Service Science, Management, Engineering, and Design (SSMED): Outline & References

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Abstract

The growth of the global service economy has led to a dramatic increase in our daily interactions with highly specialized service systems. These daily service interactions are both frequent and diverse, and may include retail, financial, healthcare, education, on-line, communications, technical support, entertainment, transportation, legal, professional, government, or many other types of specialized interactions. We often play the role of customer in these interactions, but we also play the role of provider at home and work. The purpose of these many interactions is to create (or sometimes to mitigate the destruction of) value of some type. On those especially busy days of creating or salvaging value, we all come to realize, perhaps reluctantly at first, that we live, work, and play by taking on a great many roles in a great many service systems, and that we are all, in fact, individual service systems ourselves - increasingly complex, multitasking, highly specialized, knowledge-intensive human service systems - in 'business' to interact with others and co-create value. And yet surprisingly few students graduating from universities have studied anything about service systems.

Service Science, Management, Engineering, and Design (SSMED), or service science for short, is an emerging discipline aimed at understanding and innovating service systems. Service systems are ancient, since the dawn of specialized knowledge and the division of labor, and are now rapidly evolving as costs plummet due to information and communication technologies (ICT) innovations that accelerate the creation of and sharing of specialized knowledge assets. Informal and formal service systems have been coevolving at an accelerating rate. Informal service systems depend more on traditional social systems and authoritative political systems (superordinate goal – which is why authority may appear "unfair"), and formal service systems depend more on monetary economic and strict adherence to legal system judgments (process without utility comparison – which is why bureaucracy may appear "unreasonable" or "out-moded'). Service systems exist and expand because of the value of the growing body of specialized knowledge assets distributed across a growing population of specialized people, and because of the mathematical advantages of dependent win-win value co-creation (value propositions) and collective-win (governance mechanisms) interactions over purely independent 'do-it-all-myself" activities. Service systems (normatively) co-create value by applying specialized knowledge of diverse capabilities (provider perspective) and reciprocal needs (customer perspective) as they interact with and establish relationships or one time encounters with other service systems.

This paper sketches an outline and preliminary set of references to provoke discussions about the difficult challenge of integrating multiple disciplines to create a new and unique service science. The sketch outlines the theoretical and practical foundations of the emerging field of service science, as well as the types of expertise (both broad interactional and deep contributory) that are important to service science professionals. Service science professionals seek to create and improve service systems (and their associated value propositions, governance mechanisms, and service networks). A service science lab network is also described, that could someday provide real, virtual, and simulated world experiences to educate and provide practical work experiences for future service scientists, and students of other disciplines seeking a better understanding of service systems as well.

I. Theoretical and Practical Foundations

Today we increasingly depend on interactions with others to survive and thrive. Mass collaboration and competition with people from anywhere on the planet is becoming "the new normal." As customers, interdependent on and demanding more of others and ourselves, we live in and cocreate a world of accelerating social, technological, economic, environmental, and political complexity. We seek to change these aspects of our world to better meet our wants, needs, and aspirations. Individually and collectively, we, as customers, demand and participate

in the creation of an ever growing array of business and societal service activities. To more completely, systematically and scientifically understand ourselves as customers, providers, governing authorities, and innovating competitors, an increasing number of academics and business professionals are adopting a new way to view ourselves, our organizations, and our institutions as *service systems* embedded in a world of complex, interacting populations of service systems.

We call this perspective the *service systems worldview*. The service systems worldview can be used to interpret the world that we live in as a world of (1) interacting service systems, (2) connected by value propositions (to cocreate value), (3) with governance mechanisms (to resolve disputes) among the many stakeholder service systems, (4) that collectively form many dynamic, interlocking service networks. Service systems *collaborate and compete, explicitly or implicitly, to cocreate and cocapture value*. Service systems perform a range of activities and must balance risk and reward in their interactions with each other. Service systems are knowledge-intensive systems, evolving more sophisticated (i.e., knowledge and information intensive) value propositions to enhance win-win interactions, more sophisticated governance mechanisms to resolve disputes and learn to benefit from measured risk-taking, discovery, and perpetual change, as well as more sophisticated service networks that increase value creation density (Normann 2001).

Every day we, as individuals, participate in and interact with dozens of business and societal service systems - from the moment we switch on the lights (utility and energy service), as we travel to and from the day's activities (transportation service), as we digitally connect to interact with others via telephones and computers (communication service), to the moment we relax at the end of a long day in front of our television, computer, or interact with friends or family at home or at an evening event (entertainment service). Government, healthcare, education, retail, financial, professional, business, and even on-line self-service websites add to the long list of daily service system interactions for a growing number of people around the world. Service system interactions represent a huge and growing investment of time, attention, effort, and money.

In the service systems worldview, we, as individuals, are all service systems. We are all customers. We are all providers. When we enter a retail store, we, in the role of customer, enter a provider's service system (composed of resources they own or lease). When the cable guy shows up at our house, the cable guy, in the role of provider/field-service-specialist, enters our service system (composed of resources we own or lease). In both cases, people as service systems, assume roles in someone else's service system, for the purpose of value cocreation.

The International Labor Organization released a report[1] in January 2007 that stated there are, for the first time in human history, more service jobs in the world (40%) than agriculture (39.6%) and nearly doubles those of manufacturing (20.4%). Furthermore, this shift to service jobs is continuing to increase rapidly in both developed and developing nations. Other studies indicate a growing education level on the planet, and the rise of the portion of these service jobs that can be classified as knowledge-intensive service activities. Some say the world is becoming flat, as knowledge workers, connected by technology, can work from anywhere in the world, interacting with customers anywhere else in the world. Put simply, the growth of the knowledge economy and the service economy are two sides of the same coin. People with specialized knowledge (capabilities or needs) assume roles in service systems, increasing the number of customer-provider interactions in the world.

In spite of the dominance of service jobs, few students graduate with any formal understanding of service systems. Of course, little by little, computer science students are starting to learn about web services and service oriented architectures. And for the last decade or two, management schools students have had the option of learning that service marketing and management are different from product marketing and manufacturing management. However, given the existing dominance of service activities in all national economies, and the growing importance of off-shored service offerings outsourced by businesses and governments, as well as the growing number of service interactions in our daily lives, a consensus is forming that not enough is being done to prepare students with a well thought through, and well integrated with existing disciplines, service systems worldview (IfM 2006);

Service Science, Management, Engineering, and Design (SSMED), also known as service science (IBM Research 2004; Chesbrough, 2005; Horn, 2005; Chesbrough and Spohrer, 2006; Hidaka, 2006; Monahan, Pym, Taylor, Tofts, and Yearworth 2006; Spohrer, Maglio, Bailey, Gruhl, 2007; IfM and IBM,

[1] See URL http://www.ilo.org/public/english/region/asro/bangkok/public/releases/yr2007/pr07_02sa.htm.

2007; Spohrer & Maglio, in press), is gradually emerging as an interdisciplinary approach to the understanding of service systems and the value propositions and governance mechanisms that connect them into service networks. The study of formal service systems contains the study of economic markets, and formal, written contracts between service systems as well as the legal system for enforcing those contracts. The study of informal service systems contains the study of relationships (communications, interactions, and promises) between service systems and the social systems, cultural norms and beliefs, as well as political systems that can maintain those relationships. In this first section, the theoretical foundations, including fundamental concepts and questions are introduced, as well as the practical foundations, including basic tools and methods, of service science are introduced.

1. Concepts and Questions

Service is a term that is used in many ways, often to refer to the value of actions, experience, or assurances, rather than the value of physical things. For example, Vargo & Lusch (2004, 2006, in press a and b) in their Service-Dominant Logic define service as the application of competence (knowledge, expertise, resources, relationships) for the benefit of another entity. They point out that most people today use a Product-Dominant Logic that has arisen from two centuries of measuring value as increase in physical output, for example, in terms of bushels of corn and number of widgets shipped. This is quite understandable, in part, given that physical production efficiencies have lead to enormous improvements in material wealth (Beinhocker, 2006). Western culture perhaps has a tendency to be more focused on the value of things (materialism) rather than on the value of interactions (relationships with others), and finding a balance is sometimes a challenge.

In economics, service is a category used to classify and measure types of economic activities, jobs, businesses, and other organizations as distinct from economic activities that produce physical output of an extractive or manufactured nature. The increased focus on service in recent years is in large part due to the growing dominance of service activities in national economic accounts of jobs, GDP, exports, and productivity (Triplett and Bosworth 2004; Lewis 2004; Herzenberg, Alic, Wial 2000). In everyday business and government, service is most strongly associated with types of customer-provider interactions, between entities such as people, organizations, agencies, machines, or infrastructure, in which money, taxes, or attention are typically exchanged for the service actions, experiences, assurances, or access privileges. In computer science, service refers to computational resources (as in web service or grid service) that can be discovered, accessed, and applied using standard protocols (Spohrer, Anderson, Pass, and Gruhl, submitted). In the public sector and social sciences, service is often associated with intangible value from selfless acts of loyalty, courage, or ethical/religious convictions about what is right and good in human society. For example, the removal of *unfreedoms* from the billions of underserved people around the world is one view on the importance of service activities that connects economic, political, and social thinkers (Sen, 1998; Lewis, 2004). All these views contribute to an increasing need to understand the phenomenon of service, or value from service system interactions (sometimes as one time encounters and sometimes with accompanying long-term or life-time relationships (Gutek, 1995)) and the application of knowledge as knowledge assets, not just value from use of material assets (Boisot, 2002).

Service science seeks to create an understanding of the formal and informal nature of service in terms of entities, interactions, and outcomes. An initial premise is that the entities, which are sophisticated enough to engage in rationally designed service interactions that can consistently lead to win-win value cocreation outcomes, must be able to build models of the past (reputation, trust), present, and future (options, risk-reward, opportunities, hopes and aspirations) possible worlds, including models of themselves and others, and reason about knowledge value (Fagin et al, 2003). The three foundational concepts of service science are:

service systems – the sophisticated knowledge-value reasoning entities (e.g., (1) people - perceiving, thinking, remembering, planning, and experiencing, as well as (2) organizations and machines - sensing, computing, storing, forecasting, and focusing) that can be viewed as populations of stakeholders (e.g., customers, providers, authorities, competitors, etc.) interacting in service worlds (Bryson, Daniels, and Warf, 2004; Spohrer, Maglio, Bailey, Gruhl, 2007; Spohrer, Vargo, Maglio, Caswell, in press).

value propositions - a type of shared information (capabilities, needs) between the entities that shapes the interactions between entities and are used to reason about win-win value cocreation outcomes (Anderson, Narus, Rossu, 2006; Lovelock and Gummesson 2004; Kim and Mauborgne, 2005; Slywotzky, Wise, and Weber, 2003; Afuah, 2004; Gummesson 2007; Normann 2001).

governance mechanisms - a type of value proposition (shared information) between the entities that shapes the interactions between entities and is used to reason about collective win, dispute resolution (government authority, legal process), risk taking, and learning to improve performance (Williamson, 1999; Adams, 2000; March 1991; Omerod, 2005; Bernstein, 1998).

These three foundational concepts underlie the *service systems worldview*: The view that the world is made up of service systems that interact (normatively) via value propositions to cocreate value, but often disputes arise and so governance mechanisms may be invoked to resolve disputes. In the service systems worldview, people, businesses, government agencies, nations, cities, hospitals, universities, and many other entities are instances of formal service systems. *Formal service systems* are types of legal entities with rights and responsibilities, that can own property, and with identities that can create contracts with other legal entities (Williamson, 1999; Roberts, 2004). *Informal service systems* include families (though households are formal from a tax law perspective), open source communities (that have not created a formal non-profit entity for governance or charitable giving purposes), and many other societal or social systems that are governed typically by unwritten cultural and behavioral norms (social systems with rudimentary political systems).

Unlike the entities in some traditional economic and game theory frameworks however, service systems, as entities, have the competence to reason and make judgments about *relationships* over a life time of interaction, not only the history of past interactions but also reason about the possible future *customer life time value* of service interactions (Rust, 2000)[2].

In addition to the three foundational concepts (service systems, value propositions, and governance mechanisms), a number of other concepts are fundamental to understanding the nature of service systems: value, stakeholder perspectives, measures, and resources.

Value, unlike the mass of physical entities, is not an inherent property of entities, be they physical or conceptual entities (von Mises, 1998). Value is a judgment made, in context, by a service system about the relative desirability of possible worlds, and changes or prevention of changes to their perceptions of the existing world, including their perceptions of existing relationships with other service systems. Value is a function, not only of the desirability of possible worlds to a person directly, but also the imputed desirability to those in relevant relationships (service network connections).

Stakeholder perspectives refer to types of roles that service systems can fill in service networks. Stakeholder perspectives are used to describe the role relationships that exist between service systems in a service network, such as customer, provider, authority, competitor. In addition to the four fundamental stakeholder perspectives (customer, provider, authority, competition), other stakeholder perspectives include employee, partner, entrepreneur, criminal, victim, underserved, citizen, manager, children, aged, and many others. Associated with formal stakeholder perspectives are constantly evolving sets of legal rights, responsibilities, and restrictions. Designing business and societal systems that address more than the four fundamental stakeholder perspectives (customer, provider, authority, competitor) is sometimes considered to be the difference between having a society that is merely 'prosperous' and having a society that is truly 'great' (Collins, 2005).

Measures such as quality, productivity, regulatory compliance, and sustainable innovation are used to both track improvements in service system performance over time, as well as to compare alternative designs of service systems and service value networks. The four fundamental measures (quality, productivity, regulatory compliance, and sustainable innovation) derive from the four fundamental stakeholder perspectives (customer, provider, authority, and competitor) as they separately perceive and calculate value. The value that the populations of customers' perceive relates to the measure of quality, while providers create value for themselves (profits) based on their productivity and customer perceptions of their quality. Authorities see value in terms of regulatory compliance with lower enforcement costs, and competitors see value in sustainable innovations that realize competitive advantage on an ongoing basis relative to all others. The ongoing challenge that individual service systems (people) perceive is 'self competition' to sustain a balance between too much challenge (anxiety and risk of failure, if skills are lacking) and too little challenge (boredom and risk of meaningless success). A

[2] For example, the ability to reason about customer life time value leads to some successful but non-intuitive retail service value propositions such as Zane Cycle's programs, in which parents can return their children's first and second bikes for full refunds towards the purchase of the next bike (http://www.zanes.com).

dynamic balance between anxiety and boredom helps to ensure a sense that change has meaning and value (Csikszentmihalyi, 1990). New skills (a provider knowledge asset) and awareness of new problems (a customer knowledge asset) are keys to perceptions of meaning and value, providing a sense of progress over time.

Resources extend over time and have life cycles. Resources exist in one of four logically exclusive categories, based on what is physical or what is not physical, and what can create legally binding contracts or what cannot create legally binding contracts. The four categories include: (1) Physical with contracting rights (e.g., people[3]), (2) Not-physical with contracting rights (e.g., businesses, organizations, government agencies, etc.), (3) Physical without contracting rights (e.g., technology, environment), and (4) Not-physical without contracting rights (e.g., conceptual or in general shared information such as language, laws, measures, and models, etc.). The determination of whether any named entity is physical or not-physical is the responsibility of the community of physicists, and the determination of whether any named entity has contracting rights or is without contracting rights is the responsibility of the legal community. Thus, resources and their four logical categories is socially constructed (Berger and Luckmann, 1967). Informally, not-physical is often referred to as conceptual, and without contracting-rights is often referred to as property. Informally, contracts are often referred to as 'promises.' Thus, speaking informally, or as a commonsense judgment of a person in a culture, resources fall in the four categories based on physical ("my senses make me aware of it") and conceptual ("I can think about it, and name it, but cannot 'touch' it"); as well as things that can be trusted and can freely act in the world ("X can make me a promise and keep it") and things that cannot ("Y is the property or responsibility of X, so X always needs to know and approve, before I make promises and do things with Y").

Different types of resources are governed by different types of laws (Maglio, Kreulen, Srinivasan, Spohrer, 2006). Physical resources are governed by the laws of nature. Conceptual or information resources are governed by the laws of logic-and-mathematics. And both types of resources, in a modern human culture, are governed by human law. This notion of resources is one of the first fundamental insights from service science, and is part of the service systems worldview.

A general theory of service systems has four parts, which directly lead to the four fundamental questions that SSMED seeks to answer:

• Science (use historical facts to learn, devise models, and measure predictions): What are service systems, how have they naturally evolved to present, and how might they evolve in the future?[4] What can we know about their interactions, how the interactions are shaped (value propositions, governance mechanisms), and the possible outcomes of those interactions both short-term and long-term?
• Management (use future possibilities to learn, devise strategies, and measure progress): How should one invest to improve service systems and service value networks?
• Engineering (today's and the foreseeable future's best use of resources, especially technical and information resources): How can the scaling of service systems be improved by the invention of new technologies (and environmental infrastructures) or the reconfiguration of existing ones?
• Design (today's and the foreseeable future's best use of resources, especially human and organizational resources): How can one best improve the experience of people in service systems?

The importance of the concepts and questions outlined in this section are described with some elaborations elsewhere (Spohrer, Vargo, Maglio, Caswell, in press; Spohrer, Maglio, Bailey, Gruhl, 2007). To summarize, the service systems worldview identifies entities (service systems), interactions (value propositions), and outcomes (realized 'value cocreation' or disputes,

[3] We are mindful that many find the term "human resources" to be an inadequate and inappropriate description of people as "resources." We agree that more work needs to be done to create an improved set of terms and category names. One possibility is to adopt the term "actant" for "resource" from actor-network-theory.

[4] We are mindful that theories about service systems are different from theories of purely physical systems, e.g., (Checkland & Howell, 1991, pg 19): *"Geoffrey Vickers, in developing the theory of 'appreciative systems' through which he sought to make sense of his 40 years of experience in the world of human affairs (Vickers 1965), was always cogently critical of those who blithely try to apply the method of natural science to social phenomena. In conversation he used to point out that while Copernicus and Ptolemy offer various different hypotheses about the basic structure of our solar system, we know that , irrespective of whether the sun or the earth is at the centre of the system, the actual structure is entirely unaffected by our having theories about it. Whereas when Marx propounds a theory of history this changes history! The methods of natural science, extremely productive in enabling external observers to discover the regularities of the natural universe, are exceptionally difficult to apply to human affairs."*

with governance mechanisms for dispute resolution). Service systems can fill roles in other service systems, and in service networks. The roles are often given names corresponding to the four fundamental stakeholder perspectives: customer, provider, authority, competition. So for example, in an education service system or service networks, 'student' is a customer role, 'teacher' is a provider role, and 'principle' is an authority role. Formal service systems exist within a legal and economic framework of contracts. Informal service systems exist within a social and political framework of promises. In today's global service economy, the formal and informal always exist together and coevolve, based on changes that derive in part from value judgments. The judgment of value is performed by individual service systems (people). Value judgments are a function of perceptions of the existing world (present context), the set of imaginable possible worlds (candidate futures and their possible follow-on futures), and relationships with other service systems (history, including promises and outcomes, or reputations). Service systems, which are dynamic configurations of resources, seek to cocreate value through interactions with other service systems, but the value, of the resources (knowledge assets) in interactions, is complex to estimate and predict over time (Boisot 2002). The shift from seeing the world in terms of physical assets to knowledge assets is part of the service systems worldview, and the Service-Dominant Logic (Vargo and Lusch 2004).

In the next section, some of the practical problems that derive from these questions will be discussed in the context of specific tools and methods.

2. Tools and Methods

James Teboul (2006) provides an easily accessible introduction to a few of the basic tools and methods that researchers and practitioners have created to both understand service and design new service offerings. In this section, we describe a partly overlapping set of tools and methods, and refer those readers who are new to the study of service and service systems to Teboul's introductory book for a useful overview with short cases and practical tips. In later sections of this paper, we reference some of the more advanced textbooks and expositions associated with specific service disciplines.

The design of business to consumer (B2C) service offerings have benefited from three basic tools, the service intensity matrix, service blueprinting, and service responsibility tables.

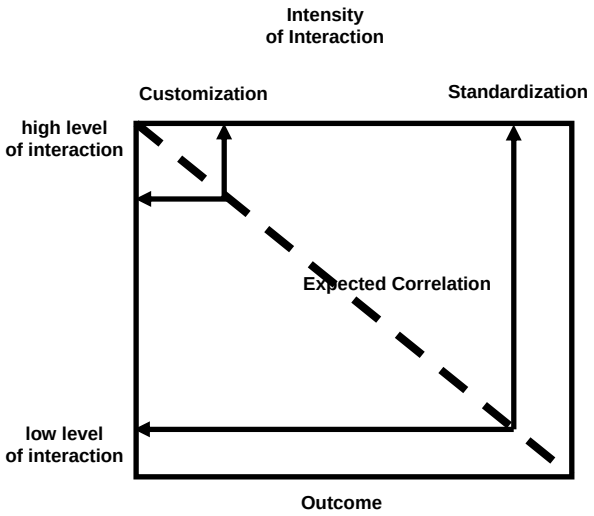

Figure 1. Service Intensity Matrix (from Teboul 2006)

The service intensity matrix (see Figure 1) can be used to show the correlation between customization and high interaction versus standardization and low interaction in classification and comparison of the front stage of service systems. It is particularly useful to show the interplay among the interdependent dimensions of product, process and people in forming the service mix.

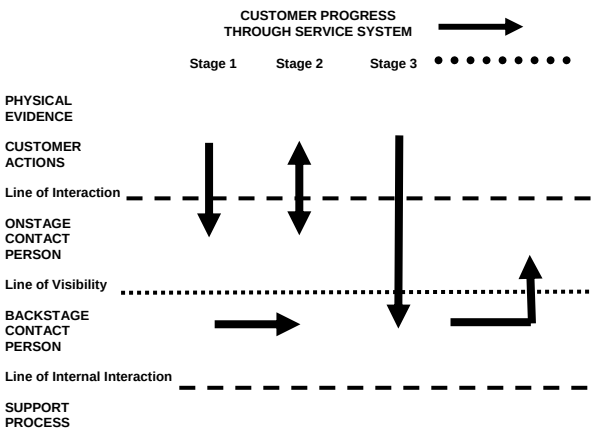

Figure 2. Service Blueprint
(from Fitzsimmons & Fitzsimmons 2008)

The service blueprint tool (see Figure 2) is used to describe and improve customer-provider interactions in the design of new and the analysis of existing service processes. The service blueprint is particularly useful in helping management test out concepts, identify potential failure points and/or opportunities for innovation. Many variations of service blueprinting tools and methods exist, including one recently

developed by Womack & Jones (2005) in their book "Lean Solutions."

Provider Activity or Responsibility	Customer Activity or Responsibility	Problems or Issues

Figure 3. Service Responsibility Table

Steven Alter in his work on work systems (Alter 2006) had developed a service value chain framework that delineated the interaction between the customer and service provider (Alter 2008). He proposed using a Service Responsibility Table (SRT) (see Figure 3) as a tool to bring the customer into the preliminary stages of analyzing a service system. The advantage of using SRT is that it is intuitive and could be used by a customer who is not trained in heavy-duty systems analysis and design. The third column of the SRT is used to highlight the problems and issues related to the interaction between the customer and the provider. This is similar in concept to using the service blueprint to identify failure points.

Gutek and Welsh (2000) proposed a COP model of encounters and relationships. The model described the linkages among Customer, Organization and Provider in a "Service Triangle". The tightness/looseness of the linkage among the components represents the type of and sustainability of the service encounter and relationship.

Heskett, Sasser and Schlesinger (1997) (p. 40) provided a method of calculating value from the perspective of the customer. The simple formula provides a good basis for formulating the win-win value proposition between the customer and the service provider.

ServeLab[5] at Germany's Fraunhofer Institute provides a disciplined approach to new service product designs (Ganz, 2006). The design of business to business (B2B) service systems has a growing number of tools and methods such as IBM's Component Business Model (CBM) approach. Glushko & McGrath (2005) on "Document Engineering" provide a disciplined approach to business process design. More and more service offerings are designed to be accessed on the web, via mobile phones, or via self-service kiosks. The design of these service systems has benefited from an explosion of development tools and methods from many.

The sketch of tools and methods mentioned in this section are just the tip of the iceberg. The reference section alludes to many more that may be of interest. A key challenge for the future is to create a proper framework to match tools and methods to tasks (service system improvement or innovation), keeping in mind that each approach has associated costs and complexities.

II. Disciplines and Broad Interactional Expertise

According to the service systems worldview, we all, as individual service systems, live our lives, from birth to death, in a world surrounded by and embedded in both formal and informal service systems. Most of us, on a daily basis, interact with other individual service systems (people) as well as complex business and societal service systems repeatedly. Some of our interactions are part of relationships and some are merely encounters (Gutek 1995). Complex society is only possible because of smooth interactions with strangers, where we know their role in their service system and they know our role (Seabright 2005). The quality of life's experiences often depend on both access to and appropriate relationships and encounters with service systems of great variety (government, healthcare, education, finance, entertainment, professional, communication, retail, transportation, family, friends, etc.). The encouraging fact of the matter is that at one level, the service systems worldview is just the commonsense of our age – the *common knowledge* (Fagin et al, 2003) that everyone is supposed to just know through experience, and growing up in our culture (Richardson and Boyd, 2005). The unfortunate fact of the matter is that most students graduating today have never heard of the concept of a service system.

To improve the rational design of complex, value creating service systems (as well as their value propositions and governance mechanisms) requires expertise from many existing disciplines. In this section, we review existing disciplinary areas that bear directly on the rational design of complex service

[5] For a recent presentation see: http://www.rhsmith.umd.edu/ces/frontiers/presentations2007/Meiren.pdf

systems. The disciplinary areas have been organized (sections 3-12) into ten areas, as follows:

3. Evolution: Learning from history of interactions
    - Economic & legal
    - Social & political
    - Knowledge & linguistics
4.-7. Measures: Four basic roles (stakeholder perspect.)
    - Customer & quality (marketing)
    - Provider & productivity (operations)
    - Authority & compliance (governance)
    - Competitor & innovation (creative design)
8.-11. Resources: Four logical categories
    - Physical and can contract (people)
    - Physical and cannot contract (technology)
    - Not-physical and cannot contract (info.)
    - Not-physical and can contract (organization)
12. Strategy: Learning from future possible worlds
    - Management and Strategy
    - Finance and Investment

Given the growing complexity and importance of complex service systems to all our lives, given the diverse nature of service systems and the extensive range of disciplinary knowledge needed to understand service systems, as well as the 'missing knowledge' that we have not yet created to better understand complex, value creating service systems, effective teamwork aimed at improving complex service system is challenging.

But is it just too much knowledge for one person to learn about? Fortunately, there is a stepping stone on the way to creating service science specialists with deep knowledge of service systems. Students in the disciplinary areas outline above can add to their core, deep disciplinary knowledge interactional expertise in the SSMED-related disciplines. *Interactional expertise* (Collins, Evans, and Gorman 2007; Collins & Kusch, 1999) implies an ability to communicate effectively with specialists from an academic discipline area. Those with interactional expertise can communicate with specialists (in the language of the specialists) about academic discipline problems and solutions. Those with interactional expertise cannot solve the problems, but they can understand the problems and understand the solutions generated by the specialists. We suggest that interactional expertise in key disciplines (see SSMED-related below) creates the *T-shaped professionals* that are most effective in business and government practice today (deep in their home discipline area and appropriately broad to work effectively with others on service system improvements and innovations). We also suggest that T-shaped professionals can learn and adapt more rapidly to the changing needs of business. We refer to T-shaped people with interactional expertise in the SSMED-related disciplines below as *adaptive innovators*. Because students start with a great deal of commonsense knowledge about the service system worldview, even though they do not have the formal vocabulary, there is good reason to believe material outlined below is not too much knowledge for students to learn.

3. History: Economic and Law Evolving[6]

The evolving nature of human society and modern industries, from the perspective of economics and law, provides the starting point for understanding service science. Prior to the rise of modern formal, codified and regulated, service systems, informal service systems existed as types of social systems with early political systems. Dispute resolution in early political systems recognized a leader, whose goals were superordinate, above all others. Informal service activities are as old as division of labor, and date back to earliest hunter-gatherer societies. Seabright (2005) in "The Company of Strangers" provides an exposition of the evolution of trust in early human groups (informal service systems), and explores the physical and cultural change in humans that bridge from nomadic hunter-gatherers to the rise of agriculture and early cities. The growth of rich, shared linguistic culture that allowed a wide range of knowledge-assets to be discussed was important in the evolution of trust.

[6] The readers should note that the knowledge in this and all the other discipline areas is expansive and growing rapidly. This creates enormous challenges for those seeking interactional expertise in all ten SSMED disciplines areas summarized in sections 3 to 12 of this paper. The ten begin with the topic of historical evolution (economic and legal, social and political, knowledge and linguistic) of service systems, four associated with measures, four associated with resources, and one associated with the future (strategy and investment). For this reason, we try to identify not only some of the key textbooks, but accounts that are more accessible to the general reader. In paper, we are in no way attempting to be comprehensive in our discussions of the discipline areas, but we are seeking to help identify key perspectives that relate to service science (history, measures, resources, future). We are also seeking to encourage those with deep contributory expertise in these discipline areas to create service-oriented textbooks and discipline overviews that tie directly to the service system worldview. This may help students, from those disciplines, who are seeking SSMED interactional expertise learn SSMED more rapidly.

In cities[7], division of labor reached new heights as population density increased, and communication and transportation costs dropped in what Hawley (1986) called the human ecology.

Adam Smith wrote about the wealth of nations as created by division-of-labor that can lead to an increase in productive capacity (Smith 1776/1904). Smith also wrote about the importance of markets ('the invisible hand') for coordinating prices based on supply and demand. Bastiat (1848; 1850), a French political economist in the early 19th century, provided one of the first and most prescient analyses of value as service instead of value in things.

Ricardo, another early political economist, addressed the issue of optimal import-export strategies for nations to maximize individual and collective productive capacities by appropriately dividing production tasks between nations (Ricardo 1817/2004). Paradoxically, even when one nation can do everything 'better' (i.e., more productively, profitably) than another nation, as long as 'comparative advantages' exist (i.e., relative differences in productivity), then there is often a mathematical, and therefore economic and social, advantage to interactions and exchange. The implications of Ricardo's insight are profound and go well beyond the notion of division of labor. The evolution of service system interactions in a population of service systems can be seen, in part, as each service system 'doing a little bit more of what they do best, a little bit less of what they do worse, and a little bit more interacting with not just complementary service systems ('division of labor,' 'opposites attract'), but service systems that are strictly superior or inferior from the standpoint of productivity of activities – as long as there is population diversity there is almost always a reason for exchange.' Diversity creates the conditions for coevolution of service systems. Learning or experience curves (Argote 2005) provide further and on-going mathematical advantage to interactions ('practice makes perfect'). Growing the service system population diversity can happen in many ways, including not simply innovating new productivity enhancements, but also entirely new types of demand ('problems to be solved,' needs, wants, aspirations), new types of value propositions, new types of governance mechanisms, and new types of service system populations (i.e., the rise of modern businesses) which are often associated with new roles (i.e., employee, manager). Alfred Chandler provides the historical account of the rise of industrial age business organizations (manager as the 'visible hand'). The creation of new roles in existing or new types of service systems often means that individual service systems (people) must step up to new levels of multitasking in their lives.

With the exception of Bastiat, it is worth noting that most of the accounts above have focused on the growth of productive capacity through manufacturing activities (i.e., the production of things). Colin Clark (1957) in his milestone work "Conditions of Economic Growth" was the first to systematically document the dramatic growth of service activities in national value creation. William Baumol also drew attention to the growth of the service sector in the latter half of the 20th century, as a drag on the productivity gains of nations. Gadrey and Gallouj (2002) have drawn attention to the difficulty in measuring productivity and quality for service activities compared to manufacturing activities that lead to tangible output. Triplett & Bosworth (2004) provide a modern account of attempts to measure productivity gains in service industries, showing recent periods of time in the US economy where service productivity gains have actually outpaced gains in productivity in extractive and manufacturing sectors. Recently, Baumol (2002) has written about the importance of R&D services ("the leader of the services") to counteract the so called *Baumol's Disease* (asymptotically static service productivity), and provide continuous improvement and even discontinuous jumps in service productivity.

Barnard provides one of the early attempts by a business practitioner to outline a theory of "cooperative systems," including a discussion of formal and informal cooperative systems (Barnard 1938/1968). Richard Normann's (2001) "Reframing Business" is a more modern treatment of many of the same issues, more from a service networks and value propositions rather than an internal organization perspective, and outlines a framework for 'value creating systems' that are very close to our notion of service systems. Normann identifies three fundamental sources of value: new technological innovation, legal and regulatory changes, and reconfigurations of resources and value propositions from existing value creating systems. Milgrom and

[7] Agriculture was a technological change that contributed to a social-organizational change known as cities. Cities were a new form of service system that arose approximately 10,000 years ago. In this first decade of the 21st century, the population of people in cities has just passed the number of people living in rural areas for the first time in human history. According to a 2007 report of the International Labor Organization (ILO 2007), 2006 was the first time in human history that more people globally were employed in service jobs than agricultural jobs.

Robert (1992) in "Economics, Organization, and Management" provide a quite comprehensive view of the value (economic advantage) of alternative organizational and management forms.

Williamson (1999) in "The Mechanisms of Governance" refines views on transaction costs and the new institutional economics that provide the foundations for empirical comparisons in context of alternative governance mechanisms. Williamson's notion of "incomplete contracting in its entirety" speaks to rational design attempts to safeguard against both opportunism and bounded rationality when creating value propositions (contracts) with others. In many ways, contract diversity is to service providers as product diversity is to manufacturers. North (2005) in "Understanding the Process of Economic Change" writes about the success of human attempts to gain some measure of control over the physical world with science and engineering, and the limited success of human attempts to control or even guide the evolution of economic growth through the creation of institutions (combined social, political, economic, legal, linguistic systems).

For the general reader, Wright (2001) in "Non-Zero" provides an accessible version of the history of the evolution in human cooperation and win-win relationship formation (as well as biological evolution and diversity). More recently, Eric Beinhocker's (2006) "Origin of Wealth" provides an introduction to evolutionary economics, including a summary of the works of many scholars on the evolution of cooperation. In the reference section below, other key references with a primary category mapping of "3" can be found. Again, our purpose in this paper is to provide an outline and preliminary set of references that others can use in creating SSMED courses and reading lists for students, as well as for those performing interdisciplinary research that is aimed at closing the knowledge gaps between the separate disciplines and creating a truly new and integrated service science discipline.

4. Marketing and Quality Measure

Marketing, as a function within a business firm, has the responsibility to understand the existing and (potential) future customers of that business. Analyzing the relationships and interactions with existing customers, understanding the quality of the customer experience, and working to communicate the appropriate image of the provider firm to attract new customers and improve the customer experience is part of the marketing function of the firm.

Service marketing is different from product marketing according to a leading textbook on this subject (Zeithaml, Bitner, Gremler, 2006). Traditional product marketing deals with the four P's of product, place, promotion, and price. However, service marketing adds three additional P's: people, physical evidence, and process, because in many service provisioning situations, the service employees and customers interact directly. The service experience in these cases of simultaneous production and consumption is determined by the people, the physical evidence where the interactions happen, and process that guides the customer-provider interactions. Of eleven challenges and questions for service marketers highlighted in this textbook (Pp. 24-25), three mention quality: How can service quality be defined and improved? How does the firm communicate the quality and value to the consumer? How can the organization ensure the delivery of consistent quality service?

There are many fine textbooks and business books in the service marketing, relationship marketing, and customer lifetime value areas (Lovelock & Gummesson 2004, Rust et al 2000). These books provide methods for pricing services, communicating service value propositions (including by word of mouth from satisfied customers), recovering from service failure, estimating customer lifetime value, demand forecasting, segmenting markets, using CRM (customer relationships management) technology and systems effectively in organizations, and many other topics related to demand innovation and revenue growth from customers.

Service marketing also has developed a growing set of methods to create value propositions appropriate for the "servitization of manufacturing companies" by which products become platforms for service provisioning. For example, Rolls-Royce is the third largest provider of jet engines to the airline industry, but does not sell the engines. Instead the engines are the basis for propulsion service contracts that allow for more sustainable innovation between the provider and customers.

As already noted, understanding the way customers perceive and are impacted by quality of a service offering is a significant concern of marketing. Zeithaml, Bitner, and Gremler (2006) advance the Customer Quality Gaps Model as a way to understand the factors that contribute to service quality. Pine & Gilmore (1999) provide a number of rules of thumbs. Chase also provides a rule of thumb formula (Chase, Jacobs, Aquilano, 2004). Ben Schneider (Schneider

and Bowen 1995, Schneider and White 2003) has performed a number of empirical studies that show service quality levels inside the firm (as rated by employees) are reflected outside the firm in the experience of quality (as rated by customers). This finding is often used to emphasize the importance of business culture and cultural factors when implementing quality improvement initiatives (Moulton Reger 2006).

In B2C service interactions, quality of service is often both a major focus of employee selection and training, as well as an 'unconditional guarantee' made to customers as part of the value proposition used to attract and retain customers. As noted previously, customer lifetime value is part of the calculation of how "generous" failure recovery value propositions can be, and still remain profitable over the expected lifetime of the relationship. In B2B and IT-enabled service provisioning, contracts may explicitly call out Service Level Agreements (SLAs) with specific objective measures and penalty clauses in case the SLAs are violated.

In sum, marketing as a function of the firm seeks to understand customers, and especially the customers' perception of quality of service. By understanding the full value that customers derive from a service, providers may be able to shift from cost-based to value-based pricing, as well as redistribute risk in the relationship. By segmenting types of customers into market segments based on growth potential and profit potential, marketing can have both a major impact on revenue growth and profitability of the firm. In the reference below, more references that deal with customers and quality are indicated by including a primary or secondary '4' mapping key (corresponding to this section).

5. Operations and Productivity Measure

A leading Operations Management textbook (Chase, Jacobs, Aquilano, 2004, Pp 6-7) states: "*Operations Management (OM) is defined as the design, operation, and improvement of the systems that create and deliver the firm's primary products and services. Like marketing and finance, OM is a functional field of business with clear line management responsibilities. This point is important because operations management is frequently confused with operations research and management science (OR/MS) and industrial engineering (IE). The essential difference is that OM is a field of management, whereas OR/MS is the application of quantitative methods to decision-making in all fields, and IE is an engineering discipline. Thus, while operations managers use decision-making tools of OR/MS (such as critical path scheduling) and are concerned with many of the same issues as IE (such as factory automation), OM's distinct management role distinguishes it from these other disciplines.*"

In operations the emphasis is on efficiency while doing things at the lowest possible cost. The tradeoff most commonly perceived is not to lower the quality of the output of a process as the cost of performing the process is reduced – in fact, ideally the quality should increase as the cost is reduced. The standardization of processes by removing waste (Lean methods), removing variance (Six Sigma method), and then automating to achieve superior quality at the lowest cost is a typical operations worldview approach. Increasingly, operations add a final step of global sourcing (see Section 11) to obtain the lowest cost labor resources required to operate the process.

Productivity, broadly defined, is a ratio of output to input. Productivity is a relative measure, typically used to compare a previous time period to a current time period to get a sense of either efficiency gains (reducing costs of inputs) or revenue gains (increasing demand for and hence value of outputs). Partial productivity measures, measure output to labor or output to capital or output to energy. Multifactor productivity measures, measure output in relation to the sum of a set of input factors. Total productivity measures combine all outputs and all inputs.

Scott Sampson's (2001) "Unified Theory of Services" extends Chase's customer-interaction model of service production processes as distinct from traditional manufacturing production processes. Sampson has been a leading thinker in trying to advance a view of service operations as a distinct scientific field (Sampson and Frohle, 2006).

The vocabulary of operations and operations management centers on the concept of *process*. The history of operations is primarily associated with the industrial revolution (processes with standard parts and economics of scale) and the rise of scientific management (processes with routine and repetitive human performance). More recently operations has sought an appropriate balancing between investments aimed at optimizing a process (queuing theory to eliminate waiting and inventory bottlenecks) and those aimed at maintaining an increasing flexibility of a process (capacity and demand matching, agility for rapid change).

A good overview of these perspectives on operations, including some basics of the human element in processes, is provided in the book "Factory Physics" by Hopp and Spearman (1996). This book also provides a good introduction to the fundamentals of queuing, inventory management, scheduling, and resource planning around factory processes where the factory is viewed as a system of interacting processes of a technological, human, organizational, and informational nature, as well as a good deal of historical perspective on attempts to create a science of manufacturing[8] in part to limit the need for off-shoring of manufacturing.

Fitzsimmons & Fitzsimmons (2007) is the author of one of top selling service operations textbooks, "Service Management: Operations, Strategy, and Information Technology" While originally primarily focused on B2C service activities, recent editions have expanded the B2B and IT-delivered service sections.

In sum, operations as a function of the firm seeks to understand provider processes and productivity, both those that do not directly involve the customer (back stage processes) and those that directly involve the customer (front stage processes). By understanding the value providers derive from a process as well as the value that customers derive from a process, appropriate operations techniques can be used to reconfigure activities, information, risk, etc. between people and technology, between organizations, and between employees and customers to improve productivity and quality of experience (Womack and Jones 2005). By segmenting types of processes into *front-stage* and *back-stage* processes, appropriate techniques can be used to optimize productivity as well as improve flexible responsiveness (Levitt 1976; Teboul 2006). By decomposing processes into reconfigurable components, service activities can be industrialized as technological capabilities advance to improve quality and economies of scale (Levitt 1976, Quinn and Paquette, 1990).

A frequently asked question is "*how does service science differ from industrial engineering*." The easiest way to appreciate the difference is to compare Hopp and Spearman "Factory Physics" to Fitzsimmons "Service Management." The key difference is the focus shift from factory systems, products, and processes to service systems, value, and interactions, from systems governed by physical laws to systems governed by human-made laws. More references related to operations and productivity can be found in the reference section below, with the '5' mapping key corresponding to this section.

6. Governance and Regulatory Compliance Measure

The overall level of regulatory compliance and the cost of maintaining or improving those levels vary considerable among the many nations around the world. Regulatory compliance is a factor in the transaction costs associated with doing business in different regions of the world (or even districts in a single city). Kaufmann, Kraay, and Mastruzzi (2003) in "Governance Matters III" describe *"The Rule of Law Index combines several indicators that measure the extent to which agents have confidence in and abide by the rules of society. These include perceptions of the incidence of both violent and non-violent crime, the effectiveness and predictability of the judiciary, and the enforceability of contracts. Together, these indicators measure the success of a society in developing an environment in which fair and predictable rules form the basis for economic and social interactions."*

Political science, legal theory, contract law, all relate to governance. Principal-agent theory in economics also relates to governance (Roberts, 2004). Management mechanisms and administrative science are associated with top down control of resources in a hierarchy, while governance mechanisms are associated with agents or organizations (service systems in our vocabulary) interacting in the context of markets and institutions, and preferring the efficiency and freedoms associated with self governance wherever possible. The Federalist Papers provide an example of a famous historical attempt to design and advocate for a particular form of self governance. Section 3 mentioned the work of Williams (1999) "The Mechanisms of Governance" which provides

[8] Hopp and Spearman (1996, pg 2) provide perspective into concerns about the shift from manufacturing to services. Apparently, one explanation why the same concerns did not arise during the shift from agriculture to manufacturing is: "But as Cohen and Zysman point out in their elegant and well-documented book, Manufacturing Matters: The Myth of the Post-Industrial Economy (1987), there is a fundamental flaw in this analogy. Agriculture was automated, while manufacturing, at least partially, is being off-shored – moved abroad." Cohen and Zysman (1988) provide an analysis of the service activities that are upstream (come before) and downstream (come after) a product is manufactured. They argue that upstream service activities are the most knowledge intensive, and that losing manufacturing to offshore operations eventually leads to the loss of the knowledge-intensive upstream service activities. The debate over whether upstream or downstream service activities are most knowledge intensive has not been conclusively decided.

theoretical and empirical investigations of alternative governance mechanisms. Computer scientists, mathematicians, game theorists, and economist have also worked to create the area known as mechanism design. Mechanism design provides a formalization of the properties of different types of auction mechanisms as well as algorithms to repeatedly exchange resources between agents in a system.

While service systems interactions (normatively) are proposals to co-create value via win-win value propositions, many things can go wrong. For example, even if the value proposition succeeds, third-party stakeholders (victims) can step forward with grievances and claims against the primary stakeholders (providers-customers). Also, stakeholders known as criminals may act in the role of customer or provider with the intention to deceive and act opportunistically, thus they seek a win-lose outcome. Stakeholders known as authorities may act to bring criminals to justice, and legitimately use coercive capabilities to realize value propositions between authorities and citizens. The ISPAR model of service system interactions provides a description of the ten most common outcomes of service system interactions (Spohrer, Vargo, Maglio, Caswell, in press).

Pigou's Paradox demonstrates that the productive capacity of a system can be increased by adding a simple law to a service system with appropriate governance mechanisms, while adding an advanced technology (i.e., zero cost network linkages) to the same service system could decrease the productivity capacity (Roughgarden 2005).

The service systems worldview does not make the assumption that 100% win-win interactions are optimal. An ecology of interacting service systems with 100% win-win interactions could be achieved with 100% compliant service systems. For example, if people were as predictable as technological components in their performance, then success rates approaching 100% might be possible. However, in the case of 100% compliance, the ecology of service systems might not be very innovative.

John Adams (2000), the UK scholar, in his recent book "Risk" describes the way people self-govern risk levels to balance risk and reward. By accepting some amount of risk, service systems (people, businesses, nations) are able to take actions in a much wider range of situations and learn more rapidly than otherwise might be possible. Adams also describes four models of rationality that describe alternative worldviews about risk taking behavior in society. Systems that tolerate risk taking can also (under certain assumptions) be demonstrated to convert *unknown unknowns* to *known unknowns* and sometimes to *known knowns* to improve future performance. Governance, compliance, risk, trust, privacy, fairness, and learning are all interrelated.

In sum, governance mechanisms do not exist simply to safeguard against or help resolve disputes among interacting service systems. Governance mechanisms can also be designed to adjust the learning rates of service systems in environments with many unknowns and dynamic properties. For example, the prime interest rate acts as a single parameter related to the cost of capital and is used by the chairman of U.S. Federal Reserve Bank to curb inflationary tendencies (raise interest rate) or curb recessionary tendencies (lower interest rate). Investing in R&D and innovation in an economy tends to diminish when the prime rate is high, and increase when the prime rate is lower. Additional linkages to governance can be found in the reference section below, indicted by the number '6' mapping key.

7. Design and Sustainable Innovation Measure

The previous three sections have looked at disciplinary areas and measures associated with three different roles or stakeholder perspectives: customer (marketing - quality), provider (operations - productivity), and authority (governance - compliance or transaction costs). Each of these roles (customer, provider, authority) is important in creating a value proposition that solves the customer's problems, matches the providers capability, and complies with all relevant regulations (is legal). However, designing a rational value proposition cannot be achieved successfully without ample consideration of the competition. Competitors who design new innovations can make a previous service offering irrelevant or undermine the basic logic of a provider's value proposition to its customers. Incremental and radical innovation is associated with a growing body of knowledge that is known simply as design.

The design of new products, interfaces, processes, spaces, and system are all related, but different. For example, the boundaries of a design task are often determined by considerations of who are the people involved: Are the people involved users of physical products? Are they users of information interfaces? Are they participants in a process? Are they participants in using a physical or virtual space? Or are they stakeholder/roleholders in a system with rights

and responsibilities? What is the likely duration of the lifecycle of the product, interface, process, space, or system?

Innovation is a measure of value (judgment of change). Innovation in service system ecologies (multiple populations of interacting service systems) is a relative measure of the value co-creation increase that results from a change. The types of changes can be the creation of new types (or instances) of resources, service systems, value propositions, or governance mechanisms. The types of measures of value in rationally designed service system improvements relate to the four fundamental measures of quality (customers), productivity (providers), regulatory compliance (authorities), and sustainable innovation (competitors).

Examples of service system innovation include: (1) a loyalty program for an airline, (2) a self-service system at a bank (ATMs), airport (tickets), or retail outlet (checkout scanning), (3) creating a financial services offering, (4) creating a new franchise model, (5) creating a new type of business or organizational structure, (6) specializing and streamlining a medical procedure to expand the number of patients that can afford and hence seek treatment, etc.

Gustafsson and Johnson (2003) in "Competing in a Service Economy: How to Create Competitive Advantage Through Service Development and Innovation" state "*As an executive, your job is to set a service strategy and enable your people to both innovate and continuously improve your services.*" They outline a progression from product value, to service value, to solution value, to experience value. Hunt (2000) in "A General Theory of Competition" outlines resource advantage theory, and warns that reducing competition in national economic systems has resulted in decreased innovation capacity over time.

Experience design is often seen as a balancing act. Csikszentmihalyi (1990) in "Flow" describes the design of optimal experience as balancing anxiety (too much challenge, and not enough skill) with boredom (not enough challenge, and too much unutilized skill). Csikszentmihalyi also describes the balancing act between differentiation (more unique individual experiences) and integration (more standardized collective experiences). Pine and Gilmore (1999) in "The Experience Economy" provide a perspective on economic evolution from commodities to goods to services to experience and then to transformations, as balancing more customization (customer satisfaction) or commoditization (customer sacrifice). They suggest two rules of thumb for estimating customer satisfaction (what customer expect to get – what customer perceives he gets) and customer sacrifice (what customer wants exactly - what customer settles for). The reference section below has more references related to design (especially experience design), innovation, and addressing competitive threats. Look for references with the number '7' as the primary or secondary mapping key, corresponding to this section.

8. Anthropology and People Resources

One view of service science is that it is the emerging theory of the lifecycles of resources (people, technology, shared information and organizations) as they are dynamically configured into service systems that interact via value propositions to co-create value (as measured or judged by various stakeholders). People play a central role, as the source of knowledge that is later embedded in other people, technology, shared information, and organizations. The value of knowledge, which is embedded in resources, changes over time depending on the context of use (Boisot 1995). As we have already noted, the term "human resources" – though widely used in business, government, academia, and the public sector today – is deemed as inadequate or inappropriate by many. In this section, we begin to show how service science draws on other disciplines that study people.

Anthropology is the discipline that is concerned with the study of humanity – all people across all places, times, and dimensions of analysis. The "four fields" approach to anthropology encompasses physical anthropology (based on physical data of biological and human evolution), archeology (based on physical artifacts and environmental data), cultural anthropology or social anthropology (based on data of past and present organized groups of people who share learning contexts or culture), and linguistics (based on language data). It is worth noting the rough correspondence between the "four fields" and the four fundamental categories of resources in service science (people, technology, organizations, and shared information).

Latour (2007) in "Reassembling the Social: An Introduction to Actor Network Theory" provides the term 'actant' to describe what we have termed 'resources' in this paper. Vargo and Lusch (2004) make the distinction between operant (actor) and operand (object) resources, and note that all resources depending on the context and event may be of either category (e.g., when considering people, the surgeon may be operant and the patient on the table operand).

Important properties of people as individual service systems include: they have finite lifecycles (e.g., time is a limited resource), identities (e.g., stakeholders and roleholders in many service systems with associated histories and future expectations), legal rights and responsibilities (e.g., ownership of property or assets, authority to perform certain acts, and this varies over the lifecycle from child to adult), perform multitasking as a way to increase individual productive output in a finite time, and engage in division-of-labor with others to increase collective productive output in finite time.

Dawson (2004) in "Developing Knowledge-based Client Relationships: Leadership in Professional Services" states that it is important to remember that ultimately knowledge and relationships are about people. He identifies seven drivers shaping the evolution of the professional services industries: client sophistication, governance, connectivity, transparency, modularization, globalization, and commoditization. One of four strategies for dealing with commoditization of knowledge proposed by Dawson is to automate ahead of the competition. This shifts the knowledge value from the people who deliver the professional service to the people who deliver the technology, and the people and systems that keep the necessary dynamic information and content up to date. One important knowledge value information flow in service systems is from frontline people who deliver service to customers to technology people who automate and operate/maintain technology systems to deliver the related service to customers. Ensuring the sustainability of this type of information flow over time is a requirement of sustainable innovation in most professional service firms.

Additional linkages to knowledge related to models of people in service systems as well as social dimensions of service systems are indicated by the number '8' mapping key in the reference section below.

9. Engineering and Technology & Environmental Resources

Engineering of sustainable service systems seeks to economize on scarce resources (individual people's time, attention, and capital as well as environmental resources, societal and business resources, etc.). Engineering in close collaboration with their underlying science areas also seeks to create new abundant resources and infrastructures that can enable the translation of desired possibilities into reality. Fundamentally, engineering is concerned with the translation of knowledge to value, by manifesting the knowledge in some physical and useful form. Engineering problems are solved in order to create solutions that help realize a value proposition between service systems.

Engineering approaches have been broadly applied to areas relevant to service science, including industrial and systems engineering, industrialization of services, engineering economics (Woods and Degarmo 1953/1959; Park 2004; Newman, Lavelle, Eschenbach 2003; Sepulveda, Souder, and Gottfried 1984), activity-based costing (ABC), incentive engineering, human performance engineering (Gilbert 2007), financial engineering (Neftci 2004), process engineering and statistical process control, product engineering, document engineering (Glushko & McGrath 2005), and of course service engineering (Ganz 2006; Spath 2007).

A good general introduction to the role of engineering in modern society is Beniger's (1986) "The Control Revolution: Technological and Economic Origins of the Information Society." North (2005) wrote about gaining control and predictability in economic systems by using knowledge to remove uncertainty first from physical systems and then social systems. Additional linkages to engineering, technology, and control can be found in the reference section below, indicted by the number '9' mapping key.

10. Computing and Information Resources

The area of services computing and web services (Zhang 2007) is one of the most fundamental of the emerging disciplines relevant to the design and engineering of scalable and sustainable service systems. Marks and Bell (2006) in "Service-Oriented Architecture: A Planning and Implementation Guide for Business and Technology" wrote that "*Many organizations wrestle with the semantic and linguistic barriers between the business community and the IT community... SOA offers the potential to create a unified language of business based on a unit of analysis known as a service.*" As businesses embrace SOA, a service system worldview is catching on slowly, and both business practitioners and IT specialist have begun to converge on a common service-oriented language. Checkland and Howell (1998/2005) developed the notion that all information systems are in fact service systems: *"A consequence of the nature of the process, in which intentions are formed and purposeful action is undertaken by people who are supported by information, is that 'information system' has to be seen as a service system: one which serves those taking the action."*

The value of information is central to all service systems. Information is used to update models of all stakeholders (customers, providers, authority, competitors) in the world (*world model fidelity*), which is essential to creating new value propositions, realizing value propositions that are part of existing relationships, as well as fairly and transparently resolving disputes. Customers 'own' the knowledge assets related to the problems they need solved. Providers 'own' the knowledge assets related to the capabilities that can be brought to bear to solve those problems. Effective customer-provider interactions are based on value propositions (or shared information) that can be communicated (a proposal), agreed to (a promise or contract), and realized (an event or assurance). Increasingly, IT enables all three of these to happen on-line (e.g., on-line learning).

Castells (2004) in "The Network Society" describes *"A network society is a society whose social structure is made of networks powered by microelectronics-based information and communication technologies."* In our terminology, the nodes of the network are service systems. The value propositions that connect the service systems (nodes) depend on the flow of information.

A key trend in service interactions is self-service. The provider that had empowered employees with a special information infrastructure opens up that infrastructure to sophisticated customers who engage in self-service interactions. Honebein and Cammarano (2005) in "Creating Do-It-Yourself Customers" examine this trend, starting with the rise of the sophisticated customer.

The connection between information accumulation and culture is a strong one. Richardson and Boyd (2005) in "Not By Genes Alone" define culture as: *"Culture is information capable of affecting individuals' behavior that they acquire from other members of their species through teaching, imitation, and other forms of social transmission. By information we mean any kind of mental state, conscious or not, that is acquired or modified by social learning and affects behavior."* In the service system worldview, money and capital are primarily information. Collins and Kusch (1999) make this point in their book "The Shape of Actions: What Humans and Machines Can Do" when they wrote: *"What makes a metal disc 'a coin,' or a piece of paper a token of value, that is, what makes such things instances of money? It is, of course, that a collective treats the items as money, that it talks of them as money, that it uses them as money, and that it sanctions and enforces this talk and this use. If the collective ceases to believe that the paper and coins are money, and that they have the value represented symbolically on their surfaces, these items cease to be money. This is not just a philosophical nicety but a practical problem, as inflationary spirals, and the precautions that governments take to prevent them, reveal."* The growth of on-line or virtual worlds with artificial currencies, makes the notion of "money as information" even more apparent.

Additional references related to the importance of shared information (e.g., language, laws, measures, models, etc.) are indicated below with '10' as the mapping key.

11. Sourcing and Organizations

Scott (1981/2003) in "Organizations: Rational, Natural, and Open Systems" observed that *"Today's organizations are vigorously pursuing a strategy of externalization, outsourcing functions and relying on alliances or contracts for essential goods and services... There is no need to belabor the assertion that ours is an organizational society – that organizations are a prominent, if not the dominant, characteristic of modern societies."* A single person can run a sole-proprietorship business, and so an organization can consist of a single individual. Clearly, a lot of functions would be outsourced in this situation. However, while most individual people are not considered organizations, all people are considered to be a service system. So 'service system' is a more general concept than 'organization,' as service system includes people, open source communities, and markets, as well as all organizations.

March (1999) in "The Pursuit of Organizational Intelligence" wrote *"Organizations pursue intelligence… In particular, organizations (like other adaptive systems) are plagued by the difficulty of balancing exploration and exploitation. By exploration is meant such things as search, discovery, novelty, and innovation. It involves variation, risk taking, and experimentation. It commonly leads to disasters but occasionally leads to important new directions and discoveries. By exploitation is meant refinement, routinization, production, and implementation of knowledge. It involves choice, efficiency, selection, and reliability. It usually leads to improvement but often is blind to major redirections."* This is a very fundamental observation. Organizations, and in general service systems, are dynamic configurations of resources in a constant process of change. However, to continue to exist that

organizational change must balance two types of activities – exploration and exploitation – in order to both exist in and adapt to a changing environment. This balance is not unlike the balance that individual people seek in optimal learning, in which too much challenge can lead to anxiety and too little challenge can lead to boredom. Balance is the key to sustainable change.

Langlois and Robertson (1995) in "Firms, Markets, and Economic Change" provide a dynamic theory of the boundaries of the firm (a type of organization) that complements much of the work by Coase, North, and Williamson on transaction costs, new institutional economics, and governance structures. One measure of the success of a governance structure is its ability to align incentives and overcome opportunism. However, many other factors beyond incentive alignment come into play to align capabilities (resources) of business institutions, which is Langlois and Robertson's term that is used to encompass both firms/organizations and markets, and related to what we refer to as 'types of service systems.' Chief among several other factors is perceived capacity for capability innovation (and overcoming inertia) that delivers more differentiated high-value service to customers than competitors are capable of delivering. In contrast to differentiated capability innovation, cost reduction often derives from outsourcing/off-shoring (use the lowest cost global capabilities to perform the work) or off-peopling (use even lower cost technologies to automate the work).

In large firms, common perceptions are that (1) internal sourcing and internal organization (management of internal organization and internal authority/control) is best to create innovations, and external sourcing and external organization (governance of external organization – external authority/partnerships) is best for cost reductions and industry standardizations. However, open innovation models (Chesbrough 2006) may challenge the former perspective, and increasingly standardized approaches to leaning and automating processes may challenge the latter perspective. Moore (2005) in his book "Dealing with Darwin" states that *"The formula for tackling innovation and overcoming inertia in tandem is simple: Extract resources from context and repurpose them for core."* What is context (can be outsourced) and what is core (should not be outsourced) changes over time, and must be constantly reassessed and is at the heart of business discipline.

The fundamental generalization of make-buy from early manufacturing is the concern in sourcing. Sourcing creates more interdependence and less independence. Sourcing can redistributes jobs and expertise on a global scale. Friedman (2005) in "The World is Flat" fueled the growing concern that expertise can be sourced from anywhere. These concerns have lead to the US report "Rising above the Gathering Storm" (COSEPUP, 2007) which provides recommendations for US policy aimed at ensuring a strong high-skill innovation economy in the US.

Moving beyond outsourcing, some authors and practitioners have begun talking about the notion of multisourcing (Cohen and Young, 2006): *"The disciplined provisioning and blending of business and IT services from the optimal set of internal and external providers in the pursuit of business goals."* Building a sourcing strategy requires a deep understanding of the short-term and long-term nature of the need for custom or standard, business outcome driven (value) or operational outcome driven (cost) service for every component of a business and service value network of partners.

Additional references related to sourcing and organizations and the nature of service systems can be found below, and have the number '11' mapping key associated with them.

12. Futures: Management and Strategy

A key responsibility of management is to provide strategic direction to the firm, and allocate resources and investment wisely to ensure the future of the firm. In section 3, we talked about the lessons of history and economic evolution. In a sense, this represents learning from the lessons of history, and an attempt to identify causal patterns that explain the observed evolution. Learning from the future is more akin to what chess experts do when they 'look ahead' to possible worlds, and then invest their efforts in trying to realize the possible worlds that are more favorable to their ambitions. The challenge is understanding the likely responses of others. Nevertheless, strategy can be viewed as the art of learning from possible futures. Management then seeks to make wise investments to realize favorable possible futures. Management of information systems (MIS), project management (PM), innovation and management of technology (IMOT), operations management (OM), financial management (FM), supply chain management (SCM), enterprise resource management (ERP), customer relation management (CRM), human resource management (HRM), intellectual property management, contract management (CM), risk management, as well as strategy and organizational change management (S&OCM) are well developed fields of knowledge

related to improving the performance of complex business and societal service systems.

Fitzsimmons & Fitzsimmons (2008) in "Service Management" provide an overview of the types of operational and strategic investment decisions typical of service firms. Mendelson and Ziegler (1999) in "Survival of the Smartest" identify the five characteristics (external information awareness, effective decision architecture, internal knowledge dissemination, organizational focus, and information age business network) of High-IQ versus Low-IQ companies, and show a correlation with superior growth rate for High-IQ companies.

Many enterprises which had successes in manufacturing and product development are facing cost and revenue pressures and are seeking new revenue models through innovation and "servitization." This includes strategies of providing "customer solution" comprising products and service options, innovative service offerings, and active customer and community participation in providing services (e.g., using Web 2.0 applications). The impact of these is dramatic in some industries. For example, the automobile industry is experiencing the same movement from product to services as with computer manufacturers. This led to Toyota to declare itself a "service company".

The increase in emphasis on services does not remain at the enterprise and industry level. Currently in 2007, the service sector accounts for over eighty percent of the US economy and forty percent of the world economy according to the International Labor Organization[9]. Trade in services has become increasingly important in the global economy. There is the growth of the traditional consumption of services where the presence of the customer is required such as consumption abroad, commercial presence and movement of natural persons[10]. Additionally, the area of services that does not require the presence (only the information assets) of the consumer such as financial, software, insurance services, etc. which is conveyed by the Internet and other electronic means is enjoying an even more remarkable growth rate. Countries which had enjoyed a trade surplus in manufactured goods (such as Taiwan, Korea, Japan, etc.) are now facing an increasing trade deficit in services with the US which had enjoyed a dominant position. These countries are also concerned that their manufacturing capabilities are now encountering competition from countries such as China, India and Vietnam. In the case of China, the service sector is one area the US had kept a growing surplus in trade in contrast to a substantial deficit in other sectors. China had designated the service sector as an area of development in its current 2006-2011 Five Year Plan. Amid much talk about the US outsourcing her manufacturing capabilities abroad, the growth in her service sector economy domestically and globally will, in the long run, help the US maintains its competitive advantage. The development of service science as a discipline in post-secondary education is essential for the US to achieve this goal.

Additional references related to management and strategy can be found below, and have number "12" mapping key associated with them.

III. Service Professionals & Deep Contributory Expertise

"The purpose of business is to create and keep a customer."
- Peter F. Drucker

In the last ten sections (3-12), we have reviewed the core disciplines that service science draws on for foundational knowledge related to the history, measures, resources, and future of reasoning about service systems. Service professionals are keenly aware that maintaining existing customer-provider interactions is not easy, in a competitive, innovative environment. *However, even more difficult is to create (establish and sustain) the next generation of customer/market and provider/industry interactions.* For example, citizens are customers of rationally designed governments. Students are customers of an education industry. Patients are customers of a healthcare industry. Consumers are customers of a retail industry. Investors are customers of a financial industry. Households are customers of a utility industry, as well as an entertainment industry. Businesses are increasingly customers of a professional consulting industry[11].

To create new generations of customers requires both entrepreneurship (establishing the new customers/markets) and leadership (sustaining the

9 *http://www.ilo.org/public/english/region/asro/bangkok/public/releases/yr2007/pr07_02sa.htm*

10 WTO service trade categories.

11 The business consultants (McKenna 2006) can be thought of (in part) as an early stage in the formation of service science professionals.

providers/industries that serve them). In the next two sections, we see that the deep contributory expertise of service science deals in part with establishing and sustaining new customer-provider/market-industry pairs. New customers are either existing service systems in new roles with new types of capabilities and requests (e.g., needs, wants, or aspirations), or entirely new types of service systems (ultimately with formal, legal status). To be successful in creating new customers, service professionals of all types need a service mindset, which is more of an attitude than an expertise. A service mindset is associated with entrepreneurship.

13. Mindset and Entrepreneurship

"The best way to predict the future is to invent it."
- Alan Kay

Why are entrepreneurs five times more likely to be dyslexic than a randomly chosen businessperson?[12] Traditional industrial-age jobs are made easier to learn and easier to govern (regulatory compliance) by reducing them as much as possible to written instructions. The more complex and potentially higher pay the job, the more complex the written instructions will be. Hence, competition for jobs is done best by those who can master a large and complex body of written instructions or codified knowledge. Those without the lexical strength must seek to provide service that is not yet codified or is based on some other source of competitive advantage. For example, they might focus on the new things that people, businesses, and government agencies (e.g., service systems) want or aspire to attain that is not yet codified. Also, they may focus on unmet needs, and develop a blue ocean strategy (Kim and Mauborgne, 2005). These are all opportunities for entrepreneurs, and create the challenge of educating potential entrepreneurs in non-traditional ways (traditional ways rely too much on written instructions and codified knowledge).

A service mindset, like entrepreneurship, is similarly difficult to teach with written instructions or from a lecture or textbook. A service mindset is based in part on empathy for customers, as well as a sense of empowerment that does not come from simply following written rules. Understanding the life time value of a customer is essential, but responding in unique ways that have the potential to scale beyond the customer to new markets is really the key. A successful service mindset, like successful entrepreneurship, comes from creating new markets (i.e., an aggregate of many similar customers). This requires learning to solve customer problems in a way that scales well, which requires thinking of a customer's problem as potentially a new category of customers (i.e., a market).

Beyond lectures and textbooks, to help ensure that students gain practical experience from realistic assignments, service science laboratories (also known as service systems engineering and design labs) are being envisioned by a number of academics (Kwan and Freund 2007). The goals of service system labs include: support of service science curriculum and research; engage industry and government partners; develop and disseminate service science curriculum materials; create collaborative opportunities among universities involved in the service science initiative; establish an entrepreneurial service mindset in students based on empathy for customers, and a sense of empowerment that can lead to establishing new markets.

The concept of a service science lab is similar to that of hands-on learning labs in other disciplines. For example, an industrial engineering lab might be populated with experimental equipment to demonstrate flexible manufacturing systems working in conjunction with production lines, robotic and autonomous inventory storage systems, etc. A computer science lab is usually furnished with rows of computer work stations where students would work on software development projects. A service science lab will be different from these types of labs in that they will be designed with collaboration among the students (especially different disciplines) and problem-based learning in mind. The structure and support it provides will be focused on integrating hands-on learning with the curriculum. This is accomplished by providing the students an environment where they can comfortably work together and collaborate in teams employing tools to seek solutions to real world, virtual world, and simulated world customer problems. In fact, the physical layout and the characteristics of the furniture are important considerations in the design of the lab. A likely physical layout of the lab is to organize the student teams (e.g., six persons) into "pods" – work spaces equipped with large screen monitors, smart boards and work stations for sharing and presentations. These pods will be in some proximity to each other and partitions between groups are designed not to form barriers which could prevent cross-fertilization among teams. The room will be equipped with a network so that any team's work station could be slaved to display

[12] URL: http://www.cass.city.ac.uk/media/stories/story_8_45816_44300.html (viewed 11/19/2007).

their work on the projection system or to other team's monitors.

The set of resources made available in the lab provides the tools and platform designed for the students to experiment with solutions to customers problems in the *physical (or real), virtual, and simulated worlds.* This includes the hardware and software resources, simulation environment for front stage/back stage service scenarios (for evaluating alternative plans, capacity, reconfiguration, new technologies, regulatory changes, etc.), curriculum materials, videos and case studies, social networking applications, virtual interactive environments (to design servicescapes and conduct rehearsals), video conferencing capabilities, etc. Some considerations must be given to provide additional space for the students to model their work physically if the space in the lab is constrained.

Some examples of service science lab resources are given here. In certain cases, specific brand name products are mentioned to illustrate the characteristics of the genre and not as an endorsement of the vendors.

Software that supports collaboration in the form of shared documents, versioning, portal, etc. is essential to ensure team work success by alleviating many of the issues associated with project management, scheduling difficulties, and team dynamics (e.g., Microsoft's SharePoint Services). Nowadays publishers usually provide online resources (such as videos, mock tests, case studies, study questions, etc.) to students and faculty who adopted their text book. These could easily be made readily accessible to the students in the lab (e.g., Fitzsimmons' text book mentioned in sections 5 and 12 also provides both online resources and a student CD). Table 1 lists some of illustrative examples of the modeling resources and tools for a service science lab.

Modeling Resource/Tools	*Examples*
Customer Relationship	SugarCRM
Process	Rational Software
Architecture	WebSphere
Prototyping	Eclipse
Data Mining	Cognos
Virtual Simulation	Second Life
Service Operations	ServiceModel (e.g., CD from Fitzsimmons)
Open System Technology	APIs from Google, Amazon, PayPal, eBay, Skype, etc.

Table 1 – Examples of Modeling Resources/Tools

Another aspect of the design of the service science lab that is different from other traditional laboratories is that it will be equipped with videoconferencing (preferably telepresence) capabilities. There are at least two levels of videoconferencing capabilities built into the lab environment. The first level allows students to engage in videoconference meetings with their team members, industry sponsors or students from other locations at their pod (more on the external collaborations later in this section). Each pod will be equipped with a large size high-definition monitor for this purpose. This level could be supported by desktop-based videoconferencing systems (e.g., WebEx, PolyCom, etc.) The second level would involve more sophisticated videoconferencing equipment that supports virtual meetings in a fabricated conference room setting (e.g., Cisco's Telepresence, HP's Halo, PolyCom, etc.) This level would probably require conference room space directly accessible and adjacent to the lab proper. This type of modern teleconference capability will provide a real-life setting for students to conduct collaborative meetings with remote locations (e.g., teams from another university or country), presentations, simulating role playing, and experiment with virtual agents in service scenarios. In this way, networks of service science labs will be developed along common collaboration lines.

As mentioned earlier, the service science lab is designed to be integrated with a service science curriculum to provide students with practical experience solving real world problems. Practitioner (business, government, and social sector) partners will play very significant parts in this. First, industry partners are the providers of the resources/tools made available to the students in the lab. Second, they are the sources of guest speakers and industry mentors for the students. Third, they are sources of realistic projects for the curriculum. Most importantly, they are the ones who value the T-shaped professionals (see the section II introduction) and would hire the graduates of the service science curriculum. As specific universities develop a reputation for working on improving a specific service system, businesses will align recruiting to match their internal as well as external client facing needs.

Real world problems devised by practitioner partners and service science faculty are important motivators for engaging students and provide them with the opportunity to fully take advantage of the resources available in the lab. The term practitioner partner is used in a general sense here. The partnership would involve business, government, NGO's, non-profit organizations, and for public benefit organizations. The full range of service systems that exist in the world could be categorized by three attributes: nation, industry, and component-measures. For example, *Ukranian-Healthcare-EmergencyRoomAdmissions-Productivity* would be an example of nation-industry-component-measure. In this case, EmergencyRoomAdmissions is a front-stage service activity, since it involves direct interactions with customers (patients). Figure 4 depicts an example of this service system problem space.

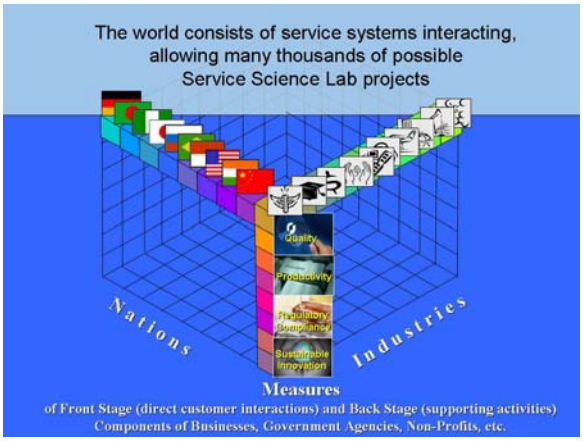

Figure 4 Service Systems Problem Space

This granularity is important because most of the business-to-business (B2B) and other types of service system improvement engagements (contracts) take place in a national-industry context (including regulatory context). Over time expertise develops associated with continuous improvement in specific contexts such as this. This is also a convenient way of categorizing projects sponsored by practitioner (business, government, non-profit) partners. Some partners might want to sponsor and collaborate on projects that would involve designs of "Innovative Service Systems of the Future." For example, "what would the supermarket (bank, hospital, etc.) of the future look like?" Each new group of students could see and build on the results of the efforts undertaken by previous groups which, in effect, form a historical/sociotechnical tableau of the nation-industry context under study. The national context is important because of legal and regulatory differences, and the industry context is important because of business model and competitive strategy differences that impact associated investment models.

Presently there are over 130 institutions in the world that are involved in or are starting service science programs. These institutions are situated in various parts of the world and include business, engineering, computer science, industrial engineering, humanities, information studies, etc. The concept of a service science laboratory to support their programs has been received favorably. There are plans to create a "Service Systems Lab Network' that would connect the labs of these programs to form a consortium for collaboration, sharing curriculum materials as well as projects and communication among project teams. The teleconferencing capabilities built in the labs mentioned earlier in this section were designed for such connections in mind. The plan also involves an effort to seek government funding for supporting this innovative educational project. It is anticipated that as more and more institutions implement service system labs for their service science programs, they will join the network and its growth will parallel that of the Internet in its early stages. Because of the large number of opportunities in the nation-industry-component-measure framework, it is anticipated that certain universities will become highly specialized in one or more specific areas of service system study. These specializations may leverage and extend existing disciplinary strengths of that academic institution, or availability of local practitioner (business, government, or social sector) partners.

In sum, one aspect of the deep contributory expertise that is required of service science professionals (and entrepreneurs) cannot be learned from written instruction alone, but must be based on work practice in service science labs or on the job equivalents. Only the real-life experience of working as a member of a multidisciplinary team to improve and innovate service systems can create the service mindset and empathy for addressing customers' most urgent challenges.

14. Science and Leadership

"For every complex problem, there is a solution that is short, simple, and wrong."
- H.L. Menckin

Weinberg (1975/2001) in his classic "An Introduction to General Systems Theory" provides a distillation of many concepts from system theorists such as von Bertalanffy (1976) and many others. While service science is less general than general systems theory, the

deep contributory expertise of a service scientist that can be learned from written instructions is rooted in general systems theory. Service science, like general systems theory, is grounded in the view that people attempt to model and measure the world as interacting systems that are part of a system of systems. However, while general systems theorists seek to understand the general principles that underlie all systems (physical, chemical, biological, computational, social, etc.), service science aims to be descriptive, explanatory, and predictive of business and societal evolution - or systems with people, technology, organizations, and shared information resource configurations.

For the general reader, understanding the evolution of complex systems that include people is essential to developing a service system worldview. Within this more limited context of complex service systems, in which all people are currently embedded, Wright (2001) in "Non-Zero: History, Evolution, Human Cooperation" provides insights into systems that establish and evolve win-win value propositions. Buchanan (2001) in "Ubiquity: The Science of History" and more recently in his (2007) "The Social Atom" provides insights into the path-dependent evolution of complex systems where, to understand the evolution, the properties of the parts are less important than the properties of their organization (or patterns, dynamic configurations) over time.[13]

The deep contributory expertise of service scientists is competence in understanding, improving, and creating new pairs of service systems (e.g., customers and providers, markets and industries), new pairs of value propositions that connect them, and in some instances new governance mechanisms, which are a special type of value proposition connecting governed and governing service systems (e.g., citizens and authorities, partners in supply chains, etc.). From a service science perspective, other disciplines study, improve, and create new types of resources (both conceptual as well as physical) and measures associated with subjective and objective definitions and dimensions of value. Working with these new resources and measures, service scientists may then create new service systems, value propositions, or governance mechanisms in simulated worlds (artificial agents interacting in an artificial environment), virtual worlds (real people and artificial agents interacting in a virtual environment), or the real world (real people interacting in the real world).

The science of service systems provides a number of challenges that are different from physics, chemistry, biology, and computer science. First, because businesses are service systems, much of the data that would inform the science are considered proprietary and hence not easily shared. For example, details of successful and unsuccessful contract negotiations and executions would be of enormous value in understanding learning curves for service system interactions. However, most business would be reluctant to share the details of successful, much less, unsuccessful contracting attempts. One implication is that developments in service science will likely be much more dependent on simulated data as a result. The properties of simulated worlds will be more transparent and repeatable, and allow cumulative progress that might not otherwise be possible. As techniques for modeling and measuring simulated ecologies of service systems advance, these efforts may someday lead to the equivalent of a CAD (computer-aided design) tool for service system design and engineering. Ultimately, service scientists will have deep competence in using service system simulations tools.

A second important challenge for service science and its associated engineering and management disciplines will be establishing property rights and establishing investment incentives around new inventions. Just as many business method and software patents are challenged on the grounds of "technicity" (technical contribution) and this area is already a major difference between US and EU patent law, the invention of new types of service systems, value propositions, and governance mechanisms may be difficult or impossible to patent. Without the ability to patent inventions, a major incentive for innovation is removed. Nevertheless, the continuous invention of new or improved types of service systems, value propositions, and governance mechanism may confer significant advantages to providers of service over their competitors, or even their own previous business approaches, and hence be a significant driver of investment. As the ability to design new service systems (CAD for service systems) increases, along with the ability to drop them into simulation of existing ecologies of service systems, the technicity requirement may improve allowing more truly innovative service system designs to become patentable.

[13] Buchanan (2007, Pg. 37), "*The situation is even worse too because we are all different, due to genetic difference and because each person has a unique history of experiences. So human science has to deal not only with individuals of near infinite complexity, but with many such individuals, all different from one another.*"

History provides evidence that emerging sciences and their associated engineering and management disciplines can provide the basis for economic leadership. For example, Murmann (2006) describes the rise of chemistry in Germany in the 19th century, Bush (1945) foresaw the rise of computing in the US in the mid 20th century, and finally, the product quality and innovation management movements in Japan provides a more recent example. In these cases, the key to successful market-industry leadership was government, industry, and academic collaboration. Today, nanotechnology, biochemistry, computational biology, and service science offer the possibilities for such collaborations around emerging areas of science. However, of these four, only service science seeks to understand in general the complex sociotechnical dimensions of using new knowledge to enable new value creating systems. The full benefits of technological inventions cannot be realized without the development of new service systems that carry the invention into the market. Understanding the science of service systems holds the potential to more rapidly realize the value potential inherent in technological inventions, as well as to help prioritize which technological inventions might be poised to provide the most benefit to business and society. For example, service scientists might seek to understand how global sensor-arrays connected to a cyberinfrastructure might be the basis of new or improved service systems aimed at environmental sustainability.

Leadership has been defined as the wise use of power and influence; power the capacity to translate intention into reality and sustain it; influence the capacity to revitalize and sustain relationships. From a service science perspective (linguistic evolution), these informal definitions become increasingly formalized as disputes that hinge on these definitions arise and are resolved. In the business world, lawsuits may arise when brands make claims ("the most popular X") and others seek to challenge them. The result is more formal ways to measure brand claims. In society, lawsuits may arise when groups challenge the legal meaning of words and associated concepts that may limit or extend their freedom of action (e.g., what is marriage and who can marry, when does life legally begins, etc.). The result is more formal ways to categorize actions and events. In science, terms and their definitions are constantly in a process of refinement that often leads to disputes with previously established orders (e.g., is Pluto a planet, etc.). While trademark law provides one way to obtain formal ownership of terms and symbols, most language is not formally regulated. Linguistic systems evolve along with business and society. The hallmark of formal service systems is increasingly clear specification of rights and responsibilities, boundaries associated with property, and efficient dispute resolution, including the use of language in value co-creation activities.

John Sterman (2000) in "Business Dynamics: Systems Thinking for a Complex World" wrote: "*The dizzying effects of accelerating change are not new. Henry Adams, a perceptive observer of the great changes wrought by the industrial revolution, formulated the Law of Acceleration to describe the exponential growth of technology, production, and population… A steady stream of philosophers, scientists, and management gurus have since echoed Adams, lamenting the acceleration and calling for similar leaps to fundamental new ways of thinking and acting. Many advocate the development of systems thinking – the ability to see the world as a complex system, in which we understand that 'you can't just do one thing' and that 'everything is connected to everything else.'*" Sterman then goes on to develop vocabulary, tools, and examples to enable systems thinking. Fortunately for our efforts, many of his examples are examples of complex service systems. Sterman contrasts the event-oriented view of the world and its vocabulary (goals + situation, problem, decision, results) with the feedback (double loop learning) view of the world and its vocabulary (real world, information feedback, decisions, mental models, strategy, structure, decision rules). He goes on to identify the impediments to learning that make even the feedback view of the world problematic for dealing with the dynamic complexity of the real world. He concludes, and we agree, that simulations are an essential tool for professionals who want to approach systems thinking rigorously and seriously. Sawyer (2005) in "Social Emergence: Societies as Complex Systems" describes third wave systems theory and ever growing importance of simulations tools for thinking about emergence in complex societal systems.

In sum, this paper has attempted to provide an outline and set of preliminary references to better understand the emergence of Service Science, Management, Engineering, and Design (SSMED). The theoretical and practical foundations were sketched, along with a discussion of the interactional and contributory expertise that needs to be possessed by service scientists. Service science is at the beginning of the beginning, and a great deal of work remains to integrate across the disciplines. A consensus that service systems, value propositions, and governance mechanisms are the three fundamental concepts that underlie service science is slowly taking hold. We believe that establishing a network of service science

laboratories will allow faculty and students from many disciplines to participate in understanding, improving, and creating simulated world, virtual world, and real world service systems, value propositions, and governance mechanisms – thus advancing the field by addressing practical problems while creating more professionals with a service systems worldview. This worldview is based on entities (service systems) that interact (via value propositions) to realize outcomes (either win-win value co-creation, or disputes; in the case of disputes, governance mechanisms, or second order value propositions, are invoked to efficiently resolve the disputes in most cases).

As a next step, we invite others to use these three fundamental concepts (service system, value proposition, and governance mechanism) to create a more integrated view of existing disciplines that are foundational to service science. Also, we invite others to propose improved sets of foundational questions of importance to both researchers and practitioners. Finally, we invite academics around the world to establish service science labs in conjunction with practitioner partners from business, government, and non-profit agencies, and seek answers to the foundational questions in the context of specific service systems in which they live and work.

Acknowledgements

This work was made possible in part with support from IBM Research (foundations for service research and practice), San José State University (service science and SSMED curriculum development), by NSF grant IIS-0527770 2006-09 (explores how humans and computerized agents interact in various one- and two-sided market formats).

References & Selected Quotations

Each of the references below has been given a primary mapping key number (1-14) as well as a list of secondary mapping key numbers (1-14) into each section of this paper. The 15th category number indicates a "must read reference." The table below provides, at a glance, the count of references that link primary (column) with secondary (rows) sections. For example, if you are an economist looking for linkages to marketing, you would probably do well to look for references [3 (4)] or [4 (3)]. Another example is:

[3 (11 12)] Milgrom, Paul and John Roberts (1992) Economics, Organization, and Management. Prentice Hall, Upper Saddle River, NJ.

This means this book is of interest to economists (3), organization theorists (11), as well as managers (12). Both of the cells (3, 11) and (3, 12) would be incremented in the table below. We hope to encourage this *interdisciplinary service science reference table* to stimulate important connections in the emerging service science community. Simply select your areas of expertise and areas you want to link to. Then look at the table to find how many references exist in that area. Then look into the reference section below for the specific readings that connect the areas. Quotations are heavily used to further aid those seeking connections across references.

The table below provides a count of the number of references that fall in each connection cell.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	x		5	3		1		1		3	2		1	2
2	1	x		2	3		2	1	3	1	1	1	1	1
3	5	1	x	3	2	4	3	4	6	1	1	5	1	1
4	5	4	1	x	1	1	5		1		1	4	1	2
5	2	7	5		x						2		1	2
6	5	1	13		1	x			1	2	8	1	2	2
7	2	1	3	2			x		2		2		3	1
8	5	1	13	3	2	2	4	x	1	1	6	4	3	6
9	2		5	1			2	1	x	2	1	3	1	4
10	5	1	6	1		2		4	2	x	4	3	1	6
11	6		16	4	2	3	3	4	2	2	x	4	2	9
12	7	6	10	10	1	5	6	2	8	3	14	x	2	5
13	1		2				2			1		1	x	7
14	5	1	2		1		1	1		2	5		4	x
15	8	6	4	4	1	1	1	1	1	4	4		2	1

The most strongly linked areas, not surprisingly, are management (12), organizations (11), economics (3), and governance (6), and people (8). Each of these strongly linked areas corresponds quite directly to a major type of service system.

A total of 206 references are distributed across the 14 mapping keys that correspond to each section of this paper.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
206	19	9	41	18	5	7	14	9	14	9	19	15	7	20

While not an exhaustive list of professionals, the following list (related to the 14 sections of this paper) summarizes some of the types of professionals we hope to engage in developing a robust service systems worldview and service science:

1. service science researchers and students of service
2. service science practitioners and other practitioners
3. economists, historians, mathematicians
4. marketing professionals
5. operations professionals
6. political scientist, legal professionals
7. designers, artists, innovators
8. social scientists, anthropologists, cognitive scientists
9. engineers, technologists
10. computer scientists, linguists
11. organization theorists, procurement specialists
12. managers, investors, strategists, mathematicians
13. entrepreneurs, professors, lab instructors
14. systems theorists, leaders, general scientists

Three challenges include: (1) Finding the right balance between these separate bodies of knowledge and professions as they related to SSMED, (2) creating new knowledge of service systems that fills the many open knowledge gaps, and (3) integrating more and more, over time, into a truly unified foundation for service science.

What follows are 206 references, mapped with a primary key and a list of secondary keys:

[14 (3 8)] Abbot, Andrew (2001) Chaos of Disciplines. University of Chicago Press. Chicago, IL. *"I begin by noting a defining characteristic of sociology – the fact that the discipline is not very good at excluding things from itself… But once such an area makes a claim for sociological attention, the discipline doesn't have any intellectually effective way of denying that claim. So sociology has become a discipline of many topics – always acquiring them, seldom losing them." (Pg. 5); "Like all divisions of labor that not specifically planned, the division of labor among academic disciplines is established by an unrelenting process of interaction between groups. Prominent in this interaction is competition, although there are also accommodation, alliance, absorption, and all the other process of group ecology." (Pp. 136-127); "Broader fields often employ faculty of diverse disciplines. We can think of them having become true disciplines in the social structural sense once they hire mainly Ph.D.s in their own field. Communications is an excellent example, reaching disciplinary status, in this sense, only recently." (Pg. 139)*

[11 (1 15)] Argote, Linda (2005) Organizational Learning: Creating, Retaining and Transferring Knowledge. Springer. New York, NY. *"'Learning curves' have been found in many organizations. As organizations produce more of a product, the unit cost of production typically decreases at a decreasing rate… This and related phenomena are referred to as learning curves, progress curves, experience curves, and learning by doing." (Pg. 1); "Psychologists were the first to discover learning curves. These researchers focused on the behavior of individuals." (Pg. 4)*

[1 (12 15)] Adams, John (1995/2000) Risk. Routledge, London, UK. *"Extreme sensitivity to subtle differences in initial conditions, the chaos theorist tells us, makes the behaviour of complex natural systems inherently unpredictable. Prediction becomes even more difficult when people are introduced into such systems – because people respond to the predictions, thereby altering the predicted outcome." (Pg. 4); "Risk management is a big business; the formal sector of the authorities – the realm of the expert – involves government, commerce, and industry; it employs actuaries, ambulance drivers, toxicologists, engineers, policemen, mathematicians, statisticians, economists, chaos theorists, computer programmers, and driving instructors – to name but a few. The work of this sector is highly visible. It holds inquest and commissions research. It passes laws and formulates regulations. It runs safety training programmes and posts warning signs. It puts up fences and locks gates. It employs inspectors and enforcers – many in uniforms. Its objective is to reduce risk. But there is also the informal sector consisting of children and grown-ups children, and it is much bigger business; it consists of billions of freelance risk managers – ordinary common-or-garden experts – each with his or her own personal agenda. They go about their business of life – eating, drinking, loving, hating, walking, driving, saving, investing, working, socializing, - striving for health, wealth, and happiness in a world they know to be uncertain. The objective of these risk managers is to balance risk and reward. The formal and the informal sectors co-exist comfortably." (Pg. 4); "A contention of chapters 5 and 6 of the 1993 report, that the physical scientists found variously maddening or frustrating, is that risk is culturally constructed. According to this perspective, both the adverse nature of particular events and their probability are inherently subjective. Slipping and falling on ice, for example, is a game for children, but potentially fatal accident for an old person. And the probability of such an event is influenced both by a person's perception of the probability, and by whether they see it as fun or dangerous. For example, because old people see the risk of slipping on an icy road as high, they take avoiding actions, thereby reducing the probability." (Pg. 9); "The problem for those who seek to devise objective measures of risk is that people to varying degrees modify their level of vigilance and their exposure to danger in response to their subjective perceptions of risk… In the physical sciences the test of a good theory is its ability to predict something that can be measured by independent observers. It is the Royal Society's purpose in studying risk – to manage it – that frustrates efforts to produce such predictions. Because individuals and institutions respond to their perceptions of risk by seeking to manage it, they alter that which is predicted as it is predicted." (Pp. 13-14); "Homo prudens – zero-risk man. He personifies prudence, rationality, and responsibility… …But people do willingly take risks. Gamblers may not like losing, but they do like gambling. Zero-risk man is a figment of the imagination of the safety profession. Homo prudens is but one aspect of the human character. Homo aleatorius – dice man, gambling man, risk taking man – also lurks within every one of us. Perusal of films, television, and the newspapers confirms that we live in a society that glorifies risk. [from sports to entrepreneurs]. …We respond to the promptings of Homo aleatorius because we have no choice; life is uncertain. And we respond because we want to; too much certainty is boring, unrewarding, and belittling." (Pp. 16-17); "Uncertainty, according to Born, is the only thing that permits us the possibility of moral significance. Only if there is uncertainty is there scope for responsibility and conscience. Without it we are mere predetermined automata." (Pg. 18); "From a Dostoevskian perspective, the greater the success of the safety regulators in removing uncertainty from our lives, the stronger will become the compulsion to reinstate it. This perspective has challenging implications for accident reduction programmes that attempt to promote safety by producing 'failsafe' and 'foolproof' environments, or by using rewards for safe behavior, or penalties for dangerous behaviour. A world from which all risk has been removed would be one with no uncertainty, or freedom, or individuality. The closer one approaches such a state, the greater is likely to be the resistance to further progress, and the more likely will be outbreaks of Dostoevskian 'irrationality'." (Pg. 19); "The world contains over 5 billion risk thermostats. Some are large; most are tiny. Governments and large businesses make decisions that affect millions if not billions… Overhanging everything are the forces of nature – floods, earthquakes, hurricanes, and plagues – that even governments cannot control, although they sometimes build defences against them." (Pg. 23); "…but people respond to forecasts. If they like them, they try to assist them; if not they try to frustrate them." (Pg. 25); "'Risk' is defined, by most of those who seek to measure it, as the product of the probability and utility of some future event. The future event is uncertain and inescapably subjective; it does not exist except in the minds of people attempting to anticipate it. … Accident rates therefore cannot serve, even retrospectively, as measures of risk; if they are low, it does not necessarily indicate that the risk was low. It could be that a high risk was perceived and avoided." (Pg. 30); "These four distinct world views are the basis of four different rationalities. Rational discourse is usually recognized by its adherence to the basic rules of grammar, logic, arithmetic. …Disputes about risk… are usually seen on dispassionate inspection to be arguments from different premises, different paradigms, different world views, different myths of nature, both physical and human." (Pg. 37)*

[1, (12)] Afuh, Allan (2004) Business Models: A Strategic Management Approach. McGraw-Hill Irwin. New York, NY. *"A business model is a framework for making money. It is a set of activities which a firm performs, how it performs them, and when it performs them so as to offer its customers benefits they want and to earn a profit. Since business models are about making money, let us first explore what determines*

a firm's profitability before we complete our definition of a business model… Table 1.1 shows the profitability of different U.S. industries over a 21-year-period. The interesting thing to note about the data is that firms in the pharmaceutical industry outperform firms in the airline industry. The average return on equity (ROE) for pharmaceuticals was 25.87 percent compared to a meager 2.68 percent for the airline industry… This suggest that there is something about some industries that allows the firms within those industries to be more profitable, on average, than firms in other industries." (Pg. 2); "The stronger the competitive forces, the less profitable the industry's firms are likely to be… Industry factors… competitive forces… cooperative forces… macro environment… country's culture, government policies, fiscal and monetary policies, judicial and legal systems, and technological change. " (Pp. 3-4) "A business model is the set of which activities a firm performs, how it performs them, and when it performs them as it uses its resources to perform activities, given its industry, to create superior customer value (low-cost or differentiated products) and put itself in a position to appropriate the value." (Pg. 9) "A business model is distinguished by how the firm earns a profit, not by how it generates revenue alone." (Pg. 11); "…a business model includes the profit-oriented aspects of strategy and operational effectiveness." (Pg. 12)

[12 (3)] Albrecht, Karl and Ron Zemke (1985) Service America! Warner Books. New York, NY. *"We believe a powerful new wave is about to hit the already turbulent business world. It is the wave of service, or more specifically a new and intense preoccupation with the quality of service. People are getting more and more critical of the quality of the service they experience in their everyday lives, and they want something done about it. The times have changed and we no longer live in a manufacturing economy. We now live in a new economy, a service economy, where relationships are becoming more important than physical products. Just as America experiences an industrial revolution around the turn of the century, so we are now experiencing a service revolution. What was once Industrial America has become Service America. Glance around you please, and notice how much of your personal experience is involved with companies and institutions that exist for the purpose of delivering services of various kinds. Restaurants, hotels, airlines, hospitals, banks, public utilities, colleges and universities – all have the problem of gaining and retaining the patronage of their customers. Many other organizations, such as department stores, mail-order firms, and even sellers of hard goods are finding that the invisible product – the service component – is becoming an important competitive weapon." (Pg. v); "It may help to think of the service strategy, the service package, and the service system as interrelated in the following way: service strategy (define the business) > service package (define the offer) > service system (delivers the service)." (Pg. 80)*

[10, (12)] Alter, Steven (2002) Information Systems: The Foundations of e-Business. Prentice Hall. Upper Saddle River, NJ. *"An information system is a work system whose business process is devoted to capturing, transmitting, storing, retrieving, manipulating, and displaying information, thereby supporting other work systems." (Pg. 6); "A system is a set of interacting components that operate together to accomplish a purpose." (Pg. 8); "A system's purpose is the reason for its existence and the reference point for measuring its success." (Pg. 9); "A system's boundary defines what is inside the system and what is outside." (Pg. 9); "A business process is a related group of steps or activities in which people use information and other resources to create value for internal or external customers. These steps are related in time and place, have a beginning and end, and have input and outputs." (Pg. 10); "E-business was defined earlier as the practice of performing and coordinating critical business processes through extensive use of computers and communication technologies and computerized data." (Pg. 14) "A framework is a brief set of ideas and assumptions for organizing a thought process about a particular type of thing or situation." (Pg. 42); "A framework is typically used to create a model, a useful representation of a specific situation or thing. Models are useful because they describe or mimic reality without dealing with every detail of it." (Pg. 44);"A project is a work system that is designed to produce a particular product and then go out of existence." (Pg 47)*

[2 (10 15)] Alter, Steven (2006) The Work System Method: Connecting People, Processes, and IT for Business Results. Work Systems Press. Larkspur, CA. *"I wrote this book because I believe that many applications of IT would be more successful if business and IT professionals had an organized but non-technical approach for communicating about how current work systems operate and how they can be improved with or without changing technology." (Pg. v); "Basic Ideas. This book's central concept is the work system. All businesses and organizations consist of multiple work systems that perform essential functions such as hiring employees, producing products, finding customers, selling to customers, providing customer service, and planning for the future." (Pg. vi); "A work system is a system in which human participants and/or machines perform work using information, technology, and other resources to produce products and/or services for internal or external customers. Businesses operate through work systems." (Pg. 12); "The nine elements of the Work System Framework… Customers are the people who receive, use, or benefit directly from products and services that a work system produces… Products & Services are the combination of physical things, information, and services that the work system produces for its various customers… Work practices include all the activities within the work system… Participants are people who perform the work… Information includes codified and non-codified information used and created as participants perform their work… Technologies are tools that help people work more efficiently… Environment includes the organizational, cultural, competitive, technical, and regulatory environment within which the work system operates… Infrastructure includes human, information, and technical resources that the work system relies on even though these resources are managed outside of it and are share by other work systems… Strategies consist of the guiding rationale and high-level choices within which a work system, organization, or firm is designed and operates." (Pp. 14-16).*

[1 (11)] Alter, Steven (2008) "Service Systems Fundamentals: Work systems, value chains and life cycle", IBM Systems Journal, Vol. 47, No. 1.

[1 (4 15)] Anderson, James C., James A. Narus, and Woutr van Rossu (2006) Customer Value Propositions in Business Markets. Harvard Business Review. Spring. Pp. 90-99. *"Suppliers use the term "value proposition" three different ways. Most managers simply list all the benefits they believe that their offering might deliver to target customers. The more they can think of, the better. Some managers do recognize that the customer has an alternative, but they often make the mistake of assuming that favorable points of difference must be valuable for the customer. Best-practice suppliers base their value proposition on the few elements that matter most to target customers, demonstrate the value of this superior performance, and communicate it in a way that conveys a sophisticated understanding of the customer's business priorities." (Pg. 93)*

[12 (4)] Anderson, Chris (2006) The Long Tail: Why the Future of Business Is Selling Less of More. Hyperion. New York, NY. *"During the course of our conversation, Vann-Adibe asked me to guess what percentage of the 10,000 albums available on the juke-boxes sold at least one track per quarter. I knew, of course, that Vann-Adibe was asking me a trick question. The normal answer would be 20 percent because of the 80/20 Rule, which experience tells us applies practically everywhere. That is: 20 percent of products account for 80 percent of sales (and usually 100 percent of the profits). But Vann-Adibe was in the digital content business, which is different. So I thought I'd go out on a limb and venture a whopping 50 percent of those 10,000 albums sold at least one trace a quarter. Now, on the face of it, that's absurdly high. Half of the top 10,000 books in a typical book superstore don't sell once a quarter. Half of the top 10,000 CDs at Wal-Mart don't sell once a quarter; indeed, Wal-Mart doesn't even carry that many CDs. It's hard to think of any market where such a high fraction of such a large inventory sells. But my sense was that digital was different, so I took a chance on a big number. I was, needless to say, way, way, off. The answer was 98 percent. 'It's amazing, isn't it?' Van-Adibe said. 'Everyone gets that wrong.'" (Pg. 7)*

[11 (8 12)] Argyris, Chris (1992/1999) On Organizational Learning. Second Edition. Blackwell. Malden, MA. *"The premise of this book is that organizational learning is a competence that all organizations should develop. The reasoning underlying this premise is that the better organizations are at learning the more likely it will be able to detect and correct errors, and to see when they unable to detect and correct errors… An error is a mismatch between plan or intention and what actually happened when either is implemented… I place heavy emphasis on upon detecting and correcting errors that are potentially or actually embarrassing or threatening to the participants…" (Pg. xiii); "I see each function such as managerial accounting and budgeting, strategy, and information systems as based upon explicit theories and methods as to how to design and implement each. For example, it is possible to specify how to produce an economic analysis of costs founded upon activity-based cost accounting theory and methods. The specifications are so explicit that if two individuals using the same data and methods arrive at different conclusions then it is possible to say that someone made an error. It is also possible to test this assertion by tracing backwards to find the error." (Pg. xiv); "Reflecting on these ideas, I think it is fair to say that we are intentionally creating a world full of self-reinforcing, anti-learning processes that will overprotect the players so that it will be difficult to detect and correct difficult and embarrassing problems. Moreover, thanks to the organizational defensive routines – with their accompanying sense of helplessness, cynicism, and doubt about change – the anti-learning and overprotective features will eventually be taken for granted. They will be perceived as necessary evils of organizations… These views are based on the assumption that social science should not only describe reality accurately, comprehensively, and economically as possible, it should also pay attention to producing knowledge about virtual worlds that provide liberating alternatives… In making this statement, I am not asserting that human beings must accept these liberating alternatives, simply that scholars have some obligation to, at least, make them available… What is likely to be new is that we can help create worlds where they are not rare but part of the practice of everyday life." (Pg. xv); "Sociotechnical systems – also known as the Quality of Work Life, or Industrial Democracy Movement – grew out of the postwar activities of the Tavistock Institute in England… Its conception of a learning organization focuses on the idea of collective participation by teams of individuals, especially workers, in developing new patterns of work, career paths, and arrangements for combining family and work lives. According to their view, individuals, workers and their supervisors can and must learn to redesign their work, and upper-level managers must learn to create the contexts within which they can do so." (Pg 2); "…we are likely to be puzzled and disturbed by the notion that learning may also be attributed to organizations. Indeed some researchers have argued, as Geoffrey Vickers did, that if the term, 'organizational learning,' means anything, it means learning on the part of individuals who happen to function in an organizational setting. From this perspective, to say that an organization learns is to commit what the philosopher, Gilbert Ryle, called a 'category mistake.' …Fiol and Lyles (1985) define learning, whether undertaken by individual or organizational agents, as 'the process of improving actions through better knowledge and understanding.' (p. 803). Organizations learn in the sense proposed by Leavitt and March (1988), when they 'encode inferences from history into routines that guide behavior.' (p. 319). Huber (1989) suggest that 'an organization has learned if any of its components have acquired information and have this information available for use, either by other components or by itself, on behalf of the organization. (p. 3)'" (Pg. 7) "A key concept for us is that of inquiry, the intertwining of thought and action carried out by individuals in interaction with one another on behalf of the organization to which they belong in ways that change the organization's theories of action and come embedded in organizational artifacts such as maps, memories or programs. A key question for us, then, is the meaning of the phrase 'on behalf of the organization.'*

We argue that it is possible for individuals to think and act on behalf of an organization because organizations are political entities, in a fundamental sense of the term. Collectivities become organizational when they meet three constitutional capabilities: to make collective decisions (so that groups of individuals can say 'we' about themselves), to delegate authority for action to an individual in the name of the collectivity, and to say who is and who is not a member of the collectivity. Under these conditions, it makes conceptual sense to say that individuals can act on behalf of an organization. It also makes sense to say that on behalf of an organization individuals can undertake learning processes (organizational inquiry) that can, in turn yield learning outcomes as reflected in changes in organizational theories of action and artifacts that encode them." (Pg. 9)

[11 (12)] Argyris, Chris and Donald A. Schon (1996) Organizational Learning II: Theory, Method, Practice. Addison-Wesley. New York, NY. *"'Learning' may signify either a product (something learned) or the process that yields such a product… Generically, an organization may be said to learn when it acquires information (knowledge, understanding, know-how, techniques, or practices) of any kind and whatever means." (Pg. 3); "Researchers and practitioners alike are unavoidably concerned with issues of causality and causal inference. When organizational researchers try to understand variations in patterns of organizational growth and deterioration or when they study how technological innovation works, how incentive systems function, how risks are managed, or how ideas circulate and evolve, their understandings hinge on causal connections. Practitioners, for their part, try to understand things so they can change them or adapt to them… The model of causality conventionally adopted by normal scientists centers on the idea of a 'variable,' a named attribute extracted from the complexity of observed phenomena which is treated as essentially the same in whatever local context it occurs… In everyday practice, on the contrary, organizational practitioners think in terms of 'design causality:' the causal relation that connects actor's intentions to the action he or she designs in order to realize that intention." (Pp. 37-39)*

[3 (1)] Arthur, W. Brian (1994) Increasing Returns and Path Dependence in the Economy, University of Michigan Press. Ann Arbor, MI.

[7 (3)] Baldwin, Carliss Y. and Kim B. Clark (2000) Design Rules: Volume 1. The Power of Modularity. MIT Press. Cambridge, MA. *"Artifacts evolve… The same is true for the firms that create products, and the markets that support them. Indeed, products and technologies and firms and markets evolve interactively over time to create a complex adaptive system, which we call 'an industry.'" (pp. 2-3). "We define and describe the six modular operators as follows: 1. splitting a design (and its tasks) into modules, 2. substituting one module for another, 3. augmenting – adding a new module to the system, 4. excluding a module from the system, 5. inverting to create new design rules, and 6. porting a module to another system." (Pg. 123).*

[8 (3)] Barley, Stephen R., and Julain E. Orr (1997) Introduction: The Neglected Workforce. In *Between Craft and Science: Technical Work in U.S. Settings*, eds. Stephen R. Barley and Justian E. Orr. Cornell University Press. Ithaca, NY. *"The upshot of these developments, as almost everyone knows, is that work has become increasingly white-collar and oriented to the provision of services... Thus, we submit that if the data in Table 1.1 indicate a shift toward a service economy, it does not appear to be an economy dominated by the low wage jobs that the government classifies as service occupations. Instead, Table 1.1 suggests that professional and technical jobs are increasing faster than all others and may become the modal form of work for the twenty-first century. The number of professional and technical jobs in the United States has grown more than 300% since 1950 (see Figure 1.1). No other occupational sector has experienced nearly that growth rate. Even sales (248%) and managerial work (182%), which expanded tremendously over the last two decades, lag behind the growth of the professional and technical labor force." (Pp. 3-4)*

[4 (11)] Barlow, Susan, Stephen Parry, and Mike Faulkner (2005) Sense and Respond: The Journey to Customer Purpose. Palgrave/MacMillan. New York, NY. *"Organizations respond to this increased demand in a number of ways, commoditizing their services to offer high-volume, low-cost alternatives where efficiency is driven, but often with a cost to service effectiveness. These organizations become caught in a downward cycle and in order to survive are faced with the reality of competing on price and searching for more volume… An alternative response by some organizations is to try to move up the customer value chain and to provide higher-quality premium service which can be tailored to meet changing customer needs. Few organizations of today, however, have the operational structures, the measurement systems, the technology, the processes or the practice to continually lock on to every changing customer needs and to respond appropriately." (Pg. 3) "Defining value correctly from the customer's perspective is the first principle in Lean Service. (Pg. 37); "Organizations that are capable of sensing what's important to customers and then engaging the resources of the entire organization in response will always dominate the marketplace (Haeckel, 1999)." (Pg. 39)*

[1 (11 12)] Barnard, Chester I. (1938/1968) The Functions of the Executive. Thirtieth Anniversary Edition. Harvard University Press. Boston, MA. *"Including families, businesses of more than one person, various municipal corporations, autonomous and semi-autonomous governments and branches of government, associations, clubs, societies, fraternities, educational institutions, religious groups, etc., the number of formal organizations in the United Sates is greater than that of the total population. Probably few persons belong to less than five or ten such organizations, and many belong to fifty or more. There individual conduct is dominated or qualified by these relationships directly. Moreover, there are in a short period of a day or a week many millions of formal organizations of short duration, a few hours at most, which are not named and are seldom thought of as organizations… Formal organization is that kind of cooperation among men that is*

conscious, deliberate, and purposeful." (Pg 4); "Cooperation justifies itself, then, as a means of overcoming the limitations restricting what individuals can do. Therefore, we should first consider what in general are their limitations." (Pg 23); "Systems of cooperation are never stable, because of changes in the environment and the evolution of new purposes." (Pg. 37); "A cooperative system is a complex of physical, biological, personal, and social components which are in a specific systematic relationship by reason of the cooperation of two or more persons for a least one definite end." (Pg. 65);

[3 (6 8 11)] Bastiat, F. (1848/1964) Selected Essays on Political Economy, Patrick S. Sterling, trans, G. B. de Huzar. (Ed.), D Van Nordstrand, Princeton, NJ.

[3 (6 8 11)] Bastiat, Frederic (1850/1979) Economic Harmonies. The Foundation for Economics Education. Irvington-on-Hudson, NY. *"We cannot feel another person's wants; we cannot feel another person's satisfactions; but we can render services to one another. This transmission of effort, this exchange of services, forms the subject matter of political economy; and since, on the other hand, political economy can be summed up by the word value, which is the thing it seeks to explain in all its detail, it follows that our notion of value will be an imperfect one, an erroneous one, if … we base it on the … the phenomena of our sensations - wants and satisfactions, which are intimate, nontransferable, not subject to measurement from one individual to another – instead of founding it on our activity, our effort, our exchange of reciprocal services, since these are capable of comparison, appraisal, evaluation, and can indeed be evaluated for the very reason they are exchanged." (Pg. 102); "If a good accountant were to analyze the elements entering into the value of my loaf of bread costing, say, four sous, he would eventually identify, in the course of searching through many complicated transactions, all the individuals whose services had contributed to determining this value, all who had saved trouble for the person who, in the last analysis, pays for the bread because he is the consumer. First, there would be the baker, who keeps a twentieth part, and out of this twentieth pays the mason, who built his oven, the woodcutter who prepared his firewood, etc.; then, there would be the miller, who would receive not only enough to pay for his own labor but also something for quarryman who made his millstone, the workman who built the hanks for the millrace, etc. Other parts of the total value would go to the thresher, the harvester, the planter, until the account was complete to the last centime. But no part of it, none whatsoever, would go to pay God or Nature. Such assumption is absurd, on the face of it, and yet logically it is implicit in the theories of those economists who attribute to matter or forces of Nature any part of the value of a product. No, once again, what has value here is not the loaf of bread, but the series of services that made the bread available to me." (Pp. 113-114)*

[3 (1)] Baumol, W. J. (2002) "Services as Leaders and the Leader of the Services," in J. Gadrey and F. Gallouj, Productivity, Innovation and Knowledge in Services: New Economic & Socio-Economic Approaches, Edward Elgar, Cheltenham, U.K., pp. 147-163.

[11 (3)] Baumol, William J., Robert E. Litan, and Carl J. Schramm (2007) Good Capitalism, Bad Capitalism, and the Economies of Growth and Prosperity. Yale University Press. New Have, CT. *"The first notion is that capitalism is not a monolithic form of economic organization but rather it takes many forms, which differ substantially in terms of their implications for economic growth and elimination of poverty. The implicit assumption underlying the idea of a homogeneous capitalism, the notion that all capitalist economies are fundamentally the same, reflects something of the mentality common during the cold war when two superpowers, representing two great ideologies, were struggling for the hearts and minds of peoples of the world. On the one side were countries like the United States, whose economies rested on the foundation of the private ownership of property, and on the other were communist or socialist societies, whose economics essentially did not." (Pg. vii); "…'entrepreneurial capitalism,' a type of capitalism where entrepreneurs, who continue to provide radical ideas that meet the test of the marketplace, play a central role in the system. This apparently new form of capitalism differed from its counterparts in other countries, especially Japan and continental Europe, where radical entrepreneurship was noticeably absent and where a combination of large enterprises, often 'championed' by their government, and small retail or 'mom and pop' shops dominated the economy… At its core, this book is about these four different types of capitalism – entrepreneurial, big-firm, state-directed, and oligarchic – and how they affect growth… …'entrepreneurial capitalism' that has powered the U.S. economy toward a higher growth rate since the 1990s and which seems to be taking hold in other parts of the worlds, such as Ireland, Israel, the United Kingdom, India, and China, to name just a few… But as one of us (Baumol) elaborated over a decade ago, it takes a mix of innovative firms and established larger enterprises to make an economy really tick." (Pg. x)*

[14 (1)] Bausch, Kenneth C. (2001) The Emerging Consensus in Social Systems Theory. Kluwer. New York, NY. *"…In the mid 20th century General Systems Theory offered a new narrative that promised to unite the sciences… GST received a cool reception from the established sciences. It was criticized for dealing in metaphors, for being philosophical speculation, and for being incapable of falsification. As a result, the claims of GST were not taken seriously in the courts of academic and public opinion. In spite of the eclipse of GST, the insights of systems theory survived and thrived. They were integrated into the fields of evolutionary theory, cybernetics, information theory, organization theory, social theory, and family therapy. With the advent of computers, new science of self-organization have arisen in fields of evolution, artificial intelligence, synergetics, catastrophe theory, chaos, complexity, dissipative structures, self-organized criticality, and so on. The richness of these sciences urges us to find some unity among them. Ken Bausch takes a large step toward such unification in this book… This book does not produce a*

metanarrative for our postmodern age. It does, however, reveal the terrain upon which such a narrative will run… Bela H. Banathy… Alexander Christakis." (Pg. vii-ix)

[3 (8 15)] Becker, Gary S. (1976/1990) The Economic Approach to Human Behavior. University of Chicago Press. Chicago, IL. *"Everyone recognizes that the economic approach assumes maximizing behavior more explicitly and extensively than other approaches do, be it the utility or wealth function of the household, firm, union, or government bureau that is maximized. Moreover, the economic approach assumes the existence of markets that with varying degrees of efficiency coordinate the actions of different participants – individuals, firms, even nations – so that their behavior becomes mutually consistent." (Pg. 5); "When an apparently profitable opportunity to a firm, worker, or household is not exploited, the economic approach does not take refuge in assertions about irrationality, contentment with wealth already acquired, or convenient ad hoc shifts in values (i.e., preferences). Rather it postulates the existence of costs, monetary or psychic, of taking advantage of these opportunities that eliminate their profitability – costs that may not be easily 'seen' by outside observers." (Pg. 7); "The central concept of the analysis is 'social income,' the sum of a person's own income (his earnings, etc.) and the monetary value to him of the relevant characteristics of others, which I call his social environment. By using the concept of social income, I can analyze the effect of these expenditures of changes in different sources of income and in different prices, including the 'price' of the social environment. Interactions among members of the same family get the greatest attention. The 'head' of the family is defined not by sex or age, but as that member, if there is one, who transfers general purchasing power to all other members because he cares about their welfare." (Pg. 253)*

[3 (8 1 14 15)] Beinhocker, Eric D. (2006) The Origin of Wealth: Evolution, Complexity, and the Radical Remaking of Economics. Harvard Business School Press. Cambridge, MA. *"Retailers have a measure, known as stock keeping units, or SKUs, that is used to count the number of products sold in stores… If one inventoried all the types of products and services in the Yanomamo economy, that is, the different models of stone axes, the number of types of food, and so, one would find that the total number of SKUs in the Yanomamo economy can probably be measured in the several hundreds, and at the most in the thousands. The number of SKUs in the New Yorker's economy is not precisely known, but using a variety of data sources, I very roughly estimate that it is on the order of 10^{10} (in other words, tens of billions). To put this enormous number in perspective, estimates of the total number of species on earth range from 10^{6} to 10^{8}. Thus the most dramatic difference between the New Yorker and Yanomamo economies is not their 'wealth' measured in dollars, a mere 400-fold difference, but rather the hundred-million-fold, or eight orders of magnitude difference in the complexity and diversity of the New Yorkers' economy versus the Yanomamo economy." (Pg 8-9); "A pattern of matter, energy, and or information has economic value if the following three conditions are jointly met: 1. Irreversibility: All value-creating economic transformation and transactions are thermodynamically irreversible. 2. Entropy. All value creating economic transformations and transactions reduce entropy locally within the economic system, while increasing entropy globally. 3. Fitness: All value-creating economic transformations and transactions produce artifacts and or actions that are fit for human purposes." (Pg. 303)*

[12 (3)] Bell, Daniel (1973/1999) The Coming of the Post-Industrial Society: A Venture in Social Forecasting. Basic. New York, NY. *"But how does one explain the coming of the post-industrial society? The first explanation was given by the Australian economist Colin Clark in his path breaking Conditions of Economic Progress (1940), where he divided the economy into sectors: primary (extractive), secondary (manufacturing), and tertiary (services). The progress of an economy was measured by the degree of productivity (output per capita) in each sector. As productivity rose in each sector (i.e., fewer persons were needed to achieve particular levels of output), labor could be transferred from one sector to another. Economic progress, thus, was defined as a function of the differential productivity among the sectors. Services was a residual category, the kind of additional benefits, so to speak, that a society could now afford. Many people, in writing about a post-industrial society, still define it primarily with respect to services. But that definition is inadequate. Clark's view of services was narrowly 'economistic.' More than that, it derived from the thinking of the classical economists, and Marx, that services were 'unproductive.' In that view, only manufacturing produced value, by labor. But momentary reflection would show that wrong. The major expansion in contemporary society is 'human services,' primarily health and education. And both are the chief means today of increasing productivity in a society; education by advancing the acquisition of skills, particularly literacy and numeracy; health by reducing illness and making individual more fit to work. This is why, in writing about services, I have broken this area into a further distinction (after the pre-industrial 'primary' and the industrial 'secondary') of tertiary (transportation and utilities), quaternary (trade and finance), and quinary (health, education, etc.). But for me, the novel and central feature of the post-industrial society is the codification of theoretical knowledge and the new relation of science to technology… An industrial society, from Ricardo to Marx, is based on a labor theory of value, and the development of industry proceeds by labor-saving devices, substituting capital for labor. A post-industrial society rests on a knowledge theory of value. Knowledge is the source of invention and innovation. It creates value-added and increasing returns to scale…" (pp. xiii-xvii).*

[9 (3 10)] Beniger, James R (1986) The Control Revolution: Technological and Economic Origins of the Information Society. Harvard University Press. Cambridge, MA. *"What we recognize in the end-directedness or purpose of organization is the essential property of control, already defined as purposive influence to a predetermined goal. Control accounts for the difference between even the most complex inorganic crystal and simple organisms like the amoeba: the amoeba controls both itself and its environment;*

the crystal does not. As noted in the previous chapter, everything living processes information to effect control; nothing that is not alive can do so – nothing, that is, except certain artifacts of our own invention, artifacts that proliferated with the Control Revolution." (Pg. 35)

[3 (10 8)] Benkler, Yochai () The Wealth of Networks: How Social Production Transforms Markets and Freedom. *"The networked information economy improves the practical capacities of individuals along three dimensions: (1) it improves their capacity to do more for and by themselves; (2) it enhances their capacity to do more in loose commonality with others, without being constrained to organize their relationship through a price system or in traditional hierarchical models of social and economic organization; (3) it improve the capacity of individuals to do more in formal organizations that operate outside the market sphere. This enhanced autonomy is at the core…" (Pg. 8); "It should not, the intuitions of the late-twentieth-century American would say, be the case that thousands of volunteers will come together to collaborate on a complex economic project. It certainly should not be that these volunteers will beat the largest and best-financed business enterprises in the world at their own game." (Pg. 59); "The salient characteristic of the commons, as opposed to property, is that no single person has exclusive control over the use and disposition of any particular resource in the commons." (Pg. 61); "This book began with four economic observations. First, the baseline conception that proprietary strategies are dominant in our information production system is overstated… The second economic point is that these expansions of rights [patents, copyright, trademark, etc.] operate, as a practical matter, as a tax on nonproprietary models of production in favor of the proprietary models… The third economic observation is that the basic technologies of information processing, storage, and communication have made nonproprietary models more attractive and effective than was ever before possible… The fourth and final economic observation describes and analyzes the rise of peer production." (Pp. 460-462)*

[8 (1 15)] Berger, Peter L. and Thomas Luckmann (1967) The Social Construction of Reality: A Treatise in the Sociology of Knowledge. Anchor. New York, NY. *"One could say that the sociological understanding of 'reality' and 'knowledge' falls somewhere in the middle between that of the main in the street and that of the philosopher. The main in the street does not ordinarily trouble himself about what is 'real' to him and about what he 'knows' unless he is stopped short by some sort of problem. He takes his 'reality' and his 'knowledge' for granted. The sociologist cannot do this, if only because his systematic awareness of the fact that men in the street take quite different 'realities' for granted as between one society and another." (Pg. 2); "Different objects present themselves to consciousness as constituents of different spheres of reality. I recognize the fellowmen I must deal with in the course of everyday life as pertaining to a reality quite different from the disembodied figures that appear in my dreams. The two sets of objects introduce quite different sets of tensions into my consciousness and I am attentive to them in quite different ways. My consciousness, then is capable of moving through different spheres of reality. Put differently, I am conscious of the world as consisting of multiple realities. As I move from one reality to another, I experience the transition as a kind of shock. This shock is to be understood as caused by the shift in attentiveness that the transition entails. Waking up from a dream illustrates this shift most simply. Among the multiple realities there is one that presents itself as the reality par excellence. This is the reality of everyday life. Its privileged position entitles it to the designation of paramount reality. The tension of consciousness is highest in everyday life, that is, the latter imposes itself upon the consciousness most massive, urgent, and intense manner… The reality of everyday life is organized around the 'here' of my body and the 'now' of my present… Closest to me is the zone of everyday life that is directly accessible to my bodily manipulation… I know, of course, that the reality of everyday life contains zones that are not accessible to me in this manner… The reality of everyday life further presents itself to me as an intersubjective world, a world that I share with others. This intersubjectivity sharply differentiates everyday life from other realities of which I am conscious. I am alone in the world of my dreams, but I know that the world of everyday life is as real to others as it is to myself… Commonsense knowledge is the knowledge I share with others in the normal, self-evident routines of everyday life." (Pp. 21-23) "The theatre provides an excellent illustration of such playing on the part of adults. The transition between realities is marked by the rising and falling of the curtain. As the curtain rises, the spectator is 'transported to another world,' with its own meanings and an order that may or may not have much to do with the order of everyday life… Aesthetic and religious experience is rich in producing transitions of this kind, in as much as art or religion are endemic producers of finite provinces of meaning." (Pg. 25)*

[12 (3)] Bernstein, Peter L. (1998) Against the Gods: The Remarkable Story of Risk. Wiley. New York, NY. *"This book tells the story of a group of thinkers whose remarkable vision revealed how to put the future at the service of the present. By showing the world how to understand risk, measure it, and weigh its consequences, they converted risk-taking into one of the prime catalysts that drives modern Western society." (Pg. 1)*

[14 (11)] von Bertalanffy, L. (1976) General System Theory: Foundation, Development, Applications, George Braziller. *"My first example is that of closed and open systems. Conventional physics deals only with closed systems, i.e., systems which are considered to be isolated from their environment… Thermodynamics expressly declares that its laws apply only to closed systems… However, we find systems which by their very nature and definition are not closed systems. Every living organism is essentially an open system. It maintains itself in a continuous inflow and outflow, a building up and a breaking down of components, never being, so long as it is alive, in a state of chemical and thermodynamic equilibrium…" (Pg. 39); "A unitary conception of the world may be based, not upon the possibly futile and certainly farfetched hope finally to reduce all levels of reality to the level of physics, but rather on the*

isomorphy of laws in different fields… The unifying principle is that we find organization at all levels." (Pp. 48-49)

[4 (12)] Berry, Leonard L. (1995) On Great Service: A Framework for Action. Free Press. New York, NY. *"The purpose of this book is to teach the lessons of service quality implementation. The book focuses exclusively on how to improve service quality… Everyone loses when service is poor. Customers lose. Employees lose. Senior managers lose. Suppliers lose. Shareholders lose. Communities lose. The country loses. Poor service has no redeeming virtue, nor does mediocre service for that matter. Service excellence is more profitable, more fun, and more conducive to a better future." (Pg. 3); "Service leadership is the engine of service improvement. Without the energizing vision of leadership, without direction, the coaching, and the inspiration, the idea of quality improvement is not transformed to action. Great service is a matter of mentality. The quest to improve is unrelenting; ideas are part of the job; the spirit of entrepreneurship is strong. Values guide, not policy and procedure manuals. Mentality is a matter of leadership." (Pg. 16); "Creating an empowered state of mind in an organization is a condition of great service. An empowered state of mind includes feelings of control over the job, awareness of the context for the work, accountability for personal performance, shared responsibility for unit and organizational performance, and equity in the distribution of rewards. Management nurtures these feelings by treating employees as part-owners of the business and expecting them to behave like owners." (Pp. 222-223)*

[3 (9 5)] Bohn, Roger and Ramchandran Jaikumar (2005) From Filing and Fitting to Flexible Manufacturing. Foundations and Trends in Technology, Information, and Operations Management. 1:1-2. *"Process control is the coordination of machines, human labor, and the organization of work to effect the manufacture of a product. It involves the specification and monitoring of machine setups and operating parameters, formulation of rules and procedures to govern operator-machine interactions, and decisions about the utilization of, and sequencing of, operations on a line. Although the details of process control can be quite different in different industries, a common theme that emerges from its study is the evolution of manufacturing from an art to a science... Based in the city of Gardone in what is now northern Italy, and controlled by the same family for fourteen generations since 1492, Baretta has been engaged in the manufacture of firearms for five hundred years. Whereas functionally the produce has remained much the same, and manufacturing is still based on fabricating precise metal parts, the detailed process by which it is manufactured have changed considerably over time. Thus, the firm provides as ideal a natural experiment as one could have. Although it originated none of the major metal fabricating innovations, Baretta was quick to adopt every one of them… (1) Craft System (circa 1500), (2) English System of Manufacture (circa 1800), (3) American System of Manufacture (circa 1830), (4) Taylor System (circa 1900), (5) Statistical process control (circa 1950), (6) Numerical Control (circa 1965), (7) Computer-Integrated Manufacturing (circa 1985)…" (Pp. 5-7).*

[1 (10 15)] Boisot, Max H. (2002) Knowledge Assets: Securing Competitive Advantage in the Information Economy. Oxford University Press. Oxford, UK. *"We live in a post-industrial society in which knowledge has increasingly come to be recognized as a primary source of wealth… Knowledge assets yield a stream of useful services over time and hence have potential economic value. Unlike physical assets, however, knowledge assets can be shared with others and retained at the same time… Yet while sharing knowledge does not reduce its utility for its original possessor… it does reduce its value. Shared knowledge loses scarcity… Understanding when it flows of its own accord and when it does not is crucial to mastering knowledge as a potential source of wealth. When, then, is knowledge likely to flow readily and when is it likely to turn viscous? I argue that fluid knowledge is knowledge that is well codified and abstract: all extraneous data has been shed. Viscous knowledge, by contrast, is data rich, qualitative, ambiguous. It flows slowly, if at all… Knowledge assets thus have a paradoxical character. The more useful they become, the more difficult they are to hold on to. The successful exploitation of knowledge assets requires effective strategies for dealing with this paradox." (Pg. xiii-xiv)*

[3 (8 9 10 11)] Bryson, John R., Peter W. Daniels, and Barney Warf (2004) Service Worlds: People, Organizations, and Technology. Routledge. New York, NY. *"In the Service World the distinction between services and manufacturing is at best misleading and at worst a fundamental distortion of the way in which production systems operate… At one level, the Service World is about the enhanced importance of knowledge in the production process, but this is only one of its most visible parts in that there are additional dimensions, such as the legal systems and institutional structures that are used to regulate and control the evolving production systems. For example, the intellectual value of physical products is regulated and protected by patents, but patents cannot protect most service knowledge; a new global legal architecture needs to be developed." (Pg. 4)*

[14 (3)] Buchanan, Mark (2001) Ubiquity: Why Catastrophes Happen. Three River Press. New York, NY. *"The key idea is notion of the critical state, a special kind of organization characterized by a tendency toward sudden and tumultuous changes, an organization that seems to arise naturally under diverse conditions when a system gets pushed away from equilibrium. This is the first landmark discovery in the emerging science of nonequilibrium physics –what we might equally well call the field of historical physics." (Pp. 16-17) "So while great characters are at the center of great happenings, they do not provide the forces that drive them. Instead, the role is more important than the person who occupies it, for the role is the point where great social forces collide, and it is in filling such pivotal roles that great men or women become great." (Pg. 222)*

[8 (14)] Buchanan, Mark (2007) The Social Atom: Why the rich get richer, cheaters get caught, and your neighbors usually look like you. Bloomsbury, New York, NY. *"Quite*

simply, we humans are the most complex things that we know about in the universe. The situation is even worse too because we're all different, due to genetic differences and because each person has a unique history of experiences. So human science has to deal not only with individuals of near infinite complexity, but with many such individuals, all different from one another. The great Austrian physicist Wolfgang Pauli readily admitted that physics is, in this sense, far easier than social science. 'In physics we can assume that every electron is identical,' Pauli pointed out, 'while social scientists do not have this luxury.' Where would physics be if every hydrogen atom had its own unique history that left indelible traces on its behavior? What if we had to know about an atom's moods and thoughts to be able to account for its actions? It is safe to say that physics wouldn't be nearly so advanced. Physics and chemistry may be called the hard sciences, yet human science is actually far harder – in part, because of the individual complexity of people and the differences among them. …Men will always do things that make the human world unpredictable – if even just to prove its unpredictability." (Pp. 37-38); "…Kahneman explored lots of simple situations in which our instincts for thinking affect how we take in information and use it, and how intelligent people depart systematically from economists' rational ideal. For example, they found that how a question or situation is 'framed' or presented can have dramatic effects on how people deal with it. Patients who are told that a dangerous operation has a 90 percent change of success are more likely to go for it than if they are told it has a 10 percent failure rate." (Pg. 55); "Arthur's model of El Farol represents a crude way to put into action one of the ideas of the last chapter – that we're adaptive rule followers, rather than rational automatons." (Pg. 75); "By this argument, the market should hover near the boundary of predictability, where limited prediction is possible, but difficult… …it captures the basic logic of what drives the market – the underlying ecology of strategies among investors… There are the moments when the number of strategies in play has effectively been reduced, either because people have dropped out of the market, or many have begun using the same strategy." (Pp. 84-85);

[10 (12)] Bush, Vannevar (1945) "As We May Think," The Atlantic Monthly 176 No. 1, 101-108 (July).

[8 (3 10 11 12)] Castells, Manuel (2004) The Network Society: A Cross-cultural Perspective. Edward Elger. Cheltenham, UK. *"A network society is a society whose social structure is made of networks powered by microelectronics-based information and communication technologies." (Pg. 3); "Thus, what is specific to our world is the extension and augmentation of the body and mind of human subjects in networks of interaction powered by microelectronics-based, software-operated, communications technologies." (Pg. 7); "We have ample evidence that there is no predetermined sense of history, and that every age and every power claims ethnocentrically and historocentrically its right to be the supreme stage of human evolution. We observe throughout history is that different forms of society come and go by accident, internal self-destruction, serendipitous creation, or more often, as the outcome of largely undetermined struggles." (Pg. 14); "The university tradition of sharing discovery and communicating with peers was relied upon, in the hope of seeing invention improved by collective work of the network, in sharp contrast to the world of corporations and government bureaucracies that had made secrecy and intellectual property rights the source of their power and wealth." (Pg. 21); "…the decision to go global in a big way, while being facilitated by government policies of deregulation, liberalization, and privatization, would not have been possible without computer networking, telecommunications, and information technology-based transportation systems." (Pg. 21); "…tasks that are not valued are assigned to 'generic labor' eventually being replaced by machines or decentralized to low-cost production sites, depending on dynamic cost-benefit analysis." (Pg. 26); "…the key issue for labor is the differentiation between three categories: those who are the source of innovation and value; those who merely carry out instructions; and those who are structurally irrelevant… either as workers… or as consumers." (Pg. 29)*

[3 (11 12)] Chandler, Arthur D. (1977) The Visible Hand: The Managerial Revolution in American Business. Belknap/Harvard University Press. Cambridge, MA.

[2 (5 15)] Chase, Richard B., F. Robert Jacobs, Nicholas J. Aquilano (2004) Operations Management for Competitive Advantage. Instructor's Edition. Tenth Edition. McGraw Hill Irwin. New York, NY. *"A learning curve is a line displaying the relationship between unit production time and the cumulative number of units produced… Individual learning is improvement that results when people repeat a process and gain skill or efficiency from their experience… Organizational learning results from practice as well, but also comes from changes in administration, equipment, and product design." (Pg. 49); "Job design may be defined as the function of specifying the work activities of an individual or group in an organizational setting… Specialization of labor is the two-edged sword of job design. On one hand, specialization has made possible high-speed, low-cost production, and from a materialistic standpoint, it has greatly increased our standard of living. On the other hand, extreme specialization (as we see in mass-production industries) often has serious adverse effects on workers, which in turn are passes on to management." (Pp. 126-127); "Customer contact refers to the physical presence of the customer in the system, and creation of the service refers to the work process involved in providing the service itself. Extent of contact here may be roughly defined as the percentage of time the customer must be in the system relative to the total time it takes to perform the customer service. Generally speaking, the greater the percentage of contact time between the service system and the customer, the greater the degree of interaction between the two during the production process. From this conceptualization, it follows that service systems with a high degree of customer contact are more difficult to control and more difficult to rationalize than those with low degree of customer contact. In high-contact systems, the customer can affect the time of demand, the exact nature of the service, the quality, or perceived quality, of the service because the customer is*

involved in the process." (Pg. 222); "Chase and Dasu suggest applying behavioral concepts to enhance customer perceptions of three aspects of the encounter: the flow of the service experience (what's happening), the flow of time (how long it seems to take), and judging the encounter performance (what you thought of it later)." (Pg 223)

[10 (1 14 15)] Checkland, Peter and Sue Holwell (1998/2005) Information, Systems, and Information Systems: Making Sense of the Field. Wiley. Chichester, UK. *"…Boland and Hirschheim (1985) describe the field as: '…a combination of two primary fields: computer science and management, with a host of supporting disciplines e.g. psychology, sociology, statistics, political science, economics, philosophy and mathematics. IS is concerned not only with the development of new information technologies but also with questions such as: how they can best be applied, how they should be managed, and what their wider implication area. (page vii)' A current text (Ahituv and Neumann 1990) lists no fewer than 19 'foundations' of IS, seeing it as the intersection of three main disciplines: exact sciences (including control theory, general systems theory, statistics), technology (including computer science, electrical engineering) and social behavioral sciences (including management theory, sociology, psycholinguistics, economics, etc.)." (Pp. 9-10); "A consequence of the nature of the process, in which intentions are formed and purposeful action is undertaken by people who are supported by information, is that 'information system' has to be seen as a service system: one which serves those taking the action. Hence its form and content will have to be dictated by how the action supported is conceptualized. This means that 'information systems development' must start by carefully defining the action to be served, in its specific context, and using that definition to decide what information is needed and how technology and help provide it. (This reverses what often happens today in organizations – with poor results – which then lead to spectacular headlines about 'another IT failure'.)" (Pp. 219-220)*

[1 (14)] Chesbrough, H. and J. Spohrer (2006) "A research manifesto for services science," Communications of the ACM. 49(7). July. 35-40.

[1 (14)] Chesbrough, H. (2005) Toward a science of services. Harvard Business Review, 83, 16-17.

[7 (12)] Chesbrough, H. (2006) Open Business Models: How to thrive in the New Innovation Landscape. Harvard Business School Press. Boston, MA. *"But hidden among these worrisome trends are other developments that are perhaps more hopeful for the future of innovation. One such development is the growing division of innovation labor. By a 'division of innovation labor,' I mean a system where one party develops a novel idea but does not carry this idea to market itself. Instead, that party partners with or sells the idea to another party, and this latter party carries the idea to market. This new division of labor is driving a new organizational model of innovation, one that may offer more hopeful prospects for innovation in the future. To tap into this new division of labor, companies will have to open up their business models… Let's be clear about what is meant by open business model. A business model performs two important functions: it creates value, and it captures a portion of that value… An open innovation model uses this new division of innovation labor – both in the creation of value and in the capture of a portion of that value." (Pg. 2)*

[3 (8)] Childe, V. Gordon (1936/2003) Man Makes Himself. Spokesman/Watts. Nottingham, UK. *"Last century 'progress' was accepted as a fact. Trade was expanding, the productivity of industry was increasing, wealth was accumulating. Scientific discoveries promised a boundless advance in man's control over Nature, and consequently unlimited possibilities of further production. Growing prosperity and deepening knowledge inspired an atmosphere of unprecedented optimism throughout the Western world. Now that optimism has received a rude shock. The last war and subsequent crises, producing even in the midst of horrible poverty an apparent surplus of goods, have undermined its economic foundations. Doubts as to the reality of 'progress' are widely entertained." (Pg. 1); "Hence the historian's 'progress' may be the equivalent of the zoologist's evolution… If the total numbers tend turn out to be increasing, the species may be regarded as successful; if the total is dwindling, it is condemned as a failure." (Pg. 10) "Very tentatively, too we might draw attention to the idea of economy in the means whereby survival is secured. Many of the lower organisms only survive, only main their numbers, by a prodigious fecundity. Each individual pair produces millions of offspring. Yet the species is so poorly fitted to survive that only one or two out of every batch live to maturity." (Pg. 11)*

[4 (12)] Christopher, Martin and Adriane Payne, and David Ballantyne (1991) Relationship Marketing: Bringing quality, customer service, and marketing together. Butterworth-Heinemann. London, UK. *"Traditional marketing has been about getting customers. Relationship marketing addresses the twin concerns – getting and keeping customers." (Pg. vii)*

[3 (11)] Clark, Colin (1940/1957) Conditions of Economic Progress. Third Edition. Macmillan. New York, NY. *"Economics is defined as the study of the production, distribution, and exchange of all those goods and services which are usually exchangeable, or are actually exchanged, for money… We cannot, however, make proper use of economics until we have determined its position in relation to certain other branches of knowledge… Economics also must take its place in the hierarchy of arts and sciences. Economics should dominate and co-ordinate the activities of engineering, agricultural science, industrial chemistry, accountancy and all sciences whose main object is the production and exchange of useful goods and services… But just in the same way economics must obey its own superiors. In the first place, it must recognize the authority of political science, for without a political order men cannot live together in communities at all. 'A political theory [describes] the kind of human community its advocate thinks desirable and also possible, having regard to human nature. An economic theory, on the other hand, is what somebody supposes to be the best way in which a community can get and use the material means to living the kind of life which it thinks possible and desirable.' The next rank in the*

intellectual hierarchy is that of the historian, for it is only by historical methods that we can assemble all the necessary facts for making a true judgment of any economic question, taking into account also the relevant facts of political, cultural, and religious history. But the final judgment on each of these questions will involve directly or indirectly, decisions in the field of moral philosophy, of what is right and what is wrong according to the true interpretation of man's nature… To refuse to accept this hierarchy of authority, and to claim that the study of economics as an isolated science can safely tell us the course of action to be pursued, is tantamount to repeating, on a much larger and more serious scale, the error of those engineers who think that their own science can settle all necessary problems in economics." (Pp. 1-3); "It was an outstanding error on Adam smith's part to attempt to exclude services from his definition of real national product. This exclusion, together with many other obsolete doctrines, persisted in the Soviet definition of national income until Stalin's recent pronouncement (October 1952) decreed that certain services (in a Soviet economy, but not elsewhere) were to be regarded as part of the national product. Adam Smith's error was not shared by a historian-philosopher who wrote on economics some four centuries early, namely Ibn Khaldun… He included in his definition of production medical service, education, and music. What he does exclude from his definition of production are activities based on fraud, exploitation, or ignorance, mentioning particularly astrology, alchemy…" (Pg. 6); "The current production of goods and services in each community, measure in a certain way, is referred to as its real national income." (Pg. 7); "It is entirely plain that the national dividend is composed in the last resort of a number of objective services, some of which are embodied in commodities, while others are rendered directly." (Pg. 8); "The bought and unbought kinds do not differ from one another in any fundamental respect, and frequently an unbought service is transformed into a bought one, and vice versa. This leads to a number of violent paradoxes… Yet again, the services rendered by women enter into the dividend when they are rendered in exchange for wages, whether in the factory or in the home, but do not enter into it when they are rendered by mothers and wives, gratuitously to their own families." (Pp. 8-9)

[14 (3 11)] Clippinger III, John Henry (1999) The Biology of Business: Decoding the Natural Laws of Enterprise. Jossey-Bass. "*This book is intended to help provide a new definition of what it means to manage, based on the application of principles and insights taken from the science of complex systems (CAS). This 'science of sciences' contains a collection of principles and methods that apply across a broad range of sciences – physics, biology, economics, genetics, computers science – and that provide powerful insights into how complex systems can evolve from relatively simple principles to become well-ordered, adaptive systems… The act of management thus becomes a matter of influencing the forces of self-organization from below, rather than controlling them from above. The notion that a complex process can be self-organizing or self-regulating is not new. Adam Smith's 'An Inquiry into the Nature and Causes of the Wealth of Nations' (1981) introduced the notion of the 'invisible hand' of market capitalism. Markets are governed by the laws of supply and demand, not by any central authority, yet they are highly efficient at allocating resources to the material well-being of all. What is new is the application of this concept to management. The traditional view of management was expressed by its leading historian, Alfred Chandler (1977), who defined classical management theory and practice by contrasting the visible hand of management with Adam Smith's invisible hand of the market. Whereas markets were governed by invisible laws and principles, Chandler argued, organization were different and required the deliberate, visible, reasoned decisions and actions of managers." (Pp. 1-2)*

[3 (11)] Coase, R.H. (1937) The Nature of the Firm. Economica. 4: 386-405.

[3 (6 11)] Coase, R.H. (1990) The Firm, the Market, and the Law. University of Chicago Press. Chicago, IL. "*One result of this divorce of the theory from its subject matter has been that the entities whose decisions economist are engaged in analyzing have not been made the subject of study and in consequence lack and substance… We have consumers without humanity, firms without organizations, and even exchange without markets." (Pg. 3); "'On order to carry out a market transaction it is necessary to discover who it is that one wishes to deal with, to inform people that one wishes to deal and on what terms, to conduct negotiations leading up to a bargain, to draw up the contract, to undertake the inspection needed to make sure the terms of the contract are being observed, and so on.' Dalhman crystallized the concept of transaction costs by describing them as 'search and information costs, bargaining and decision costs, and policing and enforcement costs.'" (Pg. 6); "Lawyers, however, habitually think of what is bought and sold as consisting of a bundle of rights." (pg. 11); "This description of the organization of industry, which reflects the traditional view of the subject, is, however, almost certainly too narrow a conception of its scope. Firms are not the only organizations which undertake economic activities. Apart from associations of various sorts and nonprofit organizations (which may, however, be regarded as special kinds of firms), there is also a large number of government agencies which undertake economic activities, many of them of great importance. Almost all, if not indeed all, of these economic activities of government – whether it be police protection, garbage collection, the provision of utility services, education, or hospitals – are also provided by firms (or other analogous institutions). It should surely be part of the task of studies of industrial organization to describe the economic activities which are performed by government agencies, and to explain why the carrying out of these economic activities is divided in the way that it is." (Pg. 59); "The Pigovian analysis shows us that it is possible to conceive of better worlds than the one in which we live. But the problem is to devise practical arrangements which will correct defects in one part of the system without causing more serious harm in another part." (Pg. 142); "Nothing could be more 'anti-social' than to oppose any action which causes any harm to anyone." (Pg. 144); "A final reason for the failure to develop a theory adequate to handle the*

problem of harmful effects stems from a faulty concept of a factor of production. This is usually thought of as a physical entity which the businessman acquires and uses (an acre of land, a ton of fertilizer) instead of as a right to perform certain (physical) actions." (Pg. 153)

[11 (6 12 15)] Cohen, Linda and Allie Young (2006) Multisourcing: Moving Beyond Outsourcing to Achieve Growth and Agility. Harvard Business School Press. Boston, MA. "*Multisourcing: the disciplined provisioning and blending of business and IT services from the optimal set of internal and external providers in the pursuit of business goals… Outsourcing worked. Using external service providers to cut costs and improve performance has become truly commonplace."(Pg. 1); "The way forward requires, somewhat paradoxically, that you abandon thinking about outsourcing in and of itself and adopt a more holistic and strategic approach to sourcing as a whole… whether internal or external… To implement Multisourcing, a new operating model must be adopted, including new approaches to sourcing strategy, sourcing governance, sourcing management, service provider selection, and service measurement." (Pp. 3-4); "The eight myths of outsourcing today… 1. The myth of sourcing independence… 2. The myth of service autonomy… 3. The myth of economies of scale… 4. The myth of self-management… 5. The myth of the enemy… 6. The myth of procurement.. 7. The myth of steady state… 8. The myth of sourcing competency…" (Pp. 10-12)*

[13 (8)] Collins, H., Evans, R., & Gorman, M. (2007) Trading zones and interactional expertise. Studies in History and Philosophy of Science, 39(1), tba.

[8 (10)] Collins, Harry and Martin Kusch (1999) The Shape of Actions: What Humans and Machines Can Do. MIT Press. Cambridge, MA. "*When humans do polymorphic actions, they draw on their understanding of society; when they do mimeomorphic actions, they intentionally act like machines…" (Pg. 1) "What makes a metal disc 'a coin,' or a piece of paper a token of value, that is, what makes such things instances of money? It is, of course, that a collective treats the items as money, that it talks of them as money, that it uses them as money, and that it sanctions and enforces this talk and this use. If the collective ceases to believe that the paper and coins are money, and that they have the value represented symbolically on their surfaces, these items cease to be money. This is not just a philosophical nicety but a practical problem, as inflationary spirals, and the precautions that governments take to prevent them, reveal." (Pg. 12); "The mutual belief that sustains institutions is self-referring; the referent of the belief is the belief itself." (Pg. 13); "The need for collective acceptance in social institutions makes the actions of members predictable; as we would say, it is one way in which action coordination is ensured." (Pg. 14)*

[12 (13)] Collins, Jim (2005) Why Business Thinking is Not the Answer: Good to Great and the Social Sector: A monograph to Accompany Good to Great. Why Some Companies Make the Leap… and Others Don't. ISBN-10: 0-9773264-0-3. "*During my first year on the Stanford faculty in 1988, I sought out Professor John Gardner for guidance on how I might become a better teacher. Gardner, former Secretary of Health, Education, and Welfare, founder of Common Cause, and author of the classic text 'Self Renewal,' stung me with a comment that changed my life. 'It occurs to me, Jim, that you spend too much time trying to be interesting,' he said. "Why don't you invest more time in trying to be interested.' …I do not consider myself an expert on social sectors, but in the spirit of John Gardner, I am a student. Yet I've become a passionate student. I've come to see that it is simply not good enough to focus solely on having a great business sector. If we only have great companies, we will merely have a prosperous society, not a great one. Economic growth and power are the means, not the definition, of a great nation." (Pg. i); "That's when it dawned on me: we need a new language. The critical distinction is not between business and social, but between great and good. We need to reject the naïve imposition of the 'language of business' on the social sectors, and instead jointly embrace a language of greatness." (Pg. 2); "In the social sectors, money is only an input, and not a measure of greatness." (Pg. 5); "It doesn't really matter whether you can quantify your results. What matters is that you rigorously assemble evidence – quantitative or qualitative – to track your progress. If the evidence is primarily qualitative, think like a trial lawyer assembling the combined body of evidence. If the evidence is primarily quantitative, then think of yourself as a laboratory scientist assembling and assessing the data." (Pg. 7); "Social sector leaders are not less decisive than business leaders as a general rule; they only appear that way to those who fail to grasp the complex governance and diffuse power structures common to social sectors." (Pg. 10; "Social sector leaders pride themselves on 'doing good' for the world, but to be of maximum service requires a ferocious focus on doing good only if it fits your Hedgehog Concept. To do the most good requires saying 'no' to pressures to stray, and the discipline to stop doing what does not fit." (Pg. 27)*

[7 (12)] Cooper, Robert G. and Scott J. Edgett (1999) Product Development for the Service Sector: Lessons from Market Leaders. Basic Books. Cambridge, MA. "*New service development is fundamental to achieving corporate growth goals. Growth in profits and enhanced shareholder value are center objectives of most firms' strategic plans. But increased profits can only come from two sources: reduced costs or increased revenue. The dilemma is that the cost-cutting side of the equation has already occurred: Companies are lean and mean, and hence little opportunity to squeeze extra profits from further cost-reductions efforts. At the same time, many service companies operate in mature markets, thus limiting revenue growth from increasing market size. Still, senior management demands that aggressive growth targets be met. How? Development of new services designed to increase marketshare or to attach new markets must be a major contributor." (Pg. 7)*

[13 (14)] COSEPUP (2007) Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future. Committee on Science, Engineering, and Public Policy (COSEPUP) US National Academies Press.

[3 (10 13)] Cohen, S. S. and J. Zysman (1988) Manufacturing Matters: The Myth of the Post-Industrial Economy, Basic, New York. *"In a catch phrase, if the United States is to remain a wealthy and powerful economy, American manufacturing must automate, not emigrate. The difference is decisive. There is absolutely no way we can lose control and mastery of manufacturing and expect to hold and expect to hold onto the high-wage service jobs that we are constantly told will replace manufacturing. At the heart of the argument is a notion we call 'direct linkage': a substantial core of service employment is tightly tied to manufacturing. It is a complement and not, as the dominant view would have it, a substitute of a successor for manufacturing. Lose manufacturing and you will lose – not develop – those high wage services." (Pg. 3)*

[7 (4 8 13)] Csikszentmihalyi, Mihaly (1990) Flow: The Psychology of Optimal Experience; Steps Toward Enhancing The Quality of Life. Harper/Perennial. New York, NY. *"We have seen how people describe the common characteristics of optimal experience: a sense that one's skills are adequate to cope with the challenges at hand, in a goal-directed, rule-bound action system that provides clear clues as to how well one is performing. Concentration is so intense that there is no attention left over to think about anything irrelevant, or to worry about problems. Self-consciousness disappears and the sense of time becomes distorted." (Pg. 71); "When describing optimal experience in this book, we have given as examples such activities as making music, rock climbing, dancing, sailing, chess, and so forth. What makes these activities conducive to flow is that they are designed to make optimal experience easier to achieve. They have rules that require learning skills, they set up goals, they provide feedback, they make control possible… Such flow activities have as their primary function the provision of enjoyable experiences… Roger Caillois, the French psychological anthropologist, has divided the world's games… into four brad classes, depending on the kind of experience they provide. Agon includes games that have competition as their main feature… alea is the class that includes all games of chance… ilinx, or vertigo, is the name he gives to activities that alter consciousness by scrambling ordinary perception… and mimcry is the group of activities in which alternate realities are create…" (Pg. 72); "It pushed the person to higher levels of performance… In short, it transformed the self by making it more complex. In this growth of the self lies the key to flow activities. A simple diagram might help explain why this should be the case… The two theoretically most important dimensions of the experience, challenge and skills, are represented on the two axes of the diagram… Neither boredom nor anxiety is positive experiences… One cannot enjoy doing the same thing at the same level for long. We grow either bored or frustrated; and then the desire to enjoy ourselves again pushes us to stretch our skills, or to discover new opportunities for using them." (Pp. 74-75)*

[8 (3 9)] Darr, Asaf (2006) Selling Technology: The Changing Shape of Sales in an Information Economy. Cornell University Press, Ithaca. NY. *"The emergence of the service economy has been a defining feature of advanced industrial societies. Citizens in the United States and Europe are increasingly producing and consuming services rather than industrial goods, which dominated the economy for most of the twentieth century. The emerging service society is supported by the growing use of computers, and computer-mediated communication in our daily life and in the workplace…As part of the current transformation, sales work has become increasingly important, and the number of people working in sales occupations has grown steadily. Between 1950 and 1991, the percentage of those involved in sales work grew from 7 to 12 percent of the U.S. labor force (Barley and Orr 1997, 3). This rate of expansion was second only to the growth of professional and technical occupations." (Pg. 1).*

[2 (5 15)] Davis, Mark M. and Janelle Heineke (2005) Operations Management: Integrating Manufacturing and Services. Fifth Edition. McGraw-Hill Irwin. Boston, MA. *"The day-to-day activities within the operations management function focus on adding value for the organization through its transforming process…" (Pg. 7); "Operations research (OR) brings together practitioners in such diverse fields as mathematics, psychology, and economics. Specialists in these disciplines customarily form a team to structure and analyze a problem in quantitative terms so that a mathematically optimal solution can be obtained. Operations research, or its approximate synonym management science, now provides any of the sophisticated quantitative tools that are used today in operations management as well as in other business disciplines." (Pg. 21)*

[12 (4 8 10)] Dawson, Ross (2005) Developing Knowledge-Based Client Relationships: Leadership in Professional Services. Elsevier. New York, NY. *"Knowledge and relationships are where almost all the value resides in today's economy… Nowhere is this more evident than in the world of professional services. The job of professionals is to apply deep specialist knowledge within client relationships. Their expertise is becoming even more valuable as business, technology, and society grow more complex. Yet they still face intense pressures of commoditization. Client sophistication, price pressures, global sourcing, and easy access to information are just some of the forces making professional services more competitive… An entire management discipline – knowledge management – has arisen to understand how to leverage the value of knowledge in organizations. The field has many problems, not least its name… It is important to remember that both knowledge and relationships are ultimately about people. Only people have knowledge, and all high-value relationships are based on individuals interacting. As such, developing knowledge-based client relationships must be based on understanding how people acquire and create knowledge, and how people can learn to exchange and develop knowledge together more effectively." (Pp xi-xii)*

[10 (3)] Deacon, Terrence W. (1997) The Symbolic Species: The Co-Evolution of Language and the Brain. Norton. New York, NY. *"Though we share the same earth with millions of kinds of creatures, we also live in a world that no other species has access to. We inhabit a world full of abstractions, impossibilities, and paradoxes. We alone brood over what didn't happen, and spend a large part of*

each day musing about the way things could have been if events had transpired differently. And we alone ponder what it would be like not to be. In what other species could individuals ever be troubled by the fact that they do not recall the way things were before they were born and will not know what will occur after they die? We tell stories about our real experiences and invent stories about imagined ones, and we even make use of these stories to organize our lives. In a real sense, we live our lives in this shared virtual world." (Pp. 21-22); "Languages are under powerful selection pressures to fit children's likely guesses, because children are the vehicle by which a language gets reproduced." (Pg. 109); "Brain evolution takes place on geological time scales. Even slight changes probably take hundreds of thousands of years to become widely represented in a species, and the basic architecture of brains has been remarkably conserved since the origins of vertebrates. Languages, on the other hand, can become unrecognizably different within a few thousand years. Language evolution is probably a thousand times more rapid than brain evolution. Such a vast difference in evolutionary mobility suggests that we may have assumed the wrong half of the evolutionary equation contained the critical variable." (Pg. 110)

[3 (12)] Diamond, Jared (2005) Collapse: How Societies Choose to Fail or Succeed. Viking. New York, NY. "*What I'm going to propose instead is a road map of factors contributing to failures of group decision-making. I'll divide the factors into a fuzzily delineated sequence of four categories. First of all, a group may fail to anticipate a problem before the problem actually arrives. Second, when the problem does arrive, the group may fail to perceive it. Then, after they perceive it, they may fail even to try to solve it. Finally, they may try to solve it but may fail to succeed. While all this discussion of reasons for failure and societal collapse may seem depressing, the flip side is a heartening subject: namely, successful decision-making. Perhaps if we understood the reasons why groups often make bad decisions, we could use that knowledge as a checklist to guide groups to make good decisions." (Pg. 421); "Most environmental problems involve detailed uncertainties that are legitimate subjects for debate. In addition, however, there are many reasons that are commonly advanced to dismiss the importance… 'The environment has to be balanced against the economy.' 'Technology will solve our problems.' 'If we exhaust one resource, we can always switch to some other resource meeting the same need.' 'There really isn't a world food problem; there is already enough food; we only need to solve the transportation problem of distributing that food to places that need it.' (The same thing could be said of energy.) 'As measured by commonsense indicators such as human lifespan, health, wealth (in economists' terms, per capita gross national product or GDP), conditions have actually been getting better for many decades.' 'Look at how many times in the past the gloom-and-doom predictions of the fearmongering environmentalists have proved wrong. Why should we believe them this time?' 'The population crisis is already solving itself, because the rate of increase of the world's population is decreasing, such that world population will level off at less than double it present level.' 'The world can accommodate more human population growth indefinitely. The more people, the better, because more people mean more inventions and ultimately more wealth.' 'Environmental concerns are a luxury affordable just by affluent First World yuppies, who have no business telling desperate Third World citizens what they should be doing.' 'If those environmental problems become desperate, it will be at some time far off in the future, after I die, and I can't take them seriously.' 'There are big differences between modern societies and those past societies… who collapsed, so that we can't straightforwardly apply lessons from the past.' 'What can I, as an individual do, when the world is really being shaped by unstoppable powerful juggernauts of governments and big business?'" (Pp. 503-514)*

[12 (3)] Drucker, Peter F. (1993) Post-Capitalist Society. Harper Business. New York, NY. "*The basic economic resource... …is and will be knowledge… Value is now created by 'productivity' and 'innovation,' both applications of knowledge to work. The leading social groups of the knowledge society will be 'knowledge workers'… The economic challenge of the post-capitalist society will therefore be the productivity of knowledge work and the knowledge worker. The social challenge of the post-capitalist society will, however, be the dignity of the second class in the post-capitalist society: the service workers. Service workers, as a rule, lack the necessary education to be knowledge workers. And in every country, even the most highly advanced once, the will continue to be a majority." (Pg. 8); "Work has been around as long as human beings. All animals in fact have to work for their living… The application of knowledge to work explosively increased productivity… Half of this additional productivity has been taken in the form of increased purchasing power; in other words, in the form of higher standard of living… And knowledge in this new sense means knowledge as a utility, knowledge as the means to obtain social and economic results… Supplying knowledge to find out how existing knowledge can best be applied to produce results is, in effect, what we mean by management. But knowledge is now also being applied systematically and purposefully to define what new knowledge is needed, whether it is feasible, and what has to be done to make knowledge effective. It is being applied, in other words, to systematic innovation... We have moved from knowledge in the singular to knowledges in the plural… The knowledge we now consider knowledge proves itself in action. What we now mean by knowledge is information effective in action, information focused on results." (Pp. 33-46); "An organization is a human group, composed of specialists working together on a common task. Unlike society, community, or family – the traditional social aggregates – organization is purposefully designed and grounded neither in psychological nature of human beings nor in biological necessity. Yet, while a human creation, it is meant to endure – not perhaps forever, but for a considerable period of time." (Pg. 49); "Knowledges by themselves are sterile. They become productive only if welded together into a single, unified knowledge. To make this possible is the task of organization, the reason for its existence, its function." (Pg. 51); "There is still another reason why so little attention has so far been paid to organizations. Armies, churches, universities, hospitals, businesses, labor unions have all been seen, studied,*

analyzed for a long time and in great detail. But each of them has been treated as unique and sui generis… Only recently has it been realized that they all belong to the same species; they are all 'organizations.' They are the man-made environment, the 'social ecology'… It is neither 'community' nor 'society' nor 'class' nor 'family,' the modern integrators which social scientist understand. But it is also not 'clan' or 'tribe' or 'kinship group,' nor any of the other integrators of traditional society known and studied by anthropologists, ethnographers, and sociologists. Organization is something new and distinct. But what is it?" (Pp. 52-53); "One implication: every organization of today has to build into its very structure the management of change." (Pg. 59); "But while the world economy will remain a market economy and retain the market institutions, its substance has been radically changed. If it is still 'capitalist,' it is now dominated by 'information capitalism.' The industries that have moved into the center of the economy in the last forty years have as their business the production and distribution of knowledge and information, rather than the production and distribution of things." (Pg. 182); "The Economics of Knowledge: How knowledge behaves as an economic resource, we do not yet fully understand; we have not had enough experience to formulate a theory and to test it. We can only say so far that we need such a theory. We need an economic theory that puts knowledge into the center of the wealth-producing process. Such a theory alone can explain the present economy. It alone can explain economic growth. It alone can explain innovation… It alone can explain the newcomers, especially in high-tech fields, can almost overnight, sweep the market and drive out the competitors, no matter how well entrenched they are… So far, there are no signs of an Adam Smith or a David Ricardo of knowledge. But the first studies of the economic behavior of knowledge have begun to appear." (Pp. 183-184); "The Educated Person:… Knowledge is not impersonal, like money. Knowledge does not reside in a book, a databank, a software program; they contain only information. Knowledge is always embodied in a person; carried by a person; created, augmented, or improved by a person; used or misused by a person. The shift to the knowledge society therefore puts the person in the center. In so doing it raises new challenges, new issues, new and quite unprecedented questions about the knowledge society's representative, the educated person… He or she defines society's performance capacity… The knowledge society must have at its core the concept of the educated person. It will have to be a universal concept, precisely because the knowledge society is a society of knowledges and because it is global – in its money, its economics, its careers, its technology, its central issues, and above all, in its information… The educated person we need will have to be able to appreciate other cultures and traditions… Tomorrow's educated person will have to be prepared for life in a global world… He or she will have to be a 'citizen of the world' – in vision, horizon, information. But he or she will also have to draw nourishment from their local roots, and in turn, enrich and nourish their own local culture. Post-capitalist society is both a knowledge society and a society of organizations, each dependent on the other and yet each very different in its concepts, views, and values. Most, if not all, educated persons will practice their knowledge as members of an organization… We neither need nor will get 'polymaths' who are at home in many knowledges; in fact, we will probably become even more specialized. But what we do need – and what will define the educated person in the knowledge society – is the ability to understand the various knowledges. What is each about? What is it trying to do? What are the central concerns and theories? What major new insights has it produced? What are its important areas of ignorance, its problems, its challenges? Without such understanding, the knowledges themselves will become sterile, will indeed cease to be 'knowledges.' They will become intellectually arrogant and unproductive. For the major new insights in every one of the specialized knowledges arise out of another, separate specialty, out of another one of the knowledges." (Pp. 210-217);

[3 (8)] Durkheim, Emile (1893/1997) The Division of Labor in Society. Free Press. New York, NY. *"Although division of labour is not of recent origins, it was only at the end of the last century that societies began to become aware of this law, to which up to then they had submitted almost unwittingly… Yet Adam Smith was the first to attempt to elaborate a theory of it… Nowadays the phenomenon has become so widespread that it catches everyone's attention. We can no longer be under any illusion about the trends in industry. It involves increasingly powerful mechanisms, large-scale groupings of power and capital, and consequently an extreme division of labour… Yet the division of labour is not peculiar to economic life. We can observe its increasing influence in the most diverse sectors of society. Functions, whether political, administrative or judicial, are becoming more and more specialized. The same is true of the arts and the sciences. The time lies far behind when philosophy constituted the sole science. It has become fragmented into a host of special disciplines, each having its purpose, methods, and ethos." (Pg. 1-2)*

[1 (10 15)] Fagin, Ronald, Joseph Y. Halpern, Yoram Moses, and Moshe Y. Vardi (2003) Reasoning About Knowledge. MIT Press. Cambridge, MA. *"A number of states of knowledge arise naturally in a multi-agent situation that do not arise in the one-agent case. We are often interested in situations in which everyone in the group knows a fact… Finally, common knowledge also turns out to be a prerequisite for achieving agreement. This is precisely what makes it such a crucial notion in the analysis of interacting agents. At the other end of the spectrum from common knowledge is distributed knowledge… While common knowledge can be viewed as what 'any fool' knows, distributed knowledge can be viewed as what a 'wise man' – one who has complete knowledge of what each member of the group knows – would know." (Pp. 2-3). "…our framework for modeling knowledge is based on possible worlds. The intuitive idea behind the possible worlds model is that besides the true state of affairs, there are a number of other possible states of affairs, or 'worlds.' Given his current information, an agent may not be able to tell which of a number of possible worlds describes the actual state of affairs." (Pg. 15).*

[2 (5 12 15)] Fitzsimmons, J. A. and M. J. Fitzsimmons (2007) Service management: Operations, Strategy, Information Technology, sixth edition, McGraw-Hill Irwin, New York, NY. *"Ernst Engel, a Prussian statistician of the 19th century, observed that as family incomes increase, the percentage spent on food and durables drops while consumption of services that reflect a desire for a more enriched life increases correspondingly." (Pg. 8)*

[10 (6 11)] Foster, I., C. Kesselman, and S. Tuecke (2001) The Anatomy of the Grid: Enabling Scalable Virtual Organizations. International J. Supercomputer Applications, 15(3).

[14 (13)] Freidson, Eliot (2001) Professionalism: The Third Logic/On the Practice of Knowledge. University of Chicago Press. Chicago, IL. *"Imagine a world in which we are free to buy and sell anything we choose, individually competing with each other to buy at the lowest possible price and sell for the highest possible price… Now imagine a different world in which the production and distribution of goods and services are planned and controlled by the administration of large organizations… Finally, imagine a third world in which those workers who have the specialized knowledge that allows them to provide especially important services have the power to organize and control their own work… They represent three logics. But while two of them are quite familiar and well worked out in theory, the third, which I call professionalism, is not. In this book I will spell out that third logic, showing it to be a set of interconnected institutions providing the economic support and social organization that sustains the occupational control of work. I will do so by systematically contrasting it with the other two, more familiar logics, treating all three as pipe-dreams or, put more academically, as ideal types." (Pp. 1-2)*

[3 (12)] Friedman, Dan (1996/2007) A little manifesto on Learning and Economics. URL http://leeps.ucsc.edu/leeps/manifesto. *"Evolutionary processes provide a complementary approach that promises to remedy the deficiencies in the equilibrium/optimization approach and to re-unify economics with its sister social sciences. Evolutionary processes operate on three distinct time scales. Individual learning is the most rapid. Given facilitating market and other social institutions, learning will rapidly and reliably produce outcomes close to equilibrium. Thus utility maximization and equilibrium should be thought of as the end result of a learning dynamic shaped by efficient social institutions. Unfortunately, social institutions evolve on a slower time scale and not always towards the efficient institutions. Our basic human nature as social creatures shapes the evolution of our institutions, and it in turn is subject to the slow force of genetic evolution. Thus the optimization/equilibrium approach will not always offer a reasonable approximation to actual outcomes."*

[11 (3)] Friedman, T.L. (2005) The World is Flat, Farrar Straus & Giroux.

[9 (2)] Ganz, Walter (2006) Germany: service engineering. Commun. ACM 49(7): 79 (2006)

[3 (5 7)] Gadrey, J. and F. Gallouj (2002) Productivity, Innovation and Knowledge in Services: New Economic & Socio-Economic Approaches, Edward Elgar Cheltenham, U.K. *"But the crucial point for the current topic is that innovative activity is fundamentally a service activity." (Pg. xii); "What I may refer to as the 'within services' part of the paradox is the long-held (and not altogether correct) perception that the services are the home to activities in which productivity growth is particularly slow – the productivity-stagnant sectors of the economy… All this seems to be a convincing case, until we look a bit further and note the profound changes in the quality of the services supplied. A twenty-first century doctor may not have many labour saving devices inventions at his/her disposal and may spend as much time per patient as a doctor in the eighteenth century, but the former may well save the patient's life will the latter was very likely to shorten it." (Pg. xiii); "By the end of the twentieth century, the developed economies had been characterized, variously, as information economies, knowledge economies, post-industrial economics, and, more recently, 'new economies'. In strictly factual terms, however, the characteristic that leaps most noticeably to the eye is the strong and sustained growth over recent decades of the share of services in the employment and in the nominal GDP." (Pg. xv); "A more complex definition, which is more useful for our present purpose, was given by Peter Hill in 1977. It says that 'A service may be defined as a change in the conditions of a person or a good belonging to some economic unity, which is brought about as the result of activity of some other economic unit with the prior agreement of the former person or economic unit' (Hill, 1977). It is this kind of approach, whose merit is first to consider a service as a process, and second to distinguish the economic units involved in this process, that we are going to develop." (Pg. 41); "In the future, the main issue will probably not be how to improve productivity measurement in order to get the acceptable single indicator of productivity. Rather it is likely to be how to go beyond a simplistic concept and correspondingly simplistic measures in order to observe, first, the operational efficiency in the provision of service (recognizing complexity and intensity changes), and second, the indirect results (or outcomes) of the transformation under study." (Pg. 50); "'Between 1921 and 1938 industrial research personnel rose by 300%...' Surely, there is no more dramatic case than that of the Great Depression to test (and reject) the proposition that weakness in aggregate demand invariably handicaps innovative activities. A plausible explanation of Fano's observation, which I believe to be the key to the story, is cost. The Great Depression was a period in which the earnings of scientists, engineers, and technicians were extremely low." (Pg. 152)*

[14 (10 11)] Garud, Raghu, Arun Kumaraswamy, and Richard N. Langlois (2003) Managing in the Modular Age: Architectures, Networks, and Organizations. Blackwell Publishing. New York, NY. *"The world is full of complex systems. Nature provides an abundance of complex organisms and ecosystems, and humans have constructed complex mechanical, intellectual, organizational, and social systems… Complexity is thus a matter both of the sheer number of distinct parts the system comprises and of the*

nature of the interactions among those parts." (Pg. 1); "…modularity facilitates the retention and reuse of system parts and enhances the speed, scope, and reach of innovation." (Pg. 2); "There is no doubt we are living in a modular age. Even as we embrace modularity and its virtues, we are also gaining an understanding of systems such as the brain the depart from the 'near decomposability.' We are beginning to appreciate broader uses related to the harnessing and exploitation of modularity." (Pg. 8)

[3 (8)] Gershuny, Jonathan (2000) Changing Times: Work and Leisure in Postindustrial Society. Oxford University Press. Oxford, UK. *"Each of these activities – the paid work, the unpaid work, and the consumption – is a distinct category of time use. So if we can measure how the members of a society spend their time, we have the elements of a certain sort of account of how that society works. And if we can make these sorts of measurements repeatedly, at different stages in the history of society, then we will have the basis for a developmental account of social and economic change." (Pg. 1)*

[9 (8)] Gilbert, Thomas F. (1978) Human Competence: Engineering Worthy Performance. McGraw Hill. New York, NY. *"Human competence is a function of worthy performance (W), which is a function of the ratio of valuable accomplishments (A) to costly behavior (B)." (Pg. 18); "Typical competence is inversely proportional to the potential for improving performance (the PIP), which is the ratio of exemplary performance to typical performance. The ratio, to be meaningful, must be stated for an identifiable accomplishment, because there is no 'general quality of competence.' In shorthand, this theorem states that: $PIP=W_{es}/W_t$" (Pg. 30); "PIPS I HAVE KNOWN: How big are PIPs , and what do they mean… My figures are not exact, but here are some PIPs I have observed: Insurance sales by salesperson 14, Packaging machine production 2.5, Reading teachers 10, ... Filling a cosmetics order (accuracy) 1.2" (Pp. 42-43)*

[10 (9 15)] Glushko, Robert and Tim McGrath (2005) Document Engineering: Analyzing and Designing Documents for Business Informatics and Web Services. MIT Press, Cambridge, MA. *"Document Engineering synthesizes the complementary ideas from these separate fields [information and systems analysis, electronic publishing, business process analysis and business informatics, and user-centered design], emphasizing what they have in common and applying it with a unified focus to broad range of documents and processes." (Pg. 28)*

[11 (14)] Goldratt, Eliyahu M. (1990) Theory of Constraints. North River Press. Great Barrington, MA. *"It is almost a consensus today that since we are dealing with so many unknowns in an organization that this field will never be a science. The unpredictable reaction of the market, the unknown actions of our direct and indirect competitors, the changing reliability of vendors – not to mention the constant steam of internal 'surprises' – all combine to defeat any attempt to approach the subject a 'scientific' way. Some – and they are certainly not a small group – even claim that since organizations comprise human beings whose reactions cannot be scientifically predicted, it is an absurdity to hope that the subject of managing an organization can be turned into a science… This muddled view stems from the fact that various sciences did not spring up as fully developed subjects. Rather each science has gone through three quite distinct and radically different stages of development… The three distinct phases that every science has gone through are: classification, correlation, and Effect-Cause-Effect." (Pg. 23)*

[2 (3 4 5 6 7 8 9 12)] Guba, Egon G. and Yvona S. Lincoln (1989) Fourth Generation Evaluation. Sage. London, UK *"We have called this new approach fourth generation evaluation to signal our construction that this form moves beyond previously existing generations, characterizable as measurement-oriented, description-oriented, and judgment-oriented, to a new level whose key dynamic is negotiation." (Pg. 8); "The premises of the scientific method were themselves siren songs, since they seem so self-evidently true. There is an objective reality 'out there' that goes on about its business regardless of our interest in it; this reality operates according to certain immutable natural laws. It is the business of science to describe that reality and to uncover those laws. Once this is done, science can be used to exploit nature to humankind's advantage; we become able to predict and control at will." (Pp. 35-36); "Surely, this effort to derive general truths through context-stripping (control) is one of the reasons why evaluations are so often found to be irrelevant at the local level, leading to the much lamented nonuse of evaluation findings about which we, as a profession, seem so fond of complaining." (Pp. 36-27); "Responsive evaluation has its advance organizer as well: the claims, concerns, and issues about the evaluand that are identified by stakeholders, that is, people or groups that are put at some risk by the evaluation. A claim is any assertion that a stakeholder may introduce that is favorable to the evaluand… A concern is any assertion that a stakeholder may introduce that is unfavorable to the evaluand… An issue is any state of affairs about which reasonable persons may disagree… Different stakeholders will harbor different claims, concerns, and issues; it is the task of the evaluator to ferret these out and to address them in the evaluation. There are always many different stakeholders. …we identified three broad classes, each with some subtypes: 1. The agents, those persons involved in producing, using, implementing the evaluand… 2. The beneficiaries, those persons who profit in some way from the use of the evaluand… 3. The victims, those persons who are negatively affected by the use of the evaluand…" (Pp. 39-41)*

[9 (6)] Guile, Bruce R. and James Bryant Quinn (1988) Technology in Services: Policies for Growth, Trade, and Employment. National Academy Press, Washington, DC. *"Value-added services… infrastructure services… manufacturing (services inside company)… distribution services… personal services.. consumer (self service)… business services… government services…" (Pg. 214)*

[4 (12)] Gummesson, Evert (2007) Exit Services Marketing – Enter Service Marketing. *The Journal of Customer Behaviour,* Vol. 6, No. 2, pp. 113-141.

[7 (12)] Gustafsson, Anders and Johnson, Michael D. (2003) Competing in a Service Economy: How to Create Competitive Advantage Through Service Development and Innovation. Wiley/Jossey-Bass. San Francisco, CA. *"Service innovation is more than just asking customers what they want. It's an explicit process of deciding where to direct your energy, immersing yourselves in your customers' lives, and working with customers to generate, design, and test new ideas." (Pg. 144) "We began this saga with a simple observation: economies are more service based than ever! Competitive forces continue to push you to provide customers with more than just product value. Increasingly it's service value, solutions, and experiences that differentiate competitors. Whether you are managing a traditional service organization or a manufacturing firm, competing through services has become a way of life." (Pg. 147)*

[12 (3 4 8 11)] Gutek, Barbara and Welsh, Theresa, (2000) The Brave New Service Strategy – Aligning Customer Relationships, Market Strategies, and Business Structure, AMACOM, New York, NY.

[1 (3 4 8 10 11 12 15)] Gutek, Barbara A. (1995) The Dynamics of Service: Reflections on the Changing Nature of Customer/Provider Interactions. Jossey-Bass Publishers. San Francico, CA. *"Today, in a post-industrial, consumption-oriented society, many of us spend much of our waking time either working as a provider of goods and services to others (that is, in a formal 'provider' role) or buying goods and services from others (that is, in a formal 'customer' role). In doing so, what kind of life are we creating for ourselves? This book addresses broadly these topics through a fresh look at interactions between people who provide goods and services and their customers. In 'The Dynamics of Service,' I describe the two fundamental social mechanisms by which providers deliver services of goods to customers. I call these relationships and encounters. Relationships happen in the context of an ongoing series of transactions in which a particular service provider and particular customer become known to each other and expect continued interaction in the future. In encounters, by contrast, each service interaction is complete in itself, and service providers are, in the eyes of both customers and providers, interchangeable. Relationships and encounters not only describe the two fundamental ways service goods are delivered but, at a broader level, they represent two basic forms of social interaction, exchanges between strangers and ongoing exchanges between people known to each other." (Pp. xvii-xviii); "A service revolution, a cornerstone of the postindustrial society described by Daniel Bell in the 1970s, is in full swing in America. Almost three-quarters of people in the labor force work in services, almost half of family income is spent on services, and providing good service is widely believe to be a, or the, key to effectiveness of all organizations – government, not-for-profit, and for-profit. At the heart of service is a special kind of interaction between customer and provider of the service – an interaction that usually involves the exchange of money for service or goods." (Pg. 1); "Most adults today enact the role of customer many times a week, whenever services or goods are obtained. We typically act as customers both in our work and outside it. At work, we may be the recipient of secretarial services, laboratory services, library services, computer assistance, training, or travel help… The service revolution has two aspects. One aspect is the sheer increase in number, amount, and availability of services… The second aspect of the service revolution is a change in the structure of service providing. Traditionally, most service providers were independent practitioners who, if they were successful, gradually developed a growing clientele. Over time, however, more and more services have been offered through organizations rather than by independent practioners…" (Pp. 2-3): "Towards the end of the nineteenth century, Ferdinand Toennies ([1887] 1957) contended that industrial societies were undergoing a major shift. Toennies observed that traditional societies had been characterized by Gemeinschaft, meaning that they were held together by feelings and a sense of community, while industrial societies were characterized by Gesellschaft, meaning that they were held together by instrumental objectives. Under Gemeinschaft, people interact with each other as personalities, not just as role occupants." (Pg. 259); "Relationships have a number of other important features. For one, by nature they increase in efficiency over time, due primarily to the history of shared interactions that gradually builds… Relationships are self-limiting systems. Because they are labor-intensive and a provider can handle only so many customers at once…" (Pg. 281); "Encounters are quite different from relationships. Encounters occur between two strangers who are essentially anonymous, known to each other only by the role each plays." (Pg. 282)*

[12 (8 11)] Handy, Charles (1989) The Age of Unreason. Harvard Business School Press. Cambridge, MA. *"While in Shaw's day, perhaps, most men were reasonable, we are now entering an Age of Unreason, when the future, in so many areas, is there to be shaped, by us and for us – a time when the only prediction that will hold true is that no predictions will hold true; a time, therefore for bold imaginings in private life as well as public, for thinking the unlikely and doing the unreasonable." (Pg. 5); "Already, the linguistic signposts are going up. The Third Age, the age of living, as the French would have it, which follows the first age of learning and the second of working, is already becoming a common term." (Pg. 43); "A move towards knowledge-based organizations: The end of labor-intensive manufacturing leaves us with organizations which receive their added value from knowledge and the creativity hey put in rather than the muscle power. Fewer people, thinking better, helped by clever machines and computers, add more value than gangs or lines of unthinking 'human resources.'… A move toward service: Paradoxically, rich societies seem to breed dependency. If you are poor, you are forced into self sufficiency. As you get rich, it is easier and more sensible to get other people to do what you do not want to do or cannot do, be if fixing the roof or digging in the garden… Like knowledge-based organizations we contract out everything*

we are not good at and so breed a raft of services on which we depend." (Pg. 52-53)

[14 (3 8 11)] Hawley, Amos H. (1986) Human Ecology: A Theoretical Essay. University of Chicago Press. Chicago, IL. *"The meaning of human ecology may now be stated as a paradigm composed of three propositions. They are: (1) adaptation proceeds through the formation of interdependences among the members of the population; (2) system development continues, ceteris paribus, to the maximum size and complexity afforded by the technology for transportation and communication possessed by the populations; (3) system development is resumed with the acquisition of new information that increases the capacity for the movement of materials, people, and messages and continues until the enlarged capacity is fully utilized. These may be characterized as the adaptive, the growth, and the evolution proposition, respectively." (Pg. 7); "In short, functions are identifiable as such where activities have been subdivided and allocated to separate units." (Pg. 33)*

[5 (2)] Heizer, Jay and Barry Render (2004) Principles of Operations Management. Pearson Education. Upper Saddle Creek, NJ. "*Production is the creation of goods and services. Operation Management (OM) is the set of activities that create value in the form of goods and services by transforming inputs to outputs. Activities creating goods and services take place in all organizations… To create goods and services, all organization perform three functions (see Figure 1.1). These functions are the necessary ingredients not only for production but also for an organizations survival. They are: 1. Marketing, which generates the demand, or at least takes the order for a product or service (nothing happens until there is a sale). 2. Production/operations, which creates the product. 3. Finance/accounting, which tracks how well the organization is doing, pays the bills, and collects the money. Universities, churches or synagogues, and business all perform these functions." (Pg 4); "The management process consists of planning, organizing, staffing, leading, and controlling." (Pg 6)*

[3 (5)] Helpman, Elhanan (2004) The Mystery of Economic Growth. Harvard University Press. Cambridge, MA. *"To summarize, average income per capita has grown significantly since World War II, and at a high rate by historical standards. Growth rates have been uneven, however, and the disparity in income per capita between rich and poor countries has increased. In order to understand these developments we need to identify the forces of convergence, which have induced [some] countries with low income per capita to catch up with the rich countries, and forces of divergence, which have induced rich countries to forge even further ahead of the poor countries." (pp. 7-8); "Macroeconomists have emphasized the accumulation of physical and human capital as major forces behind income growth. Physical capital consists of stocks of machines, equipment, and structures, while human capital consists of the stock of education and training embodied in the labor force." (Pg. 9); "The private return on institutional features, such as length of patent protection, the coverage of trademark protection, the efficacy with which the legal system protects intellectual property rights, and the nature of the regulatory framework within which business firms operate. Be this as it may, no system provides full protection. As a result, some useful knowledge that is generated in the course of inventive activities within one firm becomes available to others." (Pg 44); "…a larger capital stock deteriorates the terms of trade of a country that exports capital-intensive products but improves the terms of trade of a country that exports labor-intensive products." (Pg. 60); "The outcome depends on the size of the countries, their intrinsic productivity levels, and their speeds of learning." (Pg 63); "Improvements in the organization of trade, or more generally in the organization of economic activities, are every bit as important as improvements in technology." (Pg. 118)*

[8 (2 11)] Heritage, John (1984/989) Garfinkel and Enthnomethodology. Polity Press. Cambridge, UK. "The work itself is self-consciously revolutionary, *demanding the abandonment of a range of widely held sociological assumptions before its message can be perceived fully." (Pg. 2); "The net result was an assimilation of a range of perspectives – symbolic interaction, labeling theory, the phenomenological analyses of Berger and Luckmann, and the ethnomethodology – into a single category: the 'sociology of everyday life'." (Pg. 3); "…Garfinkel's significance as a sociologist does not arise from the encyclopedic range of his investigations nor from any attempt at large scale theoretical synthesis. Rather it derives from his sustained attack on a narrow range of problems which have preoccupied him throughout an intellectual career spanning nearly forty years. These problems – the theory of action, the nature of intersubjectivity and the social constitution of knowledge – have been central areas of investigation throughout the history of the discipline and ,in their various aspects, have persistently concerned it most distinguished practitioners." (Pg. 3); "The term 'ethnomethodology' thus refers to the study of a particular subject matter: the body of common-sense knowledge and the range of procedures and considerations by means of which the ordinary members of society make sense of, find their way about in, and act on the circumstances in which they find themselves." (Pg. 4)*

[3 (6 12)] Herzenberg, Stephen A, John A. Alic, and Howard Wial (2000) New Rules for a New Economy: Employment and Opportunity in Postindustrial America (ILR Press Books). Cornell University Press. Ithaca, NY. "*Our central conclusion is that too many policies still reflect the old manufacturing-centered economy. For this reason, they often fail to address the needs of today's workforce, while impeding the ability of businesses to respond to rapidly changing, uncertain markets." (Pg. xi); "Public policy affects economic outcomes not only directly but indirectly through its influence on work systems, business organization, and career paths." (Pg. 9); "Four work systems: Tightly constrained (telephone operators, fast food workers); Unrationalized labor intensive (janitors, security guards); Semiautonomous (supervisors, flight attendants, office*

mangers); High-skill autonomous (physicians, electricians, teachers).” (Pg. 10)

[2 (12)] Heskett, James L., Sasser Jr., W. Earl, and Schlesinger, Leonard A. (1997) The Service Profit Chain, The Free Press, New York, NY. *“In part as a reaction to the repeated stories that we got tired of hearing and the frustrated managers who got tired of trying to apply the advice they were supposed to illustrate, we sought to understand why some service organizations succeed year-in and year-out. In addition to collecting lore and listening to countless stories emanating from outstanding service organizations, we did a risk and audacious thing. We started to collect data. Our work has grown a data base comprising inputs from several dozen well-known service organizations operating in a number of different competitive markets. In addition to seeking facts, we developed measurements and began looking for relationships in our data that could shed light on ways of achieving service excellence and organizational success… This book is a record of our odyssey, the fact-based insights it has yielded for managers, and the translation of those insights into action in outstanding service organizations. We came to these conclusions from three very different directions… Heskett and the Strategic Service Vision… Sasser and Customer Loyalty… Schlesinger and Determinants of Employee and Customer Loyalty.” (Pp. 7-10); “Simply stated, service profit chain thinking maintains that there are direct and strong relationships between profit; growth; customer loyalty; customer satisfaction; the value of goods and services delivered to customers; and employee capabilities, satisfaction, loyalty, and productivity… Notice that market share is not mentioned in these relationships. In few industries studied by Sasser and Reichheld was market share a more important predictor of profitability than customer loyalty.” (Pg. 11)*

[1 (10)] Hidaka, Kazuyoshi (2006) Trends in services sciences in Japan and abroad. Science & Technology Trends: Quarterly Review. 19. April. 35-47.

[4 (7)] Honebein, Peter C. and Roy F. Cammarano (2005) Creating Do-It-Yourself Customers: How Great Customer Experiences Build Great Companies. Thomson. Mason, OH. *“Customer performance is the sum of customer actions before, during, and after a sale that unlock value embedded in goods and services. Customers who can quickly find a product in a grocery store save time. Those who can use airline self-check-in avoid long lines and time-wasting delays, as well as reduce the need for airline agents.” (Pg. viii); “The next frontier for organizational efficiency is the pursuit of customer value driven by customer behavior. For the past 30 years, we have seen organizations improve their efficiency with strategies that aim to improve internal operations, such as total quality management, Six igma, and reengineering. The age of outward-looking, customer-focused strategies is upon us.” (Pg. ix); “The rise of the sophisticated customer is a call to action for companies intent on establishing or maintaining their competitive advantage. It explains why companies and customers alike should strive for designing experience that create do-it-yourself customers and maximize customer performance. Sophisticated customers acquire the most value from products and offer companies the highest profit, the most customer equity, and the greatest lifetime value.” (Pg. 1); “A novel concept in achieving desirable outcomes associated with coproduction and unlocking of value is to treat customers like employees.” (Pg. 13)*

[3 (12)] Hoopes, James (2003) False Prophets: The gurus Who Created Modern Management and Why Their Ideas are Bad for Business Today. Perseus Books. Cambridge, MA. *“Today’s ideas about flat organizations, self-directed teams, values-driven companies, and so forth have a lot of underlying assumptions, but one of the main ones is that there has been a quantum change in the nature of work. ‘Back when work was mostly a matter of brawn,’ the thinking goes, ‘work itself could be managed.’ But now ‘there is a sizeable knowledge or service component in most jobs. The most powerful sources of value are locked in people’s heads, and in their hearts.” (Pg. xxvi)*

[5 (2 14)] Hopp, William J. and Mark L. Spearman (1996) Factory Physics: Foundations of Manufacturing Management. Irwin McGraw-Hill. Boston. *“Briefly, factory physics is a systematic description of the underlying behavior of manufacturing systems. Understanding it enables managers and engineers to: 1. Identify opportunities for improving existing systems. 2. Design effective new systems with controls that are consistent with, not contrary to, their natural tendencies. 3. Make the tradeoffs needed to coordinate policies from disparate areas into an environment of continual improvement.” (Pg. 1); “In a broad sense, the term operations refers to the application of resources (capital, materials, technology, and human skills/knowledge) to the production of goods and services.” (Pg 4); “In this book, we emphasize a spirit of rational inquiry to seek a science of manufacturing by establishing basic concepts as building blocks, stating fundamental principles as ‘manufacturing law,’ and identifying general insights from specific practice.” (Pg. 7); “People are a critical element of any factory. Even in modern ‘lights out’ plants with highly automated machinery; people play a fundamental role in machine maintenance, material flow coordination, quality control, capacity planning, and so on.” (Pg. 336); Law 16 (Self Interest): People, not organizations, are self-optimizing… Law 17 (Individuality): People are different… Law 18 (Advocacy): For any program, there exists a champion who can make it work, at least for a while… Law 19 (Burnout): People get burned out… Law 20 (Responsibility): Responsibility without commensurate authority is demoralizing and counterproductive…” (Pp. 337-348)*

[14 (10)] Horn P. (2005) “The New Discipline of Services Science,” BusinessWeek, January 21, 2005.

[3 (1 11)] Hunt, Shelby D. (2000) A General Theory of Competition: Resources, Competences, Productivity, Economic Growth, Sage Publications Thousand Oaks, CA. *“…R-A theory defines resources as the tangible and intangible entities available to the firm that enable it to produce efficiently and/or effectively a market offering that*

has value for some market segment(s). Thus, as shown in Figure 5.1, resources can be categorized as financial (e.g., cash reserves and access to financial markets); physical (e.g., plant, raw materials, and equipment); legal (e.g., trademark and licenses); human (e.g., the skills and knowledge of individuals employees, including, importantly, their entrepreneurial skills); organizational (e.g., controls, routines, cultures, and competences – including, importantly, a competence for entrepreneurship); informational (e.g,, knowledge about markets segments, competitors, and technology); and relational (e.g., relationships with competitors, suppliers, and customers)." (Pp. 34-35); "Hayek (1948) points out that 'practically every individual has some advantage over all others because he possesses unique information of which beneficial use can be made only if the decisions depending on it are left to him or made with his active co-operation' (p. 80). … Because of resource immobility, resource heterogeneity can persist through time despite attempts by firms to acquire the same resources of particularly successful competitors." (Pg. 35); "For example, Nobel laureate Douglass North (1990) defines institutions as 'the humanly devised constraints that shape human interaction' (p. 3). He distinguishes between formal institutions (constitutional law, statutory law, and common law) from informal institutions (cultural constraints, such as customers, traditions, and codes of conduct) and he distinguishes institutions (rules of the game) from organizations (the major players of the game)." (Pg. 90); "Because deontological codes focus on specific actions or behaviors and teleological codes focus on consequences, the former stress the inherent rightness-wrongness of a behavior and the latter emphasize the amount of good or bad embodied in a behavior's consequences." (Pg. 119); "For R-A theory, the firm's primary objective is superior financial performance, which it pursues under conditions of imperfect and often costly to obtain information about extant and potential market segments, competitors, suppliers, shareholders, and production technologies. (Pg. 123); "There are two units of selection in R-A theory: firms and resources. Firms are viewed as combiners of heterogeneous and imperfectly mobile resources, under the conditions of imperfect and costly to obtain information, toward the primary objective of superior financial performance. Resources are the tangible and intangible entities available to the firm…" (Pg. 148); "Competition is a process of knowledge discovery." (Pg. 165)

[12 (2 9)] Huntzinger, James R. (2007) Lean Cost Management: Accounting for Lean by Establishing Flow. Ross Publishing. Fort Launerdale, FL. *"Economies of Scale: 'Economies of scale' can be defined as costs per unit falling as the speed and volume of output rise. It has become the mantra of industry throughout the twentieth century and continues today. The economies-of-scale mentality will work as long as output growth is consumed by the market, but as soon as the market slows too much, levels off, or declines, the success gained from scale economies rapidly fails. When this happens, two undesirable issues occur. The first problem is that managers are not trained to deal with this type of situation, other than applying plant closings, layoffs, and the like. Secondly, manufacturing systems were not designed for such a situation and cannot adjust to deal with markets slowing or shrinking. This is a two-front dilemma with which industry is continuing to struggle. As industry people slowly learn about lean principles, they work to try to adjust their enterprises, but it has been and continues to be an uphill battle." (Pp. 33-34); "All Parts at an Equal Cost: If we begin to implement the concepts mentioned above, the journey to achieving all parts at an equal cost at any volume can become closer to reality… The Sawtooth Graph Should Flatten: The only issue is that people are integer entities and not fractions. The meaning of this is that when balancing takt time, it may be necessary to change from four operators to 5.8 operators. Since 0.8 person does not exist, it would be necessary to man the line with six operators. This contributes to the sawtooth configuration of the cost-per-volume graph. But as a company becomes more skilled and experiences in lean principles, the impact of increasing costs per output becomes greatly diminished." (Pp. 38-39)*

[14 (10 11 12)] IBM Research (2004) "Services science: a new academic discipline?" A 120-page report of a two-day summit entitled Architecture of On-Demand Business, May 17-18, 2004.

[1 (14)] IfM and IBM. (2007). Succeeding through Service Innovation: A Discussion Paper. Cambridge, United Kingdom: University of Cambridge Institute for Manufacturing. ISBN: 978-1-902546-59-8.

[13 (7)] Johansson, Frans (2006) The Medici Effect: What Elephants and Epidemics Can Teach Us About Innovation. Harvard Business School Press. Boston, MA. *"The idea behind this book is simple: When you step into an intersection of fields, disciplines, or cultures, you can combine existing concepts into a large number of extraordinary new ideas. The name I have given this phenomenon, the Medici Effect, comes from a remarkable burst of creativity in the fifteen-century Italy." (Pg. 2); "When we say that the Brain Science Program sits at the intersection of mathematics and medicine, of computer science, and neurophysiology, what we are really saying is that the people in the program have managed to connect these fields, and through these connection they have come up with new creative insights. Individuals, teams, or organizations step into the Intersection by associating concept from one field with concepts from another. The Intersection, then, becomes a virtual Peter's Café, a place for widely different ideas to bump into and build upon each other." (Pg. 16)*

[14 (11)] Johnson, Steven (2001) Emergence: The connected lives of ants, brains, cities, and software. Scribner. New York, NY. *"'From its origins onward,' Lewis Mumford writes in his classic work The City in History, 'the city maybe described as a structure specially equipped to store and transmit the goods of civilization.' Preeminent among the 'goods' stored and transmitted by the city is invaluable material of information: current prices in the marketplace; laborsaving devices dreamed up by craftsmen; new remedies for disease." (Pg. 107)*

[3 (6 9 11 12)] Kessler, Andy (2005) How We Got Here: A Slightly Irreverent History of Technology and Markets. Harper Collins. New York, NY. *" Here is the part of the story that may sound familiar to today's technology business. With the flooded mines (market demand), Watt's condenser (technology), Boulton's money (capital), Parliament's patent (intellectual property rights), and Wilkinson's precise cylinders (technology), they had just about everything. What they were missing was a successful business model… So instead of selling steam engines, Boulton just traveled around to mines (and later mills and factories) and simply asked the miners how many horses they owned. Boulton and Watt would then install a steam engine, and charge one third of the annual cost of each horse it replaced…" (Pp. 25-26); "Augmenting often meant replacing, and helping those who remained. It also meant the creation of jobs elsewhere to create these tools." (Pg. 154)*

[9 (7 12)] Khalil, Tarek (2000) Management of Technology: The Key to Competitiveness and Wealth Creation. McGraw-Hill. Boston, MA. *"Technology has always been intertwined with society's progress but never before in history has technology been so visibly linked to improvements in standards of living… The enhancement of economic prosperity for countries, industries, and businesses depends upon the effective management of technology… Engineers, managers, scientists, and policy makers should be aware of the issues associated with the management of technology (MOT)… Although many of us have been educators of technology for many years, it was not until the late 1970s and early 1980s that we realized the need for education in MOT. The apparent loss of competitive advantage by many traditional dominant American industries during that period heightened the need for MOT education. The research conducted by U.S. scientists and the technology created by the nations engineers were still dominant, yet American competitive advantage in the marketplace declined. Japan and Germany reemerged as economic powers, and several Asian countries became fierce industrial competitors. American industry had a rude awakening to the global competition in technology and markets and was forced to change its business paradigms." (Pp. ix-xx); "Throughout human history, technology has had a profound effect on human development and on the progress of civilization. It took humans about 2 million years to develop from nomads foraging for food in east central Africa to agricultural settlers capable of augmenting their power with tools and domestic animals. This significant development ushered in the dawn of civilization… Technology can be defined as all the knowledge, products, processes, tools, methods, and systems employed in the creation of goods or in providing services." (Pg. 1); "Management of technology (MOT) is an interdisciplinary field that integrates science, engineering, and management knowledge and practice." (Pg. 7); "When the subject of creativity is discussed in the context of technological change, two closely related terms are frequently used: 'invention' and 'innovation.' Invention is either a concept or the creation of a novel technology. It could be a product, a process, or a previously unknown system… Innovation involves the creation of a product, service, or process that is new to an organization. It is the introduction into the marketplace, either by utilization or by commercialization, of a new product, service, or process. It does not have to be new to the world… Innovation can influence a product, a process, a service, or a system." (Pp. 32-34) "Some service industries, such as utilities, transportation, and communication, are capital-intensive; others, such as hospitals, consulting, and entertainment, are labor-intensive; and still others are technology-intensive, such as public utilities, airline travel, and communications. However, one thing is consistent: All service activities can use technology to add value to customers." (Pg. 409).*

[6 (12)] Kaufmann, D., A. Kraay, and M. Mastruzzi. 2003. Governance Matters III: Governance Indicators for 1996–2002. World Bank, World Bank Policy Research Working Paper 3106. Available at: http://www.worldbank.org/wbi/governance/pubs/govmatters2001.htm

[7 (12)] Kim, W. Chan and Renee Mauborgne (2005) Blue Ocean Strategy: How to Create Uncontested Market Space and Make the Competition Irrelevant. Harvard Business School Press. Boston, MA. *"New Market Space: Cirque du Soleil succeeded because it realized that to win in the future, companies must stop competing with each other. The only way to beat the competition is to stop trying to beat the competition. To understand what Cirque di Soleil has achieved, imagine a market universe composed of two sorts of oceans: red oceans and blue oceans. Red oceans represent all the industries in existence today. This is the know market space. Blue oceans denote all the industries not in existence today. This is the unknown market space. In the red oceans, industry boundaries are defined and accepted, and the competitive rules of the game are known. Here companies try to outperform their rivals to grab a greater share of existing demand. As the market space gets crowded, prospects for profits and growth are reduced. Products become commodities, and the cutthroat competition turns the red ocean bloody. Blue oceans, in contrast, are defined by untapped market space, demand creation, and the opportunity for highly profitable growth. Although some blue oceans are created well beyond existing industry boundaries, most are created from within red oceans by expanding existing industry boundaries, as Cirque du Soleil did. In blue oceans, competition is irrelevant because the rules of the game are waiting to be set." (Pp. 4-5); "Look back one hundred years and ask yourself, How many of today's industries were then unknown? The answer: Many industries as basic as automobiles, music recording, aviation, petrochemicals, healthcare, and management consulting were unheard of or had just begun to emerge at that time. Now turn the clock back only thirty years. Again a plethora of multibillion dollar industries jump out – mutual funds, cell phones, gas fired electricity plants, biotechnology, discount retail, express package delivery, minivans, snowboards, coffee bars, and home videos, to name a few. Just three decades ago, none of these industries existed in a meaningful way. Now put the clock forward twenty years – or perhaps fifty years – and ask yourself how many now unknown industries will likely exist then. If history is any predictor of the future, again the answer is many of them.*

The reality is that industries never stand still. They continuously evolve. Operations improve, markets expand, and players come and go. History teaches us that we have hugely underestimated capacity to create new industries and recreate existing ones. In fact, the half century old Standard Industrial Classification (SIC) system published by the US Census was replaced in 1997 by the North American Industry Classification Standard (NAICS) system. The new system expanded the ten SIC industry sectors into twenty sectors to reflect the emerging realities of new industry territories. The services sector under the old system, for example, is now expanded into seven business sectors ranging from information to healthcare and social assistance. Given that these systems are designed for standardization and continuity, such a replacement shows how significant the expansion of blue ocean has become." (Pp. 5-6)

[13 (14)] Kwan, Stephen and Lou Freund (2007) Developing a Service Science, Management and Engineering (SSME) Program at SJSU.

[3 (6 11)] Langlois, Richard N. and Paul L. Robertson (1995) Firms, Markets, and Economic Change. Routledge. London, UK. *"By using the term business institutions, we intend to stress that our concern extends beyond business organization – which connotes the idea of the business firm – to encompass a wide variety of structures, including those institutions generally described as markets. Business institutions are, of course, in part a matter of legal institutions, and we certainly find occasion to discuss the notion of property rights. But by business institutions we mean more than an explicit (or even implicit) legal framework. In the broader theory of social institutions, the fundamental concept of an institution ultimately boils down to the idea of recurrent patterns of behavior – habits, conventions, and routines. In this book, we take a similar perspective, in that the most elemental form of business institution for us is a productive routine, a habitual pattern of behavior embodying knowledge that is often tacit and skill-like. Nelson and Winter (1982) used the routine as the basis of their evolutionary theory of industry structure and economic growth. But to the extent that the New Institutional Economics has focused on issues of organizational form, it has done so through the lens of transaction-cost economics pioneered by Coase (1937) and honed today by Williamson (1985) and others. One way to understand our project in this volume is to see it as an attempt to carry evolutionary economics more forcefully into the traditional bailiwicks of transaction-cost theory by presenting and applying an evolutionary theory of economic capabilities." (Pg. 1)*

[14 (13)] Laszlo, Ervin (2002) The Systems View of the World. Hampton Press. Cresskill, NJ *"The unfortunate consequence of such specialty-barriers is that knowledge, instead of being pursued in depth and integrated in breadth, is being pursued in depth in isolation." (Pg. 2); "Worldviews are constellations of concepts, perceptions, values, and practices that are share by a community and direct the activities of its members." (Pg. 12); "Whereas traditional reductionism sought to find the commonality underlying diversity in reference to a shared substance, such as material atoms, contemporary systems theory seeks to find common features in terms of shared aspects of organization." (Pg. 17)*

[14 (13)] Laszlo, Ervin (2007) Science and the Akashic Field: An Integrated Theory of Everything. Inner Traditions. Rochester, VT. "Akasha is a Sanskrit word meaning 'ether': all-pervasive space." (Pg. v); *"Until recently, science gave a fragmented picture of the world, conveyed though seemingly independent disciplinary departments. Scientists have found it difficult to tell what connects the physical universe to the living world, the living world to the world of society, and the world of society to the domains of mind and culture. This is now changing; at the leading edge of the sciences ever more researchers are searching for a more integrated, unitary world picture. This is true especially of physicists, who are intensely at work creating 'grand unified theories' and 'super-grand unified theories.' These GUTs and super-GUTs relate together the fundamental fields and forces of nature in a logical and coherent theoretical scheme, suggesting that they have common origins." (Pg. 8)*

[8 (11)] Latour, Bruno (2007) Reassembling the Social: An Introduction to Actor-Network-Theory (Clarendon Lectures in Management Studies). Oxford University. Oxford, UK.

[12 (9)] Levitt, Theodore (1976) The Industrialization of Service. Harvard Business Review. September-October.

[5 (3 6)] Lewis, William W. (2004) The Power of Productivity: Wealth, Poverty, and the Threat to Global Stability. University of Chicago Press. Chicago, IL. *"Cultural Materialism says there is a direction in the evolution of our species. That direction is that societies with higher productivity inevitably replace societies with lower productivity… The higher productivity societies have been successful in competition with lower productivity societies. They have been successful either through conquest or through simply surviving the hardships of nature." (Pg. xii); "The disparity between the rich and poor is the most serious and the most intractable problem facing the world today. In the global economic landscape, 800 million people live on a high economic peak. They reside in 18 countries mostly in Europe and North America, with a GDP per capita between $25,000 and $35,000 per year. Five billion people live in the "lowlands," 111 countries with per capita income of $8,000 or below. Only 340 million people live in between the lowlands and the peak… GDP per capita is the amount of goods and services a country produces per person. It is the best single indicator of material standard of living." (Pg. 1)*

[4 (2 8 9 10 11 12 15)] Lovelock, Christopher (2007) Services Marketing: People, Technology, Strategy. Sixth Edition. Pearson Education. Upper Saddle River, NJ. *"Like everyone reader of this book, you're an experienced service consumer. You use an array of services every day – although some, like talking on the phone, using a credit card, riding a bus, or withdrawing money from an ATM, may be so routine that you hardly notice them unless something goes wrong." (Pg. 4); "Here's a paradox: We live in a service economy, but at most business schools the academic study and teaching of marketing is still dominated by a manufacturing*

perspective." (Pg. 6); "Christopher Lovelock and Evert Gummesson contend that services involve a form of rental. Service customers obtain benefits by renting the right to use a physical object, to hire labor and expertise of personnel, or to pay for access to facilities and networks. (Many services involve all three elements.) Value is created when customers benefit from obtaining desired experiences and solutions." (Pg. 13); "Understanding customer behavior lies at the heart of marketing. Without this understanding, no organization can hope to create and deliver services that will result in satisfied customers." (Pg 32);

[4 (12)] Lovelock, C. and E, Gummesson (2004) Whither service marketing? In search of a new paradigm and fresh perspectives. Journal of Service Research. 7(1) 20-41.

[4 (12 15)] Lusch, R. F. and S. L. Vargo (2006) The Service-Dominant Logic of Marketing: Dialog, Debate and Directions, M.E. Sharpe, Armonk, NY.

[14 (13)] Maglio, P.M. and J. Spohrer (2006) SSME. Production and Operations Management. In Press.

[14 (1)] Maglio, P. P., J. Kreulen, S. Srinivasan, and J. Spohrer. (2006) Service systems, service scientists, SSME, and innovation. Communications of the ACM. 49(7). July. 81 – 85.

[11 (3 6 8 10 12)] Malone, Thomas W. (2004) The Future of Work: How the New Order of Business Will Shape Your Organization, Your Management Style, and Your Life. Harvard Business School Press. Cambridge, MA. "There are many buzzwoirds for describing the kinds of organizations this revolution will make more common. Self-organizing, self-managed, empowered, emergent, democratic, participative, people-centered, swarming, and peer-to-peer are just a few of them. The word I'll use most often in this book to encapsulate all these different terms is a simple and timeless once: decentralized." (Pg. 5);

[6 (11 12)] March, James G. (1988) Decisions and Organizations. Basil Blackwell. New York, NY. *"Except as it enters as a participant in the general political arena, the business firm has not been the focus of study of political scientists… By any reasonable descriptive definition of political science, the business firm is outside the domain. Similarly, economists have largely ignored political systems except as they impinge on the market… For practical purposes, economics is the study of markets… At the risk of offending both economists and political scientists, I will assert that this division of labor is dysfunctional. It contributes to our inability as students to understand and predict the firm; it contributes to our inability as public-policy-makers to control and direct the firm." (Pp. 101-102); "Conflict systems: Consider a general class of purposive systems characterized by two attributes: 1. There are consistent basic units. Each elementary unit in the system can be described as having consistent preferences defined over possible states of the system… 2. There is conflict. The preference orderings of the elementary units are mutually inconsistent relative to the resources of the system…These two simple postulated attributes underlie a wide variety of theories about conflict resolution, choice, or the allocation of scarce resources. (Pg. 102); "In fact, most systems studied in the social sciences are apparently conflict systems of conflict systems." (Pg. 103); "In many respects, March and Simon, Thompson, and Cyert and March view the business organization as a socio-political conflict system subject to economic constraints." (Pg. 104); "…we accept the proposition that the system in some sense prefers some state of the world to other possible states of the world. By describing the system as a conflict system, we assert that the system does not have a preference ordering in the usual sense of the term. The devices used to move from conflict to conflict resolution constitute the core of a theory of a conflict system. In general, extant theories take on of two directions for resolving conflict. Either they impute a superordinate goal in terms of which the conflict can be mediated, or they describe a process by which decisions are reached without explicit comparison of utilities. The latter is typical of theories of political coalitions; the former is typical of theories of business firms." (Pg. 105)*

[11 (5 7 12)] March, J.G. (1991) Exploration and exploitation in organizational learning. Organizatinal Science. 2(1).71-87.

[11 (6 8 12 14)] March, James and Herbert Simon (1958/2003) Organizations. Second Edition. Blackwell. Cambridge, MA. *"…actions may produce goals as readily as goals produce actions… By living, that is by producing and selling goods and services, business firms encounter problems and opportunities that are transformed into preferences and desires… We create our wants, in part, by experiencing our choices." (Pg. 15); "Students of organizations make distinctions among micro-, meso-, and macro-organizational studies, corresponding to the individual, organizational, and societal levels of analysis." (Pg. 17); "Propositions about organizational behavior can be grouped in three broad classes, on the basis of their assumptions: 1. Proposition assuming that organization members, and particularly employees, are primarily passive instruments, capable of performing work and accepting directions, but not initiative action or exerting influence in any significant way. 2. Propositions assuming that members being to their organizations attitudes, values, and goals; that they have to be motivated or induced to participate in the system of organization behavior; that there is incomplete parallelism between their personal goals and organizational goals; and that actual or potential goal conflicts make power phenomena, attitudes, and morale centrally important in the explanation of organizational behavior. 3. Propositions assuming that organization members are decision makers and problem solvers, and that perception and thought processes are central to the explanation of behavior in organizations. There is nothing contradictory among these three sets of assumptions. Human beings are all of these things, and perhaps more. (Pg. 25)*

[11 (14)] March, James G. (1999) The Pursuit of Organizational Intelligence. Blackwell. Malden, MA. *"Organizations pursue intelligence. In that pursuit, they process information, formulate plans and aspirations, interpret environments, generate strategies and decisions, monitor experiences and learn from them, and imitate others as they do the same. Organizations seek to serve their*

interests and conceptions of self, imposing coherence when they can and exploiting the advantages of confusion, chaos, ambiguity when the opportunity arises. These efforts are disciplined by the presence of organizations that, in similar pursuit of their own interests and self-conceptions, provide elements of competition and objects for emulation." (Pg. 1); "In particular, organizations (like other adaptive systems) are plagued by the difficulty of balancing exploration and exploitation. By exploration is meant such things as search, discovery, novelty, and innovation. It involves variation, risk taking, and experimentation. It commonly leads to disasters but occasionally leads to important new directions and discoveries. By exploitation is meant refinement, routinization, production, and implementation of knowledge. It involves choice, efficiency, selection, and reliability. It usually leads to improvement but often is blind to major redirections." (Pg. 5); "The canyon between these two perspectives is deep. Thou shalt not confuse behavioral (or descriptive) assertion with normative (or prescriptive) statements. Yet, many writers on organizations straddle this chasm without notable strain. They describe and they advise. Their descriptions slide into their advice (or vice versa) with the ready lubrication of common terminology, a mixed audience, and a vigorous market for relevance. If the habit of slipping from the language of observer to the language of reformers without changing the words is an academic sin, then academic hell is crowded with students of organization." (Pg. 8); "If the chapters of this book suggest anything of a general sort, it is that the pursuit of organizational intelligence is an activity in which knowledge can sometimes lead to power but more reliably produces humility." (Pg. 10)

[10 (12)] Marks, Eric A, and Michael Bell (2006) Service-Oriented Architecture: A Planning and Implementation Guide for Business and Technology. Wiley. Hoboken, NJ. *"When we began this book, we established this mission statement for our efforts: This book will represent the state of the art for SOA planning, business, organization, and service modeling, architecture design and implementation. This book will present a business and technology modeling approach that answers most of the critical questions asked by IT and business leaders in today's organizations: How do we get started with SOA? Where do we begin? Where should we focus our SOA efforts? What 'services' should we begin with? How do we identify and expose them in our SOA? How do we measure results of our SOA efforts? This book will be a reference work for IT executives, architects, team leaders, and developers seeking to understand how to make SOA real for their organizations to enable business results." (Pg. vi); "Many organizations wrestle with the semantic and linguistic barriers between the business community and the IT community, as well as between specific disciplines within the IT community. Often the overarching goals and objectives are shared, but the approaches to meeting those goals are quite different. After all, even different sides of the same coin are distinct and unique yet inseparable. And so it is with the concept of SOA. SOA offers the potential to create a unified language of business based on a unit of analysis known as a service. In fact, we dedicate a chapter to the concept of services because they are indeed the fundamental unit of analysis for an SOA. The first SOA challenge is to establish shared meaning for services in a given organization, a subset of which will most likely be Web services." (Pg. vii); "SOA is a conceptual business architecture where business functionality, or application logic, is made available to SOA users, or consumers, as shared, reusable services on an IT network. 'Services' in an SOA are modules of business or application functionality with exposed interfaces, and are invoked by messages." (Pg. 1)*

[3 (6 8)] Marshall, Alfred (1890/2006) Principles of Economics. Abridged Edition. Cosimo. New York, NY. *"Economic generalization and laws: It is the business of economics, as of almost every other science, to collect facts, to arrange and interpret them, and to draw inferences from them." (Pg. 29); "Thus a law of social science, or a Social Law, is a statement of social tendencies; that is, a statement that a certain course of action may be expected under certain conditions from the members of a social group. Economic Laws, or statements of economic tendencies, are those social laws which relate to branches of conduct in which the strength of the motives chiefly concerned can be measured by a money price." (Pg. 33); "The order and aims of economic studies: We have seen that the economist must be greedy of facts; but the facts by themselves teach nothing. History tells of sequences and coincidences; but reason alone can interpret and draw lessons from them." (Pg. 38)*

[7 (3 11)] McGahan, Anita M. (2004) How Industries Evolve: Principles for Achieving and Sustaining Superior Performance. Harvard Business School Press. Boston, MA. *"Most executives think carefully about the future and are committed to the long-term health of their organizations. They see their personal interests as fully aligned with those of the companies that they are leading. They take risks by investing in projects that create new options and, if necessary, reorganize their firms to exploit these options… The central purpose of this book is to help you achieve and sustain superior performance in your organization by adhering to two principles. The first is to avoid unnecessary risks and costs that arise from a strategy that breaks the rules of industry change… The second principle involves recognizing and then capitalizing on the lasting opportunities for developing advantage in your business that arise from industry change." (Pg. 1); "The fundamental concept is that industries each follow one of four evolutionary trajectories: 'Progressive,' 'Creative,' 'Intermediating,' and 'Radical.' …Progressive change, which is the most common type of industry evolution, involves incremental innovation through basic blocking and tackling to enhance operational effectiveness… Creative change, the least common type of change, occurs when relationships between the industry and its buyers are stable, but there's rapid turnover in the resources necessary to survive and to sustain leadership in the industry… Intermediating change, which is less common than Progressive change but more common than Creative and Radical change, occurs when the relationships at the heart of the industry structure are jeopardized while old resources retain some of their value… Radical change, which is uncommon, takes place when a fundamentally new approach for creating value arises and threatens to make obsolete all of the core assets and activities of the business." (Pp. 8-10)*

[13 (8 11 12 14 15)] McKenna, Christopher D. (2006) The World's Newest Profession: Management Consulting in the Twentieth Century (Cambridge Studies in the Emergence of Global Enterprise). Cambridge University Press. Cambridge, UK.

[12 (10 11)] Mendelson, Haim and Johannes Ziegler (1999) Survival of the Smartest: Managing Information for Rapid Action and World-Class Performance. Wiley. New York, NY. *"A company's Organizational IQ describes how well the organization performs along the following dimensions: External Information Awareness: Insuring that each part of the organization captures the external information it needs quickly and accurately. This includes information about customer dynamics, technology opportunities, and competitive actions… Effective Decision Architecture: Ensuring that decisions are being made at the right level, that is, by the people with the best information and perspective… Internal Knowledge Dissemination: Ensuring that each part of the organization knows what it needs to know when it needs to know it. Knowledge dissemination within the organization takes place both horizontally and vertically, across geographic boundaries, and over time… Organizational Focus: Fighting information overload and organizational complexity by limiting the scope of the business and simplifying structures and processes… Information Age Business Network: Recognizing that one company cannot create value on its own; that it needs to operate as part of a network. In managing partnerships, High-IQ companies apply the four previous principles of High-IQ management to their entire business network." (Pg. 3); "The Bottom Line: Does a high Organizational IQ help… Our analysis included two comprehensive worldwide surveys of the electronics industry, broadly defined…. In all more than 2000 managers from 164 business units of large high-tech companies… …High-IQ companies are much more likely to survive and thrive in the Information Age than their Low-IQ peers. During the late 1980's entire industry, including Low-IQ companies, grew at double-digit rates. When competition heated up… the overall industry growth rated declined. High-IQ companies, however, continued to grow at a comfortable double-digit rate. Low-IQ companies, on the other hand, tell a very different story…" (Pp. 5-6)*

[3 (11 12)] Milgrom, Paul and John Roberts (1992) Economics, Organization, and Management. Prentice Hall, Upper Saddle River, NJ. *"Economics organizations are created entities within and through which people interact to reach individual and collective economic goals. The economic system consists of a network of people and organizations, with lower-level organizations linked together through higher-level organizations. The highest-level organization is the economy as a whole. While it is somewhat unusual to think of an entire economy as an organization, this perspective is useful because it emphasizes that the economic system is a human creation and because many of the problems that smaller, more formal organizations face exist at the economy-wide level as well. … Formal Organizations; At the next level are entities traditionally regarded as organizations and the ones that are our main concern: corporations, partnerships, sole proprietorships, labor unions, government agencies, universities, churches, and other formal organizations. A key characteristic of the organizations at this level is their independent legal identity, which enables them to enter binding contracts, to seek court enforcement of those contracts, and to do so in their own name, separate from the individuals who belong to the organizations. …The firm itself is then a legal fiction that enters relatively simple, bilateral contracts between itself and suppliers, workers, investors, managers, and customers. Without a legal entity that can contract with them individually, these people would have to fashion complex, multilateral agreements among themselves to achieve their aims." (Pp. 19-20); "The Tasks of Coordination and Motivation: A fundamental observation about the economic world is that people can produce more if they cooperate, specializing in their productive activities and then transacting with one another to acquire the actual goods and services they desire. The problem of organization then arises because people are specialized producers who need to trade, their decisions and actions need to be coordinated to achieve these gains of cooperation, and the people must be motivated to carry out their parts of the cooperative activity. Both the existence of formal organizations and the specific details of their structures, policies, and procedures reflect attempts to achieve efficiency in coordination and motivation." (Pg. 25)*

[3 (6 8)] Mill, J. S. (1929) Principles of the Political Economy, London: Longmans Green, London, U.K. (Available on Google Books)

[3 (1 8 15)] von Mises, Ludwig (1998) Human Action: A Treatise on Economics (Scholars Edition). Ludwig Von Mises Institute. *"One must study the laws of human action and social cooperation as the physicists studies the laws of nature… Until the late nineteenth century political economy remained a science of the 'economic' aspects of human action, a theory of wealth and selfishness. It dealt with human action only to the extent that it is actuated by what was – very unsatisfactorily – described as the profit motive, and it asserted that there is in addition other human action whose treatment is the task of other disciplines." (Pp. 2-3); "All ends and all means, both material and ideal issues, the sublime and the base, the noble and the ignoble, are ranged in a single row and subjected to a decision which picks out one thing and sets aside another. Nothing that men aim at or want to avoid remains outside the arrangement into a unique scale of gradation and preference… Out of the political economy of the classical school emerges the general theory of human action, praxeology. The economic or catallactic problems are embedded in a more general science, and can no longer be severed from this connection." (Pg. 3); "The field of our science is human action, not the psychological events which result in action. It is precisely this which distinguishes the general theory of human action, praxeology, from psychology." (Pp. 11-12); "Action means the employment of means for the attainment of ends. As a rule one of the means employed is the acting man's labor. But this is not always the case. Under special conditions a word is all that is needed. Hew who gives orders or interdictions may act without any expenditure of labor. To talk or not to talk, to smile or remain serious, may be action.*

To consume and to enjoy are no less action than to abstain from accessible consumption and enjoyment… Action is not only doing but no less omitting to do what possibly could be done." (Pg. 13); "Nobody is in a position to decree what should make a fellow man happier." (Pg. 14); "Man is capable of dying for a cause or of committing suicide. To live is for man the outcome of a choice, of a judgment of value… Of course, the immense majority prefer life to death and wealth to poverty." (Pg. 20); "When applied to the means chosen for the attainment of ends, the terms rational and irrational imply a judgment about the expediency of the procedure employed… The opposite of action is not irrational behavior, but a reactive response to stimuli on the part of the bodily organs and instincts which cannot be controlled by the volition of the person concerned." (Pg. 20); "The category means and ends presupposes the category cause and effect. In a world without causality and regularity of phenomena there would be no field for human reasoning and action. Such a world would be chaos… There are changes whose causes, at least for the present time are unknown to us… As long as this is not achieved, we must acquiesce in what is called a statistical law." (Pp. 22-23); "There are for man only two principles available for a mental grasp of reality, namely, those of teleology and causality. What cannot be brought under either of these categories is absolutely hidden to the human mind… Change can be conceived as the outcome either of the operations of mechanistic causality or of purposeful behavior; for the human mind there is no third way available." (Pg. 25); "History is the collection and systematic arrangement of all the data of experience concerning human action." (Pg. 31); "The experience with which the sciences of human action have to deal is always an experience of complex phenomenon… Every historical experience is open to various interpretations, and is in fact interpreted in different ways." (Pg. 31); "Different individual value the same things in a different way, and valuations change with the same individuals with changing conditions." (Pg. 56); "We must rethink ourselves and reflect upon the structure of human action. Like logic and mathematics, praxeological knowledge is in us; it does not come from without… It would deal no less with hypothetical acting such as would take place under the unrealizable conditions of imaginary worlds." (Pp. 65-66); "The economist must never be a specialist. In dealing with any problem he must always fix his glance upon the whole system." (Pg. 69); "The living is not perfect because it is liable to change; the dead is not perfect because it does not live… They weave dreams of a perfect state. They do not realize that the state, the social apparatus of compulsion and coercion, is an institution to cope with human imperfection and that its essential function is to inflict punishment upon the minorities in order to protect majorities against the detrimental consequence of certain actions." (Pg. 70); "Thinking man sees the serviceableness of things, i.e., their ability to minister to his ends, and acting man makes them means." (Pg. 92); "Value is not intrinsic, it is not in things. It is within us; it is the way man reacts to the conditions of his environment." (Pg. 96); "Most actions do not aim at anybody's defeat or loss… It is, to put it mildly, certainly not the case within the regular operations of a social system based on the division of labor… Competitors aim at excellence and preeminence in accomplishments within a system of mutual cooperation." (Pp. 116-117); "Even if we admit that every sane adult is endowed with the faculty of realizing the good of social cooperation and of acting accordingly, there still remains the problem of the infants, the aged, and the insane." (Pg. 149); "The state or government is the social apparatus of compulsion and coercion. It has the monopoly of violent action." (Pg. 149); "The mating relation need not result in the family organization. The human family is an outcome of thinking, planning, and acting." (Pg. 168); "Language is a tool of thinking as it is a tool of social action." (Pg. 177); "…a comprehensive body of knowledge, we may speak of it as a world view." (Pg. 178); "The higher productivity of cooperation under division of labor makes society the foremost means of every individual for the attainment of his own ends whatever they may be. The maintenance and further intensification of social cooperation become a concern of everybody." (Pg. 179); "Action always is essentially the exchange of one state of affairs for another state of affairs. If the action is performed by one individual without any reference to cooperation with other individuals, we may call it autistic exchange… Within society cooperation substitutes interpersonal or social exchange for autistic exchange. Man gives to other men in order to receive from them. Mutuality emerges. Man serves in order to be served." (Pg. 194); "Now we must realize that valuing means to prefer a to b." (Pf. 204); "Technology operations with countable and measurable quantities of external things and effects; it knows causal relations between them, but is is foreign to their relevance to human wants and desires. Its field is that of objective use-value only. It judges all problems from the disinterested point of view of a neutral observer of physical, chemical, and biological events. For the notion of subjective use-value, for the specifically human angle, and for the dilemmas of acting-man there is no room in the teachings of technology." (Pg. 205);

[14 (9 10)] Monahan, B., David Pym, Richard Taylor, Christopher Tofts, and Michael Yearworth. 2006. "Grand Challenges for Systems and Services Sciences." Paper prepared for FET/FP7 Workshop, Brussels (January 31, 2006). Available as HP Labs Technical Report, HPL-2006-99, from http://www.hpl.hp.com/techreports/2006/HPL-2006-99.pdf

[7 (11 12)] Moore, Geoffrey (2005) Dealing with Darwin: How Great Companies Innovate at Every Phase of Their Evolution. Portfolio/Penguin Group. New York, NY. *"The formula for tackling innovation and overcoming inertia in tandem is simple: Extract resources from context and repurpose them for core." (Pg. xvii); "The economic argument in favor of innovation focuses on pricing power. Without innovation, offerings become more and more like each other. They commoditize… The fundamental principle that drives this argument is that innovation creates differentiation, it creates attractive economic returns. This is not, however, the only possible outcome from innovation… The pie chart defines the possible results from all innovation efforts in an enterprise: research projects, development programs, cross-functional initiatives, and the like. In addition to differentiation, there are three other possible*

outcomes, two of which are desired, one not… The first of the alternative desired outcomes is neutralization. Its goal is to eliminate differentiation by catching up either to a competitor's superior performance or to a market standard one has fallen short of… In addition to differentiation and neutralization, a third goal of innovation is productivity improvement. Here the intent is not to affect market outcomes but rather to achieve them at lower costs. …the majority of them are simply designed to cost-reduce a set of existing processes in order to either invest the savings elsewhere or increase profits… Differentiation, neutralization, productivity improvement – what's left? Waste. Wasted innovation falls into a number of classes. The first simply comprises those attempts at any of the other three goals that don't succeed. This is just part of doing business. …you just have to price such risks into your overall plan." (Pp. 5-7)

[11 (8)] Morgan, Gareth (1997) Images of Organization. Sage. Thousand Oaks, California. *"Contents… 2. Mechanization Takes Command: Organizations as Machines, 3. Nature Intervenes: Organizations as Organisms, 4. Learning and Self-Organization: Organizations as Brains, 5. Creating Social Reality: Organizations as Cultures, 6. Interest, Conflict, and Power: Organizations as Political Systems, 7. Exploring Plato's Cave: Organizations as Psychic Prisons, 8. Unfolding Logics of Change: Organizations as Flux and Transformation, 9. The Ugly Face: Organizations As Instruments of Domination." (Pp. i-iv); "This book explores and develops the art of reading and understanding organizational life. It is based on a very simple premise: that all theories of organization and management are based on implicit images or metaphors that lead us to see, understand, and manage organizations in distinctive yet partial ways." (Pg. 4)*

[8 (10 11)] Moulton Reger, Sara J. (2006) Can Two Rights Make a Wrong? Insights from IBM's Tangible Culture Approach. Pearson/IBM Press. Upper Saddle River, NJ.

[13 (6 7)] Mulgan, Geoff (2006) The Process of Social Innovation. Innovations. Spring. Pp. 145-162. URL: http://www.youngfoundation.org "*Much of what we now take for granted in social life began as radical innovation. A century ago, few believed that ordinary people could be trusted to drive cars at high speed, the idea of a national health service freely available was seen as absurdly utopian, the concept of 'kindergarten' was still considered revolutionary, and only one country had given women the vote. Yet, in the interim, these and many other social innovations have progressed from the margins to mainstream… There is every reason to believe that the pace of social innovation will, if anything, accelerate in the coming century. There is certainly more money flowing into NGOs and civil society than every before. Economics in both developed and (to a lesser extent) developing countries are increasingly dominated by services rather than manufacturing. Over the next 20 years, the biggest growth for national economies is likely to come from health, education, whose shares of GDP are already much greater than are cars, telecommunications, or steel. These growing social sectors are all fields in which commercial, voluntary and public organizations deliver services, in which public policy plays a key role, and in which consumers co-create value alongside producers (no teacher can force students to learn if they don't want to)." (Pp. 145-146) "As the great Victorian historian Lord Macauley wrote: 'There is constant improvement precisely because there is constant discontent.'" (Pg. 148); "In the long run, ideas are more powerful than individuals or institutions; indeed, as John Manard Keyes noted, 'the world is ruled by little else.' …change depends on many people being persuaded to abandon old habits… The starting point for all innovation is an idea of a need that isn't being met, coupled with an idea of how it could be met." (Pg. 149) "Needs come to the fore in many ways – through angry individuals and groups, campaigns, and political movements as well as through careful observation… Some of the best innovators spot needs which aren't being adequately met by the market or the state… Empathy is the starting point, and ethnography is usually a more relevant formal tool than statistical analysis… Some of the most effective methods for cultivating social innovation start from the presumptions that people are competent interpreters of their own lives and competent solvers of their own problems… Looking for the 'positive deviants' gives insights into what might be possible, and usually at much lower cost than top down solutions." (Pg. 150)*

[3 (6 7 8 9 10 11)] Murmann, Johann Peter (2006) Knowledge and Competitive Advantage: The Coevolution of Firms, Technology, and National Institutions (Cambridge Studies in the Emergence of Global Enterprise). Cambridge University Press. Cambridge, UK. *"Synthetic dyes represent the first time when a scientific discovery quickly gave rise to a new industry. In 1856, the nineteen-year-old William Henry Perkin serendipitously invented the first synthetic dye and successfully commercialized his discovery. Perkin, along with entrepreneurs from Britain and France, dominated the synthetic dye industry for the next eight years. Contrary to contemporary predictions, however, these firms were not able to sustain their leadership position in the new industry. By 1870, Germany had about 50% of the global synthetic dye market; Britain fell to second place…. The study identifies differences in educational institutions and patent laws as the key for the long-lasting German leadership position in this industry." (Pg. ii)*

[12 (4)) Nagle, Thomas T. and Reed K Holden (1987/2002) The Strategy and Tactics of Pricing: A Guide to Profitable Decision Making. Third Edition. Prentice Hall. Upper Saddle River. NJ. *"The Cost-Plus Delusion: Cost-plus pricing leads to overpricing in weak markets and underpricing in strong ones – exactly the opposite direction of prudent strategy." (Pg. 3); "Customer-Driven Pricing: The purpose of value-based pricing is to price more profitably by capturing more value, not necessarily making more sales." (Pg. 7); "Competition-Driven Pricing: Lastly, consider the policy of letting pricing be dictated by competitive conditions. In this view, pricing is a tool to achive sales objectives… to achieve the market-share goal." (Pg. 7); "The Discipline of Strategic Pricing: Pricing should play an integrative role in business strategy. Pricing is not*

only part of marketing, but also part of finance and competitive strategy." (Pg. 10); "Understanding the Constraints on Pricing: When making pricing decisions, the successful strategist must consider not only what is profitable, but also what will be perceived as ethical and legal." (Pg. 370)

[9 (12 15)] Neftci, Salih N. (2004) Principles of Financial Engineering. Elsevier. New York, NY. *"This chapter introduces some simple financial engineering strategies. We consider two examples that require finding financial engineering solutions to a daily problem. In each case, solving the problem under consideration requires creating appropriate synthetics. In doing so, legal, institutional, and regulatory issues need to be considered." (Pg. 1) "There is a second interesting point to the issue of credit risk mentioned earlier. The original money market loan was a Euromarket instrument. Banking operations in Euromarkets are considered offshore operations, taking place essentially outside the jurisdiction of the national banking authorities. The local yen loan, on the other hand, is obtained in the onshore market. It would be subject to supervision by the Japanese authorities. In case of default, there may be some help from the Japanese Central Bank, unlike a Eurodollar loan where a default may have more severe implications for the lending bank." (Pg 4)*

[3 (8 14)] Nelson, Richard R. and Sidney G. Winter (1982) An Evolutionary Theory of Economic Change. Harvard University Press. Cambridge, MA. *"Our general term for all regular and predictable behavioral patterns of firms is 'routine.' We use this term to include characteristics of firms that range from well-specified technical routines for producing things, through procedures for hiring and firing, ordering new inventory, or stepping up production of items in high demand, to policies regarding investment, research and development (R&D), or advertising, and business strategies about product diversification and overseas investment. In our evolutionary theory, these routines play the role that genes play in biological evolutionary theory. They are persistent feature of the organism and determine it possible behavior (though actual behavior is determined also by the environment); they are heritable in the sense that tomorrow's organisms generated from today's (for example, by building a new plant) have many of the same characteristics, and they are selectable in the sense that organisms with certain routines may do better than others, and, if so, their relative importance in the population (industry) is augmented over time." (Pg. 14); "Although our theory is concerned with the behavior of business firms and organizations, we find it useful to begin the analysis with a discussion of some aspects of individual behavior. An obvious reason for doing so is that the behavior of an organization is, in a limited but important sense, reducible to the behavior of individuals who are members of that organization… …as a metaphor for organizational behavior: the idea that 'individuals are complex organizations too" has considerable power." (Pg. 72); "By 'skill' we mean a capability for a smooth sequence of coordinated behavior this is ordinarily effective relative to its objectives." (Pg. 73); "In the first place skills are programmatic, in that they involve a sequence of steps… Second, the knowledge that underlies a skillful performance is in large measure tacit knowledge, in the sense that the performer is not fully aware of the details of the performance and finds it difficult if not impossible to articulate a full account of the details. Third, the exercise of a skill often involves the making of numerous 'choices' – but to a considerable extent the options are selected automatically and without awareness that a choice is being made. These three aspects of skilled behavior are closely interrelated." (Pg. 73); "In the exercise of these cognitive skills, an important role is played by language and, in particular, by the names of the other skills that may or may not be possessed by the planner or problem solver. This observation leads to an important distinction regarding the scope of the capabilities possessed by an individual – namely, the distinction between 'knowing how to do X' and 'knowing how to get X accomplished.' Given an appropriate environment, and the resources and skills required for implementation of plans in the environment, an effective planner can get a lot of things accomplished that he does not personally know how to do." (Pg. 86)*

[9 (3 12)] Newnan, Donald G., Jerome P. Lavelle, and Ted G. Eschenbach (2003) Essentials of Engineering Economics. Second Edition. Oxford University Press. Oxford, UK. *"This book is about making decisions. Decision making is a broad topic, for it is a major aspect of everyday human life. This book will isolate those problems that are commonly faced by engineers and develop the tools to properly analyze and solve them. Even very complex situations can be broken down into components from which sensible solutions are produced." (Pg. 1); "Engineering economic analysis focuses on costs, revenues, and benefits that occur at different times. For example, when a civil engineer designs a road, a dam, or a building, the construction costs occur in the near future and the benefits to users only begin when construction is finished, but then the benefits continue for a long time." (Pg. 3); "One possible flowchart of the decision process: 1. Recognize the problem; 2. Define the goal or objective; 3. Assemble relevant data; 4. Identify feasible alternatives; 5. Select the criterion to determine the best alternative; 6. Construct a model; 7. Predict each alternative's outcomes or consequences; 8. Choose the best alternative; and 9. Audit the result." (Pg. 5); "…a choice between new alternatives is not always what we must consider – economic analysis is more frequently performed in conjunction with existing versus new facilities… This adversarial situation has given rise to the terms defender and challenger. The defender is the existing equipment; the challenger is the best available replacement equipment. An economic analysis of the existing defender and the challenger replacement is the domain of replacement analysis." (Pg. 439)*

[1 (2 4 6 7 8 12 13 14 15)] Normann, Richard (2001), Reframing Business: When the Map Changes the Landscape, Wiley, Chichester, New Sussex. *"The new paradigm – which for the moment I will call reconfiguration of value-creating systems – also implies a dramatic conceptual change and a very real shift in how we view customers. The customer is no longer just a receiver, no longer just a source of business,*

but now actually a co-producer, and a co-designer, of value creation." (Pp. 24-25); "The dematerialized world of immaterial assets now often tends to lead, rather than follow, the development of the material world. It is now knowledge-intensive 'services', not 'manufacturing', that lead the economy. Without those services, manufacturing will flounder." (Pg. 40); "The implications of the development of the causal chain of dematerialization – unbundleability – asset liquidity – rebundleability – density are fundamental to understanding strategy and business in the new economy." (Pg. 44); "I reserve the term 'Prime Movers' for reconfigurers who do not just base themselves on historical economic imperfection, and where the reconfiguration does not only come about as a result of technological breakthroughs. Such reconfigurations mainly thrive from the effects that a technological breakthrough or deregulation have on shattering old business systems. Prime Movers reintegrate and rebundle as well as disintegrate and unbundled, though the latter is generally a prerequisite of the formed… Prime Movers tend to envision a broader Value-creating System (as opposed to a technological innovation, a new product, or the simple exploration of an economic imperfection) as the outcome of their strategy. The results tend to be boundary breaking, redefining the roles of different economic actors (as well as excluding and bringing in new ones) and setting new rules of the game." (Pg. 61); "Prime Movership is much more than skin deep. The more I have worked with these matters, the more I have come to think about Prime Movership not only as a set of objectives, observable behaviors, but also as a mode of being, a mind-set." (Pg. 69); "Coordinated efforts by different actors towards a common whole is not new. The economy has proceeded through an ever more complex role differentiation between economic actors, rendering them different and interdependent rather than similar and autonomous." (Pg. 95); "We must assume that we know something, but that we don't know everything, and that we don't know exactly what we don't know, and that recognition of the (at least partly) knowable unknown must be a platform in which we have faith." (Pg. 186); "Every organization or social system, as well as every individual or small group, has its particular language which is both structured by and structures the reality that is seen (and enacted) by the members of the collectivity… Language is a necessary companion of new knowledge and innovation." (Pg. 194); "What I am arguing for here is that it is part of the nature of the human mind to move conceptually and more or less freely between the conceptual past, the here-and-now, and the conceptual future… And the more we can bring of insightful and rich scenarios from the future into the present – the more we can become 'visitors from the future' – the richer the present." (Pg. 197)

[7 (8 9)] Norman, D. A. (1993). Things That Make Us Smart: Defending Human Attributes in the Age of the Machine. New York: Addison Wesley.

[1 (3 6 11 15)] North, D. C. (2005). Understanding the process of economic change. Princeton, N.J.: Princeton University Press. *"A complete theory of economic change would therefore integrate theories of demographic, stock of knowledge, and institutional change. We are far from having good theories of any one of these three, much less of the three together, but we are making progress. The central focus of this study, and the key to improving economic performance, is the deliberate effort of human beings to control their environment." (Pg. 1); "The human environment is divided by social scientists into discrete disciplines – economics, political science, sociology – but the constructions of the human mind that we require to make sense out of the human environment do not coincide with these artificial categories. Our analytical frameworks must integrate insights derived from these artificially separated disciplines if we are to understand the process of change." (Pg. 11); "…let us see how humans through time have altered the environment to make it more predictable. We go back to the definition of uncertainty and divide the term into different degrees: 1. Uncertainty that can be reduced by increasing information given the existing stock of knowledge. 2. Uncertainty that can be reduced by increasing the stock of knowledge within the existing institutional frameworks. 3. Uncertainty that can be reduced only by altering the institutional framework. 4. Uncertainty in the face of novel situations that entails restructuring beliefs. 5. Residual uncertainty that provides the foundations for 'non-rational beliefs." (Pp. 16-17); "…an ever growing demand for services has resulted in an ever greater percentage of resources going into services. Some of the services, such as medicine, are income elastic (as we get richer we devote an increasing percentage of income to them) but the major reason for the growth of services is that resources are devoted to transacting. Transaction costs are the costs involved in exchange, and as specialization and division of labor have increased, so has the number of exchanges, each of which has entailed devoting resources to exchange. Banking, insurance, fiancé, wholesale and retail trade, as well as a good part of government activity are all part of the transaction sector. And then inside the firm there are ever increasing numbers of accountants, lawyers, and others devoted to facilitating exchange in the complex economic world of impersonal exchange. The movement from personal to impersonal exchange always increases total transaction costs…" (Pg. 91)*

[3 (11 12)] Ormerod, Paul (2005) Why Most Things Fail: Evolution, Extinction, and Economics. Faber and Faber. London, UK. *"Failure is all around us. Failure is pervasive. Failure is everywhere, across time, across place and across all aspects of life. Ninety-nine point nine nine percent of all biological species which have ever existed are now extinct. Failure in this context is measured over hundreds of millions of years. On a dramatically shorter timescale, more than 10 percent of all companies in America disappear each year. Large and small, from corporate giants to the tiniest one-person business, they fail." (Pg. ix); "The single most useful and productive legal invention in the past few centuries has been that of the commercial firm." (Pg. 2); "However, in general, in the sorts of networks that connect individual agents in social and economic systems, we can never rule out the possibility that the smallest, most obscure shock will turn out to have massive implications." (Pg. 214)*

[11 (12)] Palmisano, S.J., The Globally Integrated Enterprise, Foreign Affairs, pp 127-136, May/June 2006

[9 (2 3 12)] Park, Chan S. (2004) "Fundamentals of Engineering Economics. Pearson. Upper Saddle River, NJ *"As design and manufacturing processes become more complex, the engineer increasingly will be called upon to make decisions that involve money." (Pg. 6)*

[3 (8 11 12)] Penrose, Edith (1959/1995) The Theory of the Growth of the Firm. Third Edition. Oxford University Press. Oxford, UK. *"In undertaking an analysis of the growth of firms in the 1950s, the question I wanted to answer was whether there was something inherent in the very nature of any firm that both promoted its growth and necessarily limited is rate of growth. Clearly a definition of a firm with 'insides' was required… The economic function of such a firm was assumed simply to be that of acquiring and organizing human and other resources in order profitably to supply goods and services to the market. It was defined, therefore, as a collection of resources bound together in an administrative framework… Following from the definition of the firm as a coherent administrative organization, I argued that managerial resources with experience within the firm are necessary for the efficient of managers from outside the firm. Thus the availability of 'inherited managers' with such experience limits the amount of expansion that can be planned and undertaken in a period of time. Such managers, by definition, cannot be acquired from the market but are a necessary input for expansion… Even growth by acquisition and merger does not escape the constraints imposed by the necessity of using inputs from existing managerial resources to maintain the coherence of the organization. This is the essence of the so-called 'Penrose-curve', curve which has been applied in a number of contexts… (Pp. xi – xii); "One of the primary assumption of the theory of the growth of the firm is that 'history matters'; growth is essentially an evolutionary process and based on the cumulative growth of collective knowledge, in the context of a purposive firm." (Pg. xiii); "'an economy is in equilibrium when it generates messages which do not cause agents to change the theories which they hold or the policies which they pursue.' (Hahn 1975; 1984, p. 59)" (Pg. xiv); "Finally, a few words about the expansion of firms outside the national boundaries. Interest in the international growth of firms – once called foreign firms, then international firms, multinational corporations or enterprises, transnational corporations*, and now apparently referred to as global firms – has grown by leaps and bounds since the 1950s." (Pg. xv)

[7 (3 4 8 12)] Pine II, B. Joseph and James H. Gilmore (1999) The Experience Economy: Work is Theatre and Every Business a Stage. Harvard Business School Press. Boston, MA. *"Consider, however, a true commodity: the coffee bean… So depending on what a business does with it, coffee can be any of three economic offerings – commodity, good, or service – with three distinct ranges of value customers attach to the offering. But wait: Serve that same coffee in a five-start restaurant or espresso bar, where the ordering, creation, and consumption of the coffee embodies a heightened ambience or sense of theatre, and consumers gladly pay anywhere from $2 to $5 for each cup. Businesses that ascend to the fourth level of value establish a distinctive experience that envelops the purchase of coffee, increasing its value (and therefore its price) by two orders of magnitude over the original commodity." (Pg. 1); "Experiences are a fourth economic offering, as distinct from services as services are from goods, but on that until now has gone unrecognized." (Pg. 2); "As Dave Powers III of J.D. Powers & Associates says, 'when we measure satisfaction what we're really measuring is the difference between what a customer expects and what the customer perceives he gets.' In other words, Customer Satisfaction = What a customer expects to get – what a customer perceives he gets. Customer satisfaction measurements essentially focus on understanding and managing customer expectations of what companies already do rather than truly ascertaining what customers really want. While such measurements have their place, companies must do more than merely measure perceptions to mass customize effectively. They must understand the nature of customer sacrifice – the gap between what a customer settles for and what he wants exactly: Customer Sacrifice = What a customer wants exactly – What customers settle for." (Pg. 78); "The question, 'What's next?' therefore becomes highly personal. To answer it truthfully requires sharing our worldview with you. …In the full-fledged Transformation Economy, we believe buyers will purchase transformations according to the set of eternal principles the seller seeks to embrace – what together they believe will last." (Pg. 206)*

[3 (8 10 11)] Porat, M. U. (1977) The Information Economy: Definition and Measurement. US Department of Commerce, Office of Telecommunications, OT Special Publication, 77-12(1).

[7 (4)] Prahalad, C.K. (2004) The Future of Competition. Co-Creating Unique Value with Customers. Harvard Business School Press. Boston, MA. *"Thus, the paradox of the twenty-first-century economy: Consumers have more choices that yield less satisfaction. Top management has more strategic options that yield less value. Are we at the cusp of a new industrial system with characteristics different from those we now take for granted? This question lies at the heart of this book… We now need a new frame of reference for value creation. The answer, we believe, lies in a different premise centered on co-creation of value. It begins with the changing role of the consumer in the industrial system… The most basic change has been a shift in the role of the consumer – from isolated to connected, from unaware to informed, from passive to active. The impact of the connected, informed, and active consumer is manifest in many ways." (Pg. 2) "…the changing relationship between the consumer and the firm. At the heart of this change is the emerging pattern of interactions between them. These interactions are the locus for the co-creation of value." (Pg. 19) "…the elements of DART – dialogue, access, risk assessment, and transparency – are the basic building blocks of value co-creation, and managers combine them in different ways." (Pg. 33); "To co-create value continually, we must continually co-create new knowledge." (Pg. 171)*

[9 (3 11 12)] Prencipe, Andrea, Andrew Davies, and Mike Hobday (2005) The Business of Systems Integration. Oxford University Press. Oxford, UK. *"Airplanes, automobiles, an electric power system, the process of producing a microprocessor, a hospital, all are complex systems, in the sense that each has a number of different components or elements, and for effective performance all these have to fit together, and work together. Making things work together well is what the authors of this book call the business of systems integration… A central theme of many of the chapters of this book is that in recent years the technological aspects of systems have become more complex, and so have the organizational and managerial aspects of firms developing and integrating them, labeled in this book systems integrator firms." (Pp. ix-x)*

[9 (4 10 11 12)] Quinn, James Bryant, Jordan J. Baruch, and Penny Cushman Paquette (1987) Technology in Services. Scientific American. 257(2). December. *"Most authorities consider the services sector to include all economic activities whose output is not a physical product or construction, is generally consumed at the time is produced, and provides added value in forms (such as convenience, amusement, timeliness, comfort, or health) that are essentially intangible concerns of its first purchaser." (Pg. 50)*

[11 (4 9 10 12)] Quinn, James Bryant and Penny C. Paquette (1990) Technology in services: Creating organizational revolutions. Harvard Business Review. No. 3.

[1 (3 6 8 9 12)] Ricardo, David (1817/2004) The Principles of Political Economy and Taxation. Dover Publications. Mineola, NY. *"Ever since I first turned by attention to questions of political economy, I have been of opinion that such an application of machinery to any branch of production as should have the effect of saving labour was a general good, accompanied only with the removal of capital and labour from one employment to another. It appeared to me that, provided the landlords had the same money rents, they would be benefited by the reduction in prices of some of the commodities on which those rents were expended, and which reduction of price could not fail to be the consequence of employing machinery. The capitalist I thought, was eventually benefited precisely in the same manner. He, indeed, who made the discovery of the machine, or who first usefully applied it, would enjoy additional advantage by making greater profits for a time; but, in proportion as the machinery came into general use, the price of the commodity produced would, from the effects of competition, sink to its cost of production, when the capitalist would get the same money profits as before, and he would only participate in the general advantage as a consumer, by being enabled, with the same money revenue, to command additional quantity of comforts and enjoyments. The class of labourers also, I thought, was equally benefited by the use of machinery, as they would have the means of buying more commodities with the same money wage, and I thought that no reduction of wages would take place because the capitalist would have the power of demanding and employing the same quantity of labour as before, although he might be under necessity of employing it in the production of a new or, at any rate, of a different commodity… These were my opinions, and they continue unaltered, as far as regards the landlord and the capitalist; but I am convinced that the substitution of machinery for human labour is often very injurious to the interests of the class of labourers." (Pp. 264-265)*

[8 (3 10)] Richardson, Peter J. and Robert Boyd (2005) Not By Genes Alone: How Culture Transformed Human Evolution. University of Chicago Press. Chicago, IL. *"Eminent biologist Ernst Mayr has argued that 'population thinking' was Charles Darwins key contribution to biology. Before Darwin, people thought of species as essential, unchanging types, like geometric figures and chemical elements. Darwin saw that species were populations of organisms that carried a variable pool of inherited information through time… Population thinking is the core of the theory of culture we defend in this book. First, of all, let's be clear about what we mean by culture: Culture is information capable of affecting individuals' behavior that they acquire from other members of their species through teaching, imitation, and other forms of social transmission. By information we mean any kind of mental state, conscious or not, that is acquired or modified by social learning and affects behavior. We will use everyday words like idea, knowledge, belief, value, skill, and attitude to describe this information…" (Pg. 5); "Human populations carry a pool of culturally acquired information, and in order to explain why particular cultures are as they are, we need to keep track of the processes that cause some cultural variants to spread and persist while others disappear. The key is to focus on the details of individual lives." (Pg. 59); "The first step in applying population thinking to human culture is to specify the nature of the information that is being transmitted. Culture is (mostly) information stored in human brains, and gets transmitted from brain to brain by way of a variety of social learning processes. Every human culture contains an enormous amount of information. Think about how much information must be transmitted just to maintain a spoken language." (Pg. 61); "Culture is maladaptive… Why do the modern middle classes have such low fertility? The proximate reason are familiar to all of us. We lead busy lives. Professional work is demanding. Affluent people can afford lots of time-consuming hobbies… Since raising children also takes time and money, we limit our fertility." (Pp. 148-129); "Because culture is transmitted, it is subject to natural selection. Some cultural variants persist and spread because they cause the bearers to be more likely to survive and be imitated." (Pg. 238)*

[11 (3 6 8 12 15)] Roberts, John (2004) The Modern Firm: Organizational Design for Performance and Growth. Oxford University Press. Oxford, UK. *"During the first two decades of the twentieth century, managers at Standard Oil of New Jersey, Dupont, Sears Roebuck, and General Motors invented a new way of organizing and managing their businesses. Their creation - the now ubiquitous multidivisional form – involved fundamental changes in the design of the firm. While the most visible change was structuring by product or geography, rather than functionally, the new form also involved new systems of collecting and recording information, for allocating*

resources, and for controlling behavior." (Pg. 1); "Achieving high performance in a business results from establishing and maintaining a fit among three elements: The strategy of the firm, its organizational design, and the environment in which it operates." (Pg. 12); "The interesting complexities arise from the interplay between the speeds of change of strategy, organization, and the environment. In the traditional view of management scholars, the environment has often been taken to be relatively stable, changing only slowly and infrequently." (Pg. 24); "When environmental change becomes extremely rapid and ongoing, however, the sequential approach to strategy and organization … may no longer be viable." (Pg. 27); "Then the two choice variables are complements when doing (more of) one of them increases the returns to doing (more of) the other." (Pg. 34); "In contrast, activities are substitutes if doing (more of) one reduces the attractiveness of doing (more of) the other." (Pg. 35); "One especially important class of circumstances generating market failure arises when there are information asymmetries among different parties." (Pg. 82); "A second form of informational asymmetry that may cause market failure involves limitations on the ability to observe others' actions, and thus to determine whether they are adhering to agreements. This leads to the problem of moral hazard." (Pg. 83); "Somewhat related are the problems of commitment. A simple instance arises when contracts enforcement is costly." (Pg. 85); "When assets are specialized, they are subject to hold up – attempts by trading partners to appropriate some of the returns that the assets' owners expected when they invested in them." (Pg. 91); "The contract, if well designed, will lead the parties to act in ways that maximize total value creation. Moreover, if explicit contracts cannot be written that adequately guide behavior, reputation mechanisms can sometimes substitute for them and take care of motivation." (Pg. 121); "The simplest agency model involves a single individual, called the agent, who acts on behalf of another, called the principal." (Pg. 126); "If the agent's choice of effort were observable and verifiable to the courts and if the desired action could be determined and described before the fact, then the two parties could simply contract on the action to be taken." (Pg. 127); "A second complaint against performance pay is that, too often, the available measures are manipulable – the agent can find ways to increase measured performance that are easier than doing what is wanted." (Pg. 156)

[1 (3 5 6 8 9 10 11)] Roughgarden, Tim (2005) Selfish Routing and the Price of Anarchy. MIT Press. Cambridge, MA. "*Pigou's example demonstrates a well known but important principle: selfish behavior need not produce a socially optimal outcome… Braess's Paradox will be a persistent thorn in our side: with selfish routing, network improvements can degrade network performance." (Pp. 5-6)*

[14 (2 8 9 10 11 12)] Rouse, William B. (2006) Enterprise Transformation: Understanding and Enabling Fundamental Change. Wiley. Hoboken, NJ. "*Change is inherent in all enterprises, whether they are companies, government agencies, educational institutions, non-profit associations or perhaps even religions. The forces driving change may have economic, political, social, and/or technological sources. The implications of change may be both positive and negative, with the balance between positive and negative depending on the perspectives of the particular types of stakeholders impacted by the change. This book concerns how enterprises can understand and should respond to change – how they can best change themselves in response to both external and internal forces." (Pg. 1); "When members of the technology community talk about systems, they often are thinking about airplanes, process plants, factories, transportation networks, and command and control systems, to name just a few typical domains… These types of systems are certainly very important. However, their importance to our economies and societies should be kept in perspective. There are thousands of commercial airplanes and hundreds of nuclear power plants, for example, and many thousands of people involved in their operations. In contrast, a much more ubiquitous types of system is the enterprise. An enterprise is a goal-directed organization of resources – human, information, financial, and physical – and activities, usually of significant operational scope, complication, risk, and duration. Enterprises can range from corporations, to supply chains, to markets, to governments, to economies." (Pp. 17-18)*

[4 (12 15)] Rust, Roland, Valarie Zeithaml, and Katherine Lemon (2000) Driving Customer Equity : How Customer Lifetime Value is Reshaping Corporate Strategy. Free Press. *"A firm's Customer Equity is the total of the discounted lifetime values of all its customers. (Pg, 4); "Customer Equity is based on three actionable drivers: Value Equity, the customer's objective evaluation of the firm's offerings; Brand Equity, the customers subjective view of the firm and its offerings; and Retention Equity, the customer's view of the strength of the relationship between the customer and the firm." (Pp. 55-56); "The Customer Equity Corporation succeeds (or fails) to the extent that it understands the drivers of Customer Equity for its business. The company no longer has a functional focus (e.g., finance, operations, marketing, and accounting). Rather, the organization and its resources are focused on the key drivers of customer equity…" (Pg. 254)*

[2 (4 5 12 14 15)] Sampson, Scott E. (2001) Understanding Service Businesses: Applying Principles of the Unified Services Theory. Second Edition. Wiley. "*With services, the customer provides significant inputs into the production process." (Pg. 16); "With services, an effective means of understanding, analyzing, and comparing processes is on the basis of customer content. There are three general types of customer inputs into the service processes: the customer's self, the customer's belonging, and/or the customer's information." (Pg. 22); "With services, the unit of analysis is a process segment. A process segment is a sequence of steps of production." (Pg. 38); "With services, different process segments have different degrees of customer input, and some may have none (acting as manufacturing)… Some segments are important for accounting, regulatory, or risk-control reasons." (Pg. 44); "With services, although the output can be identified, it often cannot be easily quantified. Therefore, it can be hard to measure productivity." (Pg. 116); "With services, quality measurement tends to be subjective and*

difficult to scale." (Pg. 124); "…in a pure service setting, customers and suppliers have multiple roles in the supply chains." (Pg. 132); "With services, often the chief competitor is the customers who can provide the service themselves." (Pg. 202); "With services, competitors posing as customers can study not only the service product, but often also the production process. Since most service processes cannot be patented, it can be difficult to keep the secrets of competitive advantage." (Pg. 224); "With services, a significant part of employee compensation can be the organization's culture." (Pg. 226); "With services, keeping track of production and inventory can mean tracking details about every customer. This often requires highly complex information systems." (Pg. 324)

[14 (4 5 12)] Sampson, Scott. E. and Christopher M. Froehle (2006) "Foundations and implications of a proposed unified services theory." Production and Operations Management, 15, 329-343. *"…a good inductive theory: (1) It is based on observations and data, (2) It defines concepts in a way that differentiates from other concepts, (3) It integrates concepts and resolves apparent contradictions, (4) It identifies causal relationships, (5) It typically takes time to develop, (6) It is open ended, allowing for extensions and re-applications." (Pg 3)*

[14 (6 8 11)] Sawyer, R. Keith (2005) Social Emergence: Societies as Complex Systems. Cambridge University Press. Cambridge, UK. *"Societies have often been compared to complex systems. Inspired by the rise of science and technology, writers in the eighteenth century compared societies to complex artificial mechanisms like clocks; such metaphors are now broadly known as mechanistic (La Mettrie [1748] 1912). Inspired by Darwin's influential theory of evolution, nineteenth-century organicists compared the various institutions of society to the organs of the human body (Paul von Lilienfeld, Albert Schaffle, and Herbert Spencer). Just after World War II, Talcott Parsons' influential structural-functional theory was inspired by cybernetics, the study of 'control and communication in the animal and the machine,' the subtitle of a seminal book published by mathematician Norbert Wiener in 1948. Cybernetics was centrally concerned with developing models of the computational and communication technologies emerging in the post-war period, but many cyberneticians applied these model to biology, anthropology, and sociology. In the 1960s and 1970s, general systems theory continued in this interdisciplinary fashion; it was grounded in the premise that complex systems at all levels of analysis – from the smallest unicellular organisms up to modern industrial societies – could be understood using the same set of theories and methodologies (Bertalanffy 1968; J. Miller 1978). Common to all of these approaches is the basic insight that societies are complex configurations of many people engaged in overlapping and interlocking patterns of relationships with one another." (Pg 1); "Third wave systems theory grew out of developments in computer technology. From the 1970s through the early 1990s, computer use in sociology was focused on systems dynamics simulations, in which changes in macrovariables of society – population, poverty rate, urban densities – were mathematically modeled (e.g., Forrester 1971). In the 1990s, however, computer power advanced to the point where societies could be simulated using a distinct computational agent for every individual in the society through a computational technique known as multi-agent systems (Chapters 8 and 9)." (Pg 2); "Complexity theorist have found that emergence is more likely to be found in systems which (1) many components interact in densely connected networks, (2) global system functions cannot be localized to any one subset of components but rather are distributed throughout the entire system, (3) the overall system cannot be decomposed into subsystems and these into smaller sub-subsystems in any meaningful fashion, (4) and the components interact using a complex and sophisticated language (Chapter 5)." (Pg 4-5)*

[6 (3)] Say, J. B. (1821) A Treatise on the Political Economy, Wells and Lilly, Boston, MA. (In Google Books)

[9 (7)] Scheer, August-Wilhelm and Spath, Dieter (2004) Computer-Aided Service Engineering. Springer. Berlin. [In German]

[2 (4 5 12)] Schmenner, Roger W. (1986) How Can Service Businesses Survive and Prosper? Sloan Management Review. 27(3). *"Service process matrix… degree of labor intensity… degree of interaction and customization… (low, low – service factory), (low, high – service shop), (high, low – mass service), (high, high – professional service)" (Pg. 25)*

[4 (7 12)] Schmitt, Bernd H. (2003) Customer Experience Management: A Revolutionary Approach to Connecting With Your Customers. Wiley. Hoboken, NJ. *"The marketing concept, customer satisfaction, and customer relationship management all promise to help managers better understand their customers. However, each approach has remained narrowly focused and unnecessarily limiting… What managers need is an approach that takes the customer seriously – finally… Customer experience management is that approach… To put it simply, customer experience management (CEM) is the process of strategically managing a customer's entire experience with a product or a company." (Pg. 17)*

[4 (8 11 12)] Schneider, Benjamin and David E. Bowen (1995) Winning the Service Game. Harvard Business School Press. Boston, MA. *"The message is simple: Service organizations can outperform the competition if they master what we offer as the 'rules of the service game.' We emphasize 'service' game because it is indeed a very different game from manufacturing. Daniel Bell's work made this most clear to us when he described the steps in the evolution of the nature of work: 1. Step 1: the agrarian 'game against nature,' in which the game was human versus the land. 2. Step 2: the industrial 'game against fabricated nature,' in which the game was between human and machine. 3. Step 3: the postindustrial services 'game between persons,' in which the game is between a clerk and a customer or professional and a client. Each of these games requires different resources and rules." (Pg. 1)*

[4 (8 11 12)] Schneider, Benjamin and Susan S. White (2003) Service Quality: Research Perspectives. Sage. Thousand Oaks, CA. *"A major reason for the development of the field now called services marketing and management was the realization that services were – in the extreme – different from goods. We typically think of a service as something that is done for us or to us." (Pg. 4); "As described below, there are several different ways to approach the definition of quality: the philosophical approach, the technical approach, and the user-based approach. …philosophical approach to quality… …quality is synonymous with innate excellent… and that it cannot be defined or analyzed further than that… The second approach is defining quality in stark contrast to the first, and considers quality from an objective and absolute perspective. Alternatively called the manufacturing-based quality, objective quality, or conformance quality, this approach to quality is concerned with the extent to which a product conforms to technical standards… The third approach to defining quality is the user-based one, in which quality of a product is determined by its user. This definition of quality takes the view that quality is subjective and hinges on the individual perceptions of the customer." (Pp. 9-10); "While the relationship is not perfect, there is growing support for a link between an organization's emphasis on service quality and profitability… This idea is captured in the service profit chain, a theoretical framework developed by the Service Management Interest Group at Harvard Business School…" (Pg. 17); "The service quality tactic is particularly interesting to us, because it requires a total systems view of how businesses operate." (Pg. 22); "In studying organizational climate, we are essentially studying organizational issues – such as service quality – in terms of what employees in organizations report they experience." (Pg. 92); "In this chapter, our goal is to integrate what we have learned about service delivery form marketing, operations management (OM), and organizational behavior/human resources management (OB/HRM) perspectives – a daunting challenge, to say the least!" (Pg. 139)*

[11 (6 12)] Scott, W. Richard (1981/2003) Organizations: Rational, Natural, and Open Systems. Fifth Edition. Prentice Hall. Upper Saddle River, NJ. *"Scholars are attending less to organizations and more to organizing." (Pg. xi); "Today's organizations are vigorously pursuing a strategy of externalization, outsourcing functions and relying on alliances or contracts for essential goods and services." (Pg. x); "Organizations play a leading role in our modern world. Their presence affects… virtually every sector of contemporary social life. Peter Drucker thus observes, 'Young people today will have to learn organizations the way their forefathers learned farming.'" (Pg. 1); "There is no need to belabor the assertion that ours is an organizational society – that organizations are a prominent, if not the dominant, characteristic of modern societies… Even such a partial listing testifies to the truth of Parson's statement that 'the development of organizations is the principal mechanism by which, in a highly differentiated society, it is possible to 'get things done,' to achieve goals beyond the reach of the individual.'" (Pg. 3); "In 1997, the U.S. Census Bureau reported the existence of '…6.9 million establishments and 5.5 million firms.'" (Pg. 4); "Indeed, more Americans are now employed in government service than in all of manufacturing." (Pg. 12); "A Rational System Definition… Organizations are collectivities oriented to the pursuit of relatively specific goals and exhibit relatively highly formalized social structures." (Pg. 27); "A Natural System Definition… Organizations are collectivities whose participants are pursuing multiple interests, both disparate and common, but who recognize the value of perpetuating the organization as an important resource. The informal structure of relations that develops among participants is more influential in guiding the behavior of participants than the formal structure." (Pg. 28); "An Open System Definition… Organizations are congeries of interdependent flows and activities linking shifting coalitions of participants embedded in wider material-resource and institutional environments." (Pg. 29)*

[3 (8 11)] Seabright, Paul (2005) The Company of Strangers: A Natural History of Economic Life. Princeton University. Princeton, NJ. *"'Tell me, for example: who is in charge of the supply of bread to the population of London?' There was nothing naïve about his question, because the answer ('nobody is in charge'), when one thinks carefully about it, is astonishingly hard to believe. Only in the industrialized West have we forgotten how strange it is… Cooperation with Nobody in Charge: This book is about the human capacities that have made such cooperation possible… Our activities are part of a network; we can play our part just by knowing how to behave toward our neighbors in the network." (Pg. 15)*

[3 (6 8 11 13 15)] Sen, Amartya (2000) Development As Freedom. Anchor/Random House. New York, NY. *"This work outlines the need for an integrated analysis of economic, social, and political activities, involving a variety of institutions and many interactive agencies. It concentrates particularly on the roles and interconnections between certain crucial instrumental freedoms, including economic opportunities, political freedoms, social facilities, transparency guarantees, and protective security. Societal arrangements, involving many institutions (the state, the market, the legal system, political parties, the media, public interest groups and public discussion forums, among others) are investigated in terms of their contribution to enhancing and guaranteeing the substantive freedoms of individuals, seen as active agents of change, rather than as passive recipients of dispensed benefits." (Pp. xii-xiii); "Institutions and Instrumental Freedoms: Five distinct types of freedom, seen in an 'instrumental' perspective are particularly investigated in the empirical studies that follow. These include: (1) political freedoms, (2) economic facilities, (3) social opportunities, (4) transparency guarantees, and (5) protective security. Each of these distinct rights and opportunities helps to advance the general capabilities of a person. " (Pg. 10); "Forms of Unfreedoms: Very many people across the world suffer from varieties of unfreedoms." (Pg. 15)*

[9 (2 3 12)] Sepulveda, Jose A., William E. Souder, and Byron S. Gottfried (1984) Theory and Problems of Engineering Economics. McGraw Hill/Schaum's Outline Series. New York, NY.

[7 (2 4 8 15)] Shostack, G.L. (1982) How to Design a Service. European Journal of Marketing. 16(1). 49-63.

[11 (3 6 8 10 12 14)] Simon, Herbert A. (1945/1997) Administrative Behavior: A study of decision-making processes in administrative organizations. Free Press. New York, NY. *"It is a fatal defect of the current principles of administration that, like proverbs, they occur in pairs. For almost every principle one can find an equally plausible and acceptable contradictory principle" (Pg. 29). "Scientific propositions… are statements about the observable world and the way it operates. Ethical propositions, on the other hand, are expressions of preferences." (Pg. 356).*

[7 (4 11 12)] Slywotzky, Adrian, Richard Wise, and Karl Weber (2003) How to Grow When Markets Don't. Warner Business Books, NY, NY. *"These companies are focused on creating new growth and new value by addressing the hassles and issues that surround the product rather than by improving the product itself. They have shifted their approach from product innovation to demand innovation. Rather than being about value migration, demand innovation is about creating new growth by expanding the markets boundaries. It focuses on using one's product position as a starting point from which to do new things for customers that solve their biggest problems and improve their overall performance. Thus, companies skilled in demand innovation do more than simply take value and market share away from traditional businesses. They also create new value and new growth in revenues and profits, even in mature industries that appear to have reached a plateau." (Pp. 15-16)*

[3 (1 5 8 11)] Smith, A. (1776/1904) An Inquiry into the Nature and Causes of the Wealth of Nations, W. Strahan and T, Cadell, London, U.K.

[3 (5 6 7 8 9 10 11 12)] Solow, R. (1956) "A Contribution to the Theory of Economic Growth," Quarterly Journal of Economics, February.

[7 (2 9)] Spath, Dieter (2007) Advances in Services Innovations. Springer. New York, NY. *"Service Engineering: State of the Art and Future Trends. Klaus-Peter Fahnrich, Tomas Meiren. A typical service can thus be said to be characterized by three dimensions: A structure dimension… A process dimension… An outcome dimension…" (Pp. 5-6); "An engineering tool for the conceptual design of service systems. Reuven Karn, Maya Kaner. A system is an organized set of objects which processes inputs into outputs that achieve an organizational purpose and meet the need of customers through the use of human, physical, and informatic enablers in a sociological and physical environment (adapted from Nadler, 1981; Checkland, 1981). It is architected as a set of nine interlinked classes of objects: (1) customers… (2) goals… (3) inputs… (4) outputs… (5) processes… (6) human enablers… (7) physical enablers… (8) informatic enablers… (9) environment…" (Pp. 65-67)*

[1 (4 5 6 7 8 11 12)] Spitzer, Dean R. (2007) Transforming Performance Measurement: Rethinking the Way We Measure and Drive Organizational Success. American Management Association. New York, NY.

[10 (1)] Spohrer, Jim, Laura Anderson, Norm Pass, Daniel Gruhl (Submitted) Service Science. The Journal of Grid Computing.

[14 (13)] Spohrer, J. and P. P. Maglio (In Press) "The emergence of service science," Production and Operations Management.

[1 (14 15)] Spohrer, J, P. P. Maglio, J. Bailey, D. Gruhl (2007) "Towards a Science of Service Systems," Computer, 40(1), pp. 71-77.

[14 (3 4 5 6 7 8 9 10 11 12 13)] Spohrer, J. & D. Riecken (2006), Special Issue: Services science. Communications of the ACM. 49(7). July. 30 – 87.

[14 (3 9)] Spohrer, J., P. M. Maglio, D. McDavid, J. Cortada (2006) Convergence and coevolution: Towards a services science. In Nanotechnology: Societal Implications: Maximising Benefits for Humanity and Nanotechnology and Society, editors Mihail C. Roco and William S. Bainbridge. Springer. New York, NY.

[1 (14)] Spohrer, J., S. Vargo, P.M. Maglio, N. Caswell (submitted) The service system is the basic abstraction of service science. HICSS Conference.

[13 (1 2 3 4 5 6 7 8 9 10 11 12 14 15)] Sterman, John D. (2000) Business Dynamics: Systems Thinking and Modeling for a Complex World. Irwin McGraw-Hill. Boston, MA. *"Accelerating economic, technological, social, and environmental change challenge managers and policy makers to learn at increasing rate, while at the same time the complexity of the systems in which we live is growing. Many of the problems we now face arise as unanticipated side effects of our own past actions. All too often the policies we implement to solve important problems fail, make the problem worse, or create new problems. Effective decision making and learning in a world of growing dynamic complexity requires us to become systems thinkers – to expand the boundaries of our mental models and dvelop tools to understand how the structure of complex systems creates their behavior. This book introduces you to system dynamics modeling for the analysis of policy and strategy, with a focus on business and public policy applications." (Pg. vii); "The dizzying effects of accelerating change are not new. Henry Adams, a perceptive observer of the great changes wrought by the industrial revolution, formulated the Law of Acceleration to describe the exponential growth of technology, production, and population… A steady stream of philosophers, scientists, and management gurus have since echoed Adams, lamenting the acceleration and calling for similar leaps to fundamental new ways of thinking and acting. Many advocate the development of systems thinking*

– the ability to see the world as a complex system, in which we understand that 'you can't just do one thing' and that 'everything is connected to everything else.'" (pp. 3-4)

[14 (12)] Subramanian, K. (Subbu) (2000) The System Approach: A Strategy to Survive and Succeed in the Global Economy. Modern Machine Shop/Hanser Gardner Publications. Cincinnati, OH. *"Every activity of any individual, organization, enterprise, or industry can be treated as an input/process/output sequence…" (Pp. 51-52); "The treatment of the process of the enterprise as a black box leaves behind untold consequences to the individuals or employees… In the absence of a clear definition, it is possible to treat the process as stochastic. In other words, variations in the process are recognized. But in the absence of a systematic and logical understanding, the variations are assumed to occur as random events. This is the definition of stochastic process. Such treatment permits the process to be managed using statistical process control (SPC)." (Pg. 54); "There is a different, perhaps more appropriate, approach to describe the input/process/output sequence of any problem, job, or activity of an individual, organization, or enterprise. We shall call this the 'Systems Approach.'" (Pg. 57); "Just as there are hundreds of perceived inputs to the enterprise, there is an equally large number of outputs to an enterprise, again based on the perspective of the individual listing these outputs. Thus, an industrial activity would appear to be a multidimensional activity comprised of hundreds of inputs and outputs made possible through individuals, organizations, and their associated jobs, tasks, and functions." (Pg. 57); "Small changes in the internal causal relations can lead to quantum changes in the output of the system (Pg. 66)*

[12 (8)] Taleb, Nassim Nicholas (2004) Fooled by Randomness: The Hidden Role of Chance in Life and in the Markets. Second Edition. Texere/Thomson. New York, NY. *"Probability is not a mere computation of odds on the dice or more complicated variants; it is the acceptance of the lack of certainty in our knowledge and the development of methods for dealing with ignorance." (Pg. xxii); "This book is about luck disguised as non-luck (that is, skill) and, more generally, randomness disguised and perceived as non-randomness (that is, determinism)." (Pg. 1)*

[11 (2 6 10 12)] Tapscott, D. (2003) The Naked Corporation: How the Age of Transparency Will Revolutionize Business, Free Press. *"Firms, or more specifically firms' various operations, work at any onf three levels of transparency… Level 1 firms focus on compliance… Level 2 firms comply with the law, but they go further when it comes to relationship management… Lvel 3 open enterprise see transparency, stakeholder relationships, and sustainability as sources of competitive advantage…" (Pp. 257-258)*

[6 (3 4 8 10 11 12)] Tapscott, Don and Anthony D. Williams (2006) Wikinomics: How Mass Collaboration Changes Everything. Portfolio/Penguin. New York, NY. *"Due to deep changes in technology, demographics, business, the economy, and the world, we are entering a new age where people participate in the economy like never before. This new participation has reached a tipping point where new forms of mass collaboration are changing how goods and services are invented, produced, marketed, and distributed on a global basis. This change presents far-reaching opportunities for every company and every person who gets connected… The growing accessibility of information technologies puts the tools required to collaborate, create value, and compete at everybody's fingertips… This new model of innovation and value creation is called 'peer production,' or peering – which describes what happens when masses of people and firms collaborate openly to drive innovation and growth in their industries." (Pp. 10-11)*

[2 (4 5 12 15)] Teboul, James (2006) Service Is Front Stage: Positioning Services for Value Advantage, INSEAD Business Press, Palgrave MacMillan. *"This idea that any manufacturing or service delivery involves activities in both the front stage and the back stage was expressed by Theodore Leavitt as early as 1972. There are no such things as service industries. There are only industries whose service components are greater or lesser than those of other industries. Everybody is in service.'" (Pp. 14-15); "Every activity, therefore, consists of both an interaction (the service aspect) and a material transformation (the product aspect)." (Pg 19)*

[14 (13)] Tien, James M., and Daniel Berg (under review) "On Services Research and Education," Journal of Systems Science and Systems Engineering.

[7 (13 14)] Tien, James M., and Daniel Berg, A Calculus for Services Innovation, J Sys Sci Syst Eng (Jun 2007) 16(2): 129-165

[5 (3 8 11)] Triplett, Jack E. and Barry P. Bosworth (2004) Productivity in the U.S. Services Sector: New Sources of Economic Growth. The Brookings Institute. Washington, DC. *"After many years of slow growth, the U.S. economy has experienced a remarkable improvement in labor productivity that began in the mid-1990's but continued through the 2001-02 recession and now has lasted for nearly a decade. This book undertakes a detailed assessment of the resurgence of the productivity growth. It demonstrates the dominant role played by the services-producing industries in recent U.S. productivity performance. This is a great turnaround from the past view of services industries. In the old view of services, they were stagnant and unprogressive sectors that slowed overall economic growth. In the new view presented in this book, they are revealed as the dynamic innovative sectors that are significant sources of economic growth." (Pg. viii); "The United States has a services-based economy. Over the past half-century, the share of the nation's output accounted for by goods-producing industries has fallen by nearly half, and the services-producing industries now account for more than three-quarters of GDP and a comparable portion of total employment. Yet services industries have long been disparaged as sources of low-skill, low wage jobs, and they often are characterized as part of a stagnant sector marked by low productivity growth and only limited opportunities for innovation…. Our fundamental motivation for writing this book was the growing realization of how much things have changed. The services industries*

have emerged as the dominant engines of U.S. economic growth. During the 1990's, services were responsible for 19 million additional jobs, while employment in the goods-producing sector stagnated." (Pg. 1); "Moreover, the services industries are the primary consumers of information technology (IT) capital." (Pg. 2); "[Business services] is a large, diverse, and rapidly growing sector of activity that raises severe measurement problems. One dimension of the problem is the lack of agreed-upon definition of the industry's output – particularly for business consulting." (Pg. 335)

[4 (3)] Vargo, S. L. (In Press) "On A Theory of Markets And Marketing:From Positively Normative To Normatively Positive," Australasian Marketing Journal.

[1 (3 4)] Vargo, S. L. and R. F. Lusch (2004) "Evolving to a New Dominant Logic for Marketing," Journal of Marketing, 68, 1-17.

[4 (1 3)] Vargo, S. L. and R. F. Lusch (2006) "Service-Dominant Logic: What It Is, What It Is Not, What It Might Be," in, R. F. Lusch and S. L. Vargo (eds) The Service-Dominant Logic of Marketing: Dialog, Debate, and Directions, M.E. Sharpe, Armonk, NY, 43-56.

[4 (1 3)] Vargo, S. L. and R. F. Lusch (In Press a) "From Goods To Service(s): Divergences And Convergences Of Logics," Industrial Marketing Management.

[4 (1 3)] Vargo, S. L. and R. F. Lusch (In Press b) "Service-Dominant Logic: Further Evolution," Journal of the Academy of Marketing Science.

[4 (1 3)] Vargo, S. L. and F. W. Morgan (2005) "An Historical Reexamination of the Nature of Exchange: The Service-Dominant Perspective," Journal of Macromarketing, 25 (1), Pp. 42-53.

[12 (6 9 10 11)] Wallin, Johan (2006) Business Orchestration: Strategic Leadership in the Era of Digital Convergence. Wiley. Hoboken, NJ. *"In the following story we will see that there are two fundamentally different ways to create a strategy. One is the industrial approach where the instinctive behavior is control and empire building. Another, but perhaps less frequently adopted philosophy, is one of mobilizing external resources and orchestrating an evolving ecosystem." (Pg. 7)*

[6 (10)] Weber, Steven (2004) The Success of Open Source. Harvard Business Press. Cambridge, MA. *"I'm a political scientist and I worry more about how communities are governed than I do about technology per se. I became interested in open source as an emerging technological community that seems to solve what I see as very tricky but basically familiar governance problems, in a very unfamiliar and intriguing way… By experimenting with fundamental notions of what constitutes property, this community has reframed and recast some of the most basic problems of governance." (Pg. iii); "This is a book about property and how it underpins the social organization of cooperation and production in a digital era. I mean 'property' in the broad sense – not only who owns what, but what it means to own something, what rights and responsibilities property confers, and where those ideas come from and how they spread. It is a story of how social organization can change the meaning of property, and conversely, how shifting notions of property can alter the possibilities of social organization." (Pg.1) "Business models and the law: …open source diverges from the conventional organizational logic of a business; it relies on idiosyncratic twist of legal structures for its principles of ownership; and it makes use of some economic principles and practices that are different from those of most of the institutions around it. Yet the open source process needs to interact deepl and effectively with each of these existing structures. The two most important are business and the law. The business model problem recognizes that there is no such thing as free standing 'open source economy' any more than there is an 'information economy' or an 'internet economy' that somehow stands alone. The legal principles that surround open source are similarly in contact with conventional rules of law. Compatibility at the points of contact allows the open source process to coevolve with these extant institutions. This chapter focuses selectively on parts of the interaction that bring open source software into close and challenging kinds of contact with basic principles of capitalist business organization and modern legal institutions of property." (Pp. 190-191)*

[3 (6 8 11)] Weber, Max (1978) Economy and Society. University of California Press. Berkeley, CA. *"Sociologically speaking, this would mean: the city is a settlement of closely spaced dwellings which form a colony so extensive that the reciprocal personal acquaintance of the inhabitants, elsewhere characteristic of the neighborhood, is lacking. But on this definition only very large localities would qualify as cities, and the special conditions of various cultures would have to determine at which size the absence of personal acquaintance would be characteristic… If we were to attempt a definition in purely economic terms, the city would be a settlement whose inhabitants live primarily from commerce and the trades rather than from agriculture." (Pp. 1212-1213)*

[14 (13 15)] Weinberg, Gerald M. (1975/2001) An Introduction to General Systems Thinking (Silver Anniversary Edition). Dorset House Publishing. *"The general systems movement has taken up the task of helping scientists to unravel complexity, technologists to master it, and others to learn to live with it." (Pg. 3); "What is the cost of computation, in time and money? … Altogether, the most general two-body system requires four equations: two 'isolated' equations, one 'interaction' equation, and one 'field' equation. As the number of bodies increases, there remains but a single 'field' equation, and only one 'isolated' equation per body. The number of 'interaction' equations, however, grows magnificently, with the result that for n bodies we would have 2^n relationships! … This annoying question – how much 'time and money'? – lies at the very foundation of the general systems movement…. Experience has shown that unless some simplification can be made, the amount of computation involved increases at least as fast as the square of the number of equations." (Pp. 6-7); "…the general systems thinker understands. He understands*

because it is his chosen task to understand the simplifying assumptions of a science…" (Pg. 12); "The misnaming of fields of study is so common as to lead to what might be general systems laws. For example, Frank Harary once suggested the law than any field that had the word 'science' in its names was guaranteed thereby not to be a science. He would cite examples Military Science, Library Science, Political Science, Homemaking Science, Social Science, and Computer Science." (Pg. 25); "Every model is ultimately the expression of one thing we think we hope to understand in terms of another that we think we do understand." (Pg. 28); "Science is the study of those things that can be reduced to the study of other things." (Pg. 30); "Among the scientists, the anthropologists come closest to doing our kind of work when they study the conceptual schemes of naturally evolving social groups. Conceptual schemes are also found, however, in any subculture that develops when people work together. By possessing a common set of standard categories of thought – usually symbolized by special words or phrases – groups can simplify the process of internal communication. Paradoxically, the more effective these categories are for internal communication, the more difficult they make communications with outsiders." (Pp. 31-32); "The disciplines within science also form social groups, and thus have category schemes to facilitate internal communication." (Pg. 33); "Just as anthropologists learn to live in many cultures, without rifles, so do certain scientists manage to adapt comfortably to the paradigms of several disciplines. How do they do it? When questioned, these generalists always express an inner faith in the unity of science." (Pg. 34)

[6 (3 8 12)] Williamson, O. E. (1985) The Economic Institutions of Capitalism, Free Press. New York, NY. *"Those two behavioral assumptions support the following compact statement of the problem of economic organization: devise contract and governance structures that have the purpose and effect of economizing on bounded rationality while simultaneously safeguarding transactions against the hazards of opportunism." (Pg. xiii); "Friedrich Hayek resisted the main tradition in his insistence that 'the economic problem of society is mainly one of rapid adaptation to changes in particular circumstances of time and place' (1945, p. 524)" (Pg. 8); "The efficacy of alternative modes of contracting will thus vary among cultures because of the difference in trust (Arrow, 1969, p. 62)." (Pg. 9)*

[6 (1 3 11 12 15)] Williamson, Oliver E. (1999) The Mechanisms of Governance. Oxford University Press. Oxford, UK. *"This book develops the argument that many puzzles of economic organization turn on an examination and explication of the mechanisms of ex post governance. It operates at a more microanalytic level than is customary in economics, and it appeals to law (especially contract law) and organization (which is broadly construed to include organization theory, sociology, and political science) as well as economics." (Pg. 3); "Institutions have been variously defined. According to Douglass North, Institutions are 'the humanly devised constraints that structure political, economic, and social interactions. They consist of both the informal constraints (sanctions, taboos, customs, traditions, and codes of conduct) and formal rules (constitutions, laws, property rights).'" (Pg. 4); "These definitions of institutions mainly operate at the level of the institutional environment, the so-called rules of the game. The second, more microanalytic, level at which institutional economics works is at the level of the institutions of governance. This book is principally concerned with the institutions of governance (markets, hybrids, hierarchies, bureaus). One of the salient differences between the institutional environment and the institutions of governance is that the former mainly defines – can be thought of as constraints on – the environment of the latter." (Pp. 4-5); "Prescribing governance structures in order to provide cost-effective relief against maladaptation hazards is a recurrent theme. More generally, the study of governance is concerned with the identification, explication, and mitigation of all forms of contractual hazard." (Pg. 5); "Transaction cost economics is a semistrong form construction. It concedes that comprehensive contracting is not a feasible option (by reason of bounded rationality), yet it maintains that many economic agents have the capacities both to learn and to look ahead, perceive hazards, and factor these back into the contractual relation, thereafter to devise responsive institutions. In effect, limited but intended rationality is translated into incomplete but farsighted contracting. The concept of contract from which transaction cost economics works is therefore that of 'incomplete contracting in its entirety'…" (Pg 9); "…governance is the means by which order is accomplished in a relation in which potential conflict threatens to undo or upset opportunities to realize mutual gains." (Pg. 12); "In general, all hazards can be attributed to the twin behavioral assumptions from which transaction cost economics works: bounded rationality and opportunism." (Pg. 12); "But insurance must also come to terms with recalcitrant problems that have their origins in human nature. The most familiar of these problems take the forms of adverse selection and moral hazard, which arise because individuals will not candidly disclose their objective risk attributes (adverse selection) and individuals who are covered by insurance will not exercise the same degree of due care (moral hazard)." (Pg 15); "In the context of insurance, the use of experience rating (a type of reputation effect mechanism, which sometimes works well and sometimes poorly, depending on particulars) is an obvious possibility." (Pg. 15); "Adaptation is taken to be the central problem of economic organization, of which two types are distinguished: autonomous or Hayekian adaptation (in which markets enjoy the advantage) and cooperative or Barnardian adaptation (in which the advantage accrues to hierarchy)." (Pg 26); "Thus, whereas the courts routinely hear disputes over prices, delivery, quality, and the like in transactions between firms, these same courts refuse to be drawn into identical disputes between divisions within a single firm." (Pg. 27); "Barnard argued that formal and informal organizations always and everywhere coexist…" (Pg. 34): "Transaction cost economics maintains that the key dimensions for describing transactions are (1) asset specificity, (2) uncertainty, and (3) frequency." (Pg. 45); "This self-interest-seeking attribute is variously described as opportunism, moral hazard, and agency." (Pg. 56); "To be sure, John R. Commons deserves credit for his early recognition that 'law and economics' was a combined*

enterprise (Commons, 1924, 1925)." (Pg. 251); "Taken together, the lessons of bounded rationality and opportunism lead to the following combined result: organize transactions so as to economize on bounded rationality while simultaneously safeguarding them against the hazards of opportunism. No only do credible commitments arise when incomplete contracts are examined in their entirety, but complaints over obsessive calculativeness, truncated calculativeness, and anticalculativeness are mitigated as well." (Pg. 254)

[14 (8)] Wilson, E. O (1998) Consilience: The Unity of Knowledge. Borzoi/Knopf. New York, NY. *"Then I discovered evolution. Suddenlty – this is not too strong a word – I saw the world in a wholly new way... I had experience the Ionian Enchantment. That recently coined expression I borrow from physicist and historian Gerald Holton. It means a belief in the unity of sciences – a conviction, far deeper than a mere working proposition, that the world is orderly and can be explained by a small number of natural laws." (Pg 4); "Consilience is the key to unification. I prefer this word over 'coherence' because its rarity has preserved its precision, whereas coherence has several possible meanings, only one of which is consilience. William Whewell, in his 1840 synthesis 'The Philosophy of the Inductive Sciences," was the first to speak of consilience, literally a 'jumping together' of knowledge by the linking of facts and fact-based theory across disciplines to create a common groundwork for explanation." (Pg. 8); "Everyone knows that the social sciences are hypercomplex. They are inherently far more difficult than physics and chemistry, and as a result they, not physics and chemistry, should be called the hard sciences… Such is the paradox of the social sciences. Familiarity bestows comfort, and comfort breeds carelessness and error. Most people believe they know how they themselves think, how others think too, and even how institutions evolve. They are wrong." (Pg. 183); "The central idea of the consilience world view is that all tangible phenomena, from the birth of stars to the working of social institutions, are based on material processes that are ultimately reducible, however long and tortuous the sequences, to the laws of physics… I know that such reductionism is not popular outside the natural sciences. To many scholars in the social sciences and humanities it is a vampire in the sacristy. So let me hasten to dispel the profane image that causes this reaction. As the century closes, the focus of the natural sciences has begun to shift away from the search for new fundamental laws and toward new kinds of synthesis – 'holism,' if you prefer – in order to understand complex systems… The strategy that works best in these enterprises is the construction of coherent cause-and-effect explanations across levels of organization." (Pg. 266)*

[5 (2 4 8 11 12 15)] Womack, James P. and Jones, Daniel T. (2005) Lean Solutions: How Companies and Customers Can Create Value and Wealth Together. Free Press. New York, NY. *"But curiously, despite a growing variety of better products with fewer defects at lower cost available from a growing range of sales channels, the experiences of consumers seem to be deteriorating." (Pg. 3); "Choice is wonderful but it requires more and more decision time from the consumer." (Pg. 5); "…consumption is often hard work for the consumer and is unpaid work to boot… Consumption is a continuing process – a set of actions taken over an extended period – to solve a problem. It involves searching for, obtaining, installing, maintaining, repairing, upgrading, and eventually, disposing of many goods and services." (Pg. 9); "The Principles of Lean Consumption: These six simple principles of lean consumption provide a new definition of value for today's consumer, which we'll express in the voice of the customer: Solve my problem completely. Don't waste my time… Provide exactly what I want. Deliver value where I want it. Supply value when I want it. Reduce the number of decisions I must make to solve my problems." (Pg. 15); "…they point out that privacy looms as a major issue because the effectiveness of the solution provider is directly proportional to the amount of information continuously shared between the consumer and the provider." (Pg. 281)*

[9 (2 3 12)] Woods, Baldwin M. and E. Paul Degarmo (1953/1959) Introduction to Engineering Economy. Second Edition. Macmillan. New York, NY. *"The engineer does for one dollar what others do for two." (Pg.v); "If the engineer is to give and obtain the proper cooperation from all phases of the business world and assume a larger share of the responsibility in the management of industry, and in government, it is essential that he be able to speak and understand the language of the businessman." (Pg. 5) "The engineer is well versed in the physical laws of the universe. He is at all times cognizant of the laws of gravitation, conservation of energy, and thermodynamics. He would never think of attempting a project contrary to the rules established by these laws. It is surprising, therefore, that many engineers (and businessmen) remain in ignorance of fundamental laws of economics, or at least refuse to abide by these laws if they aware of them. A few of these laws are of such importance and apply to so many engineering problems that they should be respectfully considered, since disregard of them may vitally affect the economy of an engineering project just as surely as will the neglect of applicable physical laws." (Pg. 5); "There is another factor which may have a tremendous effect upon the economy of an engineering undertaking. This is the relationship of the human individual to the project. It appears that industry is becoming increasingly conscious of the interdependence of humanity and itself and realizes that business without human beings would be impossible. It is only too true that the effect of the human element cannot be written down in an equation or set of rules nor can it be accurately predicted at all times, yet it may be so great as to outweigh all other factors." (Pg. 6)*

[10 (1 2 6 8 11 13 14 15)] Wooldridge, Michael (2002) An Introduction to MultiAgent Systems. John Wiley. Chichester, UK. *"Multiagent systems are systems composed of multiple interacting computing elements, known as agents. Agents are computer systems with two important capabilities. First, they are at least to some extent capable of autonomous action - of deciding for themselves what they need to do in order to satisfy their design objectives. Second, they are capable of interacting with other agents – not simply by exchanging data, but by engaging in analogues of the kind of social activity that we all engage in every day of our lives:*

cooperation, coordination, negotiation, and the like. Multiagent systems are a relatively new sub-field of computer science…" (Pg xi); "The multiagent systems field is highly interdisciplinary: it takes inspiration from such diverse areas as economics, philosophy, logic, ecology, and the social sciences." (Pg. 7); "…mechanism design is the design of protocols for governing multiagent interactions, such that these protocols have certain desirable properties… Possible properties include… Guaranteed success… Maximizing social welfare… Pareto efficiency… Individual rationality… Stability… Simplicity… Distribution…" (Pp. 130-131); "Auctions are a very useful technique for allocating goods to agents. However, they are too simple for many settings: they are only concerned with the allocation of goods. For more general settings, where agents must reach agreement on matters of mutual interest, richer techniques for reaching agreement are required. Negotiation is the generic name given to such techniques." (pg. 137); "…a systematic classification of possible types of speech acts, identifying the following five key classes… (1) Representatives… (2) Directives… (3) Commissives… (4) Expressives… (5) Declarations…" (Pg. 166)

[3 (6 1)] Wright, Robert (2000) Non-Zero: The Logic of Human Destiny. Vintage/Random House. New York, NY. *"People who see a direction in human history, or in biological evolution, or both, have often been dismissed as mystics or flakes." (Pg. 3); "Sometimes political scientists or economists break human interaction down into zero-sum and non-zero-sum components. Occasionally, evolutionary biologists do the same in looking at the way various living systems work. My contention is that, if we want to see what drives the direction of both human history and organic evolution, we should apply this perspective more systematically. Interactions among individual genes, or cells, or animals, among interest groups, or nations, or corporations, can be viewed through the lenses of game theory. What follows is a survey of human history, and of organic history, with those lenses in place. My hope is to illuminate a kind of force – the non-zero-sum dynamic – that has crucially shaped the unfolding of life on earth so far." (Pg. 5); "In short, both organic and human history involve the playing of every-more-numerous, ever-larger, and ever-more-elaborate non-zero-sum games. It is the accumulation of these games – game upon game upon game – that constitutes the growth of biological and social complexity…" (Pp. 6-7)*

[11 (1 3 6 8 12 14 15)] Young, H. Peyton (1998/2001) Individual Strategy and Social Structure: An Evolutionary Theory of Institutions. Princeton University Press. Princeton, NJ. *"[T]he problem of a rational economic order is determined precisely by the fact that the knowledge of the circumstances of which we must make use never exist in concentrated or integrated form, but solely as the dispersed bits of incomplete and frequently contradictory knowledge which all the separate individuals possess… The problem is thus in no way solved if we can show that all of the facts, if they were known to a single mind (as we hypothetically assume them to be given to the observing economist) would uniquely determine the solution; instead, we mush show how a solution is produced by interactions of people, each of whom possess only partial knowledge. – Friedrich von Hayek, 'The Use of Knowledge in Society.'" (Pg. vii); "Economics and social institutions coordinate people's behaviors in various spheres of interaction. Markets coordinate the exchange of particular kinds of goods at specific times and places. Money coordinates trade. Language facilitates communication. Norms of etiquette coordinate how we interact socially with one another. The common law defines the bounds of acceptable behavior with respect to persons and property, and tells us what to expect when we overstep those bounds. These and many other institutions are the product, at least in part, of evolutionary forces. They are shaped by the cumulative impact of many individuals interacting with one another over long periods of time… These features are determined to a considerable degree by the accumulation of historical precedents, that is, by the decisions of many individuals who were concerned only with making the best trade at the moment, not with the impact of their decisions on the long-run development of the market. A similar argument applies to economic contracts. When people rent apartments, for example, they are typically presented with a standard lease; usually the only things negotiated are the price and the period of occupancy. People prefer standard contracts because they are more clearly enforceable in court than contracts that are fashioned on the spot. The accumulation of precedent makes them better defined, and hence more desirable to both parties of the transaction. But how do standard contracts become standard? The answer, evidently, is through a long period of experimentation with different forms… A similar argument can be made for a great variety of social and economic institutions – language, codes of dress, forms of money and credit, patterns of courtship and marriage, accounting standards, rules of the road. In most cases, no one willed them into being: they are what they are due to the accumulation of precedent; they emerged from experimentation and historical accident." (Pp. 3-4);*

[4 (2 15)] Zeithaml, Valerie A., Mary Jo Bitner, Dwayne D. Gremler (2006) Services Marketing: Integrating Customer Focus Across the Firm. 4th Edition. McGraw-Hill Irwin. New York, NY. *"Challenges and questions for service marketers: …How can service quality be defined and improved… How can new services be designed and tested effectively… Hoe can the firm be certain it is communicating a consistent and relevant image… How does the firm accommodate fluctuating demand… How can the firm best motivate and select service employees… How should prices be set… How should the firm be organized so that good strategic and tactical decisions are made… How can the balance between standardization and personalization be determined… How can the organization protect new service concepts from competitors… How does the firm communicate quality and value to consumers… How can the organization ensure the delivery of consistent quality services…" (Pp. 24-25); "Services marketing mix: …product, price, place (distribution), promotion, people, physical evidence, process…" (Pg. 25)*

[10 (9 15)] Zhang, Liang-Jie (2007) Modern Technologies in Web Services Research. IGI Publishing. Hershey, PA. *"Web services are becoming a major research topic for computer*

scientists, engineers and business consulting professionals… Web services refer to networked and modular applications, as well as a set of enabling technologies, such as simple object access protocol (SOAP), Web services definition language (WSDL), universal description, discovery, and integration (UDDI) protocol, and emerging Web services flow specifications like business process execution language for Web services (BPEL4WS) and Web services chorography interface (WSCI)." (Pp. 1-2)

[3 (4 8 12)] Zuboff, S. and J. Maxmin (2002) The Support Economy: Why Corporations are Failing Individuals and the Next Episode of Capitalism. Penguin. New York, NY. *"Challenges and questions for service marketers: …How can service quality be defined and improved… How can new services be designed and tested effectively… How can the firm be certain it is communicating a consistent and relevant image… How does the firm accommodate fluctuating demand… How can the firm best motivate and select service employees… How should prices be set… How should the firm be organized so that good strategic and tactical decisions are made… How can the balance between standardization and personalization be determined… How can the organization protect new service concepts from competitors… How does the firm communicate quality and value to consumers… How can the organization ensure the delivery of consistent quality services…" (Pp. 24-15); "Services marketing mix: …product, price, place (distribution), promotion, people, physical evidence, process…" (Pg. 25)*