

# *Support Economy* Research U - Policy Considerations for a Networked University Enterprise

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## 1 Introduction

The traditional firm, the foundation of the post-Industrial age society, is undergoing significant transformation. The rise of the networked society, described by contemporary social and economic scholars, is a movement well-positioned to shift the fundamental nature of transaction and interaction in the new millennium <sup>1,2</sup>.

The well-understood form of organizations operating in a market economy was established at the end of the 19<sup>th</sup> century by Marx and Weber, and further fortified in the 1950s and 1960s by Cyert, March, and Simon <sup>3,4,5</sup>. As established, the hallmark of organizational efficiency was gained by centralization, hierarchical

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<sup>1</sup>Castells, M. (1996) The Rise of the Network Society, Vol I: Information Age. New York, NY. Blackwell Publishers.

<sup>2</sup>Axelrod, R., and M. D. Cohen (1999) Harnessing Complexity: Organizational Implications of a Scientific Frontier. New York, NY. Simon & Schuster, Inc.

<sup>3</sup>Weber, M. (1997) The Theory of Social and Economic Organization. Reprint edition. New York, NY. Free Press.

<sup>4</sup>March, J., and H. Simon. (1993) Organizations. 2<sup>nd</sup> edition. New York, NY. Blackwell Publishers.

<sup>5</sup>Cyert, R., and March, J. (1992) A Behavioral Theory of the Firm. 2<sup>nd</sup> edition. New York, NY. Blackwell Publishers.

infrastructure, and consolidation of economic resources and functions <sup>6</sup>.

Newer scholars, however, are beginning to notice a transformation in the economy, mostly enabled by the communication and transaction capabilities of information technology, and in particular centering on the facilitation the Internet provides. With information and knowledge becoming central components of the new economy, organizational structures become reliant on the movement and management of information rather than physical product. Information embodies significantly different dynamic qualities, only new emerging as driving forces behind the way in which organizations interact and adapt. Prominent information science visionaries, John Seely Brown and Paul Duguid, identify six dimensions on which information is transforming <sup>7</sup>.

1. *Demassification* - the breaking down of information resources into smaller constituents
2. *Decentralization* - the dismantling of traditionally formed hierarchies based upon co-location and streamlining of function under one roof
3. *Denationalization* - the erasure of nationally-tied governance and sovereignty typically constraining the movement of goods. Information becomes a global resource, open to all regardless of location or nationality
4. *Despacialization* - the decoupling of information and a particular physical space, as well as users who would choose to access the information
5. *Disintermediation* - the removal of information "middle men," placing users closer to the actual process and end results of information-driven decision

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<sup>6</sup>Simon, H. (1996) The Sciences of the Artificial. 3<sup>rd</sup> edition. Cambridge, MA. The MIT Press.

<sup>7</sup>Brown, J. S., and P. Duguid (2001) The Social Life of Information. Cambridge, MA. Harvard Business School Press.

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6. *Disaggregation* - the unbundling of goods, services, and the entities that provide them

If these are the evolutionary trends of information itself, it is not unreasonable that an economy based on information would exhibit some of the same shifts. Of course, not every aspect of the economy will transform in parallel (as will be discussed later); however, the 6D model presented by Brown and Duguid provides a coherent framework for defining change within information and knowledge based systems.

As an information and knowledge-driven entity, the research university stands to undergo significant transformation as part of this movement. Increasing demand for university-based research activities to shift from basic science to applied innovation ready for market entrance place the institution in closer alignment with market forces. The increase in patenting, signaled by the founding and activity of technology transfer offices, the increased flow of funds from private and industry sources, and establishment of larger numbers of academy/industry collaboratories signals the emergence of new economic structure within the traditional university structure. It is not unreasonable to think that the transformation taking place within the traditional firm will not extend to have influence over the university as it increases its partnerships. The movement toward decentralized and disaggregated business function, the realization of Castells' network society, or more recently described by Cluetrain Manifesto author, David Weinberger, "small pieces, loosely joined," defines a new form of the firm based upon relationships, transaction costs, and configurability, and complexity <sup>8</sup>.

To address the new, decentralized economy, Harvard Business School professor

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<sup>8</sup>Weinberger, D. (2003) Small Pieces, Loosely Joined: A Unified Theory of the Web. New York, NY. Perseus Books Group.

Shoshana Zuboff defines "the support economy," one vision of the future economy on this track <sup>9</sup>. While only one of many such models, Zuboff provides a workable framework for making predictions about the nature of decentralized (termed "federated" in her book) market structures. The commoditization of services, and the management by intermediary agents in ubiquitous service to consumers may have applicability to the observations made of trends within the environment of the university enterprise. In addition to providing ample historical justification for defining the support economy, Zuboff outlines eleven "metaprinciples" of the support economy - the driving forces behind emergent practices and infrastructure in networked transactions. These metaprinciples will serve as the interpretive lenses through which this paper will proceed.

## 2 Zuboff's "Deep Support"

The underlying principles of Zuboff's support economy lie in the concept of "deep support." Deep support is the emergence and enactment of specialized niche economies that serve as intermediaries between the consumer and the various nodes (providers of goods and services) within a distributed network-based market. The nature of these intermediaries is flexible and customizable, but permeates every aspect of interaction between the individual and the multiplicity of enterprise networks that converge to provide the consumer experience. The nature of deep support agents/intermediaries is perhaps best captured by Axelrod and Cohen's description of agents within a complex adaptive organizational system <sup>10</sup>.

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<sup>9</sup>Zuboff, S., and J. Maxmin (2002) The Support Economy: Why Corporations are Failing Individuals and the Next Episode of Capitalism. New York, NY. Penguin Books.

<sup>10</sup>Axelrod, R., and M. D. Cohen (1999) Harnessing Complexity: Organizational Implications of a Scientific Frontier. New York, NY. Simon & Schuster, Inc.

**Agents**, of a **variety** of **types**, use their **strategies**, in patterned **interaction**, with each other and with **artifacts**. **Performance measures** on the resulting events drive the **selection** of agents and/or strategies through process of error-prone **copying** and **recombination**, thus changing the frequencies of the types within the **system**.<sup>11</sup>

It is incidental. yet important to note that no mention is made in Zuboff's descriptions whether agents in the support economy are actual persons, occupying a new form of employment (as discussed in metaprinciple eleven) or if they are artificial intelligences or avatars representing the user within the information sphere. Significant current research in computer science, information science, and economics is directed toward construction of these types of deep support agents capable of brokering transactions in various scenarios on the behalf of users<sup>12,13</sup>. What, then, would an emblematic deep support experience look like? I provide two hypothetical scenarios of deep support within the university enterprise, one serving the graduate student as consumer, and the other serving a junior research faculty position.

## 2.1 Scenario One: Joshua R., The Deeply Supported Student

Joshua R., a new doctoral student in information and library science, has been working for several years with his agent, Zak. Zak coordinated Joshua's

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<sup>11</sup>The boldface words in the statement reflect the elements Cohen and Axelrod have determined to be the defining characteristics and concerns in managing a complex adaptive organizational system. Complete descriptions and discussions of each of these elements may be found in the referenced source. These twelve elements serve as points of conceptual convergence, each of which is a critical component in successful understanding of policy ramifications.

<sup>12</sup>Nardi, B., Miller, J. and Wright, D. "Collaborative, Programmable Intelligent Agents." March, 1998, *Communications of the ACM*. Pp. 96-104.

<sup>13</sup>Fornara, N., and Gambardella, L. M. "An Autonomous Bidding Agent for Simultaneous Auctions." *Fifth International Workshop on Cooperative Information Agents (CIA-2001)* Lecture Notes on Artificial Intelligence LNAI 2182, Pp. 130-141

undergraduate degree, compiling lists of courses and degree options from several open courseware federations, and assisted Joshua in contacting faculty whose research interests were strongly aligned with Joshua's. When considering graduate school, Zak constructed a list of the most likely faculty candidates to support Joshua's work, contacted each of them to determine their interest and availability to take on Josh as a new student, and presented Josh with a list of these faculty, ranked by availability complete with a dossier on each faculty member's curriculum vitae, list of recent projects and publications, currently active grants, federated network affiliations, past students, and list of primary collaborators (gathered from co-authorship citation on published papers.) Joshua indicated his preferences for faculty, along with a budget of how much financial support he would need for completing his studies. Zak took this information and represented Joshua to his selected faculty in bidding for grant resources, as well as submitting financial aid applications for any remaining amount.

Having successfully negotiated a graduate package for Joshua, Zak notifies each faculty member who has signed on with a constructed contract for supplying educational services for Joshua. Zak solicits input from faculty regarding curriculum requirements for Josh, searches available open courseware providers for courses that will fulfill these requirements, and presents Josh with bundles of course schedules. Josh selects a package, knowing that if a course is canceled, Zak will alert him and suggest reconfiguration options and verify these changes with his faculty.

As coursework is completed and Josh transitions to research, Zak contacts the faculty's agents to schedule video conferences for mentoring and regular meetings. Zak keeps track of writing and research progress and submits summaries to the faculty 24 hours before meetings. As he approaches his dissertation defense, Zak manages versions and reviews from Josh's committee, schedules the arrangements

for the defense, taking care of the particulars for faculty who may be traveling to see Josh in person, or joining the defense through IT-enabled means. When the defense is complete, Zak arranges for the binding and submission of the dissertation, submits the necessary paperwork to the credentialing agency for review of the degree program, and begins work on Joshua's faculty position search process.

Throughout the process, Zak is constantly taking into account Josh's history and prior decisions. Because of the long-standing relationship as Josh's agent, Zak is able to data mine patterns of behavior to present the most logical and economically-feasible packages for achieving Josh's goals.

## **2.2 Scenario Two: Annika N., The Deeply Supported Researcher/Junior Faculty Member**

Two years ago, Annika N. completed her PhD in high-energy physics through one of the most prominent educational federations. She was immediately hired by the same federation as a junior faculty member and researcher. Her agent, Syl, continued along with her as she made the transition from student to faculty. Annika goes into her office in the morning, and opens her window to see what Syl has for her today. Syl presents Annika with summaries of recently published research articles that pertain to her research, letting her mark which articles she would like to do download in full text for later perusal. Next, Syl presents Annika with a list of new grant and funding announcements, and offers to submit research abstracts and begin preparing applications for grant applications that are accepted. Syl also lets Annika know of recent calls for paper submissions at conferences she has marked as being of interest.

Next, Syl tells Annika that a recently submitted paper has been accepted at a

conference, and congratulates her (of course, automatically updating Annika's CV to reflect this most recent addition.) Syl has already searched and found the most affordable travel and lodging arrangements for the conference, and presents Annika with several packages from which to choose. Once chosen, Syl will also take care of finding a kennel for Annika's dog. All of the arrangements are set within minutes. Syl has also checked which colleagues will be attending the conference, and offers to set up meeting time with colleagues through their agents while everyone is at the conference.

Finally, Syl lets Annika know that time has come available on Stanford's linear particle accelerator, which Annika needs to run some experiments. Since a number of scientists will be needing this time, Annika must act quickly. She specifies how much time she will need, and how much grant money she is willing to put forth to secure the time. Syl then takes this information and serves as Annika's proxy in the combinatorial auction being run by the accelerator facility. Syl will report back on whether Annika has secured the time she needs, and will suggest other facilities with open time if she does not win the bidding.

### **3 The Future of the Research University**

"The university is changing" is a fairly broad statement, and difficult to quantify on an aggregate level of scale. While the emergence of collaboratories as a primary research arrangement, the proliferation of IT-enabled distance learning degree programs, establishment of open courseware initiatives, and investment in infrastructural projects like the multi-institutional *Sakai* project and the *Millennium Project* at the University of Michigan are suggestive of the changes taking place, a coherent description of the nature of this change has yet to emerge

<sup>14,15</sup>. Still, a number of senior academics, university presidents, provosts, and deans, have begun discussing with frequency the need to address what are (to them) apparent shifts in the university environment. The collective experience of these esteemed scholars and administrators is not to be dismissed lightly, despite the concrete formalization of the transformation in the university.

University of Michigan President Emeritus James J. Duderstadt focuses strongly on leading the discussion of this transformation in the "Future of the Research University" report, published through the National Academy of Sciences <sup>16</sup>. Of particular salience in defining the convergence of the university enterprise with the market economy, the report includes the following statements:

The extraordinary pace of information-technology evolution is likely not only to continue for the next several decades but could well accelerate. It will erode, and in some cases obliterate, higher education's usual constraints of space and time. Institutional barriers will be reshaped and possibly transformed.

The impact of information technology on the research university will likely be profound, rapid, and discontinuous just as it has been and will continue to be for our other social institutions (e.g., corporations and governments) and the economy.

Digital technology will not only transform the intellectual activities of the research university but will also change how the university is organized, financed, and governed. The technology could drive a

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<sup>14</sup><http://www.sakaiproject.org/cms/>

<sup>15</sup><http://milproj.ummich.edu/>

<sup>16</sup>Duderstadt, J., et al. (2002) "Preparing for the Revolution: Information Technology and the Future of the Research University." Washington, D.C. The National Academies Press.

convergence of higher education with IT-intensive sectors such as publishing, telecommunications, and entertainment, creating a global knowledge and learning industry.

From these statements, it is clear to see that the leadership community of the American university recognizes that a change is taking place, as well as the fact that this change involves increased involvement with industrial and market partners.

The National Academy of Science is not the only arena in which these changes are being acknowledged. As a primary source of academic research funding, the National Science Foundation is also investing significant attention and resources to providing the tools to transition to a decentralized model of research production. Spearheaded by Dr. Daniel Atkins of the University of Michigan School of Information, the NSF has integrated the "cyberinfrastructure" initiative into many areas of operation. Cyberinfrastructure aims to construct the backbone - technology (hardware, software, and middleware), organizational forms, communications strategies, incentive structures, human capital development - that will serve as a point of convergence for all national science and engineering research activities. In a report commissioned by the Clinton administration and released by a blue-ribbon NSF panel chaired by Dr. Atkins, the recommendations centered on the immense opportunity such a transition represents, but acknowledged the complexity (couched largely in terms of decentralization and the need for accompanying coordination policies and practices) and transformative effect on research institutions in all sectors <sup>17</sup>.

Finally, the Council on Competitiveness, in a report on the National Innovation Initiative, highlights two main points of relevance to the role of the

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<sup>17</sup>Atkins, D., et al. (2003) "Revolutionizing Science and Engineering through Cyberinfrastructure: A Report of the National Science Foundation Blue-Ribbon Panel on Cyberinfrastructure." National Science Foundation. <http://www.communitytechnology.org/nsf.ci.report/>

university enterprise in the support economy<sup>18</sup>. First, the role of cross-cutting collaboration across disciplinary boundaries is a requisite element of future innovation potential. The resources needed to consolidate these resources would be economically infeasible; thus the most efficient strategy is to develop networked or federated infrastructures to accommodate the formation of these relationships. Second, the Council freely admits that the human capital to drive the innovation machine rests in graduate science and engineering education. The fusion of these observations takes place in the formation of recommendations, namely

The physical and policy structures that support innovators, including networks for information, transportation, healthcare, and energy; intellectual property protection; business regulation; and structures for collaboration among innovation stakeholder. Recommendation support a new industry-academia alliance, an innovation infrastructure for the 21st century, a flexible intellectual property regime, strategies to bolster the nation's manufacturing enterprises, and a national innovation leadership network.

The consistent language in describing a "network" solution is strongly aligned with Zuboff's description of the support economy in an environment of distributed capitalism. The disaggregation of university resources, the founding of collaboratories enabled by Atkins' cyberinfrastructure initiative, and the acknowledged central role of the university as a producer both of new human capital as well as information and knowledge products make Zuboff's set of principles a reasonable candidate for a theoretical framework in predicting the future of the

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<sup>18</sup>Council on Competitiveness (2004) "Innovate America: Thriving in a World of Challenge and Change - National Innovation Initiative Report." <http://www.compete.org/pdf/NII.Final.Report.pdf>

research university.

## 4 Metaprinciples as Predictive Lenses

The power of Zuboff's metaprinciples is generated from the fact that it avoids a particular "roadmap" or set of instructions for implementation. Contexts are as varied as the institutions and individuals that engage them, and in a networked economy, these contexts become combinatorial in nature. The following metaprinciples are submitted by Zuboff as a "beginning to the conversation." In the same spirit, they will be discussed briefly with respect to the future of the research university without the goal of providing instructions; rather, pointing out relevant starting points for consideration of issues affecting policy construction.

### 4.1 Metaprinciple One: All value resides in individuals

President Duderstadt makes regular reference in public talks to the changing nature of the university student and the learning strategies employed through evolving information technologies. Specifically, he points out the progression of generations' relationship with technology. The current sequence moves through analog, digital, wired, and most recently, wireless. The learning styles of the most recent generation of university students revolve around immediate access to information and constant communication with each other through instant messaging. He describes the changing role of faculty in the face of this learning style as a movement from "the sage on the stage" to "the guide on the side." Students are taking more responsibility in determining the nature of information consumption, and Duderstadt argues that pedagogical philosophies must keep pace. The underlying message is that the students are in charge. The value of the information presented,

and the mentorship provided through faculty, is determined by the individual student, expressed by the level at which the consumer chooses to engage the resources. From the perspective of the university, the value resides in the student, and the institution must change to recognize this shift in value, rather than the other way around.

From the side of faculty contribution, the value structure will not shift significantly. It has long been recognized that the value of innovation from the academy lies within the faculty and graduate student researchers. Without them, there would be no intellectual capital to exploit. What will change on this front, however, is the professional arrangement between the researcher and the institution, as the researcher finds alternative ways to leverage her value.

## **4.2 Metaprinciple Two: Distributed value necessitates distributed structures among all aspects of the enterprise**

Deep support infrastructure, drawing information of value from sources dispersed across a network, requires modularity in constructing relationships. This distribution of value drives attendant resource allocation across the network in kind. The move away from centralized hierarchies (the traditional university structure) further distributes value among transient relationships and resource arrangements. Since ties between nodes within the network may be weakly persistent, the distribution of structure and value mitigates the probability of significant loss in the event of a structural failure.

### **4.3 Metaprinciple Three: Relationship economics is the framework for wealth creation**

Since value is distributed throughout a network in the support economy model, the methods for aggregating resources and wealth are defined by the ability to manage relationships among other network nodes. Resources in a network flow along the ties, and effective positioning to have maximum centrality increases wealth. As seen in the current research climate, collaboratory arrangements where multi-institutional efforts are aggregated are gaining traction. Membership in multiple collaboratories or clusters of research groups then provide access to more sources of funding. Much as water flows through a piping system, research money flows through a networked system of collaboratories. High centrality, and tending to the persistence of ties as long as they are productive are paramount to success in the support economy of the research university.

### **4.4 Metaprinciple Four: Markets are self-authoring**

For graduate students, an increased flexibility in constructing inter/multi/trans-disciplinary degree programs is a result of the institution considering the student as a consumer whose needs must be met. With individuals in the driver's seat, the self-authoring of the degree-granting market is a logical extension. Under the proviso that a given bundle of curricular goals and resources can pass credentialing review mechanisms, students will be free to write their own futures.

For knowledge producers, self-authoring markets represent a greater shift to knowledge aggregation - more licensing, cross-licensing, patent pooling, and other mechanisms to negotiate joint knowledge and product creation. Self-authoring

production markets hold the potential for heated disputes over ownership, but also may be the matrix for new paradigms of intellectual property to establish themselves.

The self-authoring and alignment with "the market" - focused on the ability to transform resources into viable products for generalized consumption, may prove detrimental to the funding of "basic" research. If sufficient incentives are not supplied to researchers, individuals will optimize gains, and innovation will be driven by application at the expense of fundamental research practices - notoriously subject to serendipity, low in return on investment by industry standards, and often abstract enough to be difficult to justify to the market.

#### **4.5 Metaprinciple Five: Deep support is the new "metaproduct"**

As discussed in Section 2, deep support will permeate the experience of the consumer. Of course, there are the fundamental products of courses, degrees, grants, research equipment, administration, etc. Deep support will serve as an architecture that bridges these disparate product providers. Consumers will purchase the "metaproduct" service of coordination.

#### **4.6 Metaprinciple Six: Federated support networks are the new competitors**

Under a market model, it would seem natural for complementary service niche economies to emerge in a competitive way. Over time, the likelihood of federation oligopolies is high in markets where complex coordination is necessary. In cases of bridges between individuals and significant institutions, such as major grant-giving

entities, natural monopolies may form; however, attention must be paid to deter anticompetitive practices.

For researchers, the multiplicity of research collaborations among previously centralized institutions creates a new competition for resources, and the individual must optimize the economics of choosing proxies and representatives - the deep support agents - through which they engage the network. The nature of cooperation suggests that individuals may form their own federations to garner resources <sup>19</sup>. This is not so different from the current federations of researchers that form to gain entrance to the National Science Foundation ITR grant competitions, which require multi-institutional involvement from both academe and industry.

In such a complex system of relationships, however, there is a strong potential for conflicts of interest in dense, overlapping webs of partnership. The responsibility for monitoring must fall to an outside regulatory agency, since individuals may be incentivized to free-ride in order to gain maximum access to wealth by manipulating relationship economies.

#### **4.7 Metaprinciple Seven: All (commercial) practices are aligned with the individual**

While Zuboff's principles frame a generalized market economy, there is little argument that there are commercial aspects to higher education. Elite universities specifically target the highest achievers and those with the most potential, students and potential faculty alike. The current practice centers on delineating castes of quality, and the responsibility rests on the individual to justify inclusion in the caste. There is a potential shift here from a student or faculty member finding

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<sup>19</sup>Axelrod, R. (1985) The Evolution of Cooperation. New York, NY. Basic Books.

research within a department to degree programs and appointments that conform to individual interests. The ability of educational federations, through new recruitment strategies, will depend on the degree of marketing flexibility institutions are willing to display toward potential students and faculty. Since the shift moves away from the caste system, this may necessitate a redefinition of institutional lineage and tradition. No longer will an individual identify with a singular institutional identity; rather, identities will be individually constructed through relationships and reputation of federation resources.

#### **4.8 Metaprinciple Eight: Infrastructure convergence redefines costs and frees resources**

Infrastructure convergence refers to the tendency of ancillary services and structures not essential to the core of knowledge production to shift to independent markets. As discussed in the section on new competition, deep support may become a point of convergence for traditional administrative functions. Through this arrangement, administrative costs for individual researchers can become fixed costs through contracts with outside "deep support" service providers. Thus, the uncertainty and variability of budgeting lies only in estimation of direct research expenditures.

On the side of student management, infrastructure convergence forces a true market economy. The cost of managing the student experience falls to the individual student in selecting a deep support agent. Thus, agent providers will need to engage supply-and-demand dynamics to compete for student business.

## 4.9 Metaprinciple Nine: Federations are infinitely reconfigurable

Given a network of  $g$  nodes, the number of possible relationships is <sup>20</sup>:

$$N = g(g - 1) \tag{1}$$

Over a specified series of  $t$  time steps, the number of possible relationships grows exponentially to:

$$N = [g(g - 1)]^t \tag{2}$$

The number of potential relationships in a networked economy of thousands of academics, students, deep support service providers, and product suppliers quickly approaches infinity for all practical purposes. For example, in a department such as the University of Michigan School of Information, with 28 faculty and 34 doctoral students, assuming five years from beginning to end of the doctoral degree, and that relationships can only be modified once per year, the number of federations possible within the department alone is 773,762,401,131,854,432 over the time period. As researchers become aligned with the federated infrastructure, they will be able to create many research relationships quickly and easily. The support economy will assist in managing these relationships. As a result, the number of possible federations is functionally infinite. Differing cycles of research, combined with the nature of transient and weakly persistent relationships, make the federations infinitely reconfigurable. Graduate students will be able to tap into the reconfigurable nature of this infrastructure to create custom training programs with more ease.

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<sup>20</sup>Wasserman, S., and K. Faust (1994) Social Network Analysis: Methods and Applications. New York, NY. Cambridge University Press.

#### **4.10 Metaprinciple Ten: New valuation methods reflect the primacy of individual space**

As discussed in metaprinciple 1, students are increasingly approaching education from a "consumer" mindset, demanding new levels of service to accompany the educational experience. This shift makes the individual space a primary motivator for the university to provide perceived value.

On the side of knowledge producers, the rights and claim over innovation become increasingly complex. Even in the current environment, researchers, universities, and governments continually wrestle with issues of balancing intellectual property ownership. The issues will only become more complex and difficult to resolve in an environment of distributed value, resources, and collaborative effort.

#### **4.11 Metaprinciple Eleven: A new consumption means new employment**

The establishment of complementary markets in the support economy opens new vistas of employment. As discussed, the particulars of the deep support metaproduct may or may not create new positions for human employees, since advances in artificial intelligence have shown significant promise in automating these brokering functions. There will, though, be a market for those who can optimize these agents, should they be the most efficient solution. If the automated solution is not feasible, deep support opens new markets for an emergent workforce of trained information and knowledge management professionals.

For faculty and research, new employment may resemble a "free agent" model, current prevalent in professional sports. Under this model, scholars are not

anchored to an institutions; rather, they self-determine the relationships and projects in which they engage. This does not place all the power in the hands of the research, however. Under this model, teaching appointments, soliciting graduate students, and acquisition of grants and other resources become individually competitive. In spirit, this is a highly Darwinian mechanism for academics, and the less adept will quickly be culled from the academy.

For students, the consumption of flexible, individualized, and customized degrees may have mixed consequences. On the positive side, the degree will represent unique skills a fresh graduate can offer to an employer. The uniqueness of the degree, however, may also be a detriment. Individualized graduate degrees could mean a redefinition of faculty position searches and require more justification to employers.

## **5 Platforms for Policy Development**

Moving forward, policy formation in the support economy, focusing on the university as enterprise, calls for significant consideration of the complexity of highly-networked interaction. The effective and efficient management of resources necessitates the creation of infrastructure/cyberinfrastructure that maintains both extensibility and cross-entity compatibility. To this end, five metaprinciples of policy development may be derived to guide future efforts. While these principles are certainly not an exhaustive list, and do not describe the operationalization of policy development for the networked university in the new economy, they outline generalized concerns that should be kept firmly in mind to manage complexity as the centralized nature of the university is abandoned or transformed.

## 5.1 Defining the University Enterprise

The increasing role of the university as a true market enterprise, defined by the relationships with and funding from private sectors, rate of innovation introduced into markets through technology transfer mechanisms, and the rise of cross-boundary collaboration through IT-enabled cyberinfrastructure, places the dual role of the university in a precarious position. On one hand, the university remains the bastille of higher education, serving the needs of both the academy and industry as a producer of new scholars, new innovation, and pushing the boundaries of basic and applied sciences. On the other hand, the shift toward applied science, driven strongly by market-based innovation, places the university in a position to be governed by the rules of the market. As the networked, deep-support structure emerges within the university, there is the possibility of bifurcation in the university enterprise into separate educational and research components. Defined by the individual consumer, the interests of students engaging the university to gain education are not necessarily aligned with the concerns of the researcher or faculty member as an agent within a knowledge-producing enterprise. Following on this thought, these former two agents and again not particularly aligned in incentive with the university itself as a provider of both educational product and market-viable innovation products.

This division into separate educational enterprise and research enterprise is not a pressing concern at the undergraduate level, where the tradition of educational product allows students to be mostly passive consumers of knowledge. Little significant research resulting in innovation takes place at this level, and the product can be largely standardized for reconfiguration. That is to say, "a bachelor's degree in economics" is a well-understood set of knowledge across universities, and an

individual receiving this degree may enter the market with a strong and definable set of skills and abilities to offer an employer (of course, with minor variance depending on institutional quality, but this variance is mitigated by institutional convergence on baseline sets of discipline-specific knowledge.) The bifurcation of the university enterprise poses the most difficult challenges at the graduate education level, where students are expected to become active contributors in the generation of new knowledge. Graduate education is a hybrid of a consumption phase (completing coursework) and contribution phase (enacting research and emerging as an independent scholar). If a division of university function takes place, infrastructure to provide these two components, or at the very least, provide a seamless transition from one to the other, will need to be constructed carefully.

## **5.2 Maintaining Accountability in Credentialing**

The reconfigurability of degree programs under a support economy model spurs the question: Is the configuration of a degree chosen by a given individual a valid compilation of knowledge, leading to a competency in professional activities? Who will oversee and credential these infinitely configurable sets of degree programs? The possible erosion of the centralized university identity in the face of educational federations shifts the responsibility of credentialing either to the federation itself, each establishing the legitimacy of their "nod of approval."

Alternatively, this shift would call for the creation of a centralized credentialing agency, serving as a quality control mechanism to which federations must provide curricula for approval, and must submit to periodic accreditation reviews. It would seem that the movement to a federated model may necessitate the creation of a complementary market for such types of review and accreditation. Policy formation,

then, must take an active role in considering which model would best serve the economy, as well as maintain an acceptable standard of quality in determining the fidelity of research activities and the granting of advanced degrees.

Likewise, the vetting of research that is produced by collaboration enterprises must be maintained to ensure the quality of research. This aspect may not undergo significant transformation under a new model. Agencies that provide grants and funding will likely retain reviewing mechanisms (though a complementary market may emerge for this as well.) Publication and review of articles, which is a topic of current debate, may undergo shifts as the legitimacy of online publishing becomes more established. The structures associated with this process, while also networked in nature, are not necessarily of the same ilk as those associated with basic academic credentialing.

### **5.3 Incentive-Centered Design for the Research Enterprise**

Recent research efforts at the University of Michigan School of Information have centered on *incentive-centered design (ICD)* - the interdisciplinary melding of cognitive and social psychology principles with economic mechanisms. The result is a corpus of new knowledge in designing strategies to elicit desired behaviors, whether from individuals or groups.

By giving serious credence to ICD-based research frameworks, effective and practical strategies may be developed to align the basic incentives of actors within the complex federated network of the market/university enterprise. Though it will take significant research investment, ICD is an area of research that holds much promise by abdicating a false sense of control over highly emergent (and thus intractable) outcomes, and capitalizing on the underlying, relatively immutable economic factors

of incentive, revealed preference, and individual actor tendencies toward optimization. The result will be policies that allow natural market forces to shape events at a minimally disruptive pace.

## 5.4 Balancing Centralization and Decentralization

As seen in the discussion of Zuboff's metaprinciples, in opposition to Brown & Duguid's general observation about the decentralizing tendency of information via information technologies, there are aspects of both centralization and decentralization at work in the transformation to a support economy. While the nature of research and education processes themselves (that is, from the point of view of the individual agent) become decentralized (e.g., research done in cyberinfrastructure-enabled collaboratory environments, taking classes through distance programs, etc.), some of the complementary support markets that form the infrastructure enabling this shift must be centralized. The emblematic example of the support economy, the agent, represents a centralization of trust and representation within the virtual realm. For the purposes of the university, credentialing, management of financial aid and grants, and other administrative functions are positioned to enter a tumultuous period of market competition but seem suitable for natural monopolies. The way to avoid undesirable monopolies in this case, then, is to carefully engineer standards for interoperability and information exchange, circumventing a standards war which could have strong negative effects in the stability of the emerging enterprise <sup>21</sup>.

To this end, policymakers must make judicious choices regarding which entities and levels of aggregation are best served by centralization, and which should be

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<sup>21</sup>Shapiro, C., and H. Varian. (1998) Information Rules: A Strategic Guide to the Network Economy. Cambridge, MA. Harvard Business School Press.

allowed to decentralize. Coordination of these opposing vectors must be carefully managed, and short-term tensions between the two should be regarded with compassion. They are inevitable as the system grows. Avoiding reactionary policy strategies during these times will be critical.

## 5.5 Embrace of Open Source Models

On the surface, initiatives such as MIT's OpenCourseware project seem to be an opportunity for broader access to quality education; however, the nature of open source is more fundamental. Open source serves as a coordinating framework in a distributed, federated innovation environment. As observed by Steven Weber:

End-to-end innovation goes a step beyond simply reduced transaction costs. It enables parallel processing of a complex task in a way that is not only geographically dispersed but also functionally dispersed.

End-to-end architecture takes away the central decision maker in the sense that no one is telling anyone what to do or what not to do. This is the essence of *distributed innovation*, not just a division of labor. There are no weak links in this chain because there is, in a real sense, no chain.

Innovation is incentivized and emerges at the edges; it enters the network independently; and it gets incorporated into more complex systems when and if it improves the performance of the whole <sup>22</sup>.

Following along incentive-centered design principles, open source initiatives function to align the incentive structures of those who would choose to innovate. As Weber points out, no one is telling innovators what to do - a principle common among independent scholars. Many choose to enter the academy because of the relative

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<sup>22</sup>Weber, S. (2004) The Success of Open Source. Cambridge, MA. Harvard University Press.

autonomy in charting one's own research destiny. The topics on which to focus, and the desire to create and innovate along those vectors, are incentives that will draw those who gravitate naturally to an open source model. By formalizing open source as a fundamental infrastructure, the operational (and reward) structures become aligned with those who have the potential to be most productive and self-driven.

## 6 Conclusion

Although the future, as a cliché, is uncertain, appropriate theoretical frameworks can mitigate this uncertainty in making predictions upon which to base critical policy development. In the case of the future of the research university in a federated environment, Zuboff's support economy metaprinciples provide a set of reasonable foundations upon which to proceed. Observations and concerns expressed by the upper echelons of American higher education professionals suggest that the consumer-based views of the support economy are salient and relevant. The foundational structure of the university both as educational and research enterprises are shifting quickly, and reticence to transform in parallel may have detrimental consequences for the viability of the institution. In short, better to change with the times and preserve the underlying vision and philosophy of the academy than to stand on tradition and ceremony, only to be left behind as an anachronism that has outlived its relevance.

The need, then, for mindful and carefully engineered transformation strategies is clear. As a point of policy, the intermediate steps for transforming the university enterprise to fit within the support economy must fit into a strongly controlled plan. Care must be taken, as Axelrod and Cohen advise when dealing with complex

adaptive organizations <sup>23</sup>:

- Look for shorter-term, finer-grained measures of success that can usefully stand in for longer-run, broader goals.
- Do not sow large failures while reaping small efficiencies.

The two statements above represent an inherent tension in directives when constructing policy in an environment of incomplete information and complex interaction. Policymakers, then, must be especially skilled at tending to the short-term needs of the enterprise, while maintaining strong stewardship of the longer-run goals and "bigger picture." By embracing emergent forms of organization, enabled through constantly evolving information technologies, and driven by changing societal conceptualization of incentives, value, and interaction, the future of the research university will not be in the hands of chance. By taking the reins of change and proactively harnessing the complexity, bringing to bear the significant intellectual heritage of the academy, and asserting its historical role as an agent of social transformation, the research university is well-positioned to lead, rather than follow, the coming revolution.

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<sup>23</sup>Axelrod, R., and M. D. Cohen (1999) Harnessing Complexity: Organizational Implications of a Scientific Frontier. New York, NY. Simon & Schuster, Inc.