaviors, knowledge and technologies are emerging. The present scenario characterized by accelerated mutations on the economic, social and technological levels makes it absolutely necessary to re-examine the role of education, particularly that of higher education. Being one of the most relevant social organizations, higher education tries to be sensitive to the forces that surround it. Therefore it attempts to adapt to this new reality by re-examining trends, objectives, structures, functions and strategies in order to make a better contribution to economic, social and political development. Sometimes, it succeeds.

It is the place of higher education institutions to play an important role in the realization of numerous and diversified activities that are indispensable to society on the economic, social, political and cultural levels. The commonly referred to functions of higher education institutions are teaching, scholarship and service to the community. These are the arenas of involvement institutions use to establish themselves as pillars of balanced growth in search of individual and collective well being. The role of higher education in a knowledge driven world is the development of needed resources through the mobilization of human talent and potential. This is accomplished through lifelong learning; the training of high-level skills; the production, acquisition and application of new knowledge; and research addressing the needs of society and industry. Ultimately it is the creation of a better-educated, more productive populace that can more effectively contribute to the overall well
being of society. This is the standard by which higher education should and will be judged now and in the future. We must always be focused on this, for it defines our future success or failure as a social institution. Higher education throughout the world is a large enterprise. Looking over its purposes, functions and the significant amount of resources used in the creation of educated people and public services reveals the importance of higher education to society. There is a common understanding based on philosophical and pragmatic views that higher education produces benefits that accrue to both individuals and society. On the other hand, higher education utilizes a significant amount of resources like land, buildings, technology, people, time and money. More recently, issues of productivity, cost containment, quality improvement, outcomes assessment and the social relevance of its courses, have challenged higher education organizations. Comparisons have been made between universities and business corporations.

A concern for better use of resources and improvement of college and university performance is growing among legislators, public officials, parents, funding agencies, the media, civic organizations and society at large. Why does higher education continue to languish? One of the strongly held beliefs in higher education is that it is not a business, and therefore should not be held to the criteria of efficiency and productivity seen in the business world. The argument simply does not withstand scrutiny. If you can't be compared to the corporate world, then it would seem by definition that you do not have any competitors. As noted by Zemsky et al. (2005), those wanting to advance the agenda of higher education tend to be either exhorters or lamenters. While the former might be preferred, when that approach fails (and it does too often), lamentation will logically follow. The tired argument that is frequently presented to funding agencies is that a greater investment in higher education will produce economic growth and prosperity. Data from the United States, as reported by Vedder (2004), would suggest just the opposite. The 10 states spending the least on higher education showed a median real income growth per capita of 46%, while the 10 highest spending states only showed 32%. The author also points out that only 21% of new funding is being allocated to instruction, which is the core mission for creating a productive workforce. Of course, not every institution is pursuing this path.

Organizations are changing. With the changes witnessed everywhere in the world, are new challenges that the organizations that want to accompany the winds of change must face. Regarding what is expected of the university, the organization for economic cooperation and development (OECD, 1993) states:

"... in fact, not only does it have to adapt in order to respond to present and future social demands, but it is also hoped that it will play the principal role in the preservation of the traditions and cultural heritage of each nation and contribute actively to the formation of future democratic societies."

The development of a new type of higher education institution that is aimed into the third millennium is an urgent necessity. Higher education needs to put its arms around its capacity, and embrace the magnitude of its impact on people, social institutions, nation-states and overall cultural advancement. It is not suggested that the institution of higher education is devoid of this sensitivity, responsibility and obligation, but that few people within the enterprise realize their obligation to hold this broader view. Everyone must deliver their commitment to those they serve. Higher education needs to understand that it cannot preserve the "status quo" indefinitely. As the world changes and advances, so must the higher education system. Situations and circumstances will not stay the same while the system tries to maintain what it has. The external environment will advance, and by default, higher education will fall farther behind as other competing social forces pass it by.

The world cannot wait for higher education to make the necessary decisions that will advance it and give it much needed forward momentum. The world is moving at an exponential pace and it has no time for excessive shared governance, countless bodies that must approve everything and dialogue ad infinitum. As stated by Keller (1983, viii, x),

"The dogma of colleges as amiable, anarchic, self correcting collectives of scholars with a small contingent of dignified caretakers...is crumbling...(and they cannot) continue to claim to be akin to a tiny monastic order deserving special dispensation from the rigors of planning, priorities, and management."

**HIGHER EDUCATION'S CONUNDRUM**

"He who rejects change is the architect of decay. The only human institution which rejects progress is the cemetery" (Harold, 1967).

In today's world of rapid change and uncertainty, only human systems that are capable of adaptation and flexibility will prosper and thrive. Global trends, including those impacting higher education, are moving inextricably toward a tangled web of unparalleled complexity. This new reality requires that institutions alter their methodologies for innovation, change and organizational structure. Semi-closed, equilibrium-seeking systems served higher education well in the more stable, socially insulated and predictable past, but are woefully inadequate today and in the future. Highly structured systems of management, planning and leadership must give way to strategies that will maximize organizational potential in the face of environmental volatility. Scholars and practitioners alike
have tried to move higher education from fragmented, reductionistic collections of independent specialists toward more global, interdisciplinary and integrated systems. The goal is to focus on the whole and bring together the many disjointed functions with collaborative unity in order to propose changes to make the system better (Bredo, 1999). The literature on higher education management today is in general agreement that there should exist a top-down leadership function coupled with a bottom-up participatory one, with neither operating in isolation of the other (Machado et al., 2004, 2005). It is not uncommon for these views to conflict, if not be diametrically opposed.

Modernist views took the position that a given stance was correct unless opposing views could be scientifically substantiated. Post-modernist perspective has been that no opinion is necessarily right, and that all views need to be put into context. Thus, the either/or view of organizational versus individual input as the correct way of thinking about and dealing with institutional management has given way to the perspective that there are many sources of input and collaboration that must be melded for effective strategy development. All of this has led higher education down the path toward transformational leadership, and strategic thinking, management and planning. The authors would assert that this “systems theory” approach has been a productive journey that has elevated the enterprise to a more effective and strategic level of dynamic, continuous and interactive problem solving. I suggest, however, that the necessary journey is not yet concluded. Despite the positive gains realized from this managerial evolution, the process is still not as effective and efficient as it needs to be. The process continues to place too much emphasis on linearity, while the world is, in fact, quite nonlinear. Systems have chaotic interactions that preclude the possibility of long-term predictability. This highlights the distinction between linearity and nonlinearity. Linearity deals with straight lines and predictability. Nonlinearity addresses systems that do not fit expected patterns and do unpredictable things. Such can be the case with social institutions, including higher education.

In recent decades, it has been realized that linear prediction has been a somewhat oversimplified process that was applicable to few systems. As noted by Neave (2005: 117):

“The linear model...sees policy as a logical and linear process.... Unfortunately, the mass of literature – let alone experience over the past two decades – shows that this is not the way things work.”

Most systems are nonlinear, and this has vastly changed the way we must view their management and control. Management by control, policy, regulation and bureaucratic thinking is ineffective, inefficient and, quite frankly, passé. Thus, higher education as a social system needs to embrace a distributed systems approach to management that shows greater flexibility and complexity. One approach to conceptualizing this challenge is complex adaptive systems theory (CAS). This will be presented as a perceptual focus that can place a perspective on institutional change and innovation. It will be followed by the author’s viewpoints on how institutions must go about reengineering and restructuring the manner in which they pursue their futures based on sound strategies more compatible with contemporary realities.

Complex adaptive systems theory

“It is very hard for (us) to let go of...mechanistic and very linear cause-and-effect models and adopt an evolutionary model in which we sit back to see what can happen from any direction without knowing what will come of it. To do so is to relinquish control, direction, role and intentionality. (We) get very nervous just at the idea of this process” (Sherman and Schultz 1998).

Complex adaptive systems theory (CAS) has its origins in science and technology. Early authors tended to align CAS with an orthodox Darwinian view of the survival of the fittest. The more recent school of thought puts far less focus on the reductionistic approach of Darwinian selection (Capra, 1997). CAS is not only a model for theorizing about biological ecosystems and their evolution. It has been used as a research approach for examining ideas and problems involving chaos theory, artificial life, evolution and genetic algorithms, among other areas (Wikipedia, 2005). More recently, it has been applied to human interactions, macroeconomics and social organizations as first noted by Hodgson (1993). Just as multivariate research introduces increased methodological complexity with multiple independent variables, so environmental complexity introduces multiple interactions and relationships between human systems. In the latter case, many of these connections are unpredictable and therefore, unforeseeable. The continuous and accelerating advances of civilization are placing more and more human systems into interaction with one another. As this trend grows, more independent variables emerge and the milieu continues to become more complex and multivariately interactive.

Systems and complex systems

A system is defined by the Merriam-Webster Dictionary(2003) as:

“...a group of units so combined as to form a whole and to operate in unison.”

This definition may be appropriate for natural systems,
but it is inadequate for human systems with their unique labyrinth of intricacies. A complex system is one whose properties are not totally explained through an examination of its individual parts. In complex systems, the myriad parts are interrelated and interact in sometimes unpredictable ways. They are systems that continually evolve and unfold over time through multiple pathways (Science, 1999). Traditionally, empirical inquiry has studied objects in isolation, breaking them down to further dissect them. More recently, inquiry has focused on the external reality that surrounds the issue of investigation. Rather than analyzing the pieces of the whole, complex systems thinking focuses on the interaction between the pieces. It can create a Gestalt. Max Wertheimer established Gestalt psychology from research in the area of human perception and psychophysics. The seminal book on the subject, however, was written by Kurt Koffka (1935). Essentially, it suggests that viewing something in its entirety gives it a completely different meaning and perspective than examining it part-by-part. Imagine a computer disassembled down to each individual part and piled on the floor. Perhaps you would recognize the individual keys from the keyboard or the shell of the mouse strewn among the thousands of parts, but for the most part it would be a meaningless collection of pieces. Fully assembled, it would take on significant meaning and “become” a computer. Thus, Gestalt psychology coined the phrase, “the whole is different (not greater, as is often misquoted) than the sum of its parts” to explain this perceptual phenomenon. This form of thinking is fundamental to the concept of change. A complex adaptive system is one that is optimally equipped to confront and conquer issues of survival and self-renewal in the face of environmental complexity. It also has the adaptive capacity to improve and strengthen its position in a resilient way.

CAS can be viewed as the interface of three concepts: cybernetics, innovation and complexity (Lucas, 2005a). Cybernetics is the use of control through feedback. When positive or negative effects feed back to the cause, the system grows or maintains its current state, respectively. Thus, the system becomes a complex network of feedback loops that oppose and support actions. The “status quo” reflects no change. If it is altered, change exists. This can be deliberate (internally-driven) or random (externally-imposed), and also good or bad. All changes are not for the better. Change of the institution’s doing (proactive) that makes a positive difference is termed an innovation. If it results from a response to outside forces (reactive), it is adaptation. Finally, un-successful attempts to create change can be viewed as failures, and inability or refusal to adjust to environmental events can be termed self-maintaining replication. These relationships are seen in Table 1. Complexity is the third concept. The system must have diversity and the freedom for the many actors within it to interact. This complexity must be measured carefully. Too little freedom creates constraint; too much becomes chaos. Chaos, in this sense, is the point where an initial small deviation has escalated into a completely unpredictable state. It is the point where the system is overwhelmed and thus dysfunctional. A dynamic and complex system must operate at the edge of chaos. However, Lucas (2005a) complicates this by identifying three levels of systems that exist simultaneously and interact with one another: intra-system, inter-system and hierarchical.

The first represents interactions within the institution, the second interactions with other institutions and related bodies and the third the larger even global environment. All of these systems must interact, and in doing so create a “hyper-system” where they can all co-evolve (Batty and Torrens, 2001).

### Properties of complex adaptive systems

CAS models have five basic attributes in common: relationships, complex order, evolution, natural hierarchy and strategy (Waldrop, 1992). Each is addressed briefly as follows:

#### Relationships

Individual organisms and organizations alike exist in ecological niches that are defined by their relationship to other members of the ecological system. Each competes in its own way for differential survival and prosperity. Higher education institutions have many complex and often competing relationships with other external entities at the local, national and international levels. These relationships interact in many ways and create a heightened level of complexity to the system.

#### Complex order

Higher education institutions are complex systems, whether we treat them as such or not. Within any given HEI there are many different and sometimes competing agenda working toward autonomous and not infrequently competing goals and aspirations. Yet, somehow (in most cases) the confluence of these myriad components merges at a higher order to bring some level of stability and definition to the operation. I am not suggesting here that this necessarily represents sufficient complexity within higher education.
Evolution

As discussed earlier and in need of no further elaboration, systems adapt and evolve over time. This results from constant interactions with other systems in an evolutionary process. In time, this produces new systems designs and, in some cases, eliminates or at least diminishes others. The dynamics of this process are addressed from the perspective of higher education later in this paper.

Natural hierarchy

The phylogenetic order in biology is well established. Similar, but more dynamic hierarchies can be observed in social organizations. Languages, for example, diversify from their common origins to create dialects. Religions form sects. Scholarly areas of inquiry multiple and differentiate themselves one from the other (Price and Kennie, 1997). In higher education, people within an HEI group themselves into sometimes differentiated professional and personal units; units become academic and administrative sections, divisions or colleges; researchers form interdisciplinary research networks; these units converge to form the institution itself; HEIs collaborate to form larger consortia, and these, like CHER, unite the enterprise internationally.

Strategy

A biological gene is a strategic algorithm designed to replicate itself with an anticipation of the environment that will allow it to prosper in the future in some ecological niche (Dennet, 1995). These instructions, however, are based on a linear extrapolation of the past, since a gene can do no more than advance the successful genetic code it possesses. Human organizations, on the other hand, possess the capacity to influence their future, at least theoretically. This strategic freedom and flexibility is the defining difference between the biological and social domains of systems adaptation. Unfortunately, as Mintzberg (1994) points out, too often strategies are reduced to nothing more than expecting that those of the past will succeed in the future. Within higher education, unwritten rules, antiquated paradigms, lock-step formulae for change, intractable mental models and centuries of tradition have conspired to keep too many institutions shackled to the belief that the future will be a simple linear extension of the past. Recent history, as discussed later, already shows this to be a fallacy.

Important biological and cultural differences

The simplistic view that the biological model of evolution can be applied directly to the cultural changes within human institutions is naïve. Biological organisms are, with a few exceptions, incapable of interbreeding. Human organizational entities can and do merge at will. There are, of course, innumerable cultural challenges and even barriers to this cross-pollination, but it struggles to persist nonetheless. The central dogma of Darwinian biology is that an organism cannot transmit environmentally acquired characteristics; that genes are immune to environmental interactions. The Lamarckian model of cultural and technological evolution suggests the experiences gained through culture and language are indeed, passed on through educational and cultural programming (Price and Shaw, 1996). This is most prevalent, but certainly not unique to the human species. While beyond the intent of this paper, it is worth noting that another striking difference between non-human and human systems is ethical choice. Most of nature’s species parasitize and even cannibalize each other.

From this perspective, above the levels of survival and physiological needs, it makes little logical sense to judge human behavior, interactions and organizations by any model that parallels the traditional laws of nature.

Equilibrium shifts

Geological and biological evolutionary events are sporadic and non-continuous. While the processes that promote and encourage adjustments are in constant operation, they produce only sporadic changes. Consider the continual shifting of tectonic plates resting on the Earth’s molten core that only rarely create a major event, or the 130 million year domination of the dinosaurs that was abruptly ended by an asteroid. These are events that produce major change and cause shifts in the equilibrium of existing (and, in the case of humans, possibly complacent) systems. Within the domain of human organizations, as suggested earlier, there is a cultural tendency to resist change in spite of continual environmental advancement. An analogy might be Ager (1973) explaining the life of a soldier as one fraught with extended periods of boredom infrequently interspersed with brief moments of terror. The equivalent to this from the perspective of higher education is illustrated in Figure 1. While the environment is in a state of constant and exponential change over time, the HEI is often seen as maintaining (replicating) the “status quo”. Thus, over time, the HEI gets farther out of equilibrium with the external reality it must interact with. In time, this disconnect reaches a level where institutional change becomes inevitable and unavoidable. At this point, a crisis management mode of response is generated.

In some cases, it is only partially effective and fails to fully align the HEI with its environment. Over extended time, these change deficiencies can grow until another “moment of terror” is called for. However, if the disconnect continues to widen, the possibility of an equilibrium-disrupting situation can become a reality.
COMPLEX ADAPTIVE SYSTEMS AND HIGHER EDUCATION

“I find it striking that in the entire spectrum of complex adaptive systems only when we come to human organizations do we typically find a powerful agent in charge of the whole operation. And these are precisely the complex adaptive systems that break all the time and that we are always trying to fix” (Simmons, 1999: 68).

Organizational theorists have long postulated that successful organizational structures are often built around a network of dependent and interdependent actors that are simultaneously competitive and collaborative (Rothchild, 1992; Moore, 1993). For higher education, this challenge can be defined as the need to be entrepreneurial, visionary and capable of sustaining a legitimate and distinctive niche in an emerging system and environment. Jongbloed et al. (2000: 3 to 4) suggests HEIs are complex systems in as much as;

“They create, interpret process, distribute, and store knowledge. They do so by offering a wide range of services, such as... courses to undergraduate students, training postgraduate students, doing research for different parties, generating inventions for industry, offering consultancy services to businesses, supplying short-term training programs on demand, and offering cultural and (sometimes) sports facilities to students and the general public....”

However, somewhat unique to higher education are the deeply ingrained traditions and cultural heritage that can stifle innovation to the point of creating system disequilibrium. The human mind clings to replicate survival. Within institutions, this “group think” mentality is reinforced and even stronger and more prevalent. The modus operandi too often is to maintain stability and even erect barriers to intruding change. Survivors who evolve will be those that play by new rules.

International equilibrium shifts in higher education

Once again, we can turn to many universal issues that pose challenges to higher education throughout the world and across many cultural boundaries. While country-specific factors may alter the exact nature of the challenges, these issues can be recognized as having common impact across the broader higher education landscape and ecosystem. Clearly, they point to the fact that the arena of higher education is non-linear and complex.

Funding streams and marketization

Fiscal resources are clearly one of the major challenges facing higher education institutions throughout the world. It would seem fairly certain that this dilemma is not a short-term “blip” on the radar screen, but rather a pervasive trans-cultural phenomenon that will continue into the foreseeable future. The problems exacerbating this crisis include many different factors. In Latin America, over-subscription wherein the higher education infrastructure is not equipped to handle the number of candidates is a major obstacle. In the majority of Europe, the remnants of the Welfare State are placing inordinate strain on governments to fund all of the social programs that demand resources. In the United States, one sees a government increasingly disdainful of higher education and much more inclined to support more immediate returns through investment in other areas. Because the U.S. is identified most with a market mentality, it can serve as an example to examine more closely. The intensely competitive nature of the enterprise there is beginning to stifle inter-institutional collaboration and dialogue for many institutions. Each HEI works to maintain its competitive advantage. Declining governmental support in the public sector has continued for so long, even the eternal optimists are recognizing that this trend will not reverse itself in the near future. HEIs are working...
hard to establish alternative funding streams. Of course philanthropy and fund raising have been staples of U.S. higher education since John Harvard first pursued them. Beyond that, entrepreneurial pursuits have been recognized as important in the overall scheme of funding the enterprise. While the market-driven mentality in the U.S. is probably suspect, it is driven by outside forces.

More importantly, perhaps, is to recognize the entrepreneurial adaptations that have transpired to cope with this situation. At the same time, it can be argued that HEIs are selling their souls (missions) to serve the needs of outside entities that can and do provide needed revenues.

**Competition and alternative providers**

A reasonably sound analogy can be developed between the recent and present dangers of wildfires in Portugal and the impact of market competition on higher education. When a forest full of mature trees becomes overgrown with weeds and underbrush, the ingredients for wildfires exists. Controlled burns where the undergrowth is carefully removed with strategically placed fires without damaging the trees is the usual remedy. However, this must be done with great skill and expertise or the remedy could create the very wildfire it is designed to prevent. Now consider Portuguese higher education (or higher education anywhere) as a “forest” of mature institutions that have become smothered by problems surrounding an expanding private sector, low graduation rates, excess bureaucracy, lack of responsiveness, and resistance to change and innovation. Some would suggest the remedy to this malady is market competition. While this may be true, if not managed properly, it could create the exact problem it is designed to prevent. There are two strands to the issue of market competition in higher education. First, governmental regulations designed to protect higher education from this phenomenon are being reduced. More and more, policy makers are turning an unsympathetic ear to the concerns expressed by higher education. Secondly, the higher education enterprise’s penchant for deliberating ad infinitum and resisting change instead of being proactive has opened the floodgates to alternative providers who are strategically positioned to take an ever-greater share of the market. These groups include consortia of traditional institutions, for-profit degree granting institutions, virtual providers, and to some extent, the charlatans that merely open storefronts. These providers are growing faster than any other segment of the competitive system.

As noted by Newman and Couturier (2002: 1) after researching market forces in higher education worldwide for two years,

…”the market has arrived in higher education. There is no turning back.”

Their research further revealed striking similarities in countries throughout the world with respect to the forces and challenges they faced. In addition to those factors mentioned above (the affinity for market competition by policy makers and the emerging alternative providers), the author points to expanding enrollments. While Portugal, (though certainly not alone) is in a demographic downturn, this issue deserves our attention. Global enrollments in higher education have more than doubled since 1975 (World Bank, 2000). In Asia alone, from 1995 until 2020, it is estimated demand will grow by 48 million students, which translates into 37,000 new classroom seats every week (Bright, 1997). Why is this important to Portugal? Because it represents an exploding international student market that can be tapped to offset declining national population trends. This, of course, cannot happen without strategic initiatives to make Portuguese higher education more globally attractive. The challenges are not about academic quality, but rather international competitiveness. In response to this exponential market expansion, new competitors are emerging to challenge the traditional higher education institutions for the available students. Consider the following facts: 1) private institutions grew in Poland from near zero to over 180 in the last decade and 2) Malaysia’s private sector expanded by 276% from 1992 to 1999. Additionally, virtual universities (Open University, R.M.I.T. University of Australia, Teikyo University and the University of Phoenix as examples) and university consortia (U21 Global, International Cyberuniversity, Fathom.com and OntarioLearn.com as examples) are appearing more and more frequently in an effort to take important market shares away from the traditional institutional sector (Lee, 1999). Leadership from the traditional higher education sector needs to be stronger in this arena.

The continuum of new actors entering the higher education market spans the spectrum from prestigious world-class universities to renegades totally lacking in academic credibility. The traditional sector must lead in addressing the questions of quality that are inevitably arising from this new movement. The higher education community needs to openly recognize and accept the market reality that exists. Institutions need to develop strategies. Leadership needs to step up and make proactive decisions about the directions institutions should take and the goals they should strive to achieve. As Newman and Couturier (2002: 6) stated:

“If the voices of the academy are not heard in this critical time, if the public and policy makers do not see higher education stepping forward in service to those who have supported its 'special' role in the past, higher education will have lost a critical opportunity to reaffirm its status as a public good even in its new market orientation. This reaffirmation must come from within.”
Internationalization

Internationalization is considered a major area of importance to higher education in many countries throughout the world. This is a broad and multifaceted area that embraces many issues; for example, student and scholar mobility, research collaboration, branch campuses, distance learning, student support services, governmental policies and regulations, to name a few. Probably the first efforts toward internationalization centered on student mobility. In most cases, developed countries attempted to devise strategies to attract students from other countries. The true heart of internationalization, to provide opportunities for intercultural exchange and develop a broader global perspective, may not have been at the center of the motivations in many cases. The author served as a vice president at a university in the United States, where international affairs was one responsibility. The main goal of internationalization there, as in many U.S. HEIs, was to attract as many students from abroad as possible for the economic benefits they provided. It was simply another alternative funding strategy. Although in most cases, students came under a formal exchange agreement wherein they only paid tuition at their home institution, they added to the overall enrollment. State funding was derived from enrollments, thus their presence from nearly 60 countries enhanced the budget significantly.

The outgoing exchange of local students was much less evident, since this not only did not add revenues, but in fact cost the university in the form of scholarship support to assist these students abroad and enrollment reductions. International affairs officers know exchange student enrollments ebb and flow and should not be counted on in any predictable way. However, many times, other decision-makers do not understand or accept this premise, especially when enjoying the benefits of burgeoning international enrollments. It is generally held that the preponderance of study abroad students are going to the English speaking countries of the United States, the United Kingdom, Canada, South Africa, New Zealand and Australia. The dynamics inherent in global student mobility are not that simple or predictable. A few representative examples of equilibrium shifts in this complex arena are presented. First, the advantages of being an English-speaking country are offset by the fact these are also among the most expensive countries to study in. A study by IDP (2004) ranked their tuition and living costs in the following order from most expensive to fifth-most expensive (South Africa was not included): UK (essentially England), Australia, US, Canada and New Zealand. The range expressed in U.S. dollars for one year’s study was from $11,152 to $8,686. In contrast, some Asian destinations were much less expensive. Even Hong Kong was at $7,081, with China at $5,219, Malaysia at $3,785, Thailand at $2,918 and India at $1,515. According to the study, Australia is moving its marketing strategy away from the idea of being the affordable study destination to the one with the best quality programs and employment prospects. It has been said that the future dominant country in international higher education is fast becoming China (M. Peterson, Michigan University, USA, personal communication). There is much expansion and growth to support this assertion. Of course, any educational statistic generated by a country with 1.3 billion inhabitants and more than 2,000 universities will make an impact. In an effort to increase their international competitiveness, many Chinese institutions are moving toward instruction in English.

The number of English-speaking professors is growing and more frequent student papers are being accepted in English (Amin, 2004). At the same time, there is another side to internationalization efforts within Chinese higher education. The massive efforts to expand enrollments began in 1999, and in five years, enrollments had doubled to 4.2 million students. In 2005, it is expected to peak at 5.1 million. Problems, however, have prompted the Ministry of Education to conduct a probe into the viability of institutions to sustain this expansion. There have been occurrences of land acquisition scandals and debt crises. Facilities expansion is moving too fast and cannot be maintained. Many new buildings remain empty. The Ministry suspects it has been reduced to a process whereby real estate developers make money and local politicians claim achievements. The dilemma is that the old existing educational facilities are inadequate and too few to support demand and the expansion effort is becoming overwhelmed and corrupted. The title of the article from which some of this information was taken is appropriate to note: "Colleges must learn to walk before they can run" (China Daily, 2004).

Consider Mexico, which is having an explosion of private institutions much like other South and Latin American countries, with the predictable exception of Cuba. Their quality and credibility cover the spectrum from storefronts to multinational institutions. Unfortunately, government oversight in Mexico is minimal, and quality has become a major concern. Higher education enrollments have doubled since 1993 to 2.5 million students. New HEIs are opening almost weekly, and the estimated enrollment needs are fast approaching 4 million (Lloyd, 2005). The premiere destination for studying abroad has tended to be the United States. This is changing, and simply attributing declines to the events of 9/11/2001, is insufficient. However, the more rigorous visa-screening procedures and embassy policies have played a legitimate role in causing declines. While Chinese students used to be the most numerous, students from India are replacing them. Typical are the numbers from San Jose State University in California. In 2004, their Indian enrollments increased by 21%, while the Chinese enrollments fell by 35% (Schoenberger, 2005). Thus, the international higher education arena is awash with change and flux. Some of these vicissitudes
may well be equilibrium shifting events for HEIs in many countries.

Astute institutions will monitor all of this, expand their objectives beyond economic gains and establish themselves by finding a productive niche. Others will, of course, maintain the “status quo”, react belatedly with crisis management and continue to lose pace with the progressive advancements of others.

**The role of leadership**

“We know nothing of what will happen in the future....” (Abraham, 1839).

All of this suggests concepts such as leadership, strategic management and planning, and innovation and change in higher education should perhaps be viewed differently. Perhaps higher education should grapple more with attempts to contain, if not explain, complexity. If so, this does not bode well for the more traditional models that strive to predict the (singular) future and set specific, targeted goals to confront it. We must embrace uncertainty. We cannot successfully plan for every possible contingency or predict the future with any degree of confidence. However, even worse that pursuing that frustrating path is to adopt an isolationist attitude and effectively ignore outside environmental forces. As Lissack (1999, 5) states:

“Organization science for fifty years has focused on ‘controlling uncertainty.’ Complexity science for the past ten years has focused on how to understand it so as to better...channel (it).”

The world is becoming overwhelmed with information. It becomes easier and easier to generate and distribute information. In a never-changing 24 h day, one can only process so much information. Our ability to absorb it is largely constrained by time, which advances at its own constant cadence, and human capacity, which imposes its own inherent limitations. Thus, the challenge is to retrieve and comprehend vital information while screening out the vast majority of irrelevant or redundant information. Institutions must construct models that help them decide what information to collect, and ultimately how to act on it.

The central actor in providing an institution with the focus and perspective to discern what is and is not relevant and important is the leader. While many different types of individuals sit in the office of leadership, only some of them effectively exercise the role of leadership. This is a role that is becoming increasingly difficult to fulfill. Bar-Yam (2000) suggests when a single individual controls collective behavior that collective behavior cannot become more complex than the individual behavior it is bounded by. It could be posited that a “group think” mentality could actually reduce the overall functioning of the HEI below that of the leader. Thus, institutional leadership is a key issue in the debate. Of course, there already is a move toward flatter, less hierarchical organizational structures that stress distributed leadership and decision-making. The author would suggest, however, that in some cases this is as much rhetorical and organizational chart prestidigitation as it is reality and meaningful managerial restructuring. Clearly, it would seem that leading a complex higher education institution requires engaging the expertise of many individuals from within the HEI, and orchestrating rather than professing its forward movement. It is insufficient to follow the Newtonian model where knowing what happened in the past will tell us, through simple linear extrapolation, what will happen in the future. This overly simplified approach gives a false sense of confidence. In a complex and nonlinear world, all this really provides is the illusion of certainty.

Ultimately, a higher education institution needs a modus operandi for leadership that is vigilant, open to adjustments and willing to benefit from the expertise of many others within the institution that can contribute meaningfully to its advancement. It needs a strategic plan that is, in fact, strategic and not merely long-range. The difference is essentially that the former is aware of the external environment, in constant anticipation of change and prepared to adapt, while the latter is lock-step, of multiple year’s duration and inviolate until its timeframe expires. There is a huge difference between the two. This distinction differentiates an institution that is being led and managed as a complex and adaptive organization.

**The role of strategic planning**

Here the author takes some license and shares personal views about the process of planning in higher education. First, it is not working all that well. The pundits have championed the cause with excellent books that articulate the necessary components (wrapped around their particular model) and have given the institutions a plethora of viable alternatives that have legitimacy. The problem is not the structure of the planning models. Any number of effective models have been presented that could serve an HEI quite well. The problem lies in the execution of the model, and that tends to focus on the leadership and the members of the institution charged with implementing the planning process. Institutional planning efforts tend to do several things that seriously impair their ability to be successful:

i) To bridge the great communication divide, the administration puts academics in charge of creating the process, which results in an intellectual and research-laden structure that appeals only to them.

ii) HEI motivations to plan are suspect: a ruse to create
It is analogous to a group of musicians in a ‘jam session,” creating a new composition, but specific outcomes are contemporaneously adapted accordingly. What results can changes in a way that will best advantage the institution.

Of course, when concrete answers to questions such as plan to play experimental jazz with an overall goal of a complex adaptive system. They may have a general a musical score. This is actually a very good example of easily be superior to what might have been produced with doing, anticipates multiple future changes, and each musician monitors what the others are creatively

vii) Endless meetings go on and documents continually emerge, but no meaningful goals get met (at this point, the academic convolutions and the administrative bureaucracy have essentially doomed the process).

viii) High expectations get dashed quickly when it is discovered that the entire process is, in reality, nothing more than an unfunded mandate by the administration.

ix) Due to a lack of results, the process eventually dies a natural death (do not try to resurrect it at that HEI anytime soon).

From institutional planning consulting experience on several continents, a consistent pattern among institutional leaders that transcends cultural differences has been observed. They predictably ask questions that arise from their fixation with quantification and their desire to establish improved levels of certainty. They want linearity in a non-linear reality.

i) How long will this planning process take?

ii) What measurable results will be produced?

iii) What exactly must we do to produce the results?

iv) What guarantee is there that we will succeed?

v) How much will the ongoing costs be to the institution?

vi) By how much will the benefits offset the costs?

Of course, when concrete answers to questions such as these are not forthcoming, the consultant’s credibility can quickly be called into question. Ultimately, the consultant must help the leadership and the members of the planning group understand that the world is a “moving target.” The goal is not to find certainty in the future, but rather a method of adapting and adjusting to environmental changes in a way that will best advantage the institution. It is analogous to a group of musicians in a ‘jam session,” where they are each improvising without written music. Each musician monitors what the others are creatively doing, anticipates multiple future changes, and contemporaneously adapts accordingly. What results can easily be superior to what might have been produced with a musical score. This is actually a very good example of a complex adaptive system. They may have a general plan to play experimental jazz with an overall goal of creating a new composition, but specific outcomes are not rigidly prescribed in advance. The process will evolve based on the events that take place. This analogy can be carried forward to the planning process at a higher education institution when seen as a complex system.

Of course an institution will have hopes, aspirations, priorities, goals and a vision for its future. At the same time, it will be open to adaptation and proactive change as circumstances dictate. This flexibility is at the heart of moving a complex higher educational system around the “perfect storm” and into the calmer, but always somewhat unpredictable waters of the future.

CONCLUSIONS

“We live in an age disturbed, confused, bewildered, and afraid of its own forces, in search not merely of its road but even of its direction. There are many voices of counsel, but few voices of vision; there is much excitement and feverish activity, but little concert of thoughtful purpose” (Woodrow, 1907).

CAS theory is a rather recent approach to examining the non-linearity of social institutions and the unpredictability of the environmental milieu surrounding them. Rather than providing a plethora of new variables about institutional functioning, CAS provides an alternative way of explaining and envisioning the institution and its multifaceted interactions with the environment. As more research emerges, hopefully more insights will be gained about the factors impacting institutional effectiveness and change, and how the higher education enterprise can move toward the reduction of its tenacious and sometimes expanding disequilibrium with the environment. The process can take time, but it is a clarion call for the institution of higher education to change. As stated most eloquently by Thomas Jefferson in a letter to Samuel Kercheval:

“…Laws and institutions must go hand in hand with the progress of the human mind. As that becomes more developed, more enlightened, as new discoveries are made, new truths discovered and manners and opinions change, with the change of circumstances, institutions must advance also to keep pace with the times” (Thomas, 1816).

Higher education is confronting new times that are no longer entirely within the realm of its control. The institution of higher education needs strong, visionary leadership. We must stop perpetuating the “status quo” with a desire to resist change. We must also recognize that meaningful change for the enterprise will come from our proactive engagement in the change process. We no longer have the luxury of governments that protect us and take care of our needs. More and more, higher education is on its own, being called upon to prove its credibility, accountability and legitimacy. We need to
establish and implement our strategies for this reality, and quickly. We cannot pause to contemplate the issues; the world is not waiting for us.

REFERENCES