TRENDS SHAPING SOCIETY: IMPLICATIONS FOR HIGHER EDUCATION IN THE 21ST CENTURY

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TRENDS SHAPING SOCIETY: IMPLICATIONS FOR HIGHER EDUCATION IN THE 21ST CENTURY

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I dedicate this project to my children, Alyssa and Riley. I love both of you and I wish for you a lifetime of joy and learning.
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CONTENTS

Abstract...................................................................................................................................................... vi

CHAPTER I: INTRODUCTION ...................................................................................................................... 1

CHAPTER II: TRENDS SHAPING SOCIETY .............................................................................................. 18

CHAPTER III: DEMATERIALIZATION AND DEMONETIZATION .............................................................. 38

CHAPTER IV: CONNECTIVITY .................................................................................................................... 59

CHAPTER V: AUTOMATION ....................................................................................................................... 85

CHAPTER VI: PERSONALIZATION ............................................................................................................. 105

CHAPTER VII: CONCLUSION .................................................................................................................... 122

REFERENCES ............................................................................................................................................. 138
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The world is changing quickly and in complex ways, and this study addresses some of the key implications of these changes for higher education leaders today. Many leaders are facing the difficult task of determining which developments in the larger society are most important and what they may mean for their institutions and for higher education as a whole. This study presents a broad analysis of trends shaping society, highlights patterns within these trends that are important, and offers a framework based on these patterns that leaders might use to help them clarify and evaluate the implications of these changes. The purpose of this project is to help higher education leaders identify germane insights for understanding and planning for the future.
CHAPTER I: INTRODUCTION

Harold Shapiro, former president of the University of Michigan and Princeton University, contends that the modern higher education presidency:

involves not only the assertion of a “vision” of the contemporary academic enterprise and its legitimate social functions but also the energy to pursue this vision and the capacity to inspire others — including faculty — to support this remarkable venture despite the inevitable criticism that arises when an institution’s success often includes leaving the familiar for new territory. (Bolman & Gallos, 2011, p. 219)

This complex task of simultaneously focusing on the contemporary enterprise, while also preparing people who are often reluctant or even terrified to join in the transformative journey to a new territory, is a critical challenge facing higher education leaders in the 21st century. Part of the leadership task involves understanding and inspiring individuals; another component entails the ability to evaluate what is happening, as well as assess what is possible and what is desirable, and then conceptualizing a forward thinking vision that accurately captures that understanding. Effective leaders need to understand the contours of the rapidly transforming world and create a vision that is inspiring enough to break the inertia and counter the “inevitable criticisms” that stand between people clinging to an unsustainable status quo and embracing the changes that must be taken in order to meet the needs of a radically different future.
Problem Defined

This study focuses on the relationship between the current higher education system in the United States and the larger super-system in which it is embedded. Many of the challenges faced by higher education today derive, at least in part, from a growing disconnection between occurrences that are happening inside the system of higher education and those happening in society at large. Significant demographic, cultural, economic, and technological changes already have transformed many aspects of the larger system; yet, in many ways, these changes are not reflected within higher education itself. As postsecondary leaders survey the current situation and develop their plans for the future, they need to ensure that they are implementing strategies that are congruent with the broader trends likely to shape society as a whole. One of the key concerns facing higher education leaders today is the means by which to accomplish this most effectively. This study is an effort to address this issue.

Research Goals

The goal of this study is to provide an assessment of important trends shaping society, to evaluate the implications of these trends for higher education, and to provide a conceptual tool postsecondary leaders can apply to guide their analysis and planning processes. The purpose is to help higher education leaders with the difficult task of understanding what may happen in the future, so that they can plan accordingly.

Significance

An important debate is occurring in the United States today. This debate is about whether higher education is up to the task of meeting the great challenges of this time: the gridlocked political system; the persistent unemployment problem; the growing
divide in terms of earnings and life outcomes; the unsustainable rate of consumption of some resources; and, ultimately, our security and well being as citizens, as a nation, and as residents of this planet (Gore, 2013). Higher education leaders face the monumental challenge of leading institutions that are engaged in addressing all of these concerns, while at the same time navigating their way through the pressing and often related crises brought about by budget cuts, concerns about access, affordability, and perhaps most fundamental of all, creeping doubts about quality, accountability, and whether college is really “worth it” in the face of a range of new alternatives.

These are formidable challenges; and, in order to effectively lead their institutions forward, administrators need to understand the underlying forces at work so they can allocate their resources wisely. They need to be able to discern whether popular trends will be truly important parts of the landscape of higher education in decades to come—or whether they are simply fads. A compelling vision of the future that is ill informed and based on a misreading of these dynamics may result in squandered resources or even complete collapse. If leaders are going to get people to join them in doing the work necessary for higher education to truly lead during these challenging times, they need to have a clear, well-reasoned, and informed vision of what is likely to be needed and what role their institutions will play in helping to get there. This study is an effort to contribute to that important process by providing a new analytical tool with four lenses through which to view the sweeping changes shaping the road ahead.

Background

Leaders in postsecondary education throughout the United States, like their counterparts in other sectors and in other countries, are trying to understand current
social, political, economic, environmental, and technological trends in order to assess what they portend and position their institutions accordingly. As a result, many campus leaders are searching for analytical tools and sources of information to help them get their bearings. Industry-specific publications produced by organizations such as the Association of American Colleges and Universities, the American Council on Education, the Association for the Study of Higher Education, the Chronicle of Higher Education, and think tanks such as the New America Foundation and the Lumina Foundation are all helpful sources of information about both important trends in higher education and the forces behind them. However, the sheer volume of data and analyses resulting from these organizations presents a real challenge for postsecondary administrators, who often feel overwhelmed by the pressing issues and commitments that fill their schedules.

Even if these leaders are able to carve out the time to read through these reports and position papers, they still face the daunting task of making sense of all of this information and determining which of the many trends are most pertinent to the specific institutional context in which they operate. The dynamics shaping society are diverse and so, too, is the landscape of higher education — perhaps now more than ever. Today more than 4,490 degree-granting institutions exist in the United States (up from 3,200 in 1980), and each has its own unique set of circumstances, mission, and leadership challenges (National Center for Education Statistics, 2014). One thing that nearly all have in common, however, is a sense that economic considerations are looming larger in their thinking and that many current budget trends are unsustainable. For example, in a recent survey of 842 Chief Academic Officers, over half strongly agreed that financial concerns are prevalent in their institution’s discussion about a wide array of issues,
including the development of new academic programs (Inside Higher Education, Survey of CAOs, 2014).

Some observers have argued that the challenges facing higher education today may even be existential in nature — at least for some types of institutions, programs of study, and academic workers, such as tenured professors (Arum & Roksa, 2011; Hersh & Merrow, 2005; Mehaffy, 2012; Nussbaum, 2010). Eva Bogaty, Assistant Vice President at Moody’s Financial Services (the largest credit rating company in the United States), said in a recent report, that “the US higher education sector has hit a critical juncture in the evolution of its business model," and that “even market-leading universities with diversified revenue streams are facing diminished prospects for revenue growth” (Bogaty, 2013). In fact, over the last five years, one third of all U.S. universities and colleges have had their credit rating lowered or are on watch lists to do so (Selingo, 2013a). Therefore, a principal challenge facing higher education leaders today is to create strategic plans and revenue models that position their organizations, not just to survive in the short term, but for sustained success over the long haul. To do so, they must create strategies congruent with larger forces that are shaping society as a whole.

Interestingly, despite the vast differences between the circumstances of the nearly 4,500 institutions that make up the landscape of higher education in the United States, many colleges and universities seem to be responding to present challenges in remarkably similar ways. For example, in the face of declining state appropriations, many public higher education institutions across the country are increasing their tuition rates and fees, attempting to grow their enrollments (especially of the more lucrative
international and out-of-state students), emphasizing externally-funded research agendas, taking on more bonded debt, and devoting enormous efforts to cultivate private donors by expanding their development staff (State Higher Education Officers Association Annual Report, 2014).

These responses make sense and may even be prudent in the short term or at the level of the individual institution. However, as with investment banks during the early 2000s, having large numbers of institutions employ the same strategy at the same time can be catastrophic. In the case of the banks, it began when nearly all of the large players decided to pursue new revenue by extending credit more loosely and bundling and selling the sub-prime mortgages that these policies produced. To spread their risk, they began issuing derivatives and swapping credit default insurance based on these sub-prime mortgages. The problem, of course, was that they were all basing their investment and their risk mitigation plans on the same underlying strategy. Ultimately, this entire system was unsustainable and collapsed, leading to widespread bankruptcies and a global recession (Zolli, 2012). The fates of these large multinational and well-financed operations were in the hands of well-educated leaders who, despite their cleverness and their efforts to shield themselves from risk, did not understand the big picture adequately enough to anticipate the danger. Or, perhaps, they were unwilling or unable to see the reality of their situation. As the statistician Nate Silver quips, “The most calamitous failures of prediction usually have a lot in common. We focus on those signals that tell a story about the world as we would like it to be, not how it really is” (Silver, 2012, p. 20).

The recession that began in 2008 holds several important insights for higher education that extend beyond its impact on the stock market and the economy. Clearly,
the recession affected endowments (for those institutions lucky enough to have them),
retirement systems, state budgets, federal monies available to support research and
student aid, the balance sheets of potential donors, and the job market for graduates.

Obvious lessons can be learned about too much reliance on any one of these areas since
the recession revealed the interdependencies between these different factors. Yet, this
insight about interconnectivity also reveals a larger lesson for higher education leaders if
they apply it by thinking about their institutions, not in isolation, but as a part of a larger
system. The concern has to do with an economic phenomenon called the *fallacy of
composition* (Wetzstein, 2013). This term refers to a condition whereby behavior that
might be good for the individual or a single family (e.g., saving rather than spending or
moving from urban to suburban neighborhoods) is disastrous if everyone does it at the
same time.

Just such a scenario may be unfolding in American higher education right now (a
tuition and bonded debt bubble?). All public higher education institutions, or even a
majority of them, cannot employ the same budgeting and fundraising strategies at the
same time and be successful over the long haul. There are simply not enough students
who can pay ever-increasing amounts of tuition, well-heeled alumni, and season ticket-
holding or (better), skybox-buying football fans to continue down the path of relying on
growth in these areas to sustain the status quo. Something will have to change. The
important questions are these: What needs change? How will these changes be
implemented? When do we begin? Many higher education leaders today are looking for
new insights and new models to help guide their responses to these questions.
Going back to the observation by Silver (2012): leaders need to ensure that they are seeing the world and the trends around them as they are and not as they would like them to be. They need to really understand the dynamics at work and to think about the kinds of changes these trends truly herald. Leaders need to make certain that they are not too reliant on the same relatively small number of journals, published by education-specific policy organizations, with a limited geographical (or political, social) focus, or the advice of a common cadre of consultants who all come from within higher education. If they are going to be able to view the world around them in varied, novel, and potentially helpful ways, a diversity of perspectives is critical; yet, such views are not necessarily easy to find or incorporate.

Unfortunately, other forces are at work that may exacerbate these leaders’ tendency toward myopia. Narrow perspectives are not solely a function of limited scope or biased information; they also are the result of common and powerful cognitive biases that affect everyone. For example, the very heuristics that can help individuals think quickly may also lead them to fall victim to the kinds of anchoring and confirmation biases that cause them to see only that which supports the current understanding or beliefs about the world. Combine these biases with a tendency to join in with processes set in motion by others —the bandwagon effect — and a formula is created for a potentially dangerous level of narrowly informed “group think” (Kahneman, 2011).

Evidence exists that this may indeed be happening in higher education. Take the case of the way in which technology is being discussed on many campuses. Most leaders recognize that technological changes are an important trend to watch. Not surprisingly, many institutions are looking to innovate their way to a sustainable future by embracing
an array of new technologies and technical approaches to content delivery in the hope that these will make education more efficient, drive down costs, and even provide new revenue streams. However, here too, a great deal of mimicry is seen. Distance learning, flipped classrooms, Massive Open Online Courses (MOOCs), and other technology-based learning platforms or initiatives are being implemented by a wide range of institutions with the intent of getting in on these well publicized trends to seize the high ground in the battle to control whatever revenue may eventually flow from these experiments (Bowen, 2013). When surveyed, many Chief Academic Officers have relatively little understanding of these technologies or pedagogies, and many even harbor real concerns about them, but they don’t want to be left out should this prove to be more than just a peripheral movement (Inside Higher Education, 2014).

Herein lies the problem. It is hard to know whether MOOCs, for instance, are a passing fad or a glimpse into the future of higher education— and the stakes are high. One of the founders of the MOOC movement, former Stanford professor Sebastian Thrun recently opined that, “In 50 years there will only be 10 institutions delivering higher education” (as cited in Watters, 2013a, p. 2). This is the type of statement that is likely to get some postsecondary leaders’ attention and makes them think twice about ignoring the MOOC phenomenon entirely.

Of course, no one can know for certain where all of this is headed and how impactful these technological innovations might be in the long run. Perhaps the best one can do is to think about these trends in a more holistic way. As previously noted, many CAOs indicate that financial considerations drive much of their thinking about new programs. Many of the technology-based initiatives that are widely discussed in higher
education literature today, such as MOOCs, are a direct response to market forces — in this case, to the online institutions that have emerged on the scene over the last decade (Bowen, 2013). Bricks and mortar institutions now view themselves as latecomers to the education technology party and, in many cases, they feel compelled to jump in with both feet.

This phenomenon extends well beyond MOOCs. For-profit universities, offering primarily online degrees, have positioned themselves to compete with traditional institutions by providing fully accredited degrees in a wide array of disciplines and at a significantly lower cost — to them, though not necessarily to their students (Lynch, Engle, & Cruz, 2010). In addition, a range of private startups and not-for-profit postsecondary initiatives are now in existence, many with significant venture capital behind them, and they entering into this market (Watters, 2013b). All of this might compel some leaders to get on the bandwagon before all the good seats fill up. This poses a real conundrum for traditional higher education institutions: Do they go “all in” on doing what has worked up until now (going into debt building classrooms, recreational facilities, athletic programs, and other amenities to lure students and then counting on increased tuition and fees), or do they try to add technology and replicate their online competitors? Or does the magic formula lie somewhere in between as can be seen with many successful businesses in the retail sector?

It is logical that technology should be central in the thinking of higher education leaders both as a challenge and as a solution, as technology is one of the key drivers of change. (It always has been, but as will be seen in the chapters that follow, with the onset of the digital age, many technologies are accelerating at an exponential rate.)
Confusion exists regarding whether technology is best viewed as an end or a means. MOOCs, for instance, are perceived as a challenge to traditional education, in that they offer an immersive technical experience (an end), while also serving as a means to reach a much broader audience at a very low cost. So how should postsecondary leaders assess and understand this development? The best way may be to broaden the perspective and to look at the changing landscape from which this innovation emerged. What makes MOOCs so appealing? What may make them ineffective or less of a threat to traditional modes of instruction and learning? These answers are hard to ferret out without understanding how this movement reflects a range of other changes that are occurring at the same time, such as increased population mobility, improvements in connectivity, and growing expectations for personalization in many areas of life. The ultimate staying power of these types of innovations will largely depend on the extent to which they are congruent with broader developments that will likely shape the future, not only of higher education, but of society at large.

The essential leadership task, then, is to contextualize these developments. The best way to do so is to develop a macro scale understanding of the wide range of forces that are likely to play a role in creating the context in which more obvious changes are occurring, such as the growth of online learning, for-profit educational institutions, and reductions in public funding. How can educational leaders develop this understanding of what is likely to have staying power and what will prove to be more transient? The simplest answer is that they need to ensure that they are responding to significant and long-lasting changes — trends that are likely to be sustained and impactful — as opposed to superficial developments or fads. To do this, they need an accurate
understanding of the big picture and how it will impact their work over the next several decades.

The key insight is that higher education is a complex system embedded within an even more complex super-system – society at large (Wiley & Hilton, 2009). Therefore, the changes that are occurring within this larger system will shape, not only the context within which higher education institutions operate, but also the outcomes for which they strive. The extent to which changes in higher education are aligned with the transformations that are occurring in this larger system may be a good indicator of how likely these innovations are to succeed.

**Methodology**

The methodology utilized in this research is a qualitative approach referred to as content analysis. For the purposes of this study, this is defined as “a research method for the subjective interpretation of the content of text data through the systematic classification process of coding and identifying themes or patterns” (Hsieh & Shannon, 2005, p. 1278). The subjectivity of this type of research stems in part from the fact that “the qualitative researcher is the primary instrument for data collection and analysis” (Creswell, 1994, p. 145). In this investigation, data were analyzed using two distinct forms of content analysis. The initial process involved applying the method of directed content analysis. The goal of this directed approach is to “extend conceptually a theoretical framework or theory” (Hsieh & Shannon, 2005, p. 1281). This line of inquiry is premised on the notion that “[e]xisting theory . . . can provide predictions about the variables of interest or about the relationships among variables” (Hsieh & Shannon, 2005, p. 1281) that are relevant for the study of a particular phenomenon. The
phenomenon being examined in this case is society at large and the changes that are occurring within it.

The first step in this process was to select an existing theoretical framework that could be used to identify key trends shaping society. Rather than selecting a model developed specifically to consider changes widely viewed as being relevant to higher education, this study utilized a framework designed to highlight topics and trends that are shaping society as a whole. Because this research focuses on identifying trends that are shaping the super-system within which higher education is embedded, the goal was to select a model that explores as wide a range of topics as possible. A well-established theoretical framework was selected that allows for both a breadth of analysis and a synthesis of a diverse set of data.

This theoretical model, *The Seven Revolutions*, has been used by leaders in many different sectors of society to analyze current trends and make projections about the future. The model was first developed in 2005 by Erik Peterson, when he served as director of the Global Strategy Institute (GSI) at the Center for Strategic and International Studies (CSIS), a non-partisan think tank located in Washington DC (CSIS.org). GSI, the “think tank’s think tank” (CSIS.org) was tasked with organizing and synthesizing the work of the 220 full-time CSIS analysts on staff. In studying the themes that connected their work as a whole, Peterson created an inclusive framework to identify and analyze significant challenges for policymakers and leaders out to the year 2025. He called his project *The Seven Revolutions*, because he identified seven key areas in which he believed “revolutionary” changes were occurring. These seven areas are: (1) demography, (2) resource management, (3) technological innovation, (4) the digitization
and diffusion of information and knowledge, (5) economic integration, (6) the nature and mode of conflict and security considerations, and (7) the challenges of governance (Elliott-Gower, Falk, & Shapiro, 2012). This model has proved to be very useful for developing a comprehensive understanding of the dynamics driving many of the changes occurring on both local and global scales.

The next step was to use the Seven Revolutions Model to identify the variables of interest, or key trends that are likely to shape society over the next several decades. This involved conducting basic research into each of the trends identified and producing up-to-date information about the key drivers transforming society as a whole. After information regarding each trend was gathered, these data were evaluated to identify themes or patterns within them. The goal of this step was to determine whether there were identifiable patterns within the data produced by this model that might be a useful focus for higher education leaders as they consider what is occurring both inside and outside higher education.

This inductive step in the process involved using a second variant of content analysis. While the first phase of the research was deductive in nature — applying an existing theoretical model — the second phase involved using a process that “is inductive in that the researcher builds abstractions, concepts, hypotheses, and theories from details” (Cresswell, 1994, p. 145). This inductive analysis identified four broad patterns or themes within the Seven Revolutions data: dematerialization and demonetization, connectivity, automation, and personalization. Each of these patterns was identified through a process of coding and classifying the data gathered in phase one. Not every piece of data gathered and examined in the first phase fell neatly into one
of the four meta-categories that were identified in phase two. However, the four broad patterns encapsulate enough of these data to serve as a useful re-conceptualization, capturing the breadth of the original model while also providing a simpler and more process-oriented analytical framework to understand how society is changing and what these changes might portend for higher education.

Thus a new analytical framework is proposed. This framework is called DeCAP, which serves as both an acronym and a mnemonic device (dematerialization and demonetization = De, connectivity = C, automation = A, and personalization = P). The DeCAP framework emerged organically from the inductive phase of the research and is posited as a useful way in which to explore some of the deeper patterns that exist within the data derived from the Seven Revolutions Model.

The final phase of this project is a systematic application of the DeCAP framework to identify some of the ways in which society is changing and to assess the implications of these changes for higher education. Specific examples of changes that illustrate each of the four patterns identified in the framework are presented and analyzed within separate chapters devoted to each of the meta-trends. Since the Seven Revolutions Model, and by extension the DeCAP framework, was not designed to look only at areas that are of a priori relevance to higher education, this research involved exploring literature and data about a range of technologies and developments that are not currently prominent in higher education literature.

Limitations

Some important limitations exist in this study. First, despite the global orientation of the Seven Revolutions Model, this application of the model focuses primarily on the
implications of these trends for higher education in the United States. Second, the scope of this study is confined to considering the future of only undergraduate education and the institutions that provide it. The special circumstances of graduate and professional programs and institutions are not addressed. In addition, the trends identified in this study and presented as the DeCAP framework may not apply to all educational settings equally. There are 2,774 institutions in the United States that currently grant four-year undergraduate degrees, and no two are exactly alike (National Center for Education Statistics, 2014). The focus of this research is on the broad trends that are affecting undergraduate-level higher education as a system. Therefore, the analyses provided may not be generalizable to all settings, at least not in the same way. Each leader will need to determine how the framework can be used most effectively to shed light on the circumstances and challenges that are unique to his or her own institutional setting.

Despite these limitations, leaders of many organizations (educational and others) may benefit from pondering whether their current understandings, policies, and practices are congruent with the trends identified in the DeCAP framework. This new set of lenses is proffered as an adaptable and broad ranging tool that can be used to help chart an informed path forward for any leader hoping to better understand the forces shaping the territory ahead.

**Project Overview**

The second chapter of this study begins with a presentation of the Seven Revolutions Model and explores data related to each of the trends in the model. This material provides an overview of the categories included in the model and helps to introduce a basic understanding of the nature, scale, and pace of the changes highlighted
by the model. This chapter introduces the *variables of interest* and provides a brief analysis of their applicability for higher education leaders. At the end of the chapter, the results of the inductive analysis are presented and the DeCAP framework is introduced and explained. Following this analysis, separate chapters are devoted to a detailed exploration of each of the four meta-trends identified in the DeCAP framework. The purpose of these in-depth analyses is to systematically apply the framework and to demonstrate how it can be used to illuminate new perspectives on current trends and to identify questions for leaders to consider as they explore the implications of these changes. The final chapter synthesizes these analyses and considers some deeper philosophical questions for higher education leaders to ponder in light of the changes described, including the purpose of higher education in a society that is being radically transformed.
CHAPTER II: TRENDS SHAPING SOCIETY

The 20th century witnessed incredible technological developments, social and cultural transformations, unprecedented population growth, and far-reaching changes in the material lives of people living in many areas of the planet. The century began with the horse and buggy and ended with intercontinental flight and manned space exploration.

In the United States, the higher education system both reflected and propelled many of these changes. The system itself was transformed by huge increases in the student population, first in the late 1940s with more than two million World War II veterans using their benefits under the Servicemen’s Readjustment Act (“the G. I. Bill”) to attend colleges or universities – and millions more attending trade schools – then, in the late 1960s, enrollments skyrocketed yet again when the first wave of the Baby Boom generation started to come of age. Higher education also was altered during this period by the influx of enormous quantities of government-backed research funding designed to stimulate scientific and technological advances (Lucas, 2006).

The connection between higher education and desirable employment was well established and well publicized, and undergraduate enrollments at American universities and colleges continued to expand by nearly 50% between 1970 and 1983 (National Center for Education Statistics, 2014). Flush with federal money, strong public support, and ever-increasing enrollments, many campuses expanded their faculties and their physical structures to keep up with demand (Graham & Diamond, 1997).

The landscape of higher education today is different. Many four-year institutions are seeing declines in both their funding and their enrollments, and potential students are
now beginning to question the return on investment of a college degree as they look at increasing tuition costs, rising levels of student loan debt, and the poor job market for many recent college graduates. In response to these changes, some institutions are evaluating the prospect of cutting their faculties and halting new construction (Kiley, 2012). To understand the reason that this is happening, it is important to analyze, not just what is going on inside the higher education system, but in the broader society as well.

The 20th century demonstrated that events and technologies as disparate as the Civil Rights Movement, the Cold War, the birth control pill, and the personal computer can radically transform the higher education system (Lucas, 2006). These developments may not have appeared to be important to higher education leaders as they were occurring, but in hindsight their impact was profound. So what current changes might herald similarly significant transformations in the higher education system of this century?

To help answer that question, this chapter briefly examines a broad array of changes occurring in contemporary society. The chapter is organized around the Seven Revolutions Model developed in 2005 by analysts at the Center for Strategic and International Studies in Washington, DC (csis.org). Since it was first developed at CSIS, the Seven Revolutions Model has been used all over the world by hundreds of organizations representing many different sectors of society as a means to explore the implications of change and create effective long-term strategic plans. Erik Peterson, the original architect of the Seven Revolutions Model, now uses it in his capacity as Director of A.T. Kearney’s Global Business Policy Council, “a strategic advisory service specifically designed for the world’s top CEOs and business-minded thought leaders”
Organizations in the United States that have used this model to evaluate the implications of change include the following: The Army Medical Strategic Leadership Program, Coast Guard, Department of Agriculture, Department of Defense, Department of Energy, Department of State, Internal Revenue Service, Joint Chiefs of Staff, National Defense University, Walmart, Boeing, General Electric, ExxonMobil, Johnson & Johnson, and the Western Governors Association, among many others (csis.org). As this model has not yet been rigorously applied to the education sector, by doing so, it may be possible to gain some fresh insights and clarify key shifts or inflection points of interest to higher education leaders seeking a clearer sense of context as they develop their institutions’ strategic plans.

The seven trends represented in the model are: (1) demography, (2) resource management, (3) technological innovation, (4) the digitization and diffusion of information and knowledge, (5) economic integration, (6) the nature and mode of conflict and security considerations, and (7) the challenges of governance (Elliott-Gower et al., 2012). Each of the trends represents an area in which significant changes are occurring in the present. These trends are referred to as revolutions in this model because they have the potential to catalyze significant changes in society in the years ahead. It is their revolutionary potential that makes them important to understand, and it is for this reason that they are all presented here, even though it may not be immediately apparent that all seven have a direct bearing on higher education.

As the United States’ higher education system is embedded in a larger super-system, understanding changes that are underway in this larger system may shed light on important topics or trends that are significant for higher education leaders to consider,
but are not currently on their radar. The chapter ends with a discussion of some patterns in these data and describes how these patterns highlight a broad set of changes that may have important implications for higher education. A new analytical framework based on these patterns is then presented.

**Revolution One: Demography**

The first demographic trend is the overall growth of the world’s population. According to the United Nations’ Population Division, approximately 360,000 babies are born and 151,000 people die every day, worldwide (un.org). The estimated worldwide annual birthrate, mortality rate, and growth rate are 1.89%, 0.79%, and 1.096%, respectively (cia.gov). This pace of growth is significant, not only because of what it portends for the future, but also how it differs from the growth rates of the past. According to estimates from the U.N. Population Division, when Christopher Columbus first sailed west from Europe in 1492, the planet was home to approximately 500 million people. The world crossed the 1 billion mark around 1800; it took another 145 years to reach 2 billion at the end of World War II (Livi-Bacci, 2012). However, the pace of growth has now accelerated to the point that the last billion people were added to the population in only 12 years; today more than 7 billion people are on the planet (un.org). Demographers at the United Nations predict that this number is likely to rise to somewhere between 9 and 10 billion by the year 2050 (un.org). The rapid growth that characterized the last few decades is predicted to slow somewhat as fertility rates fall worldwide. If this occurs, overall population growth will continue to slow in the latter half of this century and plateau somewhere in the range of 10.5 billion by the year 2070 (un.org).
An important characteristic is present in the overall pattern of this growth. Over 80% of the projected growth in the world’s population will occur in those countries least capable of supporting it — politically, economically, and environmentally. According to U.N. predictions, between 2014 and 2050 nine countries will be responsible for nearly half of the world’s population growth. Only one of these countries, the U.S., is in the so-called most developed world (un.org). Overall, the population growth rate is projected to be around 1.1% annually during this period; but the developed world is expected to grow at a rate of only .4% annually, while the developing world is expected to grow at a rate of 1.4% annually (un.org).

Global aging also is an important demographic trend to observe. Most of the developed world will not experience a net growth in population; rather, the 50 wealthiest and most developed countries are expected to experience either static or negative population growth over the next two decades. The consequence will be a significant aging of these populations. For example, by 2030 one in four western Europeans will likely be over the age of 65. This stands in sharp contrast to sub-Saharan Africa, where it is projected that people over age 65 will account for less than 4% of the population by 2030 (Jackson & Howe, 2013).

A third demographic trend is urbanization. The growth of the city is a major development of the last 100 years. In 2009, for the first time, more than half of the world’s population lived in urban areas — some 3.4 billion people (Livi-Bacci, 2012). By 2050 that number is expected to rise to more than 70% of the world’s population, and approximately 6 billion people will live in cities of one million or more (who.int).

According to the U.N. Environmental Program, by 2030 nearly 75% of the world’s
population will live within 50 miles of a coastline, many of them in the projected 28 mega-cities of more than 20 million, making them vulnerable to sea-born natural disasters such as hurricanes, tsunamis, and rising ocean levels (unep.org).

Another important trend is migration, both within countries and internationally. According to the Pew Research Center, some 232 million people are currently living outside of their country of birth, up from 154 million in 1990 (as cited in Connor, Cohn, & Gonzalez-Barrera, 2013). The faster population growth rates in developing countries, and the flat or declining rates of growth in most of the developed world, likely will lead to increased levels of migration due to the incumbent benefits and challenges of relocating. The main exporters of migrants will be China, Mexico, India, Philippines, Indonesia, and Pakistan, while the U.S., Canada, Germany, UK, Spain, and Australia are expected to be the leading destinations of these immigrants (un.org).

Inside the United States, due to a combination of immigration and higher than average fertility rates, the fastest growing ethnic group likely will continue to be Hispanics. Between 2000 and 2011, the United States saw an overall increase in its population of approximately 30 million people to a total of 311,592,919 in 2011 (census.gov). Of this 30 million increase, 55.4% of the growth is attributable to Hispanics. In contrast, during this same period the non-Hispanic White population grew by 8.5%, Blacks by 14.9%, and Asians by 15.8% (pewhispanic.org). If these trends persist, this will mean a significantly changed ethnic and racial profile of the United States by mid-century.

The final demographic trend worth noting is change related to gender. Many work settings continue to be dominated by men, and the wage gap between men and
women still persists (Bureau of Labor Statistics Report, 2012). However, the workforce is often a trailing indicator of larger social transformations, and significant changes are beginning to be seen in education. Higher education began a shift 20 years ago that is now well known — more women than men are earning virtually all types of college degrees in the United States (Rosin, 2012). This is true of undergraduate as well as graduate and professional degrees, and the gap is increasing. According to the United States Census Bureau (census.gov), 36% of American women, age 25-29, have earned a bachelor’s degree, whereas only 28% of men in the same age group have accomplished this feat (census.gov).

Interestingly, gender ratios also are changing in society as a whole. According to the U.N. Population Division, China now has 107.4 men for every 100 women. Conversely, the United States has 96.7 men for every 100 women. These ratios are consistent with trends that can be seen across the world – in the more developed countries the ratios average 94.3 men to every 100 women, while in less developed countries the average is 103.3 men to every 100 women (un.org).

All of these demographic changes will play some role in shaping the landscape of higher education in the future. The trends may change, but for now several things appear likely: (1) individuals will live longer, and as a consequence, “non-traditional” learners will be seeking postsecondary education in ever-larger numbers; (2) the percentage of Americans who classify themselves as non-Hispanic Whites will continue to decline relative to other groups, and more Hispanics and foreign-born students will enter higher education than ever before; (3) the educational divide between men and women will
continue to grow; and (4) more people will live in cities, and the cities will be larger and more diverse than ever.

**Revolution Two: Resource Management**

The first resource identified in the Seven Revolutions model is food. There are currently 800-900 million chronically malnourished people on the planet, and that number is predicted to rise (oxfam.org). The rate of food production has grown faster than the population, but there is reason to believe that these increases in productivity are not sustainable indefinitely. Poor land management practices, increased reliance on chemical fertilizers, mono-cropping, and the resulting reduction in biodiversity are all undermining the long-term sustainability of the current food production system (Tscharntke et al., 2012). The cost of food also is increasing due to higher demand for meat, staple crops such as corn (going into biofuels), rising energy costs, and shortages of arable land with adequate access to reliable supplies of water (Timilsina, Beghin, Van der Mensbrugghe, & Mevel, 2012).

The second resource addressed in the model is water. Many analysts believe that water will be the next great strategic resource. Only 3% of the water on earth is fresh, by 2030, 3.5 billion people will face severe water shortages if new sources of potable water are not identified and made available (McKinsey, 2012). The same report indicates that, by 2030, the global water demand is expected to exceed the supply by 40%. Climactic changes also may affect water supplies in many areas (McKinsey, 2012). For example, more than 70% of the land area in the U.S. underwent drought conditions during the summer of 2012, and many regions are still feeling the effects (Wang, Schubert, Koster, Ham, & Suarez, 2014). The winter of 2013-2014 was the driest on record in western
states like California and Arizona, and agricultural yields are expected to be sharply lower as a result (Almaguer & Arkin, 2014).

The third resource in the model is energy. Despite the growth in a range of alternative energy sources, most analysts predict that society will still be heavily reliant on fossil fuels in 2030. In fact, some models predict that the trend is toward even more reliance on hydrocarbon fuels in the future than in the present (Ladisaw, 2013). According to this assessment, as a percentage of production, OPEC countries will increase their “market share” of total output by 2030 to more than 50% of the world production of oil. The explosion of demand in countries like China and India will stimulate this production (Bardhan, 2012). The number of cars on the road in China has increased five fold in the last 10 years and passed 250 million in 2013 — there were fewer than 15 million in 1999. Analysts estimate that car ownership in China will increase to more 500 million by 2050 (World Economic Forum, 2013). Automobile ownership in India is predicted to grow even faster to more than 600 million by mid-century (Bardhan, 2012). Today, the U.S. has a fleet of approximately 200 million vehicles and uses approximately 11% of the world’s daily output of oil (Ladislaw, 2013). This number has remained relatively flat over the last five years, with some indicators that younger Americans are less likely to drive than older generations. For example, in 2012 9.2% of U.S. households were without a motor vehicle, compared to 8.7% in 2007. This decline is in part due to increased urbanization during this period; from 2007 to 2012, an increase was seen in the proportion of households without a vehicle in 21 of the 30 largest cities in the United States (Healey, 2014).
As a percentage of use, oil consumption is expected to decrease, but most analysts see the “real” volume of consumption rising in the U.S. during this period. The same is likely true with coal consumption. Today, U.S. citizens use an average of 20 pounds of coal/person/day (or 7,300 lbs/person/year). China is expected to triple its coal-fired electricity production; if this occurs, this one country will account for more than half of the world’s growth in coal-fired electricity generation growth over the next 20 years (eia.gov). The average American home now has 26 plug-in devices, and the rest of the world is gaining quickly (Ladislaw, 2013).

**Revolution Three: Technology**

One of the key technologies driving change in the 21st century is the computer. Both the speed and the ubiquity of computation are accelerating at an exponential rate (Kurzweil, 2005). *Moore’s Law*, named after Intel co-founder Gordon Moore, states that the number of transistors on a silicon chip double every 18 months or so (meaning that computer speeds double). This kind of exponential growth rate has held steady since the 1960s (Kurzweil, 2012). Consistent with Moore’s Law, computers are becoming staggeringly fast. For example, in July 2008 IBM’s Roadrunner computer achieved computational capacities of over 1 petaflop/second (or one quadrillion calculations per second) for the first time. In late 2013 China’s Tianhe-2 computer demonstrated computational speeds in excess of 33.86 petaflop/second (http://www.top500.org/).

These types of supercomputers are the tools that will be used for modeling all kinds of complex systems — from the weather to the human brain. These machines also are critical for the kind of computation associated with the deep data mining necessary for sorting and analyzing the enormous quantities of information gathered for national
security purposes, and even for modern marketing techniques. These computers hold
great promise for a variety of applications that will enhance transportation technologies
and systems, communication, weather prediction, and all types of basic research that
involves analyzing large data sets. Data mining capacities are expected to grow
significantly as a result (Mayer-Schonberger & Cukier, 2013).

Wide arrays of high tech products are now commonplace, including
communication devices, on-board navigation systems, GPS watches, and computer-
assisted home appliances. There are nearly four times as many cell phones in use in
China today (approximately 1.2 billion) than there are people in the United States (314
million); approximately 50% of the world’s population now has access to a cell phone,
as compared with only 2 billion just two years ago (Informa Telecoms & Media, 2013).

Some are calling the 21st century the biocentury due to the incredible
breakthroughs that have occurred in the biological sciences and are predicted over the
next decades (Smith et al., 2011). The completion of the Human Genome Project in
2003, mapping the 30,000 genes and sequencing the 3 billion chemical base pairs that
make up the human genome, opened up a wide number of doors for current researchers
(genome.gov). Today, work on chromosomal structures, gene regulation, and protein
synthesis is well underway, with the promise of enormous breakthroughs in diagnosing
and treating a wide variety of diseases (Guttmacher, McGuire, Ponder, & Stefánsson,
2010). Genetically engineered food also is increasingly common and important.
Approximately 60% of the food on the shelves in American supermarkets has at least
one ingredient that has been genetically engineered — the most common being the
byproducts of corn, soybeans, canola and cotton (Pollan, 2009). Currently, no
genetically modified animals are approved for consumption in the United States (usda.gov).

Nanotechnology is another powerful area of technological advancement. Scientists already have created a wide assortment of micro-miniature devices, including micro-mechanical machines (MEMs) that are smaller than dust mites and made up of microscopic gears, chains, and computer chips. These devices are being deployed in medicine, agriculture, manufacturing, and warfare (Drexler, 2013). Within the next 15 years, National Science Federation analysts believe that there will be more than two million nanotechnology workers in the world, with more than one trillion dollars in annual investments (Roco, 2011). By 2030 these devices will have moved from the microscopic to the molecular and even atomic levels (Drexler, 2013). Promising nanoscale research currently is underway, which may contribute to achieving the National Cancer Institute’s stated goal of eliminating suffering and death from cancer within a decade (Farrell, Ptak, Panaro, & Grodzinski, 2011).

Revolution Four: Information

The fourth overall revolutionary trend is in the development, dissemination, and proliferation of information. As far back as 1996, Nicolas Negropante, the founder of Massachusetts Institute of Technology’s Media Lab, observed that every issue of the Wall Street Journal ever published can now be passed down a fiber smaller than a single human hair in less than a second (Negropante, 1996). According to a study by the Internet organization Word Press, roughly 150 million blogs are on the Internet and two new blogs are created every second (Gaille, 2013). More than 50% percent of Americans get their news from the Internet rather than any print news sources (Pew, 2012). With
decentralization and a proliferation of media options from which to choose for accessing information, the traditional media sources are under pressure to adapt.

Internet connectivity is spreading rapidly. Nearly 100% of American schools are now connected to the Internet, and more than 97% have high-speed Internet access. More than 90% of American institutions of higher education have some form of distance learning available for their students (National Center for Education Statistics, 2014). Connectivity also is spreading abroad; and with the MIT One Laptop per Child (OLPC) program, consumers who choose to participate can buy one laptop, and for $200 send another laptop to a child in a developing country. This increased access, combined with a movement toward more open source information production (e.g., Wikipedia), has furthered the development of information available to the average consumer (Bowen, 2013).

Advances in artificial intelligence and robotics are transforming many work settings, and the efficiencies and accuracy of these sophisticated systems make it likely that they will continue to grow in importance (Kurzweil, 2012). This knowledge-based economy requires more constant training than older economic systems, and predictions are that knowledge workers will experience at least six significant changes in their work life over the course of their career (Lund, Manyika, & Ramaswamy, 2012).

**Revolution Five: Economic Integration**

Global economic integration is predicted to continue through the year 2030 (Friedman, 2005). The integration of developing and developed economies through international markets has driven down commodity prices worldwide and increased the Gross Domestic Product (GDP) of many countries. It also has led to the creation of a
series of trade blocks such as the North American Free Trade Area, the European Union, and the Eurasian Economic Community, among others. The Southern African Development Community plans to emulate the European Union and develop a common currency by 2016 (Kaminska & Visser, 2011).

The BRICS countries (Brazil, Russia, India, China, and South Africa) will increasingly define the world’s new economies. Analysts at Goldman Sachs estimate that these countries will actually surpass the combined economies of the G6 countries (U.S., Japan, France, Great Britain, Germany, Italy) by 2040 (Elliott-Gower et al., 2012). The massive populations of the BRICS will likely equal 40% of the total world population by 2030. The growth of their populations will mean that, despite their overall growth in GDP, they may not experience rising per capita incomes (Nelson, Maniam, & Leavell, 2013). This leads to a related prediction: income inequality will grow significantly in the future. Today, approximately 2.8 billion people live on less than $2/day. More than 1 billion live on less than $1/day. The prices of basic commodities fluctuate due to market forces that operate well outside of local control; thus the poorest in the world are and will remain extremely vulnerable (un.org).

Disparities in wealth also are widening. For instance, according to the U.N. Development Program, the accumulated wealth of the richest 225 people in the world is equivalent to the combined wealth of the poorest 2.7 billion people. The same report indicates that the richest 2% own more than half of the world’s wealth. The wealthiest 15% of the world’s population consume more than 56% of the world’s goods and services. The poorest 40% consume less that 11% of the total (undp.org).
Most predictions indicate that conflicts of the 21st century will be *asymmetrical* in nature (Singer, 2009). Non-state actors and transnational criminal syndicates, employing unconventional tactics, will be the most prevalent sources of conflict. Terrorist attacks using a range of technologies (from very crude to highly sophisticated) are likely to play an expanding role in the future. Great concern abounds regarding the proliferation of information and materials that might be used to produce chemical, biological, and nuclear agents. Controlling access to these materials will be one of the key security challenges of the 21st century. These challenges are even more daunting with widespread access to information on the Internet, digital currencies that can be used to transfer large sums of money that are hard to trace, and the growth of high density cities as potential high value targets (Kay, 2011).

Another source of vulnerability lies in the use of computers to attack systems that either control important facilities or store valuable data. Among the possible targets are water treatment plants; health facilities; food processing centers; transportation systems (e.g., trains or airlines); energy facilities (e.g., power plants, nuclear facilities); or military facilities or equipment. As more of these systems are networked together, they become susceptible targets of *cyber-warfare*. Systems that are fully automated, such as drones, may be particularly vulnerable to these types of computer attacks (Singer, 2009).

Information security is a growing concern. As more information is digitized and stored on computers, these databases are subject to attack. The targets might be financial records, proprietary commercial data, or simply personal information that can be used to create false accounts (Menn, 2010). Preventing these attacks, whether from organized
crime, nation-states, or ideologically oriented groups or individuals, will be an important goal in the future.

In terms of conventional wars, much has changed in the last century. For example, in WWI, only 5% of the casualties were civilians. In the 21st century, more than 75% of those killed or wounded in armed conflict were civilians. On a more positive note, since 1990 negotiations have produced settlements in 59 conflicts worldwide. Military victories have ended only 27 conflicts in the same period (un.org). This is the first time in history where more conflicts have ended through negotiation than through violence. However, there still is reason to be concerned, as 22 of the world’s poorest 34 countries are engaged in or have recently emerged from armed conflicts (un.org). The UN survey on Food and Agriculture concluded that armed conflicts are the single largest cause of world hunger; conflict was the primary cause of 35% of the food crises between 1993 and 2003 (un.org).

**Revolution Seven: Governance**

National and international governmental organizations are no longer the most powerful actors orchestrating international efforts to achieve economic coordination, social cohesion, and political order. The private sector and Non-Governmental Organizations (NGOs) are playing an increasingly important role in these efforts on the international stage. In fact, 52 of the largest 100 economic entities in the world are now corporations, not countries. Walmart’s revenue is roughly equivalent to Norway’s GDP, making it the 25th largest GDP in the world (Roberts & Berg, 2012).

In 2013, there were more than 60,000 registered international NGOs operating in the world. There are many more than this operating within individual countries; for
instance, there are more that 1.5 million operating in the United States. The largest of these organizations operate on a scale that rivals national governments and they play a significant and growing role on the world stage. For instance, the Bill and Melinda Gates Foundation has an endowment of more than $38 billion. In the United States alone, there are more than 70 philanthropic foundations with endowments of more than one billion dollars (foundationcenter.org).

**Assessing the Seven Revolutions**

In looking carefully at the overall picture of change that emerges from this assessment of the Seven Revolutions, it is possible to identify four broad themes that appear to transcend, or cut across, the specific developments described by the Model. These four themes, or meta-trends, represent patterns in these data. These patterns are repeated across many of the topics addressed in the Seven Revolutions Model, and all four of these themes appear to have important implications for higher education.

The first pattern is a reduction in the cost of many digitally rendered goods and services. While the price of many items has increased (e.g., housing, education, food), clear signs can be seen that many goods and services that used to be expensive are now considerably less expensive or even free (Diamandis & Kotler, 2012). The main reason is the emergence of the digital economy. As goods and services become digitized, they generally become less expensive. In part, this is because digital objects are not physical objects — they are just information. A related phenomenon is the overall reduction in the size or even complete elimination of many physical objects. As technologies allow for analog materials to be converted to digital, this process will continue. In addition, nano-scale materials are, by definition, tiny, and the growth of manufacturing at this
scale will mean that a variety of materials and machines will continue to get smaller in the decades ahead. These two processes — reduction in cost and reduction in material size — are called dematerialization and demonetization.

A second pattern in these data is increased connectivity – the eco-systems, resources, economies, cultures, and peoples of the world are becoming more connected and inter-dependent than ever before. This is evident in demographic patterns: in the ways in which resources are secured and used, in developments related to information and communication technologies, in changes in the global economy, and in emerging security challenges and modes of governance. The planet never has been more densely populated or more interdependent than it is today (Friedman, 2005; Friedman & Mandelbaum, 2011). This trend is likely to continue.

A third pattern is increased automation. Advancements in artificial intelligence, robotics, and in computer speed and connectivity, combined with a growing consumer demand for less expensive and more efficient goods and services, has led to significant changes in the way many systems and processes are conducted. Today, many systems that identify and process resources such as coal, oil, and even food and fresh water are fully automated. Computers assist or control medical devices, banking services, even braking systems in cars. They control the means by which information is filtered on the Internet and how trades are made in the stock market. Automated systems control how munitions are targeted in the military, they fly and land commercial aircraft, they can even grade papers and write articles for the newspaper. Fully automated cars are under development by every major car company right now; as these systems improve, they will become more essential in many aspects of society (Barfield & Dingus, 2014).
The last broad pattern is personalization. This trend can be seen in the way in which entertainment is delivered to and enjoyed by many people. In the United States, people use on-demand services like Netflix to watch what they want to see, when they want to see it, rather than watching shows according to the network schedules. Rather than listening to or buying an entire album of songs put together by someone else, people can listen to individual songs from their iTunes account — the name says it all — and create their own personal playlists and radio stations with online music services such as Pandora or Spotify. Individuals personalize the avatars they use in video games; they use aggregating software and algorithms to personalize their web searches and their social media feeds. Personalization is a major trend in medicine, and in many sectors of the retail market, in the ways information is used and accessed on the Internet. It is what many information workers do for a living – personalize and bundle information. It can be seen in political discourse and in discussions about how healthcare benefits, retirement systems, and even education should be organized and delivered.

The DeCAP Framework

Taken together, these four trends (dematerialization/demonetization, connectivity, automation, and personalization) help to clarify what is occurring in many different areas of society. They help to explain what is responsible for some of the changes identified in the Seven Revolutions Model and, by doing so, these four trends illuminate something important about the super-structure within which higher education is embedded. If postsecondary leaders are going meet the challenges facing the higher education system in ways that are sustainable for the long haul, they need to attend to what is happening outside of higher education (Wiley & Hilton, 2009). They need to
ensure that they develop strategies that are congruent with, or adaptive to, these broader forces.

The next four chapters will examine each of these trends in turn. Each chapter will examine the implications of these patterns for society at large and for higher education, specifically. Collectively, these four chapters represent a new way of framing an analysis of the changes that are identified in the Seven Revolutions Model, or in developments that are reported in the media and in higher education policy papers. This approach, thus, represents a new framework that can be used to evaluate what is occurring and what is likely to occur in the future. The name of the framework, DeCAP, is simply an acronym for the four trends (dematerialization/demonetization = De; connectivity = C; automation = A; and personalization = P). The acronym should make it easier to remember the trends and how they relate to one another.
CHAPTER III: DEMATERIALIZATION AND DEMONETIZATION

Dematerialization is the process whereby physical objects are significantly reduced in their material size or composition to the point that, in some cases, they simply cease to exist (Diamandis & Kotler, 2012). For example, digital files have largely replaced vinyl records and compact disc collections, and these in turn are now being supplanted by services that simply provide access to streaming digital music without even presenting the need for listeners to store the digital files at all. In streaming, the files are held on the remote servers that make up the cloud. When individual music collections are dematerialized in this way, what was once a bulky stack of vinyl record albums ceases to exist as a physical object and becomes materially manifest only as information on an access device when it is needed.

Demonetization refers to the process whereby the price, or monetary value, of a product or service is either significantly reduced or eliminated entirely (Diamandis & Kotler, 2012). For example, long distance phone calls used to be expensive, but now international video conferencing is free as long as both parties have access to the proper hardware, an Internet connection, and a program such as Skype or FaceTime to facilitate the interaction.

These two trends, dematerialization and demonetization already have transformed life in the 21st century in far-reaching ways. The near complete elimination from most campuses of what were once common and expensive physical objects (items like typewriters, overhead projectors, encyclopedias, television carts, and so on) is tangible evidence of these processes at work. In part, dematerialization and demonetization are about changes in access and use, or what might be called the
consumer experience. However, these processes also have transformed the provider or producer experience. Individuals no longer need to go to bookstores, movie rental or record stores, or avail themselves of expensive typing services. As a consequence, the businesses that once provided these goods and services have either had to change their business model or have been eliminated. Herein lies one of the important lessons from the business world for higher education leaders — as the customer experience changes, the provider experience will also change. Business models that do not evolve to meet the changing context of user needs and desires are models that are likely destined to fail.

**Dematerialization in Higher Education**

The smartphone is perhaps the most obvious and potentially disruptive example of a single device that epitomizes dematerialization and, as a result, has the potential to transform the business of higher education in profound ways. Cameras, radios, televisions, clocks, calculators, address books, calendars, dictionaries, encyclopedias, spreadsheets, video games, photo albums, atlases, translators, textbooks, notebooks, pens and pencils, novels, telephones, and many other physical objects once common in higher education settings have, to a significant extent, been replaced, or likely will be replaced, by just this one tool. The learning outcomes and activities that used to require students and faculty to access and use all of these resources continue to be important, but the material need for them has either been reduced or eliminated.

Of course, this is true only for students and faculty who have access to the right hardware, software, and Internet connectivity. The number of individuals who have access to these is rising rapidly, however. Currently, 58% of all adult Americans own a smartphone (Pew, 2014). As of 2013, 72% of American college students own one, and
this number is up from just under 50% as recently as 2010 (Pearson Student Mobile Device Survey, 2013). Sixty-six percent of American college students say they regularly use their smartphone for some type of schoolwork (Pearson, 2013).

Interestingly, in light of the demographic information highlighted in Chapter II, it is noteworthy that smartphone ownership and usage is greater among two of the populations that are expected to grow the fastest in higher education over the next several decades: students of color and students of non-traditional age. Both groups own and use smartphones in greater percentages than traditionally aged White students. For example, Black (81%) and Hispanic (77%) college students are more likely to own smartphones than White students (70%), whereas more students between 25-30 (79%) own these devices than those age 18-24 (70%) (Pearson, 2013).

Also it is important to note that those who do not currently use smartphones are still able to access digital information in ways that reflect and support this overall dematerialization process. The types of devices used by college students are instructive and show some clear trends. Laptops have largely replaced desktop computers (ownership rates among college students are currently 90% and 42%, respectively); tablets are growing in their use (from 7% in 2011 to 38% in 2013); and the rate of growth in ownership of smartphones exceeds both tablets and laptops (Pearson, 2013). These trends indicate that it is likely that smaller devices (smaller tablets and smartphones) will see the greatest growth of use over the next several decades, and a growing preference for these devices is reflected in recent polls (Pew, 2014).

The reduction in the physical size of computing devices is potentially limited by practical considerations having to do with the ways in which they are used and by
current human and technical capabilities. If these small portable devices are going to be useful for accessing print or video materials, they will need to have screens large enough to serve these purposes. Thus, it is possible that a point may be reached at which it will cease to be advantageous for these devices to get smaller — particularly for an aging population with near-sighted vision challenges. However, at least two technological trends may allow for this process to continue. The first is in projection capabilities—small mobile devices could project to large screens. The second is a movement to reconfigure these devices to be something other than hand-held implements. This type of engineering already is underway, and an important new class of wearable and even implantable computing devices soon will be appearing on many campuses. These technologies, currently exemplified by the Google Glass device, are the next wave of computing hardware (Hong & Baker, 2014).

Google Glass presents information on a tiny screen affixed to a standard-looking eyeglass frame. The device allows one to view information that would normally appear on a computer monitor or smartphone. For example, it allows for the wearer to stream or shoot video, take still photos, surf the web, and do other computer work, all using a variety of hand-free techniques including voice commands and motion tracking that uses head and eye movements to control the device (Stern, 2013). Work already is underway to reduce wearable computer screensizes even further by creating contact lenses with many of the same capabilities as the current “glass” design. Researchers at Ulsan National Institute of Science and Technology in South Korea, along with colleagues at the University of Illinois and the University of Washington, are currently using
nanomaterials and embedded LED technologies to develop a contact lens that will have the full display capabilities of Google Glass (Bourzac, 2013).

Another example of wearable technology that is poised to become commonplace very soon is an array of wristwatch-like computing devices that allow users to send and receive texts, make calls, surf the web, and do other traditional smartphone tasks with a small device wrapped around the wrist. Bluetooth connections from these devices will allow for a small wireless ear-bud to receive (and potentially send) audio as well (Wasik, 2013). Research on nanomaterials and stretchable circuitry soon will produce a range of new products to replicate the functionality of computers and sensors in completely unobtrusive and wearable devices. These technologies will be built into fabric, jewelry, and other wearable components and likely will be the next wave of dematerialized computing appearing on many campuses (Drexler, 2013).

These ever-smaller devices present a series of opportunities and challenges for higher education leaders. As these devices get smaller and less expensive, many of the costs associated with providing computer hardware for students (computer labs) may be reduced or eliminated. Arguably, as the utility of these devices for everyday use increases, higher education institutions can realistically expect most students to provide their own hardware. This could result in significant cost savings for the institutions. These devices also present some exciting opportunities for students and faculty to learn, share, develop, and access information in new and creative ways. Continuous hands-free computing offers a range of interesting new teaching and learning possibilities.

The small size of these devices and, thus, their ability to be used surreptitiously, also may make them difficult to regulate or control. Maintaining academic integrity,
protecting intellectual property rights, and meeting basic privacy expectations may become increasingly difficult in the ubiquitous and stealthy computing environment that these technologies portend (Watters, 2013b). Already, pressing issues to be addressed with regard to intellectual property rights and privacy in the classroom. For example, it is now possible with smartphones to video or record class activities without the knowledge or permission of the instructor or members of the class. This is made all the more problematic by the ease with which these recordings can be instantly shared through a range of platforms including Facebook, Twitter, Instagram, Snapchat, and YouTube, to name just a few. With smaller devices, these kinds of surreptitious uses may increase; thus, it is possible that higher education leaders will have to create policies on the use of these devices with little real scholarly understanding of their impact. Indeed, very little research has been undertaken as of yet to examine these issues (Trushell, Byrne, & Hassan, 2013).

Ironically, the “evidence” of some potential misuses of these technologies may be increasingly subject to dematerialization. For example, one of the emerging trends today is the popularity of applications designed to erase the digital footprint of the user. The most common example is an application called Snapchat, which does just that—messages or images sent with this application disappear 10 seconds after they are viewed. The ephemeral nature of these communications is the primary value of the application and the reason for its popularity (Kotfila, 2014).

Another area where significant changes are taking place is the publishing industry. A whole new industry has emerged to produce online learning systems and electronic journals, texts, and monographs. Large publishing companies control much of
this, but a variety of small players are in this arena as well. Free blogging software and inexpensive self-publishing tools mean that small companies and individuals are able to publish without having to go through the older vetting processes and corporate channels. Content producers can make their materials available as digital objects and, therefore, bypass the printing houses that once controlled the production of goods.

The dematerialization of academic writing is perhaps most evident in the changes that have occurred in the ways these materials are stored and accessed (Cassidy et al., 2011). Academic libraries were once judged by the physical size of their holdings; today, many institutions are observing their overall collections of books and other print materials shrink. Print book circulation declined by 23% between 2005 and 2009 (Rose-Wiles, 2013). Interestingly, although student overall use of libraries and their attitudes toward them have changed, the physical space still draws students for the purpose of studying; libraries retain a positive resonance associated with an academic aura to many college students (Jackson & Hahn, 2011).

One additional technological advance that is fueling dematerialization is 3D printing. The ability to do rapid prototyping and to produce physical objects from digital information files has far-reaching potential to change life both on campuses and in society at large. The ability to produce low cost models and prototypes using 3D printers already is accelerating research and development in many fields and may dramatically reduce the need to own and store tangible objects, such as equipment used in laboratories (Lipson & Kurman, 2013).

Dematerialization also has implications for reducing the workforce on campuses. Two trends widely practiced outside of higher education are becoming common in
academe: the in-sourcing and out-sourcing of labor. In-sourced talent for faculty development and specialized services has been common in higher education for quite a while. However, bringing in outside talent to teach courses and conduct research is a relatively new phenomenon and would be a significant departure for many campuses. Evidence is beginning to be seen that universities are turning to external talent, often funded by external sources, to meet even basic research goals and outcomes (Cantwell, 2011).

These phenomena will certainly impact higher education personnel decisions. For the most part, these outside experts are brought in to provide short-term training or to meet a temporary need. However, it also is common for human relations departments to allow staffing to fluctuate in order to accommodate changes in demand. This kind of shrinking of human resources is a classic example of the dematerialization trend.

**Forces Behind Dematerialization**

The digitization of information is largely responsible for the phenomenon of dematerialization and for the dramatic reduction in costs associated with many products and services. One of the key trends identified in the Seven Revolutions model, the movement of individuals from rural to urban areas, has helped to usher in the “digital age” and accelerated the dematerialization process. Those who live in urban areas have greater access to digital technologies as well as to the Internet, which is fundamental to this transformation. Urban life facilitates dematerialization by bringing people together into higher density living situations. This causes the per-foot cost of housing and commercial real estate to rise, putting a premium on space and thus increasing the cost of storing physical objects. Generally speaking, urbanites have smaller homes and
businesses than rural or suburban dwellers; and, thus, a more urbanized future may mean that people will have fewer physical objects to secure and for which to care than today.

Urbanization also makes sharing easier. If one needs a place to watch TV, one can go to a restaurant or bar. If individuals want to exercise, they can go to a gym rather than purchasing specialized equipment to use in their own home. In order to rent or borrow a bike, a book, a set of tools, or take public transportation, it is much easier to do so in an urban setting. Many apartment dwellers have no need for cars, ladders, lawn mowers, wheelbarrows, and the other objects that clog up the garages of more rural and suburban homeowners. Smaller kitchens and refrigerators mean that the ability to obtain premade food and small quantities of perishable items on a daily basis is important — something that is easily done in an urban setting.

Similar dynamics apply to postsecondary institutions in urban settings. Access to plentiful rental housing reduces the need for dormitories. Access to good public transportation reduces the need to provide buses and extensive parking lots and car infrastructures. Access to public art collections, hospitals, and other potential research and training facilities means that these can be leveraged by the institution without providing duplicate services and amenities for students. The same may be true for athletic and artistic performance facilities and even recreational facilities (e.g., social and fitness centers, coffee shops, and dining options). Thus, dematerializing some of these types of services and amenities may be very helpful for institutions of higher education situated in growing urban centers. The savings could be significant and allow for campuses to focus more of their resources on targeted educational facilities and services. In higher education settings outside of large urban centers, the ability to provide access
to digital information and to dematerialize teaching and learning processes means that campuses of the future will not need to provide as many analog devices such as books, physical cables, and outlets for “wired” computing, computer centers, and other space-consuming resources.

Helping to blaze this new digital trail are a range of transformative technologies. These technologies fall into four broad areas: those related to information processing and storage, communication, biomedical knowledge and enhancement, and manufacturing (Diamandis & Kotler, 2012). The common denominator is that these technological innovations all involve the manipulation of information or the transformation of physical objects or processes into digital objects or processes.

**Implications of Dematerialization**

A set of concepts borrowed from economics is helpful for understanding some of the implications of the dematerialization process. Economists differentiate between rival and non-rival goods. Rival goods have a physical dimension to them that differentiates them from their non-rival counterparts. Stanford economist Paul Romer explained the distinction as follows:

Picture a house that is under construction. The land on which it sits, capital in the form of a measuring tape, and the human capital of the carpenter are all rival goods. They can be used to build the house but not another simultaneously. Contrast this with the Pythagorean theorem . . . [which is] non-rival: every carpenter in the world can use it at the same time to create a right angle. (Cited in Diamandis & Kotler, 2012, p. 151)
What is the analog in higher education? Only so many students are admitted to higher education institutions, and only those admitted students can physically occupy the classrooms, labs, residence halls, and access the full range of materials and experiences that constitute the educational enterprise of that institution. In this way, this form of bricks and mortar education constitutes a rival good. The promise of dematerialization is the prospect that the essential elements of higher education can be re-framed or re-conceptualized into non-rival goods that can be utilized simultaneously by unlimited numbers of students from anywhere in the world. This would indeed be an enormous change.

One potential pathway to this end is through online learning, as embodied by the much-discussed Massive Open Online Course (MOOC) phenomenon. Tens or even hundreds of thousands (with potentials that reach into the millions or billions) of students can all share access to the content of the course (dematerialization) and, in most cases, can enroll free of charge (demonetization). Increasingly, the important commodities of the digital age, or the information age, are not physical objects, but ideas. The implications for higher education leaders are that they will need to offer the things that are necessary for these ideas to be created, analyzed, and shared (Bowen, 2013).

Technology companies often team up with others or license their products in order to share ideas and risk, or they use open-source methods to design, de-bug, or otherwise improve their products and services. Institutions within higher education are inherently competitive with one another and rarely like to cooperate; for some, in order to remain competitive — and even to survive — they will need to share resources as
never before (Selingo, 2013b). Many examples exist of colleges sharing resources and faculty in this way, such as the sister colleges in New England or consortia built around pooling study abroad opportunities. St. Olaf and Carleton College recently announced that students are eligible to take any classes at the other institution that meet their educational needs, as long as they are not offered at their home institution (Friedrich, 2013).

Another potential model to emulate is the loose federation of institutions that EdX and Coursera have created to develop MOOCs. Many of the institutions participating in these efforts still compete on every other front for students, faculty members, and funds; but they have agreed to team up for this online endeavor. More of these types of cooperative agreements are beginning to be seen. This kind of sharing affects space needs, and one consequence of the spike in online learning is that classroom building construction is down across all of higher education (Selingo, 2013a).

Dematerialization is even affecting currencies, and higher education leaders already are beginning to formulate policies to deal with digital currencies like Bitcoin. Some schools have begun to accept it as payment for tuition (O’Neil, 2014), while others are preparing to receive donations in these currencies (Perez-Hernandez, 2014).

**Demonetization in Higher Education**

For decades, the proliferation of free information has been seen on the Web, but now more sophisticated and authoritative efforts are seen to organize free digital content into academic modules, courses, and even whole programs of study (Bowen, 2013). This is obviously a radical form of educational demonetization — taking what was once expensive (college) and making it free. To the extent that higher education institutions
can leverage free content and tools to fulfill their mission (such as Prezi, Gapminder, archived faculty development webinars, repositories of lectures, presentations, and videos), this could be a huge boon to efficiency and, by extension, to the bottom line of operating budgets.

In addition to dematerializing published materials in the form of ebooks, many publishers also are promoting open source materials to support higher education. The entire open source movement is based on the notion that freeware and freely accessed materials can be as good or better than traditional proprietary products (Mehaffy, 2012). This movement has not only driven down the cost of producing and consuming academic materials, it also has brought new players into the process as a result. Today, the once-clear boundary separating producers and consumers is becoming more permeable, as the tools needed to produce and disseminate materials are so accessible and inexpensive. Nearly anyone with a computer can now publish and share his or her work for free (Lanier, 2013).

These changes may pose a grave threat to institutions that are dependent upon revenue derived from the old model of delivering education. Higher education leaders need to think about ways to position the resources of the university so that they are adding value to the flow of information that is increasingly going to be free. The value-added model will focus on filtering, bundling, and framing these materials in ways that are most appropriate for effective learning (Bowen, 2013).

The movement to lessen the cost of higher education has many supporters; and, as income inequality both inside the U.S. and abroad continues to gain attention, some are turning to demonetizing higher education as a possible solution. Among the more
radical proposals is one by the recently elected president of Chile, whose plan is to provide a free postsecondary education to every citizen (Lloyd, 2013). Is it possible for something of this nature to emerge in the United States, where the definition of basic education might be expanded to include K-14 or K-16? This may seem unlikely in light of the current struggles to fully fund even K-12 education; however, something like public supported postsecondary education may be possible if the per student cost can be decreased substantially.

The demonetization process is most widely discussed with regard to the MOOC movement. These initiatives have resulted in a range of profit and non-profit actors entering into a contest over who can bring highly sophisticated content into the educational marketplace for little or no cost to the learner. This is the business model behind start-ups such as Udacity, Coursera, and the not-for-profit EdX (Selingo, 2013a). The intent for some of these organizations is that the credentialing process can be monetized. One scenario is that students who want to earn a document certifying their completion of a free program will pay for this service. Small charges to large numbers of users may actually generate significant revenues.

These developments mirror trends occurring outside of higher education. The whole freeware, shareware, open-source movement has transformed the development and refinement of software since it was first introduced (Mehaffy, 2012). However, these newly instantiated education platforms have raised concerns about quality. A similar debate occurred when free reference books first appeared on the Web. In an early study on this topic, investigators examined the entries in Encyclopedia Britannica and Wikipedia and concluded that they were of similar accuracy (Mehaffy, 2012).
Surowiecki (2005) went one step further and concluded that crowd sourcing can actually improve the quality of data gathering and analysis.

Codeacademy is a web-based platform for teaching and learning computer code. Individuals are using it to augment exiting computer science courses or as a stand-alone approach to learning to become a programmer. It is currently free for all users (codecademy.com). The Kahn Academy (also a free service) is being used to provide tutorials in many different subject areas. Classrooms are being flipped, and classroom costs are being reduced in different educational settings by requiring students to learn specific lessons online and then using class time to practice or apply the concepts with the assistance of an instructor, who may themselves not always be capable of presenting the materials themselves (Shirky, 2012).

In light of the demographic trends highlighted in Chapter II (longer life spans) and the changing nature of employment (more jobs, more changes in careers), higher education will increasingly be something that individuals seek to access at different times in their lives, for different purposes, and at different levels of intensity. Flexible access will be more important that ever. Just as people have no need to own books, magazines, or music anymore (and many don’t want these material objects cluttering up their homes), in the future, people will want to pay for access to higher education, but at the times, locations, and in the formats of their own choosing.

The current movement to create more of an a la carte approach to goods and services will ultimately affect higher education. The unbundling of goods and services already can be seen in the way in which music is consumed. Rather than buying entire albums or CDs, consumers simply purchase the songs that they want individually.
through iTunes. The same can be seen with TV services. There are now ways that people can buy access to only movies (Netflix) or TV shows (Hulu) without paying for the programs they do not watch. Airlines now charge different prices for different levels of service. If one wants to check a bag or eat a meal on the plane, one will pay for these services; if they do not want these things, they will not pay for them. It is less expensive for the frugal customer, but also quite lucrative for the airlines (Strutner, 2013).

This trend likely will continue. The implications for higher education are that the services currently offered (food services, residential facilities, athletics, recreational facilities, and libraries), and potentially even curricular pieces (general education, laboratories, and theses), will be unbundled so that consumers pay only for what they want or can afford. Students will pick and choose from different providers to cobble together the education that they desire and can afford. Majors might have different prices, as they will require different coursework to complete.

Unbundling also will affect campus services. Outsourcing will occur of things such as lawn care, food and health services, dormitory management, parking enforcement, internet security, campus security, cloud storage, IT support, benefits, payroll, health insurance, and retirement systems. Faculty, staff, and students who want these services will pay for them. It is even possible that supplementary teaching and learning assistance might be available only for an additional cost.

Textbook rental programs have been growing rapidly for the last five years, but free textbooks that are being offered through a range of websites are now undermining even these programs. Increasingly, instructors are choosing to require students to access materials electronically rather than buy them (Young, 2010). The cloud that currently
hosts so many important commercial documents and data files soon will be the home of nearly all forms of academic materials as well (Bowen, 2013; Lanier, 2013)

Another demonetization trend is to provide high school students with more options to complete college-level coursework and, thus, get a free or inexpensive head start on their college classes. California and Texas already have initiated programs that go beyond dual-credit and allow some high school students to earn associate degrees while still in high school (Selingo, 2013a).

Implications also are seen for college athletics. Many of the forces operating to lower the costs of doing and owning are likely to undermine the current system that creates and supports big-time athletics programs. The most significant effect of these changes may be a decline in the revenues derived from ticket sales and TV contracts. Individuals now have more options for entertainment than ever before, many of which are accessible for free. Many athletic venues do not support the connectivity that people want, so they stay at home or watch from a bar where they can use their mobile devices to interact with others (Hammond, 2014). Evidence exists that a desire to use these technologies is one of the reasons that attendance at college sporting events is down nationwide (Kramer, 2013). Another disincentive for many schools to invest in athletics may be the competitive disadvantage they face from funding athletic programs, which for many schools is already a financial loss, while confronting competition from online institutions that do not have to manage these kinds of costs.

A final trend in higher education that also may be subject to demonetization is one of the most difficult for many students to afford—international learning experiences. The notion of a “flat” world, as described by Friedman (2005), refers to the
idea that people no longer have to leave home in order to “plug in and play” as they become networked together through technologies and global markets. Globalization has leveled the playing field, he argued, and the main tool responsible is networked computers (Friedman, 2005). Globalization will be addressed more directly in Chapter IV, but one interesting aspect of this movement with implications for higher education is the way in which technology may drive down the cost of providing international experiences for many students who would otherwise be unable to do so. For example, international education is being radically transformed through the use of technologically-mediated learning platforms like Soliya (Soliya.org). These programs create online classrooms that allow students to be enrolled in rich, immersive learning environments with peers located anywhere in the world. The cost of the programs already is very low, with efforts underway to make at least some version of them entirely free (Soliya.org).

**Implications of Demonetization**

Higher education is suffering from what has been labeled *cost disease* (Baumol & Bowen, 1966). Cost disease, also known as the *Baumol Effect*, occurs in contexts where the per hour value of labor does not go up due to increased efficiency over time. He found this to be true in many sectors of the arts. For example, a two-hour performance by a string quartet or a ballet troupe still takes the same number of performers the same amount of time today as 200 years ago. This is not the case in most sectors of the economy in which worker productivity has increased dramatically. However, many higher education institutions suffer from cost disease. Most faculty members are only as efficient as their counterparts of 200 years ago relative to their
ability to teach students. A 50-minute lecture given to 50 students takes just as much
time to deliver in 2014 as it would have in 1814.

The cures for this disease in the context of higher education could include using
lower paid teachers, increasing the number of students per teacher, or increasing the cost
to students. All of these solutions are in evidence today. Each has its problems.
Decreasing the pay of instructors brings with it concerns about quality and fairness.
Increasing the costs to students will eventually reach an unsustainable point, and many
analysts think society is nearly, or perhaps already, there (Mehaffy, 2012; Selingo,
2013a; Sharky, 2012). The faculty/student ratio is deemed to be one of the most
important measures of quality, and is featured as one of the criteria by which schools are
assessed in the rankings issued by organizations such as *US News and World Report*
(which no longer exists except as the source of this annual report); thus, some will be
reluctant to change that ratio very much. Which of these variables is most likely to be the
one that can be manipulated to bring down the cost of delivering education? Despite the
reticence of some leaders to do so, the trends indicate that changing the student/teacher
ratio is the most likely candidate, as it is the most likely to bring the other two variables
into balance with the gains in efficiency seen in other sectors of the economy.

In some important ways, the higher education market is similar to the restaurant
market. A variety of options are available from which to choose, they cater to different
tastes, have different strengths, and cost different amounts. Some choose the most
expensive restaurants where they expect to receive excellent service, personalized
attention, well-appointed surroundings, and a hand-crafted meal made just for them by a
highly trained chef. They also expect to pay more for it. Some choose to dine in
restaurants that provide less personalized service, unremarkable surroundings, and menus that feature food choices that can and are prepared by less well-trained cooks. They expect to pay less.

Some restaurants try to hit a sweet spot that provides interesting foods and surroundings, but at a lower price. How do they do it? By selecting ingredients and menu items that replicate expensive restaurants, are developed by a few select and well-paid chefs in central test kitchens, and then are reproduced in large quantities by a large staff who are trained to follow the recipes (but not develop them) over and over. These restaurants may not provide as personalized an experience, but they can provide good food at a much lower price.

What is the lesson for higher education? Should professors function like chefs in a fancy restaurant, producing each lecture from scratch for a small number of customers, or should they be more like the “fast casual” restaurants that take a good idea from a true expert and replicate it? Should they use technology to meet the demands of a large number of “customers” at a lower price? Would the product be of a lower quality? Perhaps compared to the best restaurants (colleges), but how many people are eating (attending) these to begin with? Chipotle and Panera are not going to put Wolfgang Puck out of business; but in a situation where customers are getting fast casual food (or worse) food at what are increasingly “fine dining” prices, the restaurant market would not be very sustainable. That may be where higher education as a system is today. Many students are receiving mediocre quality at an increasingly high price (Arum & Roksa, 2011; Metler, 2014).
Which of the three variables (lower salary, higher student/teacher ratios, increased costs) are most likely to be changed? All, and it will occur through the processes of dematerialization and demonetization. These processes already have exerted competitive pressure on nearly every sector of the economy and society, and it is inevitable that they will begin to take a toll on many traditional higher education institutions as well. The ones that cannot provide good quality at a reasonable price will be eliminated. Institutions struggling with tight budgets and declining revenues will need to become more efficient and provide services to more students at a lower cost. Some of the models for how to do this — flipping classrooms, distance learning, and MOOCs — are getting a lot of attention. However, perhaps these developments can be understood best as outgrowths of these two widespread trends that are re-shaping many sectors of society. Educational leaders may be able to better understand these movements if they view them as part of a larger set of changes that are making things smaller and cheaper. Higher education institutions will have to attend to these changes if they are to be successful going forward.
CHAPTER IV: CONNECTIVITY

Connectivity refers to the processes that bring people, resources, and ideas together. The main forces driving these processes today are powerful new information and communication technologies (ICTs) such as computers, mobile communication devices, and the Internet. These technologies are radically transforming the way individuals interact with one another and the ways in which they create, aggregate, and disseminate knowledge. These technologies are changing how and where people learn, the way they think about and interact with one another and, perhaps most importantly, these technologies have the potential to expand what they can know about the world around them. This is because ICTs now connect more people together than ever before, while also producing unprecedented quantities of data that may reveal patterns of behavior never visible in the past (Lanier, 2012; Watson, 2010).

As a consequence, these technologies have opened up all types of new possibilities and new questions. Can every neuron in the human brain be mapped? Can the insights derived from modern neuroscience be used to understand how learning really works? Can ICTs be utilized to examine data from the social and biological sciences to further knowledge about the roles that both nature and nurture play in human development and behavior? Can these insights be used to anticipate student outcomes and to provide targeted interventions to improve them? Can our ICT resources be used to provide access to quality education for more people and at a lower price? The answer to all of these questions is probably “yes,” which is what makes these technologies so important to the future of higher education.
In a sense, ICTs can be viewed as resource-liberating technologies, in that they allow for existing resources to be more readily accessed and, thereby, developed and put to new and better purposes. Many resources that are now common and even vital were once regarded as rare and superfluous. For example, books once were extremely expensive, and the information contained within them (outside, perhaps, of the knowledge revealed in religious texts) was regarded as irrelevant to the lives of most. This changed with the advent of a new technology called the moveable type printing press (Eisenstein, 2012). Aluminum once was so rare that it was regarded as more valuable than gold. For instance, at state dinners, Napoleon reserved his few aluminum utensils for his most honored guests. This changed when technologies were developed that could be used to easily extract this metal from the common element bauxite (using electricity) and turn it into this now ubiquitous commodity. Thus, scarcity is contextual, and technology often plays an important role in transforming what once was rare into something common (Diamandis & Kotler, 2012).

Quality education is currently a rare and expensive commodity in many places. The books, lab equipment, physical facilities, and well-trained teachers that constitute a good education today are prohibitively expensive in many contexts, and this is one reason that quality education is not widely available. There may be ways in which technology can help with this problem. For instance, if technologies could help make the components of a good education (access to accurate and up-to-date information, tools to generate and share knowledge, lessons that foster communication and learning skills) more widely available at a lower cost, this now scarce commodity could become much
more common around the world. The key is to think about the technologies that might be most useful in advancing this cause.

Picture a pecan tree covered in nuts. Individuals with the ability to reach up and grab them can readily pick those at the bottom — the proverbial low hanging fruit. Barring some type of innovation, the rest can be seen but cannot be enjoyed without technology that makes them accessible. In some ways, this is analogous to the situation in higher education today. Many can see the fruits of education all around them, but they are unable to reach them because they lack the proper tools to do so. ICTs may provide the ladder necessary for them to both reach these fruits and enjoy their benefits.

A good education requires more than just access to information, however. It requires engaging in meaningful interactions and experiences that are intentionally designed to foster intellectual growth. The central feature of a good education is the ability to make connections—between people, between ideas, and between the “real” world and the classroom (Kuh, 2008). Quite a lot is actually known about what fosters and inhibits this kind of learning, but many people are not yet benefiting from these insights because they either attend institutions where this knowledge has not yet been translated into common practice or they do not have access to any formal education at all. The challenge is, thus, to find a way to transform common practices and to make education based on these practices available to as many as possible.

Through the connectivity of the Internet, individuals now have access to a wide array of talented thinkers and to an assortment of data in many different fields. What was once scarce — expertise in a variety of areas — is now abundant. How should this talent best be used? One should begin with the basic unit in education: the individual section of
a college course. The traditional method of delivering a course is for a faculty member to create each lesson from scratch. Each lesson is a unique and tailored product delivered in person to each and every enrolled student in every course every semester. From one (perhaps idealistic) perspective, this makes perfect sense, in that it captures the essence of academic freedom: teach what you want, when and where you want, and in your own way. This also reflects professionalism and accountability. Faculty members are qualified and responsible for facilitating a high quality learning process. However, as anyone who has been around higher education knows, some instructors are better at this than others, and even the best can have an “off” day, week, or semester (Shirky, 2012).

Other reasons exist to think that this traditional model will need to be revised, at least on many campuses. Accumulating evidence can be found indicating that the traditional face-to-face lecture does not work well for many students (Kuh, 2008). Indeed, in recent studies on this subject, learning and retention dropped to nearly zero for information introduced in the middle 20 minutes of a standard 50-minute lecture. This is because few are capable of absorbing new information for more than approximately 10 minutes, unless they are given the time to process it (Bajak, 2014). Thus, in an ideal setting, students would be able to stop and process material periodically; backtrack and listen again if necessary; ask questions; attend to other needs (sleep, food, distracting thoughts or people); and then return to the material when ready to think again. This is nearly impossible in a standard lecture environment.

Another concern deals with the accountability movement currently sweeping accrediting bodies and state legislatures, bringing with it a growing emphasis on demonstrating consistent outcomes across all sections of a course and throughout the
curriculum as a whole (Altbach, Gumport, & Berdahl, 2011). Increasingly, this means that universities, colleges, and departments are looking for common assessment processes and even common instruments. Assessing the work of individual instructors engaged in an independent and artisanal approach to teaching is more challenging than measuring the output of a more uniformly prepared and presented course or set of courses. As a result, added pressure will be applied to make many educational processes more uniform so that they can be evaluated more easily and accurately. Thus, to the extent that decisions on higher education will be data driven in the future, teaching methods and processes that produce useful (and easily analyzed) data will be favored over more idiosyncratic approaches, for better and for worse (Altbach et al., 2011).

A movement can also be seen to create national (and even international) standards in many disciplines. These efforts might undermine support for courses that are taught in an idiosyncratic way. If global standards for quality are developed and implemented, they will need to be based, at least in part, on an understanding of the potential role the ICTs will play in education worldwide in the future (Fischer, 2014). The development of shared models will be key in this process.

The traditional lecture model also looks somewhat out of step in another way. Few faculty members would support the notion that they should assign only readings that they personally produce. Yet, many balk at the idea that others could produce the content that is presented in place of traditional lectures or class activities. The published work of the best thinkers in an area is widely assumed to be most appropriate for students to read; but for some reason, the same is not true of the other content and processes that make up the learning experience (Shirky, 2012). It is true, that at many
institutions, the faculty is well versed in the latest developments in their disciplines and is quite capable of providing insightful analyses of course content for their enrolled students. However, it also is true that this is not the case at many institutions. In fact, many of the more than 21 million students currently enrolled in degree-granting institutions in the United States are probably taking courses from faculty who are only marginally prepared to provide that type of cutting edge assessment (National Center for Education Statistics, 2012; Shirky, 2012). It also is true that instructors who know their field do not always excel in teaching the content effectively. So why not incorporate the insights of the best lecturers and the best teachers? Let the faculty at these institutions facilitate analysis of these materials and use their teaching and learning activities in the same way they facilitate analysis of “expert produced” written materials on a regular basis.

This is the essence of the flipped classroom movement. The idea is to deliver the content outside of the class so that class time can be dedicated to processing that content through meaningful interactions between and among the students and the teacher (Bowen, 2013). This type of teaching is enhanced by improvements in connectivity, as the flipped classroom allows both faculty and students to take advantage of the best materials available for learning, which often include non-print materials accessed through the Internet.

Modern connectivity is made possible by significant improvements in processing and storage technologies. As more individuals in more parts of the world gain access to computers and computer networks, they are beginning to contribute to the enormous amount of information stored on the servers that make up the World Wide Web. They
also are able to access the information posted by others. This connectivity and the potential to exchange information has created a host of new Web-based learning platforms and, most recently, has allowed for the development and proliferation of MOOCs (Bowen, 2013). These courses, which are now being produced by some of the most prominent universities in the United States, are open to anyone who chooses to register, usually for free, and as a result, they are receiving a great deal of media coverage (Selingo, 2013a). They represent a radical shift from the traditional mode of delivering academic content and are viewed as one possible innovation that could make quality higher education available to large numbers of individuals for whom it is currently out of reach. In this sense, the promise of MOOCs is that they might improve access for those without good options, but it is not clear that they are likely to undermine higher education institutions already providing good access to quality education (Bowen, 2013).

What makes the MOOCs a novel challenge to the status quo is that, unlike previous online education initiatives, they provide more than simply individual lessons. They are complete courses, created by leaders in the field, scalable to reach hundreds of thousands, if not millions of students, and are available at no cost to the participant in many cases (Bowen, 2013). This free learning movement is open to students from any background, located anywhere in the world and, as such, represents a potential game-changing development in higher education. Leaders need to contemplate the implications of these courses for their individual institutions, their students, and higher education as a system as a whole (Matkin, 2013).
MOOCs may be a helpful hand up for many students, but they can be accessed by only those who are connected to the Internet. Currently, approximately 2.5 billion people have such access, but Google and other technology leaders are hoping to dramatically expand that number in the near future. In fact, Google has publically stated that its goal is to bring access to the Internet to every corner of the world by 2020, and they have launched two recent initiatives to help achieve that goal (google.com). Project Loon is a plan to bring Internet connectivity to remote areas of the planet by deploying a series of ground-based antennas that communicate with a network of high altitude balloons to relay signals from remote regions to existing nodes on the global Internet (google.com/loon). A second project involves deploying solar powered drones to achieve a similar network of high altitude equipment that can provide a similar expansion of connectivity (Barr, 2014).

Expanding connectivity will be essential if higher education is going to be able to take advantage of the potential improvements that can come with developments in ICTs. As bandwidth and processing power improves, possibilities can be seen with the emergence of the Internet of Things (IOT). This term refers to the next era of the Internet, when a wide range of objects will be connected to function as a coherent system. Objects such as cameras, motion sensors, light switches, computers, door locks, climate control systems, and others can be networked together so that they can interact with one another and all be monitored at the same time (Chui, Löffler, & Roberts, 2010). For instance, when sensors or cameras indicate that the last person has left a classroom, a signal would be sent to the door lock, lights, computer projector, climate control system and other relevant devices indicating that the room is unoccupied. This could provide a
range of security and efficiency benefits, and institutions of many types will be transformed by this emerging IOT.

Many possibilities come with this kind of connectivity. One example is a new online music-streaming service called Beats. This site monitors what members are listening to, at what volume, at what time of day, and in what locations, and then connects these data with information gathered from social media sites such as Facebook to develop a rich profile of their users’ tastes and habits so that they can provide a fully customized experience to each of their clients (Protalinski, 2014). This type of integrated connectivity between platforms also may provide new possibilities for higher education institutions that are attempting to learn about and then meet the needs of their students.

Evidence exists that societies that have only recently acquired ICTs may be more likely to quickly adopt innovations based on them. This is likely due to the lack of any history with, or preexisting infrastructure from, the old system. For example, cell phone penetration in China and Sub-Saharan Africa are on par with the developed world, and they have built the infrastructure of these ICTs to modern specifications, completely bypassing all of the infrastructure associated with the old telephone system (Diamandis & Kotler, 2012). In some areas that have only recently become connected, these technologies are bringing significant changes to the way in which money is exchanged. In countries that do not have well-established banking systems, or where a large percentage of the people are rural or poor, digital currencies and digital transactions already are widely in use. In sub-Saharan Africa, for instance, mobile money that is loaded onto cell phones is far more common than it is in more developed countries in Europe or in the United States (Olopade, 2014). In the developed world, these mobile
money systems are still rare, as individuals have access to banking services like credit and debit cards and, thus, are reluctant to change over to this new system. This could signal a similar trend in higher education. Countries and regions that do not currently have well developed higher education systems may be more likely to jump right into these ICT based systems and skip many of the elements of the traditional western higher education system that date back to the early days of the Industrial Revolution (Mehaffy, 2012).

Other examples can be found of interesting innovations emerging in the more developed world related to digital currencies like Bitcoin. These currencies are not backed by any nation-state; rather, their value is determined by the value of the computing time required to “mine” them, their collective recognition as representing value in exchange markets, and by the perception that digital transactions of these currencies are secure and free of fraud. The emergence of these stateless currencies is an excellent example of the power of connectivity. They are based on peer-to-peer exchanges not mediated by any treasury system or bank. The system is built around a global economic commons and universal modes of understanding, accessing, and protecting digital information that would not be possible without a high degree of connectivity and transparency.

Some higher education institutions are taking notice of this trend, and a few have now begun accepting Bitcoin for tuition payments (O’Neil, 2014). Others have established protocols to accept donations of digital currency through their foundations (Perez-Hernandez, 2014). These new currencies are not without problems, however, and the recent thefts from, and subsequent closure of some digital currency exchanges,
highlight some of the challenges that come with an increasingly connected and digitized world.

One of the trends seen today is a movement for increased transparency and openness in exchanges of all types. Open and interconnected systems allow individuals to observe what is occurring and to assess both the strengths and the flaws of the system revealed. Problems with open source reference tools like Wikipedia are quickly identified and, through the work of many participants, these tools are improved in a transparent way. The same may be true of MOOCs. Rapid improvement in quality and in accountability is more likely to occur in an open system than in a closed system similar to the ones currently common in academia (Shirky, 2012). What occurs in a face-to-face course or in online courses that is hidden within closed learning management systems, such as Blackboard, Web CT, or Moodle, are still a mystery and are not subject to these same kinds of crowd inspired improvements and accountability. Connectivity is necessary, but not sufficient for transparency. If the benefits that come from accountability and transparency are to be gained, higher education leaders will need to embrace more open systems and processes (Wiley & Hilton, 2009).

Connectivity allows for crowd sourcing and for meaningful interactions between those who may be physically far removed from one another. This is beginning to allow for research to be conducted in new ways. For example, a researcher attempting to identify a large number of fish gathered in the Amazon Basin uploaded photos of each unidentified species to an ichthyologist group page on Facebook and, within 24 hours, all were successfully identified. (Science Daily, May 2011, as cited in Mehaffy, 2012). Crowd sourcing also is the fundamental idea behind the ninth most visited site on the
Internet, Wikipedia. With more than 117 million users per month, this is a prominent example of a valuable resource that is created, maintained, and improved by some 130,000 registered users who donate their time to the site (Wikipedia.com).

Crowd sourcing and interactivity are transforming the way in which individuals shop online as well. According to research about Millennials’ online shopping preferences and habits, they differ from Generation Xers and Baby Boomers, in that *instant ownership* is not the reason they liked online shopping. Rather, it was the *unlimited options* and the social dimensions that online stores allow such as, comments, reviews, and sharing capabilities (Peterson, 2013). The explosion of online commerce has come at the same time as a rapid proliferation of wireless devices of many kinds. One of the most daunting challenges that these present on many campuses is the difficult task of providing adequate bandwidth, security, and reliable service for all the devices and users, many of which are now being used for gaming, downloading large music or image files, streaming videos, and doing other capacity-demanding tasks. These challenges are so great that last year the Educause IT Issues Panel named the *device explosion* the number one issue of concern on their campuses (Straumsheim, 2013).

Connectivity also is changing the way in which citations and references are made in many digital materials. For example, static paper documents used to include lists of source materials either at the bottom of the page or at the end of the paper. Today, digital resources often include hyperlinks within the text that allow readers to connect directly to the source. This provides a much richer experience for the reader and allows for sources or links to other related materials to be consulted much more readily. This nearly seamless process allows for more of an iterative exchange between the reader and the
source materials, which can speed up analysis and sharing, thereby accelerating the exchange of ideas that lies at the heart of the education process.

Technological changes also are enhancing the way in which individuals interact with one another. Traditional paper communications through letters and books provide an asynchronous dialogue, but people today can connect with one another using a variety of social media platforms, including videoconferencing services such as Skype, SMS texting protocols, *always on* mobile devices (like the ubiquitous cell phone), and through interactive documents similar to wikis and Google docs. Together, these changes allow for individuals to connect with information and with one another more directly in ways that allow for both synchronous and asynchronous interactions.

This level of interconnectedness, commonplace in many aspects of life, stands in contrast with the realities of higher education as many individual students live it (Wiley & Hilton, 2009). For example, in many classrooms students are asked to shut off their technological connections to the outside world (e.g., phones, computers) and to sit quietly and listen to material being presented to them. In addition, for many students the class time and location also are inflexible — they are all required to meet at the same time and place regardless of their individual circumstances, preferences, and commitments. This inflexible, disconnected, and unidirectional learning is quite unlike life now experienced outside of the higher education system, at least for many well-connected younger people (Wiley & Hilton, 2009). To the extent that these two systems are perceived to be out of synch with each other, especially if these differences are perceived to be impediments to participation or learning, these differences will likely add to the calls for higher education reform.
ICTs free people to think in new ways and also allow for rich interactions to occur outside of the classroom, whether synchronously or asynchronously. Technologies that allow instructors to create or post materials that can either be viewed or listened to immediately or downloaded for later (like podcasts) allow for a much more flexible learning environment. This may result in more effective learning for the student who works odd shifts, is a parent, or has other responsibilities that require working on schoolwork at diverse times and locations. Electronic proctoring of exams with devices that use a 360-degree video range and electronic fingerprinting technology to verify identities and eliminate cheating may allow students to take tests anywhere and at any time without a human supervising the process. Such a proctoring system is now being used at Troy University in Alabama for these purposes (Dew, 2010).

In observing the most popular sites and platforms on the Internet, the outlines of some of the changes that are occurring in society can be seen. These sites all allow for a high level of interactivity. Social media sites such as Facebook allow individuals to post content and also comment on and repost the content added by others. Even the websites of mainstream media outlets such as USA Today or ESPN have interactive components that allow for readers to connect with one another, the content providers, and to link to other content through the site. Virtually every media website now allows people to share or directly link to stories by simply clicking on the icon for the medium they choose to use (e.g., Twitter, Reddit, Tumblr, Facebook). This interconnectivity between platforms and sites allows for these features of the interactive Internet (sometime called Web 2.0) to work. The development of what is called the Semantic Web, which encourages interaction and co-creation on the Internet, is predicated on the notion that users and
producers will agree to use common data formats that will allow for this type of cross-platform interaction (Teich, 2012).

One of the benefits of wide participation in the Semantic Web is the *network effect*. This refers to the idea that the value of the system to any one user multiplies as the number of member users increases (Lanier, 2013). Tangible evidence is beginning to be seen that the interactive Web is creating significant change in how even basic research is conducted. For instance, international co-authorship of scientific publications has more than tripled over the last 15 years, as these tools of collaboration have become more widespread (Jackson, 2013). As more people participate in sharing and working in this manner, the value of the systems to which they contribute will go up.

The connections between technologies also are a key aspect of what will drive innovation in the years ahead. Emerging fields like genomics, when connected with developments in nanotechnology, have the potential to totally transform how drugs will be delivered in the future (McKinsey, 2013). Advancements in sensor technologies, combined with nano-scale machines, hold great promise for improving efficiencies in everything from agriculture to manufacturing to healthcare delivery (McKinsey, 2013). Another example is the relationship between developments in battery technology and the viability of a wide range of renewable energy sources that are currently in development. The connections between these efforts will prove to be a vital dimension of their success, and advances made in each of these areas will increasingly inform research in other areas.

Connectivity is changing some other basic aspects of daily life. For example, many individuals now out-source memory functions in ways that allow them to be more
productive. Many have always relied on technologies and others to help them remember important tasks and information. In part, books, diaries, archives, and even friends and family members do that—they help individuals to remember. These are called transactive memory relationships (Hollingshead, 1998). One hands off things that he or she does not want to worry about remembering (to pick up milk after work) to someone or something else (a grocery list, for example). Today, these transactive memory interactions are increasingly done with digital devices of varying kinds. Many individuals do not remember phone numbers, birthdays, appointments, passwords, or even how to get somewhere, as these are now stored in their phones, GPS devices, and so forth (Sparrow, Liu, & Wegner, 2011). This transactive memory is a byproduct of connectivity, in that this information is only remembered and thus retrievable if one is connected to the proper device. As cloud storage continues to grow, more of these memories will be stored outside of the physical devices, people will become increasingly reliant on their connection to these external data repositories to remind them where to be, what to celebrate, and how to get what is needed to live.

Evidence exists that transactive memory mediated by technology is actually changing the way individuals think. For example, when a person who relies on ICTs to access and remember information is asked a question such as, “What does the flag of Nigeria look like?”, the parts of the brain that are activated are different from the parts of the brain activated in someone who uses analog technologies. Researchers believe this is because they are using different processes to remember. For those who are accustomed to using search engines, they actually think about where they would go to find a picture of the Nigerian Flag. People who are accustomed to using analog technologies actually
search their own memories for any information to answer the question. They think about possible shapes and colors, while the others think about search engines, key words, and websites (Carr, 2011). These findings highlight some of the possible effects of ICT connectivity; it may change the way in which one thinks and diminish the capacity to think in *pre-digital* ways.

Connectivity also has the potential to turn what were formerly private activities into public acts. In some cases, this may be beneficial; in others it may be regarded as an unwelcome invasion of privacy. Using social media sites to access content can mean that others are able to view what someone has been listening to, watching, and saying. This kind of self-disclosure can lead to bullying and embarrassment, or it can help to connect people together into communities based on shared interests (Siddiqui & Turley, 2006). Connectivity allows people to share, and in self-presentation through sites like Facebook and Twitter, it allows them to overshare as well (Milne, Labrecque, & Cromer, 2011). This phenomenon is not new, but it is exacerbated by online interactions that grant a sense of anonymity to many individuals who suffer from what is called a disinhibition effect (Ridley, 2012). This refers to the idea that people feel fewer inhibitions about saying or doing things online than in face-to-face interactions. For some, this is liberating, and online expression is perceived to be a better representation of their *true self* than would be possible in traditional in-person interactions (Tosun, 2012).

Interactions online also can change the reader-creator relationship by providing more direct feedback than is typically possible in traditional print media. For example, many digital sites provide analytics that allow content producers to see how many people have read their work, how long they stayed on the page, what they skipped, and what
they commented on or shared (Lanier, 2013). This information changes the dynamic between producer and consumer in interesting ways and has the potential to change the types of content that are produced. One possible danger is that this might lead authors to be overly influenced by these data and to produce materials that are designed specifically to cater to existing tastes (as a politician who “leads” by following the polls). This may undermine the independent thinking that is vital for the creation of groundbreaking work or ideas.

The more systems and people that are connected, the more data is produced, and the more value these data may have. Examining these large data sets requires powerful computers. Modern supercomputers and storage facilities already are impressive in their speed and size; due to Moore’s Law, they are improving at an exponential rate (Kurzweil, 2005). It is important to note that a supercomputer is not one big computer, but a series of small computers or processing cores connected in such a way that they work together. Thus, the tools of connectivity are an example of the same phenomenon. With these connected machines working together, huge quantities of data can be gathered, organized, and interpreted (Mayer-Schonberger & Cukier, 2013).

These analytics produce a new data-driven understanding of patterns and outcomes. This process is sometimes simply referred to as Big Data (Mayer-Schonberger & Cukier, 2013). Data gathered in educational contexts can be used to understand everything from the most successful recruiting strategies to identifying students who are most likely to need extra support, to the characteristics correlated most closely with success in certain majors or academic settings. These data can help determine best practices in areas ranging from teaching to how to use classrooms most
efficiently. Insights also can be used to improve the fit between students and their roommates, teachers, programs, and even institutions. This is very significant, in that anything that can be done to improve the ways in which students are recruited and retained can be of great value to both the students and the institutions involved. The efficiencies that can be gained through analytics are widely known in the business world and are central to the successes of companies such as Walmart, Coca-Cola, and UPS (Mayer-Schonberger & Cukier, 2013). Analytics may be one of the most valuable tools available for higher education leaders who want to use data to drive their decisions about how to allocate resources most effectively.

**Challenges of Connectivity**

The ability to connect to academic materials, even those that are well designed to foster learning, does not mean that a high level of learning will actually take place. Early assessments of MOOCs indicate that they may be most effective for well-prepared, autodidactic students (Thrun, 2013). This means that, at least in their current form, they might not be as helpful for the large number of students who need remedial assistance or face motivational challenges. Sebastian Thrun, the former Stanford Professor and one of the founders of the MOOC provider Udacity, recently stated that only the top 5% of students are really prepared to benefit from these free courses as they are currently configured (Thrun, 2013).

A lingua franca also is critical for connectivity to be fully realized. Today, English is the language of internationally circulated academic journals, and researchers in non-English-speaking countries are increasingly using English for their academic writings and communication. Major academic Websites tend to be in English as well. As
English is the language of scholarly communication, the methodological and intellectual orientations of the English-speaking academic culture hold sway globally. The implications for developing countries are potentially significant. MOOCs produced in the current centers of research are easy to gain access to and inexpensive for the user, but their adoption may inhibit the emergence of a local academic culture, local academic content, and courses tailored specially for national audiences. MOOCs have the potential to reach non-elite audiences, thus extending the influence of the main academic centers to massive numbers of people (Altbach et al., 2013).

A related issue is the normative effect of connectivity on everyone involved. This concern already has been raised generally about the ways globalization may be undermining local and regional cultures by homogenizing culture on a global scale (Zhuojun & Hualing, 2014). The same process may occur with the proliferation of MOOCs. In an opinion piece in the Chronicle of Higher Education (December 4, 2013), Philip G. Altbach, research professor and director of the Center for International Higher Education at Boston College, argued that society needs to think about the implications of pushing the MOOC too quickly or broadly.

These issues come into even sharper focus in the social sciences and humanities. In fields such as literature and philosophy, most courses reflect Western traditions of knowledge, the Western literature canon, and Western philosophical assumptions. The social sciences reflect Western methodologies and basic assumptions about the essentials of scientific inquiry. Mainstream ideas and methods in fields like anthropology and sociology reflect Western trends, especially those of the American academic community. The major academic
journals and the big academic publishers are located in the global centers of knowledge, like Boston, New York, and London. It is, under these circumstances, natural that the dominant ideas from these centers will dominate academic discourse, and will be reflected in the thinking and orientations of most of those planning and teaching MOOCs. MOOC gatekeepers, such as Coursera, Udacity, and others, will seek to maintain standards as they interpret them, and this will no doubt strengthen the hegemony of Western methodologies. (Chronicle, 2013, p. 6)

This process could reduce the potential diversity of opinions and ideas within academia, as these courses shape and filter what is learned on a global scale. Lanier (2012) raised a similar point on the dangers posed by the rapid adoption of any innovative technology. He noted that pioneering approaches and decisions can become technological lock-ins that restrict the possibilities for everyone and everything that follows. Facebook, for example, set up certain parameters within which every user must work to create a profile. Other restrictions control what users can do on the site. For instance, one can like but cannot dislike something.

Some of these lock-ins or characteristics might not be important, but some early decisions may have unintended consequences that are more profound. For example, musicians currently using digital music technologies are working with technology called MIDI; it was originally designed to represent musical notes as performed on a keyboard (Lanier, 2012). This technology was developed to recognize whether the key was in an up or down position and for how long. This is appropriate for music played on a keyboard, but the on-off quality of the MIDI technology does not do well at capturing
the more fluid notes caused by the vibrating strings on a violin or the sliding qualities that can occur with a voice or horn. Yet, because the MIDI technology was established as the common protocol for digital music recording software, it has become locked in, even though it is not very good at capturing a lot of what musicians do or want (Lanier, 2012). Is this also a danger with the MOOC phenomenon? Will it lock in certain attributes that restrict rather than enlarge the possibilities for both students and teachers, much in the way lecturing has been locked in for centuries?

The economics of the information age highlight some important questions about the role that connectivity will play in creating revenue in the future. Connected people leave a prominent digital footprint and, as these data are gathered, aggregated, and analyzed more effectively, they are increasingly valuable (Mayer-Schonberger & Cukier, 2013). One of the challenges of the information economy, then, is that these data often are gathered without compensation and then monetized and sold for a profit (Lanier, 2013). Will individuals be able to be paid for the value of the data trail they leave behind? Lanier (2013) proposed that a revenue sharing model be developed to allow individuals to receive compensation for their personal data in a way that is similar to the royalties musicians receive when their music is sold or streamed on the Internet. These issues also pertain to the intellectual property created by individuals in higher education that is posted on the Web. Perhaps a model similar to Lanier’s proposal might emerge to compensate people for the value of these intellectual products. Will intellectual property accessed through the Web be monetized in the future? Should faculty be paid for writing a journal article that is widely cited and accessed for free on the Web? What about a PowerPoint presentation that they make available on a site such as SlideShare?
Global connectivity, facilitated by ICTs, also has created a new characteristic that may further the divide between rich and poor countries of the world. Today the distinction is no longer just between the physical assets that these countries hold, but their *immaterial* assets as well. Freedom to access information and to express opinions is more than just an intellectual or social concern; increasingly, free access to information is a precondition for full participation in economic and political activities. Thus, in the information age, unfettered connectivity may be regarded as a basic right and a necessary precondition for full participation in civil society (Lor & Britz, 2007).

Connectivity also will expose people and systems to risk. One such danger was brought into stark relief in June 2010, when a computer virus called Stuxnet was discovered to have infiltrated the programmable logic controllers (PLCs) that monitor operations at the uranium enrichment facility located in Natanz, Iran (Langner, 2013). This virus was designed to enter the computer systems that control the speed of the centrifuges at the plant and to accelerate these systems to destructive speeds while informing the system operators that everything was normal. The result was that the centrifuges were destroyed and the facility was taken offline. These types of PLCs are extremely common and are used in many different manufacturing systems worldwide. In fact, the Stuxnet bug was found in the software of PLC systems at thousands of facilities around the world in the months that followed the attack, as the virus was designed to infiltrate industrial software produced by the multinational firm Siemens. Siemens has since released a detection and removal tool, but the idea that connected systems are vulnerable to such attacks has now been proved. Stuxnet was a cyberweapon built
Data security is crucial in the digital age. It is estimated that university computer systems face near continuous attack from a range of sources (Poremba, 2012). Information and network security are essential for the benefits of connectivity to be fully realized, and protecting these systems is a real and expensive challenge for connected organizations of all types, including higher education institutions. The challenge is particularly acute on college campuses, where open access is important and thousands of users want to use the system in ways that are relatively hassle free, at all hours, and with thousands of different devices. Most campuses want to provide wireless service, and this presents even more challenges (CSIS, 2013). Network security will be a critical aspect of connected higher education in the 21st century, and one of the leadership challenges will be finding the right balance between access and security.

In addition, with increased connectivity, it may be increasingly difficult to prevent ICTs from becoming a distraction in the classroom. In a study of hundreds of graduate and undergraduate students from five different states, one researcher found that 80% of students indicated that they regularly text during class. Fully one third use digital devices more than 11 times per class period for non-classroom related activities (Ryan, 2013). This is certainly not a recipe for effective learning, but it may point to the need for more engaging activities that take advantage of the students’ connectivity. How could this propensity to be connected and engaged with others be used to further learning within the classroom?
Increased connectivity tends to blur the boundaries between work, school, personal time, and entertainment. Because connectivity allows for schoolwork or professional life to take place anywhere or any time, it means that it is sometimes difficult to maintain boundaries between these domains. In an age of high connectivity, is it reasonable to expect employees, students, or teachers to be responsive to questions or requests at all hours and on the weekends? How can people protect their private time from the intrusions that come with connectivity? This is very difficult, as the same devices and platforms that people use to communicate at work or school also are used for entertainment and personal business.

Increased connectivity also is making it difficult for many to concentrate. With an unlimited amount of information potentially available at any given time, one sometimes struggles to concentrate on a single task. Analysts call this *continuous partial attention*, and it is a byproduct of the multitasking that comes with living in a highly connected world (Rose, 2011). Managing the flow of information and communication in a highly connected world is a real challenge, and one that has the potential to deeply impact the interactions and learning that take place both inside and outside of higher education.

Higher education stands poised to benefit greatly from many of the technologies being developed to help individuals connect with one another and to find and share information faster and over greater distances than ever before. The enormous flows of data and communications produced by these technologies on a daily basis offer the promise of huge improvements in the way in which we higher education is delivered and received in the future. These technologies also pose significant challenges, and higher
education leaders will need to find the right balance between change and continuity, openness and security, and flexibility and structure. All of these decisions will need to be made with a solid understanding of the implications that come from living and working in a society characterized by increased connectivity.
CHAPTER V: AUTOMATION

Automation is a term coined to describe a wide variety of processes by which human labor and intelligence is replaced by mechanical, electrical, or computerized activity. A dictionary definition defines automation as “A technology concerned with performing a process by means of programmed commands combined with automatic feedback control to ensure proper execution of the instructions. The resulting system is capable of operating without human intervention” (Merriam-Webster.com).

Today automated systems perform all types of processes, including checking spelling and grammar, transferring funds in and out of bank accounts, and translating text and audio from one language to another. Automated systems of one kind or another have been used for a long time, and many people are accustomed to the idea that these systems can change the gears in their cars and turn on their furnaces when the temperature falls below a specified number. What is novel about 21st century automation is the broad range of activities now being transformed and the capabilities that these automated systems may have to completely reinvent activities and processes in the future.

Automation has played a crucial role in improving the safety, convenience, and efficiency of many systems that Americans have used for well over a century. In fact, automation was one of the critical developments that led to the creation of the modern industrial economy in the United States. It was the main force driving the first wave of the Industrial Revolution in the 1820s and 1830s. Huge machines that separated cotton seeds from their fibers, automatically spun these fibers into thread, and then turned these threads into fabric, helped to create the first great industrial enterprise, the textile factory
(Laurie, 1989). This industry had enormous effects on society as a whole. It drove down the cost of cloth and, thus, created the opportunity for many to have high quality clothing and other textiles for the first time. It created changes in the lives of those who lost their jobs in the old system, while also creating a whole range of new positions in the factory towns that popped up all over the Northeastern parts of the United States. It helped to fuel the first wave of urbanization in American history, as people moved from rural agricultural settings to cities where wage work was now available on an unprecedented scale (Laurie, 1989). It also gave new life to related industries, such as cotton production, and helped to fuel the expansion and increased profitability of slavery in the southern parts of the country. The divergent paths taken by these two regions were one of the chief causes of the tensions that ultimately led the country to Civil War in the 1860s (Calore, 2008).

In the early age of automation, concern existed that the factories were filled with women and children working (primarily because their labor cost less than that of a man at the time) and that this represented a dangerous break with economic and cultural traditions where men had been the only workers to play this role in the economy. Questions were raised about what this would do to gender roles, family life, and even childhood (Griffin, 2013).

Automation has a long history of transforming the social, economic, and political lives of people in far reaching ways. The transformative potential of these processes likely will continue over the next century. Anyone who has gone into a grocery store and seen the scanning devices that have replaced human checkers knows that one of the outcomes of automation can be job loss, but they also know about the speed and
efficiency that these systems can bring to a busy commercial setting. As convenience and cost are two important variables for many shoppers, automated systems that can improve efficiency will usually be widely adopted if they can help drive down costs and improve access and service.

Automation processes today are being applied to new purposes in part because they are increasingly based on artificial or machine intelligence. Advances in artificial intelligence are driven largely by improvements in the way in which computers are being taught to adapt their behavior by using algorithms to understand and anticipate patterns (Huhns, 2012). Computers also are becoming better at processing natural language, which means they are now able to understand input from humans that is not written as computer code. As these capabilities improve and more types of data become available (from sensors and computer networks), and these data are produced in ever-increasing quantities, these artificial intelligence systems will have more information to analyze and with which to build better models of human behavior. As a result, it is possible that these systems will improve their thinking capabilities at an exponential rate (Kurzweil 2012).

The MIT trained inventor and futurist Ray Kurzweil claimed that, within five years, individuals will be able to purchase computers with processing power that exceeds the human brain for less that $1,000 (Kurzweil, 2012). He also agreed with the founder of Lotus software company, Mitchell Kapor, that a machine will be able to pass the Turing Test by the year 2029 (Watson, 2010). The Turing Test refers to an experiment designed to evaluate whether a machine can be considered intelligent. The British mathematician and computer scientist in Alan Turing first proposed this test in 1950 (Harnad, 2006). The test is designed to measure the capabilities of an artificial
intelligence system. To pass the test, the system needs to be sufficiently capable such that a human cannot distinguish whether he or she is dealing with another human or with a machine (Harnad, 2006).

Practical reasons abound as to the importance of being able to tell whether one is dealing with a human or a machine when online. For instance, many Websites want to keep algorithmic systems, or bots, from entering the site so that they can prevent these systems from doing things such as taking a poll or entering a contest. In an effort to deny access to algorithmic (non-human) users, many Websites now employ the CAPTCHA system (Bursztein, Martin, & Mitchell, 2011). This is designed to determine whether an automated system or a real human is trying to access the site. When users go to a site protected by the CAPTCHA system, they are presented with a graphic image of several alphanumerical characters that are intentionally distorted. The assumption is that no machine-based system can figure out how to interpret these images, so any system that is able to write them correctly is likely to be human (Bursztein et al., 2011). In this sense, the CAPTCHA system is a reverse version of a Turing Test; it is a machine testing whether a human is human, rather than a human testing whether a machine is a machine.

This may soon be hard to do. Some impressive automated thinking systems already exist. One of the best known is the Watson Program developed by IBM. This system gained fame in 2011 by competing with the best human champions on the game show Jeopardy. To play the game, Watson needed to be able to recognize human speech; understand colloquialisms, humor, and irony; sort through enormous quantities of information (it had large servers at its disposal, but was not connected to the Internet);
select what was most germane from this data; and then formulate a response in perfectly intelligible English. It did this with ease and won the game handily. This was an impressive and very public display of what machine intelligence could do in 2011 (Best, 2013).

The system developed by IBM engineers for this contest has since been improved through the collaboration of researchers at more than 300 universities. Much of this research is focused on its use in the health sciences, and it is now being put to work on learning to conduct sophisticated medical diagnostics (Diamandis & Kotler, 2012). The plan is to reduce the size of the system so that it could be run in any hand-held device and used in field operations anywhere in the world. Some IBM engineers see it as becoming a much more sophisticated version of the Siri *personal assistant system* now widely used on the iPhone (Best, 2013). Siri is an impressive early iteration of an artificial intelligence system, and it is already small and inexpensive enough to be installed as basic software in any new iPhone (Aron, 2011).

The capabilities of these portable systems will grow as they are able to access the vast information made possible by improvements in *Big Data* servers and network technologies. As a result, they will soon be able to do more than simply find information or give advice about the best way to get somewhere. IBM envisions individuals being able to ask complex questions. It sees a future where they will hold up their phone and shoot video and then pose questions such as: What is this and what is it worth? What should I plant here? What is this skin problem and how should I treat it? (Best, 2013). Some computer scientists believe that these systems will even be able to *feel* in remarkably human ways in the near future (Kurzweil, 2005; 2012).
These types of artificial intelligence are now an integral part of the automation efforts transforming many areas of society including transportation. Every major car company now has an autonomous vehicle division that is working on adding automation everywhere possible to make these vehicles safer and more efficient (Kelley, 2014). Already it is possible to buy cars that brake on their own; have autonomous speed controls; and set off sound alerts when drivers are distracted, sleepy, or cross over a lane marker. Many cars automatically adjust seat, media, and temperature settings when a driver enters the vehicle. Several companies have prototype cars that can park themselves; come when called like a valet service; and, most remarkably, drive in regular road conditions without any human involvement at all (Brown, 2013). Audi, Mercedes, Ford, Volvo, and GM all have plans to release semi-autonomous vehicles to the public by the end of the decade. These vehicles will be capable of driving under many conditions but will still require a trained and alert driver to assist as needed (Kelley, 2014).

Beyond changes in the cars themselves, the entire road infrastructure may be part of an autonomous transportation system of the future. Smart roads with sensors to control every vehicle in a certain section are currently being tested (Gilroy, 2013). These systems will improve gas mileage, help prevent accidents, and help reduce traffic congestion. Similar systems are being developed to improve air traffic control by interacting directly with the sophisticated autonomous systems already on the aircraft. Unmanned drone aircraft already are being flown with autonomous capabilities enhanced remotely by human pilots (McMahan, 2013).
The smart grid refers to the autonomous components now widely used to improve the efficiencies in the means by which electricity is delivered and used. Monitors assess demand, identify problems, route electricity around blockages, and increase production as necessary to meet demand. These systems take electricity into the grid from systems like individual solar arrays when they are producing a surplus and then feed electricity back into the same areas when demand requires it (Chiemezie, Gloria, & Gordon, 2013). These new smart grid systems also take into consideration historical data and other information, such as predicted weather and local events, and use these data to anticipate demand and adjust accordingly. All of the decisions made in these systems are autonomous, though human oversight is still crucial for them to function at maximum efficiency.

The existence of large quantities of data (Big Data) combined with fast computers is opening up many new possibilities for automation. For instance, within law enforcement a movement exists called predictive or autonomous policing (Perry, 2012). Police have been using autonomous systems that take pictures and issue tickets for traffic violations for years. They also use camera systems mounted on their cars to photograph license plates and match these automatically to databases in order to identify stolen cars or vehicles driven by individuals with warrants out for them. Face recognition software now allows these automated camera systems to identify individual drivers or pedestrians. As useful as these technologies are today, even larger databases are being added to the analysis, and a possible new chapter in policing is beginning to take shape.
A hint of what may be coming can be found in the work of a company named PredPol. This company uses algorithms to sort through data related to weather, demography, seasons, time of day, crime reports, and GPS information to create maps of, not just historical crime patterns, but also to predict where certain crimes are likely to occur in the future, including characteristics of both perpetrators and victims (Economist, 2013). Predictive policing uses algorithms to highlight patterns and make predictions based on them. These technologies are being developed, as they allow police departments with tight budgets to allocate their human resources in more efficient ways.

As the Chief of the Los Angeles Police Department, Charlie Beck, stated,

“I’m not going to get more money. I’m not going to get more cops. I have to be better at using what I have, and that’s what predictive policing is about… If this old street cop can change the way that he thinks about this stuff, then I know that my [officers] can do the same. (PredPol.com)

Algorithmic systems are being used to make decisions in many businesses. Companies such as Infosys, Mu Sigma, and Market RX all create and sell software that can help companies make decisions about things relative to where to locate production and sales facilities, how to set prices for different products or subsets of customers, where to advertise, and how much to spend on marketing (Watson, 2010). ERP solutions and SAS are companies focused on developing business-specific decision-making software; IBM has an entire division dedicated to creating automated Decision Management software for its clients (IBM.com). General Electric Corporation has been using this type of software to make decisions for more than a decade, and others are joining the movement in large numbers (Koksalan, Wallenius, & Zionts, 2011).
Amazon has begun to use automated systems to monitor purchasing patterns of individual customers, including data about how long users hover with their cursor over certain items. Based on these data, the company has begun to *pre-ship* orders to distribution centers located near their customers so that if (when) the customer orders the product, it will get to the buyer even faster. They call this their *anticipatory shipping* initiative (Lomas, 2014).

Netflix, Spotify, Pandora, and other popular content service providers run algorithms to make recommendations and to select materials to feature for their customers. They make these selections by collecting enormous quantities of data and observing patterns. They also break down the media files and look at many different characteristics within them and assess how each variable affects viewership. For instance, Netflix tags movies in terms of demographic data about the actors and directors, set locations, themes or subject matter, music, ratings, length, and the period in which they are set, and they then create algorithms that sort through these data and identify patterns that can be used to predict what people will like based on past preferences. Netflix has more than 800 engineers designing and refining these automated systems, and they estimate that more than 75% of viewer activity is driven by automated recommendations. To date, the company has shipped more than 4 billion DVDs and streams more than one billion hours of programming per month based on these systems (Vanderbilt, 2013).

Google is perhaps the largest company advancing automation today. Best known for its search engine business, Google has been acquiring an interesting range of companies over the last two years. They recently acquired an advanced robotics
company called Boston Dynamics, which makes incredibly life-like robots and is considered one of the leaders in the field of robotic design. Google also has purchased the artificial intelligence company DeepMind and a company called Nest Labs that designs and manufactures smart thermostats. Google just acquired Titan Aeronautics, a company at the forefront of developing fully automated, solar powered, drone aircraft. Google also recently announced that it is partnering with the largest solar power system producer in the United States, SolarCity. The company has already perfected the fully autonomous car, and they recently announced that Ray Kurzweil has been hired as the new Director of Engineering. His new position comes with a one-sentence job description: "To bring natural language understanding to Google" (Holman, 2013). It is unclear what all of these purchases and collaborations portend, but they represent billions of dollars worth of investments, and it appears evident that the aim is to bring automation to many sectors of society, and to do it on a global scale.

**Automation in Higher Education**

Many potential implications exist for these types of automation for higher education leaders to consider. As these systems become more common in the broader society, they also will become more common within higher education. The most widely recognized form of automation that is used in higher education on a daily basis is probably the automatic spelling and grammar features that come with most word processing programs. Similar spelling assistance is routinely encountered on most search engines when words that are transnosed are fixed automatically (to “transposed” in this case), or when the user misspells a search term and the system responds by automatically providing results for the closest word with an accompanying note saying something to
the effect, “Did you mean to search for ‘transposed’ instead?” Programs that automatically fill in email addresses as they are begun or complete the full addresses of previously visited Websites after only a few letters are other examples of this type of automated support. These are simple forms of algorithmic artificial intelligence and are now widely utilized.

Other forms of automation are common on college campuses, but may be less visible— for example, the programs run by many IT departments. Computers and computer systems are automatically updated and replaced on specific schedules. Software (particularly anti-virus software) is updated automatically on most campus computers. Many IT departments are using automated programs to assess the overall status of the network and to generate automated messages with updates about the system as needed. These real-time automated programs allow for faster responses to problems and for all users to be informed about any developments relevant to them. Several areas where automation provides significant efficiencies and cost savings address common problems that do not require human oversight: resetting passwords and unlocking accounts, rebooting computers, restart services, monitoring alert notifications, and user and machine provisioning (Nizri, 2013).

Many campuses are using automated systems to assist with academic advising. These systems allow students and advisers to track progress and to make recommendations based on automated analyses of information about program requirements, courses taken, and options available (Shana & Abdullah, 2014). Many of these programs allow students to explore hypothetical outcomes by analyzing the impact of changes in the program, such as a change of major or minor. These programs can be
quite helpful for both students and advisers, and they reduce the likelihood of misinformation leading students taking the wrong courses or miscalculating their progress within the program (Shana & Abdullah, 2014). This can make the job of the registrar’s office much easier, as all parties work with the same understanding of the requirements throughout the process, making it less likely that students will be surprised when their final audit occurs prior to graduation.

Companies like Oracle are now developing a range of software to provide automated student support services. These programs are part of the company’s Automated Higher Education initiative (Oracle.com). One of the most advanced features of these programs is their use of natural language capabilities to “harvest rules directly from complex policy documents and regulations” (Oracle.com). These rules and policy statements are then aggregated into one centralized repository and converted into decision trees that can be integrated into customer service software that allows an automated self-service approach to answering many different types of questions. Because these programs have built-in multi-language capabilities, they can be useful for international students (and parents) or others with language deficits (Oracle, 2012).

Among the advantages of these automated systems is their ability to accurately answer questions without the involvement of a human. This frees up staff members to address other institutional needs and can also allow a smaller staff to handle a large volume of inquiries. Because these programs automatically update themselves as policies are revised, they always will provide the most up-to-date information; thus, fewer staff members need to be responsible for keeping up with the latest knowledge about policy changes. Because these systems are fully automated, they can be accessed
every hour of every day, which means that users do not have to wait for business hours to have their questions answered. It also means that staff members do not deal with the frustrations that come with responding to repetitive questions. These systems can provide more privacy for users, as they do not involve sharing personal information with a staff member (often a student worker in many offices). Finally, these systems have the ability to perform what if analyses on proposed policy revisions. They can automatically assess the implications of an amendment to a policy and, thereby, provide useful guidance to administrators contemplating a change (Oracle, 2012).

Many applications can assist with enrollment management concerns. These range from developing marketing materials such as automatically personalized postcards, calendars, and other print materials; to software programs that identify likely prospects and automatically contact them through direct mail campaigns; and programs that predict the students who will most likely need extra support services in order to be retained (Educationdynamics.com).

Automated career guidance software is now available to help students learn about and clarify their interests and strengths. These insights can assess possible majors and match these majors to specific careers. Programs like the Magellan Career Assessment Program are connected directly to large employment databases and can inform qualified users about specific employment opportunities (Valparint.com)

Other student support services that may be transformed through automation include health and behavioral counseling. Robotic therapists have been developed to answer questions, listen, and provide advice on a range of topics (Spiegel, 2013). These automated therapists are being used to provide services to patients in rural areas or in
places where demand exceeds staffing capabilities. Automated counselors have the advantage of allowing those who may feel uncomfortable seeking help from a human therapist to somewhat *impersonally* access the assistance of a robotic therapist (Helgadottir, 2014).

Human resource departments are beginning to experience benefits from automation in their hiring practices as well. For instance, a company called Gild has created a software program that eliminates human bias in the assessment of job applications. This company is part of a larger movement referred to as *workforce science* that uses computers to sort through large quantities of data to find information to anticipate job performance and identify qualified candidates for specific positions. Companies like TalentBin and RemarkableHire scour Internet data and examine social media sites to provide rich profiles of prospective candidates and then integrate this information with more generalized data about the likely fit of the person for specific employers (Mitchell, 2013).

Automated processes are used in many payroll departments; on most campuses, the days of paper checks are long gone, as automated electronic deposits are the norm. Automated payments are common in purchasing departments, and these processes and the electronic records they produce have allowed for staffing and filing space to be reduced.

Many applications of automation can be seen in the physical plant. Efficiencies can be gained through automated lighting, heating, and cooling and irrigation systems, to name just a few. All are areas where educational leaders might garner significant savings by replacing manual and human systems with automated systems.
For faculty and students, automated speech recognition software has the potential to increase the speed of many academic tasks. It could be used to convert audio or speech to a written format; this could be useful for note taking, writing papers, giving feedback to students, or preparing class activities or lectures. For those working with materials or colleagues where language barriers exist, connecting natural speech capabilities to translating software will be increasingly helpful. The programs that automatically convert text and spoken language from one language to another will become increasingly valuable as they improve in speed and accuracy.

Automated readers and scanners are making available all types of digital materials. Initiatives, such as Google’s program to scan books and make them available for free, with full text and search features, are changing the way in which research is conducted. Automated programs that send information about relevant grants and conferences based on search parameters, disciplinary affiliations, or other variables identified in their searchable profile also are assisting researchers. These programs make it easier to stay informed and can lead to more productive research agendas as a consequence.

Automated attendance systems are being used on some campuses with large lecture sections. These programs allow for student attendance records to be kept and uploaded directly into a course management system without faculty members spending valuable class time doing the actual record keeping. This has the potential to provide extra instructional time across many sections over the course of a term. Most course management systems also have automated systems that allow all enrolled users to receive messages when new materials or comments are posted.
Book ordering and even selecting class materials is now being automated as well. These systems alert faculty about materials that may be relevant for their courses, and some even allow faculty members to add materials automatically to the book order software at their home institution.

Two areas that are central to the core mission of higher education also may be affected by automation— instruction and assessment. Adaptive learning systems are one of the key technological innovations of the past decade. These systems allow instructors to customize lessons for each student through the use of automated decision trees. When students complete a lesson or a section of a course, they are given an assessment. Their answers to these questions determine what the algorithm will show them next. It might be a review of portions of the lesson that were not mastered, or it might skip ahead and present new material. This individualized instruction allows each student to be challenged and supported and for instructors to monitor each through the analytics generated by these programs. This allows the instructor to identify patterns, address concerns as needed, and attend to the needs of individual students more efficiently. These data also may be useful for dividing students into work or study groups in an intentional way.

Automation may impact classroom instruction through the use of automated grading systems. These systems hold the promise of freeing up faculty time by allowing for more time-intensive assessments such as essays to be used in large sections. These systems have expanded beyond the Scantron readers of yesteryear and are being used to evaluate and comment on written essays. Done well, these automated essay graders hold the promise of reducing bias, providing consistency, and increasing the speed of
feedback for the students (Mayes, 2014).

**Implications of Automation**

The history of technology illustrates that changes do not always go as planned, and that unintended consequences often flow from the development and adoption of any complex technological system (Joy, 2000). One of the concerns about automation is that, if more tasks and processes are turned over to these systems, people will become increasingly reliant upon them and, thus, susceptible to risk should anything go wrong. Overdependence can have at least two different types of unwanted outcomes. Service can be interrupted if the relevant system is not working, or if the imported data are not accurate. The other problem has to do with the quality of the service provided by automated systems, even when working as intended, and the effect of these systems on both users and the human staff they are designed to support (Goddard, Roudsari, & Wyatt, 2012).

The automated essay grading systems may be a case in point. Some well-publicized studies indicate that these systems work about as well as humans at assigning grades based on a rubric (Shermis, 2013). However, the quality of the feedback from an automated program was significantly different than would be expected from a well-trained and conscientious human. To the student, this difference may be a problem. The grades given by the machine-based system may be admirably consistent, but the feedback may not provide the human touch that is critical to both inspire and guide improvement. Moreover, a more recent analysis indicates that some of the early research on these systems presented an overly optimistic view of their effectiveness (Perelman, 2013).
Even if these systems are improved to the point that they can give detailed feedback that is equivalent to a human grader, these kinds of systems may still be unwelcome in many higher education settings. The teacher-student relationship stands at the very core of the education enterprise. The ability to inspire and be inspired is central to that relationship and plays a critical role in learning. Students will never aim to please, or hope to avoid disappointing, a machine. A machine will never pick up on personal interests or concerns that may come through in a student’s written work. Sometimes these are important issue to address. At their best, automated grading systems can give useful feedback to improve a student’s writing and they can avoid human bias. These are both significant contributions, but the real value of these systems will probably come in situations where the choice is not between a human or a machine grading a paper, but between a paper assigned because a machine can grade it or having no papers assigned at all. As workloads and class rosters increase, some faculty will be increasingly reluctant to assign any assignments that require significant extra time to review. If that is the case, these systems may be a welcome innovation.

These systems raise questions about staffing as well. Will automated systems allow for staff to either be reduced or re-positioned? Will these systems allow for workloads to increase because of the assistance these systems provide? Given the budget realities on most campuses, there are certainly strong economic incentives to increase the productivity of educational workers. If automated systems can increase productivity, reduce bias, and improve instruction (by providing more feedback on writing, for instance), then it is likely that these systems will become more prevalent in academic settings where the needs for improvements in these areas are most acute.
Many of the decisions that are made about staffing issues and productivity are themselves based on data that is analyzed by computer programs. The chief problem with this workforce science approach is that it imposes a reductionist view of productivity and the means by which it can be measured. What can be measured by these automated systems will tend to be valued in part because they are easily quantifiable. This can undercut or devalue other important worker or workplace attributes. Another problem is that some correlational relationships may be misinterpreted as causal relationships. For instance, if these systems are allowed to evaluate candidates for a position, a spurious statistical artifact could affect career or other important decisions that are made based on a misreading of the data produced and analyzed by an autonomous system. Similarly, statistical correlations might send students into certain majors or hire individuals for certain positions based on a misreading of what are often complex and messy data. The danger is that if humans are removed from these processes, one might end up being overconfident that these systems are producing outcomes better than those that would have been achieved with human decision makers in charge. This assumption may not be true.

Perhaps the biggest concern regarding the use of automation is the potential that these systems will erode the human dimensions of the academic communities where they are employed. If relationships within this community become increasingly defined by the algorithms that assess and mediate them, the human element, with all of its emotional, unpredictable, and idiosyncratic characteristics — so central to the human and educational enterprise until now — may be erased or undermined in ways that significantly devalue what education is and can be – preparing humans for a life well
lived (Delbanco, 2012). In an age where many aspects of life are mediated by autonomous systems, it may be all the more important that higher education retain the human instinct to ask deep questions, identify and support unique talents, and inspire students through personal relationships. The era of the technologist has produced huge advancements in data gathering and automation and, perhaps ironically, it also has produced a growing need for individuals who can think creatively and deeply about the logical, linear, system-based, and data-driven world that is emerging in the information age. Too much automation in higher education may mean a lack of these *big picture* thinkers to do this type of work (Pink, 2006).
CHAPTER VI: PERSONALIZATION

Personalization refers to the process of customizing or modifying something to meet the tastes, needs, or preferences of an individual (Eirinaki & Vazirgiannis, 2003). Personalization is a phenomenon that can be seen in many areas of society today, and a variety of technologies are making it easier to personalize or customize products and services to meet the needs and desires of specific individuals. Any technology that might be used to accommodate the differences between individuals may play a role in advancing personalization processes in the 21st century.

Personalized medicine is one of the most important trends in healthcare today. As more is learned about genetics and tools are improved to sequence and map individual genomes, this information likely will be used to provide medical treatments tailored to the specific characteristics of each patient. The goal is to identify information about metabolic and other key processes to determine the effectiveness of different drugs, dosages, and interactions so that each patient will receive a treatment personalized to his or her specific biological and psychosocial profile (nih.com; Futurist, 2014). One of the key advancements underlying personalized medicine is the work of the Human Genome Project, which was completed in 2003 (Genome.gov). The success of this nearly three billion dollar scientific endeavor (mapping the entire human genome) opened up many avenues for research in genetics. People can now have their own DNA sequenced for approximately $1,000 (Hayden, 2014). The possibilities for personalized medicine are enormous, and it is one of the central developments that may help to extend the trend of increased longevity that has occurred over the last century.
Personalization also is seen in many areas of retail. *Loyalty cards* are common in many industries; customers use these cards to obtain discounts on everything from groceries to airline tickets. In return for large quantities of data about their buying habits and tastes, retailers provide deals that are customized specifically for the individual consumer (Coll, 2013). Many companies produce coupons or highlight products that are likely to be of interest to the customer based on previous buying habits. Several grocery store chains are now flirting with personalized pricing formulas based on assessments of buying habits and what customers are willing to pay for products and services. Inequities in pricing have been common for items such as airline tickets, hotel rooms, and car rentals, but this may soon become common in other retail sectors as well (Farnham, 2013). As the capacities for personalization grow in the future, personalized pricing may become the norm.

Smart Carts are currently being tested in some supermarkets. These carts will provide a personalized experience for each shopper by connecting to their mobile devices and through their membership account. Once shoppers are logged in, the carts will help guide them to the products and services that are most likely to be desired and useful. These systems provide convenience for the consumer and also provide the retailer with the ability to target individual shoppers with advertising and price discounts designed to stimulate the purchase of specific products (Van Ittersum, Wansink, Pennings, & Sheehan, 2013).

Personalization is increasingly common in the clothing business. Technologies that allow customers to view prototypes of their own designs make it possible for them to design items such as tennis shoes, dresses, and shirts. Software programs will assess
pictures of clients, or other information they input into the system, and then make specific clothing recommendations for them (Yu-Chu, Kawakita, Suzuki, & Ichikawa, 2012). 3D printing may make it possible to manufacture one-off designs at reasonable prices, which will open up the possibility of personalized production of many types of consumer products.

Customers are accustomed to personalizing many of the items they buy. Before individuals purchase a computer or a car, for instance, they expect to be provided with a range of choices in features and specifications. The same is true with the now ubiquitous smartphone. In fact, the personalization movement is a big business for after-market cell phone accessory suppliers. The industry sold more than 20 billion dollars in accessories to smartphone owners in 2012. This includes items such as personalized covers and ring tones. According to one study, the average smartphone owner spends approximately $56 personalizing his or her device (Graziano, 2012).

Personalization also is a feature of virtually every media platform on the Internet. The newsfeeds viewed by individuals when they visit a site like Yahoo News, Google, or Facebook are all personalized for each customer. These sites gather a wide array of data to determine what the viewer will see. Even if the user is not logged in to Google, the site monitors the location, computer type, browser type, operating system, previous searches, and other variables to assess as much as possible about the user in order to personalize their experience (Pariser, 2011). Facebook uses a sophisticated set of algorithms to determine everything from economic status to political orientation in order to provide a newsfeed tailored to each individual (O’Banion, Birnbaum, & Hammond, 2012). In fact, even the posts of Facebook friends are filtered using this software, so that
the comments of friends with different political beliefs may be filtered out completely (Pariser, 2011).

Major media companies such as *The New York Times*, Time Warner, and ABC are experimenting with different personalized approaches to content delivery. The reason for this is that personalized products are utilized more often and the data that is gathered in the process can be used both to further personalize the experience and to provide a rich user profile for potential advertisers. This makes the advertising on personalized sites more targeted and, thus, more valuable (Boyd, 2011). Media companies that personalize their products can give the customer a steady stream of content tailored just for them and then sell this knowledge to advertisers who are now able to provide highly personalized campaigns targeted to the individual consumer’s interests and pocketbooks. Because these advertisers know more about their audience than was ever possible in the past, they are willing to pay more for this access. This revenue is providing a much-needed boost to many media companies that are seeing a decline in revenues from the old subscriber model. Thus, these new revenue models are accelerating the overall trend toward personalization (O’Banion et al., 2012).

**Personalization in Higher Education**

Many of the current developments in higher education are aligned with this trend toward personalization. A growing movement exists to re-think the means by which learning is assessed and the ways by which progress is measured toward, and ultimately awarded for, degrees. Most institutions measure learning outcomes by calculating the amount of time a student spends in the classroom (credit hours). An alternative system, called *competency based assessment*, is a more personalized version of evaluation, as it
is designed to measure what each student knows, rather than assessing a generic input like instructional time (Morcke, Dornan, & Eika, 2013).

One of the better-known innovations in the area of personalized assessment is the Western Governors University (WGU) project that began in 1995. The project grew out of the frustrations expressed by a group of governors from western states who were considering the creation of alternative pathways to degrees in areas that were priorities in their region. WGU now has more than 25,000 students enrolled and offers 50 degrees in four broad areas: business, education, health professions, and information technology (Selingo, 2013a). The essence of the WGU model is personalization of both schedules and learning assessments, with a goal of creating a more flexible model of education that can be modified to meet the needs of different students or programs and allow for prior coursework or experiences to be included in the learning assessment, and for programs to have increased flexibility in terms of how they are delivered. These programs are designed specifically to meet the needs of a wide variety of individual students and industries (Selingo, 2013a).

Three universities have recently launched competency-based degree programs. Northern Arizona University, the University of Wisconsin system, and Southern New Hampshire University (SNHU) have introduced programs aimed at working adults and are separate from the institutions’ other undergraduate programs, which are still based on seat time. Students are able to move quickly through courses for which they are well prepared and focus more of their energy on classes covering material that is new or more challenging. In some cases, they take classes offered on a traditional schedule and credited in the usual way; in other cases, they work their way through material and get
credit for the courses by proving their mastery of the content. Both types of courses can be applied toward the same degree. This flexibility allows students to continue to work, to get credit for past experience and knowledge gained, and also to engage in many of the traditional activities that colleges highlight as the most rewarding, such as undergraduate research, study abroad, and practical internships (Porter, 2013).

In January 2013, the United States Department of Education took a step that may help institutions interested in this type of experimentation by providing a provision to allow students in competency-based programs to receive federal financial aid (Field, 2013). This has potentially far-reaching consequences beyond just rethinking the means by which colleges award credits. It could mark the beginning of a reimagining of the entire academic calendar.

A few campuses are experimenting with shorter semesters interspersed within the traditional 15-week terms. Arizona State University, for instance, has increased its offerings of 7½-week courses to provide an option for students who have finished shorter online courses and would otherwise have to wait until the next semester to enroll in a face-to-face option (Selingo, 2013a). The need for more personalized and flexible scheduling means that many institutions will have to re-think one of the bedrock inheritances of 20th century higher education, the 15-16 week semester. This tradition is the centerpiece of most institutions’ academic calendars; and, importantly, it is part of what creates the overall feel and pace of traditional campus life and work schedules. If personalized scheduling means that more flexible course offerings will necessitate changes in the basic segmenting of the academic year; the rhythm and pace of academia as it is lived on many campuses will change in a substantive way for the first time in
In competency-based programs, student learning is assessed through tests, portfolios, clinical observations, and other measurements of knowledge (Morcke et al., 2013). This makes it difficult to mix and match credits earned in this type of system with one based on seat time. Institutions need to establish ways to make these two approaches compatible if transferability within the overall system of higher education is to function smoothly. One way to accomplish this is to frame expectations in terms of common outcomes. “If we all work from common outcomes,” says Paul LeBlanc, president of SNHU, “we won’t have to care where or how students addressed those outcomes as long as they are well developed, agreed upon, and backed with rigorous assessments” (Quoted in the Chronicle of Higher Education, March 19, 2013). SNHU already is exploring an outcome-based model that would allow students to migrate from its competency-based program to the university’s traditional 16-week semester or its 8-week online format as desired (Selingo, 2013a). If SNHU can resolve some of these complexities internally, they may provide a model that could be used more broadly to address transferability issues.

Not all students are in a position to be selective about where they attend college; however, for those who can choose, many options are available. Students can customize their education to a certain degree by selecting where they attend school in the first place. Some students personalize their education by attending schools that are particularly well suited for them in terms of their level of rigor, specific programmatic opportunities, or the availability of athletics or other extracurricular programs of interest. Some institutions cater to specific religious preferences or have reputations for being
more or less liberal or conservative politically. Single gender institutions are available for both men and women. Some institutions are recognized as being historically black colleges or universities (HBCUs) and an increasing number are classified as Hispanic-Serving Institutions (HSIs) (National Center for Education Statistics, 2014).

Due to the demographic changes that are described in Chapter II, it appears likely that the number of Hispanic students in American higher education institutions will continue to rise over the next several decades. HSIs currently represent 11% of all higher education institutions in the United States, and the number is growing rapidly — from 242 in 2003 to 370 in 2013 (EdExcelencia.org). Forty-seven percent of the students enrolled at these institutions are self-identified Latinos, and 59% of all enrolled Latino undergraduates in the United States are enrolled at HSIs (EdExcelencia.org).

As the demographic landscape of higher education evolves, students who are able will continue to self-select and attend institutions where they are likely to find others with whom they share something important. Some evidence exists that these self-selecting dynamics can improve learning outcomes for many students (Fryer & Greenstone, 2010; Sullivan, Joshi, & Leonard, 2010). However, many of the schools that are in the worst financial condition are small religiously-based institutions or traditional HBCUs (Snyder & Dillow, 2013). Thus, these types of personalized options may not be sustainable over the next few decades, unless these institutions find alternative funding sources or broaden the scope of their traditional missions to align with demographic trends shaping their regions.

Personalization also has affected the faculty at many institutions. An entrepreneurial movement is growing within the profession, and organizations are
emerging to support independent scholars. For instance, a new for-profit venture, called Oplerno, just received accreditation. This company will allow adjunct professors to create, own, and teach courses through their platform. The instructors/creators retain 80-90% of the tuition raised in their courses. Fees will range from $500 to $1500 per course, and the instructor establishes the tuition price for each course they teach. Transferability of these courses is the decision of the receiving institution (*Chronicle of Higher Education*, April 16, 2014).

Instructors can now reach students directly through MOOCs as well. Colleges may need to accommodate professors who operate as free agents and who have developed their own following external to the reputations of their departments and universities. Academic celebrities or public intellectuals with an external following have always existed; the difference today is that these faculty members can now teach outside of their institutions and on a large scale.

A similar trend has been seen in the journalism and music industries. Newspapers and record labels are a lot less important to the success of writers and performers than in the past. In his recent book on the collapse of a number of large institutions, Mele (2013) argued that large institutions are susceptible to collapse when they can be undermined by individual entrepreneurial activity. Because of the ability of individual academics to reach students directly through MOOCs, blogs, e-publications of various kinds, and now through platforms like Oplerno, this individualism is likely to grow in higher education.

If faculty members can gather students, much as bloggers and syndicated columnists gather readers online, will universities support these activities by developing...
the capacity to support these types of individualist endeavors? Will higher education institutions increasingly serve as platforms for talented professors who maintain an identity, as a teacher, that is both internal and external to their home institution? What would be the effect of such a model on organizational morale and, by extension, on institutional effectiveness? What will happen if institutions do not make the effort to support these entrepreneurial models? Will they lose out on significant revenue?

Increased mobility is a well-documented demographic trend in the United States (census.gov). Students are moving around more than any previous generation; as they migrate through the higher education system, they gather credits and experiences from multiple institutions. This situation raises concerns about the transferability of credits from one institution to another. Today, fully one third of all students will transfer at least once before completing an undergraduate degree in the United States (Selingo, 2013). Some observers have noted that this means that mobile students pay less attention to brand names except, perhaps, for the elite names (Selingo, 2013a). If this is true, colleges should worry less about for whom a professor works, and more about becoming the gathering place and platform where the best teachers are available and programs are offered to meet the individual needs of their students, regardless of from where the courses originate. Universities are beginning to establish systems to allow this type of personalization across institutional boundaries. For example, students at Southern Methodist University, Baylor University, and Temple University can take courses for credit that are taught online by professors from Emory University, Notre Dame University, and Washington University (Kolowich, 2013). These programs expand the offerings at each of the participating institutions and allow for students to personalize
their choice of courses and programs beyond what might be available on their home campuses.

Personalized learning systems are beginning to be widely available on many campuses. These systems, sometimes called adaptive learning technologies, are being built into many of the basic course management systems that are used in online or hybrid courses. These systems allow the instructor to adapt the course to different users by opening up lessons and assessments at a pace tailored to each individual student’s needs. These systems also personalize the assessments based on the level of preparation of the student. For instance, some adaptive learning programs offer different questions to different test takers based on their answer to the previous question. The goal is to provide a personalized assessment that identifies exactly what material each student has mastered and what needs further attention. These systems will be quite valuable in developing the capacity to create individualized assessments that will be needed as higher education moves away from assessing time spent learning and more toward measuring competencies gained.

**Implications of Personalization**

At its worst, personalization can lead individuals to become closed-minded by creating an intellectual world that simply reinforces their preconceived ideas and beliefs. Through the tools of personalization, individuals have the ability to selectively choose their news and information sources; due to the proliferation of options, sources can be found that present information and interpretations that will support their existing world view (Pariser, 2011). The ability also exists to filter out the information and opinions with which one might disagree. The majority of Americans get their news from digital
sources (Pew, 2012). For those under the age of 25, this is very common; indeed, polls indicate that more than 85% of young adults obtain their news exclusively from online sources (Pew, 2012). Most under the age of 25 do not read any print newspaper on a regular basis, and most report that they do not visit Websites that are defined exclusively as news sites. The greatest source of news for many young people is social media platforms like Twitter and Facebook, or broad-based Websites like Yahoo! (Pew, 2012). This means that the personalization featured by these sites is filtering much of what they learn and view about the world.

This is a problem for several reasons. The first is that these filtering programs run without the user’s knowledge or consent. There is no switch that can be pushed to turn them on or off, and no monitor tells a user that an algorithm is filtering the information they are seeing on Facebook or other sites. Instead, the user’s newsfeed is filtered based on what they have clicked on in the past and how quickly. This raises a second problem. Not only are individuals unable to control what is filtered out or in, these programs also privilege what they click on first. This highlights a problem that engineers at Netflix noticed when observing what individuals actually watch compared to what is waiting in their queue or “my list” folder on the site. They found that people are impulsive, and that they often watch the least challenging and most conventional titles in their queue. Many want to see challenging and obscure movies, so they add them to their list; but they actually watch the same big Hollywood blockbusters over and over. This means that one’s impulsive side, the part that wants mindless entertainment, often wins in the internal battle with the higher-minded aspirational self (Pariser, 2011).
This would not be a problem, perhaps, if filtering software was not capitalizing on these habits to encourage one to get more of the same. If personalization software bases its recommendations on what is chosen first, or most often, one might end up with an imbalanced diet of more “soft” news about celebrities and sports than hard news about environmental challenges, economic developments, or policy proposals (Pariser, 2011). Research is finding that to be true, especially for young people (Pew, 2012).

A third problem concerns the social and political consequences that might flow from this way of viewing the world. If people are unaware that their views are being influenced by these personalization programs, they may be unaware of just how tailored their view of the world has become. This may lead them to be incapable of considering how anyone could possibly perceive things differently without being ignorant, or perhaps even evil. As personalized media can bring a steady diet of supporting evidence to justify preconceived, first click views of the world, these media sites can foster a very biased and narrow view — one that makes any alternative appear uninformed and baseless. It can tune out important information that may be less pleasurable to consider in favor of first click options, and it also can make people see even very important and complex challenges in simplistic terms (Pariser, 2011).

How are these concerns about personalization connected to higher education? There are several ways. First, higher education should train students to be informed and analytical thinkers. These personalizing systems can undermine the development of both of these dispositions. Second, college graduates should be able to engage with the important debates and issues facing society. However, if they are unfamiliar with the complexities of the issues, or the multifaceted ways in which different groups or
individuals learn about and approach them, they may not possess the skills or knowledge to effectively participate in important discussions about a range of topics (Arum & Roksa, 2011).

The personalization that is seen in the media and in the larger society also are what is seen in the educational software being adopted on many campuses. Many of the educational programs marketed to campuses are being sold on the strength of the argument that they can provide a personalized learning experience to meet the needs and learning styles of different students (MyEdu.com). This raises the question of whether catering to the pre-established styles and interests of the student while they are inside the educational system is really adequately preparing them to deal with the highly personalized world of information, information sharing, and information access that exists in the larger society. This is a fundamental question: How much should the trend of personalization that is so prominent in the larger society be emulated within higher education? A significant challenge of leadership is to find the right balance between supporting the needs of different learning styles, schedules, and tastes, while also teaching students how to find new ideas, explore alternative opinions, work well with others, and struggle with challenging material.

Another danger is present: the possibility that institutions will turn to for-profit organizations for products and services to assist with their personalization efforts and, in doing so, open the possibility that personal information is used or accessed inappropriately. This is already happening. More than 30 million people use Gmail, and Google has recently developed an App for Education program that works with Gmail and personalizes a number of different educational resources. This app allows
universities to create programs that integrate with Google products such as Google Docs and Google Now (a system that connects materials and programs across different digital platforms—laptops, smartphones, tablets). These products and services were distributed free of charge to higher education institutions; subsequently, hundreds of campuses adopted the *App for Education* (Herold, 2014).

Google currently is under heavy criticism, after it was revealed that the company was using this product to run crawlers through students’ Gmail accounts in order to target them with personalized ads. IT administrators at the participating institutions had the ability to turn this feature on or off, but most were not aware of their responsibilities or options. The controversy over this program has produced a series of discussions over whether these partnerships (and the sharing of personal information that they necessarily entail) open institutions to liability for any violations of FERPA regulations that might occur as a consequence. Beyond the legal issues, these programs raise questions about how much students should be required to reveal about themselves and whether these initiatives violate the basic expectations of privacy that is held by many students outside of higher education (Herold, 2014). As institutions turn to private vendors for a range of personalization services like this in the future, these commercial entanglements are likely to grow.

A process that is related to, but distinct from, personalization is called *massification*. Retailers use this term to describe the process whereby something that was once exclusive becomes accessible to the masses (Anderson, 2013). This can happen in a variety of ways, but usually it is through efficiencies created by technology. Something that was difficult to obtain becomes easier to acquire. In education, MOOCs
are an example of massification. They have the potential to bring access to at least some elements of a Harvard (or some other elite institution) education — an exclusive commodity — to millions. They clearly are an example of massification because, as of now, they do not have the ability to provide a personalized education.

This is an important distinction, as it reflects two different but related trends occurring in the larger society. One is a trend that is bringing formerly exclusive items to the masses by employing efficiencies, usually gained through technology; the other trend is empowering individuals to personalize their products and experiences and to benefit from services tailored just for them — such as personalized medicine.

How will these two trends influence and be influenced by what occurs in higher education in the decades ahead? As postsecondary leaders observe the changes both inside and outside of higher education, it may be helpful for them to retain a sharp sense of the differences between these two trends in order to evaluate them and more clearly understand their potential significance. Doing so may help them see the benefits and potential challenges that come with each. For the most part, massification threatens established purveyors of a product or service by potentially devaluing what they have to sell. Of course, another way of viewing it is that massification creates a much bigger market for those same goods and services, albeit at a lower price. As has been seen, the challenges posed by personalization are different — they are often cognitive, social, and political in nature. Together, these forces have the potential to shape, not only how things are accomplished, but also who we become as individuals and as a society.

These two processes possibly could be brought together to deliver a world-class education to the masses, but in a way that is tailored to the individual needs and
circumstances of each participating student. This will likely be the goal of the next wave of innovation. New initiatives like the Minerva Project are trying to combine the benefits of online courses taught by great instructors (massification) with small face-to-face classes offering extensive personalized attention for each participant (Rivard, 2013). Other experiments are sure to follow. As people survey the landscape and look to the future, technologies likely will continue to be developed that support both massification and personalization. However, to benefit from the liberating possibilities of the empowering technologies that are being designed to fulfill personal and collective ambitions, society needs to ensure that they are not used in ways that undermine the ability to think critically, interact effectively, and positively impact the world.
CHAPTER VII: CONCLUSION

The premise of this study is that higher education faces some important challenges and leaders need to understand what is happening in the broader society or super-structure, so they can position their institutions for success within it. The goal of this research is to provide an assessment of some of the key trends that are shaping society, to evaluate the implications of these developments for higher education, and to provide a conceptual tool that higher education leaders can apply to guide their analysis and support their planning processes.

The study began with an examination of the Seven Revolutions Model to develop an informed sense of the scope and range of forces shaping the broader society, or super-structure, within which American higher education exists. This section provided a global-level overview of some key dynamics that leaders need to consider in the areas of demography, resource management, technology, economic integration, security, and governance. Understanding the broad outlines of current developments in these areas, on a global scale, provides the necessary context for leaders to evaluate how their local and regional circumstances fit into the bigger picture. This broad perspective provides a critical first step toward understanding some of the challenges and opportunities that may lie ahead.

After a careful review of the challenges identified in the Seven Revolutions Model, a new conceptual framework was introduced that highlights four specific meta-trends that explain and describe significant changes that are occurring within the broader society. This framework, identified by the acronym DeCAP, is presented as a tool to highlight, clarify, and contextualize four broad developments: dematerialization and
demonetization (De), connectivity (C), automation (A), and personalization (P). Separate chapters explored each of these four meta-trends in detail, highlighting particular developments related to each, and evaluating some of the specific implications they may have for higher education over the next several decades. These chapters introduced in detail the key elements of the DeCAP framework and highlighted many of the specific technologies and processes that are both reflective of, and driving, these trends.

To be successful, higher education leaders need to ensure that their institutions are efficient and relevant so they are sustainable for the long run. One way they can assess whether they are on track with these goals is to evaluate how their institutions align with some of the broad changes that are occurring in society. By evaluating their institutional priorities and practices in relation to the four meta-trends emphasized in the DeCAP framework, leaders will better understand how congruent — and thus potentially relevant and sustainable — their institutions are with regard to these trends. This process involves thinking about what is happening in the broad society and anticipating what these trends may portend for the future. The goal is to develop (or maintain) policies that will position their institution for sustained success in a changing environment. This means that leaders must anticipate what the future might look like.

**Why is Thinking about the Future Important?**

Many people are uncomfortable pondering the long-term future. They want to stay close to the data and to the known. Because of this, futurists are sometimes dismissed as charlatans or quixotic dreamers due to the inherent uncertainties that characterize their subject matter. This is a mistake. The future is indeed unknown and there are many possibilities. A serious inquiry into the future is worthwhile nonetheless
because of the clarity it can provide about what is desirable (Diamandis & Kotler, 2012; Elliott-Gower et al., 2012). Futurists examine whether certain outcomes are more or less probable based on existing trend data and other knowns, but these analyses also stimulate thinking about preferable outcomes. If the probable future and the preferable future are different, this type of assessment provides an opportunity to re-think the overall direction of the organization and to consider strategies to change course if necessary (Cornish, 2005).

Action in the present shapes the future, and perception of the future shapes behavior in the present. Thus, the feedback loop between perception and action plays a vital role in determining what will occur over the next several decades. Two phenomena are important to consider in this regard. They both concern prediction. There are self-fulfilling predictions, and there are self-canceling predictions (Silver, 2012). The first type is more widely recognized. If one predicts a certain outcome or behavior, it is possible that this will influence the very actions that are likely to produce the outcome. So if an individual was to predict that universities will move away from a traditional nine month academic calendar, for instance, this may lead to actions that are consistent with this prediction and, thereby, make it so — a self-fulfilling prediction. Conversely, predicting that the gender gap in graduation rates currently seen in higher education will continue to widen, may actually lead to policies and behaviors that prevent that prediction from being realized — a self-canceling prediction (Silver, 2012). In the latter case, does the outcome mean that the original analysis of the trend was incorrect? Did the analyst misread the future? Not necessarily. Analysts interpret a trend and identify its possible implications, which can lead to considerations about whether it is something
desirable (or not) — and this awareness can catalyze action. This is the power of thinking about the future and why it is important for leaders to engage in a deep analysis of these trends.

As these feedback loops make clear, examining current trends and analyzing their possible implications for the future can help to frame issues in ways that bring about desirable outcomes. Leaders need to carefully evaluate what is possible and probable, and then, to consider what is preferable within their specific institutional context. To begin this process, they need to pose relevant questions. The DeCAP framework can help leaders identify and frame germane questions about the future by highlighting key developments that are occurring right now, and by bringing attention to some of the long-term implications that may result from them.

A thoughtful vision of the future that is grounded in a firm understanding of relevant trends will help leaders build support, and, thus, avoid some of the *inevitable criticism* that comes with leadership. Recall that Shapiro (as cited in Bolman & Gallos, 2011) identified the central challenge of higher education leadership as creating a vision and inspiring others to work to achieve it. A compelling vision must be forward-looking, achievable, and specific. Building such a vision requires understanding what a desirable future may look like, and then reverse-engineering back to the present to identify the appropriate steps forward. Examining the DeCAP trends can help develop this understanding.

**How to Apply the DeCAP Framework**

The DeCAP framework is a conceptual tool that leaders can use to focus their thinking around a circumscribed set of ideas about how the world is changing. The
cacophony of new technologies, innovations, and challenges that are reported every day, and that make up so many of the headlines that higher education leaders see in their trade journals and newsletters, can be overwhelming. The DeCAP framework can help leaders see through this confusion by giving them a tool they can use to ask clarifying questions about these developments. The framework gives them a starting point to develop questions that can help them focus on what these technologies, behaviors, and innovations might signify for higher education in general or for their own institutions in particular. The framework is thus a means for channeling and focusing their analysis around a specific set of patterns that characterize how the world is being transformed.

All of the trends that make up the framework are important, and each of them captures a unique dimension of the way society is changing. Each trend raises distinct possibilities and challenges and postsecondary leaders will benefit from thinking systematically about the implications of all four trends. Below, each of the trends in the framework is briefly summarized, and some sample questions are offered at the end of each section. These questions are extracted from the specific trends highlighted by the framework. *These questions are not an exhaustive list;* rather, they are offered to illustrate the kinds of questions that leaders may want to develop and consider on their own. *Leaders are encouraged to extract their own questions* based on their assessment of these trends and their individual interests and concerns.

**Dematerialization**

It is probable that dematerialization will continue to reduce the importance and size of many physical objects. Some familiar objects and processes will cease to exist entirely, as they are rendered superfluous by new technologies. Large computing devices
will be reduced in size and rarely seen; ever-smaller electronics will be common, including even implanted and wearable devices of varying kinds. Most electronics will connect wirelessly to each other and to their power supply. More activities will take place in digital environments and simulations or digitally mediated encounters will replace many physical interactions.

These developments will transform the physical appearance of campus work and living spaces, and will alter the ways in which individuals interact with one another. The prevalence of digital information and objects will create a growing need for both continuous and reliable access to these data and strong security systems to protect them and keep them stable. Maintaining digital records against decay, both from the deterioration of the digital files themselves, and from the effects of obsolescence among the technologies used to produce and access them, will pose a growing challenge. Nanoscale technologies also may present new security, privacy, and academic integrity concerns since they will be too small to be detected in many cases.

Electronic publishing will change the role that private companies play in higher education. Many will serve as aggregators of digital content; faculty members will customize and integrate these materials with learning and assessment platforms that they create or have provided to them by private contractors. This may result in for-profit vendors becoming increasingly and directly involved in training, pedagogical support (e.g., electronic tutoring), grading services, and other traditional teaching and learning activities.
Possible Questions for Leaders to Consider about Dematerialization

- What will be required to support a significant increase in small computing devices on our campus?
- What special concerns do these devices present?
- What policies are in place to regulate how digital objects and tools are used at our institution?
- How may dematerialization transform the means by which academic materials are produced, accessed, and purchased at my institution?
- How will e-publishing impact the way faculty and students conduct and disseminate scholarly work?

Demonetization

Demonetization will likely continue as inexpensive digital objects that can be easily replicated, shipped, and modified, replace physical objects. This process also will be accelerated by the entry of more foreign competition into the global information market. Information workers will compete on a global scale, and this will drive down the price of many types of information-based services. Efficiencies gained from faster and less expensive computers, networks, and automated systems, will also drive down the price of some goods and services. It is probable that the enormous amount of free information available on the Web will continue to expand, and that current efforts to organize this material into inexpensive educational products, such as lessons and even whole courses, will continue to improve.

This trend poses a grave challenge to many higher education institutions because it runs directly counter to what is taking place within the traditional higher education
sector: tuition prices keep rising faster than almost any other area of the economy. Thus, in a time of deflationary pressures within the online education market — exemplified by the MOOC phenomenon — many traditional higher education institutions have come down with a serious case of cost disease — a condition that stems from the inability to benefit from the efficiencies that have driven down the price of other goods and services in the economy (Baumol & Bowen, 1966). Higher education leaders will need to think about the implications of ever-increasing tuition costs within the context of a society that is experiencing demonetization. These two trends appear to be incompatible.

Possible Questions for Leaders to Consider about Demonetization

- What are the forces that are driving down costs?
- How can we harness these forces without compromising quality?
- How may demonetization impact enrollment?
- What value can we add to the inexpensive educational products and services that are beginning to proliferate on the Web?
- Are there partnerships that would be helpful to cultivate in this environment?

Connectivity

Connectivity is bringing the peoples, economies, and machines of the world into closer and more continuous contact than ever before. The digital networks that link the planet together are making it easier to source products and talent on a regional, national, and global scale. It is probable that connectivity will continue to strengthen and improve over the next several decades as the Internet of Things connects billions of sensors and machines together into clustered interactive systems. These systems will generate enormous quantities of data and will put huge demands on the physical infrastructure
that constitutes the backbone of the Internet (e.g., servers, fiber optic cables). The efficiencies that these systems produce will put further downward pressure on the cost of some activities and products, while likely increasing the cost of others. For postsecondary leaders, this means that the marketplace for electronic learning will likely become even more competitive as these dynamics and capacities bring new global players into the education market (Friedman & Mandelbaum, 2011).

Increased connectivity will bring with it many possibilities to improve efficiency. The Internet of Things will be a place where all types of objects are networked together so that they can be monitored and interact with one another. Sensors and networks can bring significant benefits to many campuses; all of the data provided by these networks can be analyzed to learn more about the use of resources and to create more efficient processes. Networked and connected systems also will be one of the key developments to allow campuses to benefit from deep analytics (Mayer-Schonberger & Cukier, 2013).

Adequate network capacity will be vital. Maintaining the servers that connect institutions to the Internet, and the connections between all of the devices that make up the Internet of Things, will present real challenges for IT departments. This level of connectivity will require enormous bandwidth to handle the volume of exponentially larger quantities of data being transmitted within the system. As sharing electronic data becomes more central to the work of higher education, reliable and secure transmission and storage of these data will be vital. This means that significant resources will need to be allocated to maintain and protect these systems, increasing the cost of developing and maintaining the IT infrastructure on many campuses.
Possible Questions for Leaders to Consider about Connectivity

- What will be necessary to support the creation and expansion of the Internet of Things?
- How will improvements in connectivity impact communication on our campus?
- How can my institution differentiate itself from others in a highly interconnected online environment?
- What strengths can we build upon through increased connectivity?
- How can connectivity make our institution more efficient?

Automation

Automation will improve many processes. Some automated systems will simply supplement existing practices and workers. For example, intelligent voice recognition software may run continuously during meetings in order that information about topics such as proposed future meeting times and locations will be identified and added directly into the calendar software of the relevant parties. Other systems may replace human workers; for instance, minutes for meetings may be automatically transcribed from audio files by these systems and archived electronically. Phone calls, emails, and other electronic communications may be answered by systems that use artificial intelligence to run autonomously.

Nearly all workers will be assisted in some way by automation. Automated systems will assist with teaching functions such as grading and tutoring. They will be responsible for monitoring inventories and automatically re-ordering supplies. Automated systems will handle a great deal of the maintenance, security, accounting, and communication work that is currently the purview of human staff members on many
campuses. They will even be used to assist in decision-making. Some administrators will choose to supplement their decision-making processes with automated systems that can sort through huge quantities of data and produce what if scenarios for different hypothetical changes in policy. The implications of the combined effects of workforce science and automation present higher education leaders with many questions to ponder.

**Possible Questions for Leaders to Consider about Automation**

- What is the proper balance between automated systems and human workers?
- Which units on my campus are most likely to be directly affected by automation?
- Do we have any automated systems on our campus right now?
- Do they work well?
- What positions and processes could be replaced by an automated system?
- How will we respond if these systems do not work as expected?

**Personalization**

Personalization will continue to shape higher education in far-reaching ways. As more information about individual students become available, these data will be used to tailor a range of services to their specific needs or desires. For example, materials produced by the admissions, alumni, and development offices will benefit from increased levels of personalization. The more information that is gathered about individual preferences, tastes, and needs, the more these data will be used to tailor and target marketing and fundraising campaigns to increase their effectiveness. It is probable that instruction also will become more personalized, with adaptive learning systems customizing both face-to-face and online offerings on many campuses. Academic schedules will become more flexible to accommodate individual preferences. Student
data will inform decisions about the curriculum. Food and health services will use information about individual student needs to plan services and products that are customized specifically for them. The overall implication of this trend is that expectations for personalization will continue to rise, and institutions will be challenged to find cost-effective ways to meet these expectations.

Possible Questions for Leaders to Consider about Personalization

- What technologies could assist in our personalization efforts?
- What services should we consider unbundling to better meet the needs of individual students?
- If we make our academic schedule more flexible, what impact will this have on staffing?
- What experiences do we want to make sure all of our students share?

The Value of a Comprehensive Approach

The four trends examined through the DeCAP framework are highly interconnected. Demonetization is driven, in part, by automation and connectivity. Personalization is increasingly achieved by the possibilities engendered by the other three trends. Connected systems are made possible through automated processes, and these in turn reduce the size or even eliminate the need for many material objects. Recognizing these interconnections is important, as changes in one area are likely to affect developments in the other areas as well. Thus, it is helpful to view developments through all four frames and to consider the ways that changes in each area can impact the others.
Competency-based education is a case in point. This trend was introduced in the chapter on personalization, as the movement to create a personalized, outcomes-based model for credentialing is congruent with this general trend. Many institutions are viewing competency-based learning in terms of its utility to meet the needs of non-traditional students or others who want more flexible ways in which to earn degrees. Thus many postsecondary leaders may see this movement primarily from that frame of reference. However, when competency-based education is examined in relation to the demonetization, automation, and connectivity trends, new implications emerge and a different set of challenges are presented for higher education leaders to consider.

Outcomes-based credentialing could lead to significant decreases in the cost of academic credits (congruent with demonetization) if the mastery of certain content can be accomplished in less expensive formats than the traditional classroom setting. If the developers of MOOCs or other freeware approaches to learning operate within a context in which competency-based assessments are an acceptable metric for credentialing purposes, then any approach that can successfully produce these outcomes might enter onto the playing field that has, thus far, been monopolized by traditionally accredited institutions. One possible business model for MOOCs (or similar low-cost online offerings), in such a competency-based system, would be to sell the credential after students have had access to the free education. From a student’s perspective, a credential that costs $100 per course is a bargain. From the perspective of a MOOC company, one million students at $100 apiece is a $100,000,000 business.

The potential implications are profound for established bricks-and-mortar institutions. If the world is becoming more connected, and automated teaching,
proctoring, and grading systems are growing more robust in their capabilities, it would appear likely that a technologically enhanced, if not entirely online, education will be a viable alternative for many students worldwide. For leaders who oversee institutions with a cost disease problem, these interconnected trends warrant significant attention. Thus, the value of looking at a development like competency-based credentialing through all four frames is that it contextualizes this trend in relation to several broader developments.

A comprehensive analysis also may make it easier to assess if a movement has staying power or is just a fad. If a trend seems to be congruent with many other forces that are shaping society, it seems more probable that it will continue than if it is out-of-step with what is happening in the larger picture. Finally, a comprehensive view also provides deeper insight about the possible implications of the trend. For example, because this movement to re-think the credit hour is happening at the same time as the proliferation of low-cost educational options, powerful mobile communication devices, and rising expectations for personalization, this trend poses an even greater threat to traditional education providers than might be evident if this trend were viewed exclusively through a narrowly conceived analysis.

Thus leaders should assess these trends individually and collectively. The preceding sections offered some examples of questions specific to each of the individual trends; below is a brief list of questions that are more synthetic in nature. These are offered as an example of the kind of questions that may be beneficial for leaders to consider as they ponder all of the trends in the model comprehensively.
Broad Questions for Leaders to Consider

- What impact will these trends have on the characteristics, capacities, and goals of the students who come to our institution?
- How might these trends affect the purpose of higher education in the 21st century?
- How responsive should institutions be to changes taking place in the larger society?
- To what extent should institutions cater to student tastes and preferences?
- In light of these trends, what constitutes essential learning for students in college?
- How are these trends related to one another and in what ways are these interrelationships beneficial?
- What challenges do these interrelationships pose?
- How may these trends improve higher education?
- What can we do to mitigate potentially undesirable outcomes that may result from these trends?

The Value of this Study

The world is changing rapidly and in complex ways, and these transformations will have far-reaching implications for many institutions, including higher education. Understanding the dynamics behind these changes is difficult because there are so many innovations occurring at the same time. For leaders who are busy with many pressing daily concerns, this poses a real challenge. They appreciate how important it is to be informed, and how essential it is to have a clear understanding of the changes that may impact their organizations, yet many do not have the time to adequately build this knowledge on their own. This study provides a useful framework that leaders can
employ to quickly identify developments that are important and understand how
individual trends fit into larger patterns of change.

This research identified four specific overarching themes or patterns that appear
to be particularly significant. Identifying these meta-trends is very helpful because it
makes it easier to understand how specific innovations or technologies fit into these
larger patterns. The DeCAP framework is presented in this study as a conceptual tool
that leaders can use to highlight these larger patterns and to generate questions about
them that may be helpful for planning purposes. By carefully considering of the
implications that dematerialization, demonetization, connectivity, automation, and
personalization may have on their institutions over the next several decades, leaders can
hone their understanding of what is possible and preferable, and use these insights to
create the kind of compelling vision of the future that will motivate the behaviors
necessary for long-term institutional success.
REFERENCES


http://www.techrepublic.com/article/how-sports-teams-are-scrambling-to-keep-millennials-coming-to-games/


147


http://online.wsj.com/news/articles/SB10001424052970204795304577221164189123608


Wasik, B. (2013). Why wearable tech will be as big as the smartphone. *Wired, 22*(1).


155

