Three frameworks for service research: exploring multilevel governance in nested, networked systems

Jim Spohrer, Paolo Piciocchi and Clara Bassano*

Jim Spohrer
IBM Almaden Research Center
Innovation Champion and Director, IBM University Programs World-Wide (IBM UP)
650 Harry Road
San Josè, CA 95120
Tel: 408-927-1928 (o) Fax: 408- 927-1230 Email: spohrer@almaden.ibm.com

Paolo Piciocchi
University of Salerno
Department of Political, Social and Communication Science
Via Ponte Don Melillo
84084 Fisciano (SA), Italy
Tel: +39 089 963164 Fax: +39 089 963505 Email: p.piciocchi@unisa.it

Clara Bassano
"Parthenope" University of Salerno
Department of Business Studies
Via Medina, 40
80133 Napoli, Italy
Tel: +39 081 5474853 Fax: +39 081 5522313 Email: clara.bassano@uniparthenope.it
* corresponding author

James Spohrer
Dr. James ("Jim") C. Spohrer, is an IBM Innovation Champion and Director of IBM University Programs (IBM UP) World-Wide since 2009, Jim founded IBM's first Service Research group in 2003 at the Almaden Research Center with a focus on STEM (Science Technology Engineering and Math) for Service Sector innovations. He led this group to attain ten times return on investment with four IBM outstanding and eleven accomplishment awards over seven years. Working with service research pioneers from many academic disciplines, Jim advocates for Service Science, Management, Engineering, and Design (SSMED) as an integrative extended- STEM framework for global competency development, economic growth, and advancement of science. In 2000, Jim became the founding CTO of IBM's first Venture Capital Relations group in Silicon Valley. In the mid 1990's, he lead Apple Computer's Learning Technologies group, where he was awarded DEST (Distinguished Engineer Scientist and Technologist) Jim received a Ph.D. in Computer Science/Artificial Intelligence from Yale University and a B.S. in Physics from MIT. He is also co-chair with Prof. Louis Freund of the upcoming 1st International Conference on the Human-Side of Service Engineering, that will be held in July 2012 in San Francisco.

Paolo Piciocchi is Associate Professor of Business Management at the Department of Political, Social and Communication Science, at the University of Salerno, where he is chair of: "Business Management" and "Network Management". He has a PhD in Business Administration and he is Member of the PhD doctoral Program on "Marketing and Communication" at the University of Salerno. He was Lecturer at the Westminster University of London for ten months focusing on internationalization processes in Italian SMEs. He has been reviewer for several Refereed Journal

Articles and International Conferences as the Journal of Global Information Technology Management (JGITM) and the Special Issue of Service Science (SS) and he is Member of several PC (Programme Committee) International Conferences. He is now Board Members of the Scientific Committee of the upcoming 1st International Conference on the Human-Side of Service Engineering, that will be held in July 2012 in San Francisco; and he is also a member of the Editorial Board for the digital and hard-bound book versions of the Proceeding of this Conference. His fields of research comprise: Communication Crisis Management, Innovation and Creativity in Complex Systems (Manufacturing and Cultural Districts), the Viable Systems Approach. He is Author of several works, including articles, papers, books, and international conference proceedings. He is now applying the Viable Systems Approach framework to public and private sector organizations. His main area of interest is linked to the studies of service systems, local tourism system, destination brand communication and creativity in cultural districts. He can be contacted at: p.piciocchi@unisa.it

Clara Bassano is Assistant Professor of Business Management and Marketing, Faculty of Economics, "Parthenope" University of Naples. She was Visiting Researcher at IBM Almaden Research Center (Silicon Valley – California) and Visiting Fellow at the Ovidius University (Romania). She was awarded of the IBM Faculty Award 2010 for outstanding academic achievements with Stanford University (California) in the field of a research project entitled "Smart University Relations System".
She has been Associate Editor of the track "IT Services" of the International Conference on Information Systems (ICIS), Saint Louis, Missouri, USA 2010 and she has been reviewer for several Refereed Journal Articles as well as for International Conference Proceedings such as the *17th European Conference on Information Systems (ECIS 2009)*, the *16th American Conference on Information Systems* (AMCIS 2010), the *40th Conference EMAC 2011* and she is Member of several PC (Programme Committee) International Conferences. She is now Board Members of the Scientific Committee of the upcoming 1st International Conference on the Human-Side of Service Engineering, that will be held in July 2012 in San Francisco; and she is also a member of the Editorial Board for the digital and hard-bound book versions of the Proceeding of this Conference. She is the Author of several publications including national papers, books and international conference proceedings on the search for the most appropriate reticular configuration such as networks and districts for the studies of governance and management of Italian SMEs. She is now focusing on the search of governance models to manage service systems from a methodology which merges Service Science and Viable Systems Approach.

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Forum Session: *Business models to manage networks and service systems*

Service Science and/or Network and Systems Theory

ABSTRACT

Purpose – Three frameworks are used to analyze multilevel governance in complex human systems, such as nations, states, cities, universities, hospitals, hotels, homes, or nested, networked holistic service systems, which provision "whole service" to the people inside them. The three frameworks are: Service Science (SSME+D), Viable Systems Approach (VSA), and Institutional Analysis and Development (IAD). IAD is a mature framework, and its originator shared a 2009 Noble Prize for work on governance of commons. Our purpose is to expand awareness of IAD in the service research community.

Methodology/approach – Each framework introduces a focal building block, service systems (SSME+D), viable systems (VSA), and polycentric systems (IAD), which can be compared and contrasted to help enhance analytic and design frameworks for complex human systems.

Findings – There are still many areas of knowledge that the service research community needs to incorporate to provide the "big tent" needed to make progress understanding complex business and societal systems, where local optimization rarely leads to global optimization.

Practical implications – Service researchers benefit from improved frameworks to analyze/design complex human systems that (1) can integrate across diverse disciplines, systems, cultures, (2) improve multilevel governance making it more likely that local optimizations contribute to global resilience and sustainability, (3) move beyond dyads, be they customer to provider, or even business to business, and analyze nested, networked systems in the wild, as Ostrom has done with IAD.

Originality/value – Evert Gummesson inspired us to think about service network theory, and break down silos to connect with frameworks such as Ostrom's IAD.

Key words (max 5): whole service & holistic service system, multilevel governance, Service Science and Viable Systems Approach (SS&VSA), polycentric systems, Institutional Analysis and Development (IAD) framework.

Paper Type: Conceptual paper

1. Introduction: Why Governance?

Governance, or a shared system of rules is observed in complex human systems, and can be seen as an approach to solving social problems (Ostrom, 2005; Williamson, 1996). In everyday practice, policy-makers, business consultants, and many others try to envision better rules to solve a wide range of political and business problems (Sterman, 2000; Friedman, 2008). Figure 1 shows Pigou's example, and provides a mathematically simple and elegant demonstration of the power of a simple rule to improve expected commute times in a congested system with selfish actors (Roughgarden, 2005).

FIGURE 1 about here

Recently within the service research community, governance has been attracting more attention. For example, *Service Science, Management, Engineering, and Design (SSME+D*), or service science for short, provides a framework for studying service system, that includes governance within its core set of concepts (Spohrer and Kwan, 2008; Spohrer and Maglio, 2009). Also, the *Viable Systems Approach (VSA)* includes governance within its core set of concepts used in the study of viable systems (Golinelli, 2000; Barile, 2009; Piciocchi and Bassano, 2009). Furthermore, Gummesson (2010, personal communication), the father of service network theory, has suggested that the service research community would benefit from a deeper understanding of *Institutional Analysis & Development (IAD)* framework (Ostrom, 2009). IAD has been used to study governance of commons in polycentric systems, and was cited in the 2009 Nobel Prize award in the area of economics.

Nevertheless, a quick scan of newspaper headlines on any day suggests that humanity still has much to learn about creating good rules to govern an environmentally and economically sustainable smarter planet (IBM, 2010). One problem is that local optimization rarely leads to global optimization in complex systems, and so better system architectures are needed (Ricketts, 2007). Second, real world problems rarely respect discipline boundaries, and so better frameworks for integrating across disciplines, systems, and even cultures are needed (IfM and IBM, 2008).

The real-world *human ecology* (Hawley, 1986) is made up of people, organizations, and institutions (so called complex human system entities) that depend on multilevel systems of rules to help govern interactions, and thereby affect the odds of outcomes, both mutually-beneficial and non-beneficial. In the real-world human ecology, some of the rules are implicit, embedded in diverse cultures and evolved over many millennia, while others are explicit and more recently adopted. The explicit rules are encoded in language and laws, which are in turn part of a broader system of symbols that facilitate communications and reasoning. In addition to symbol systems, the human ecology also depends on natural systems and technological systems (especially transportation, communication, and energy systems), which are part of the real-physical-world. The resources available to any entity in the real-world human ecology include both other entities as well as the natural, technological, and symbolic systems accessible to the entity in a given situation.

The human ecology can change itself (Hawley, 1986). Individual actions can proactively make changes, and in modern societies diverse types of professionals are also at work recommending changes. Given a *real-world problem* (P_{RW}), professionals use *frameworks* (F_N) to analyze the situation and generate *a set of recommendations* ($\{R_C\}$) that stakeholder entities can consider implementing to address the problem. If only some of the stakeholders implement the recommendations, and others do not, the local changes may create local optimizations, but not the desired global change. If the frameworks do not incorporate environmental considerations, then even if all stakeholders implement the recommendations, then the long-term results may not be environmentally sustainable. Similarly, if the frameworks do not incorporate economic considerations, then the results may not be fiscally sustainable. Even if the framework incorporates all known considerations, and all stakeholders implement all valid recommendations well, it is still possible new problems will be created. These unexpected problems create learning opportunities for the professionals to improve the frameworks.

The human ecology can be characterized by the type, size and distribution of entities, their resources, and their relationships over time (Hawley, 1986). Complex human system frameworks are used by professionals to map nested, networked entities and their resources, both directly and indirectly accessible, in diverse real world situations. Complex human system frameworks (F_N) provide professionals with ways to describe the architectures of types of entities, or *entity architectures* (ϵ_N). Entity architecture includes ways to describe the governing rules, relationships, and other resources characteristic of instances of that type of entity. While computer-aided design tools exist to aid professionals building integrated circuits with billions of transistors, according to a variety of multicore architectures, no such computer-aided design tool yet exists to aid professionals who use complex human systems frameworks, with diverse architectures of entities, for modeling the real-world human ecology of billions of people. However, early attempts to build such tools are underway (Spohrer and Maglio, 2009).

Returning to a scan of today's news headlines, many real-world problems can be seen, including the problem of environmental sustainability (e.g., dependence on oil, depletion of aquifers, etc.) and the problem of economic sustainability (e.g., Social Security shortfalls, Greek bankruptcy, etc.). As professionals study these problems and recommend solutions to stakeholders, two systems-oriented challenges are clear:

1. In general, $O_L \neq O_G$
Local Optimization does not equal Global Optimization

In nested, networked, complex human systems, careless local optimizations can degrade overall performance. However, perhaps for some entity architectures and rules the odds of global optimization from appropriate local optimizations can be increased. In this respect, are some entity architectures (ϵ_N) better than others?

2. In general, $P_{RW} \neq P_{SD}$ or P_{SS} or P_{SC}
A Real-World Problem does not equal a Single Discipline, System, or Culture Problem

In nested, networked, complex human systems, solving a real-world problem only rarely equates to solving a single-discipline, single-system, or a single-culture problem. However, perhaps for an important set of real-world problems, some frameworks are better integrated across disciplines, systems, and cultures, and so do a better job generating valid, actionable recommendations for stakeholders. In this respect, are some frameworks (F_N) better than others?

If some entity architectures (ϵ_N) and some frameworks (F_N) are better than others, in these respects, then professionals solving real-world complex human system problems (P_{RW}) might benefit from knowing about them. In turn, researchers might benefit from an efficient and effective way to search the design space of possible architectures and frameworks. Using a version of the *Repertory Grid Technique (RGT)*, existing architectures and frameworks can be compared and contrasted to identify the dimensions of the relevant design spaces.

Therefore, it is entirely fitting and appropriate to acknowledge the opportunity for the service research community to embrace frameworks (F_N) originating from other disciplines that have already been used to analyze governance in complex human systems with diverse entity architectures (ϵ_N). The service research community has been described as a "big tent" and so identifying, evaluating, evolving, and embracing, where appropriate, other frameworks is a competence that the service research community aspires to perform well. The service research community can be seen as an *epistemic community* (Holzner, 1968). This requires the development of a shared theory, codes and tools, organizational culture, common vocabulary and boundary objects. An *epistemic community* consists of professionals with identical or similar "frames of reference" and cognitive orientation systems. Employing a sociological view of knowledge and the concept of epistemic-community, Hakanson says that the "ease or difficulty of managing knowledge-intensive interactions is as significantly dependent on the cognitive background of the exchange partners as on the degree of articulation of the knowledge they exchange" (Hakanson, 2010: 1819).

In the next section, the methodology of using a modified Repertory Grid Technique (RGT) on existing entity architectures ($Є_N$) and frameworks (F_N) is explored. First, entity architectures for such entities as nations, states, cities, universities, hospitals, hotels, businesses, and family households are examined. Second, the three frameworks Service Science (SSME+D), Viable Systems Approach (VSA), and Institutional Analysis and Development (IAD) are examined.

In the findings section, first evidence is presented to support the fact that entity architectures ($Є_N$) known broadly as nested, networked Holistic Service Systems (HSS) have the characteristics that more readily enable local optimization to lead to global optimization. Second, evidence is presented to support the fact that complex human system frameworks (F_N) that explicitly focus on governance of Holistic Service Systems (HSS) and the provision of "Whole Service" (WS) have the characteristics that more readily enable problem situations to be analyzed (i.e., multiple disciplines, systems, and cultures). "Whole Service" (WS) includes flows (transportation, water, food, energy, communications), development (buildings, retail, finance, health, education), and governance (city, state, nation). Holistic Service Systems (HSS) provision "Whole Service" (WS) to the people inside them, and entity architectures ($Є_N$) of HSS are such that they can survive for some period of time if cut off from all external entities.

In the practical implications section, these two findings are related to improved governance mechanisms (or system of rules) well suited to investing in the continuous improvement of nested, networked holistic service systems. A revised *Run-Transform-Innovate investment governance approach* is related to the need for more *T-shaped professionals*, who have both deep, specialized problem-solving skills and broad, integrated complex-communications skills, across disciplines, systems, and cultures.

In the final section, the originality/value of this work is summarized. Some directions for future work and open research questions are also summarized. In real-world human ecology, the ecology is increasing changing itself, in part through better recommendations generated by professionals using improved complex human system frameworks to address real-world problems, $Є_N$: $F_N(P_{RW}) \rightarrow \{R_Є\}$. The improved recommendations suggest changes to the multilevel systems of rules associated with entity architectures ($Є_N$), resulting in more environmentally and economically sustainable solutions, which in turn help to build a smarter planet, as shown in Figure 2.

FIGURE 2 about here

2. Methodology/Approach

The Repertory Grid Technique (RGT) was originally developed by psychologist George Kelly in the 1950's as a means to interview and represent the way individuals and groups understand the world (Kelly, 1955). Since then it has evolved and is now used by many types of professionals to construct exploratory design spaces, based on sets of instances of artifacts (Fransella and Bannister, 1977; Goffin, 2002).

A generalized Repertory Grid Technique (RGT) can be summarized as the following seven steps: (1) assemble three or more instances of artifacts, (2) select three of the instances at random, and ask a subject "pick the two that are most similar, and say what makes the other different," (3) record both a contrast word or phrase that describes the contrast attribute as well as the similarity attribute, (4) repeat this process until the subject can no longer generate contrast and similarity attributes, (5) create a rating grid using the attributes, and ask the subject to rate each instance on a scale of 1-5, (6) repeat for additional subjects, (7) if desired, use statistical techniques (e.g., principal component analysis, etc.) to determine if two subjects mean the same thing using different words, or different things using the same word. The resulting representation of the design space can be used for many purposes, such as searching for “plausible, but missing instances” as well as quantifying systematic variations in ratings by people in diverse professional, age, demographic, and cultural groups.

For our purposes, a modified RGT approach is used to generate (1) candidate attributes of entity architectures ($€_N$) that relate to rules that tend toward local optimizations contributing to global optimization, and (2) candidate attributes of frameworks (F_N) that tend toward including multiple considerations (disciplines, systems, and cultures, etc.) in the analysis, of real-world problem situations, and resulting generation of recommendations to stakeholders, including rule changes. Furthermore, rather than interview subjects, our exploratory approach is based on extracting attributes mentioned in a sampling of relevant literature previously identified as well as extensions (Spohrer and Kwan, 2008). Future directions under consideration include both interviewing expert authors and text mining of the authors’ relevant literature.

Before considering the findings, concise summaries of the instances are provided.

Entity Architectures ($€_N$)

Instances of entity architectures include comprehensive descriptions of nations, states, cities, universities, hospitals, hotels, businesses, and family households. The following short summaries hint at only a small number of relevant attributes that may be impacted by the rules governing the behaviors of people within these types of complex human system entities.

Nations: Today there are approximately two hundred sovereign nations. The United Nations lists 192 members. Their resources include their population and territory, and they range in size from small to large. Their interdependencies are partially reflected in imports and exports, immigration, and tourism statistics. Types of government span the gamut from dictatorships, monarchies, democracies, and more. For example, the Constitution provides a concise summary of the operations of United States of America, including mechanisms for filling roles and changes laws. The Federalist Papers provides the rationale behind much of the design, including alternatives explored and rejected, as well as limitations of the current architecture (Simon, 1996).

States: Today there are approximately two thousand states, provinces, or cantons as the major subdivision of nations. Like nations their resources include their population and territory, ranging from small to large. Also like nations their interdependencies are partially reflected in imports and exports, immigration and tourism statistics. The relationship of state governments to national governments varies widely. For example, the types of income, sales, and property taxes vary considerably.

Cities: Today there are over three thousands cities with populations over 50,000 people. Counties and metropolitan regions may include multiple cities and towns, and there are nearly two dozen megacities with over ten million people. The daily transportation and congestion patterns of people within a city can vary considerably between, including the ways adults commute to work and the way children get to school. Rules apply to a wide range of flows of materials, energy, information, and people. Qualify of life, including quality of jobs, varies from city to city, and depends on numerous subjective and objective characteristics.

Universities: Community colleges, teaching schools, and research universities vary in the number of students, both commuter and residents, and size of their campuses. The number and type of degrees granted, drop out rates, transfer rates, endowment sizes, and qualification of faculty can also vary widely. Rules apply to activities from admissions to graduation requirements.

Hospitals: The system of rules associated with hospitals govern hiring of medical staff, admission of patients, medical procedures, visiting hours of family and friends, janitorial activities, waste disposal, and more.

Hotels: From safety regulations to check-out times, hotels large and small must comply with numerous rules and regulations. Especially, large conference hotels and luxury resort hotels, can vary in the number and variety of service offerings to guests. Tax regulations can be especially complex depending on where, when, and by whom the reservation for a guest room was made.

Businesses: Businesses span an enormous range depending on number of employees, revenues, industry, assets including buildings, location of regional operations, whether they are private or public, with shareholders and annual reporting requirements. Some businesses must provide living quarters for employees, such as oil rigs, trucking companies, cruise ships, etc. as well as customers, such as universities, hospitals, and hotels.

Family Households: Formal rules (e.g., taxes) and informal rules (e.g., bed times and chores for children) affect the operations of households. Schooling, marriage, divorce, death, inheritance, and more are governed by rules. Owning a home, renting an apartment, living on a military base, living in a homeless or disaster relief shelter, or staying with family or friends can all be impacted by formal and informal rules.

Frameworks (F_N)

Instances of complex human system frameworks include comprehensive descriptions of Service Science, Management, Engineering, and Design (SSME+D), Viable Systems Approach (VSA), and Institutional Analysis and Development (IAD), and case studies of their application.

Service Science, Management, Engineering, and Design (SSME+D)**:** SSME+D framework begins with an analysis of the service systems in a real-world problem situation. In broad outline (Maglio *et al*., 2006), the SSME+D analysis approach is to (1) identify all the stakeholders service system entities in a network under study (a network analysis is always done in the context of the entire service system ecology), (2) examine existing relationships, value cocreation mechanisms, and understand the problems and opportunities the stakeholders have identified, (3) next try to improve existing value cocreation mechanisms (this may involve freeing up resources from existing service system entities and redistributing them), (4) if problems and opportunities remain, create new service system entities to address them.

SSME+D is built on top of the Service Dominant Logic (SDL) worldview (Spohrer and Maglio, 2009; Vargo and Lusch, 2004). SDL defines service as the application of competence (knowledge, resources, etc.) for the benefit of another entity. SDL's ten foundational propositions begin with the premise that service is the fundamental basis of all exchange. SSME+D defines service as value cocreation phenomena that occur when service system entities interact according to value propositions that guide the application of competence for mutual benefit.

SSME+D is a specialization of Systems Science, in which service system entities interact and create outcomes (Spohrer and Maglio, 2009). The service system ecology is the population of all types of service system entities. A service system entity is a dynamic configuration of resources (at least one of which, the focal resources is a person). The four types of resources include people, technology, organizations, and shared information. The dynamics result from the interactions of four types of stakeholder service system entities; customers, providers, authority, and competitors. Stakeholders are typically concerned with specific measures, such a quality, productivity, compliance, and sustainable innovation. Value-proposition-based interactions reconfigure access rights to resources.

FIGURE 3 about here

SSME+D can be summarized in three propositions (Spohrer & Maglio, 2009):

First:
"Service system entities dynamically configure (transform) four types of resources"

Second:
"Service system entities calculate value from multiple stakeholder perspectives"

Third:
"Service system entities reconfigure access rights to resources by mutually agreed to value propositions"

The second proposition can be further elaborated as shown in Table 1:

Table 1 – Value propositions coordinate & motivate resource access

Stakeholder Perspective (the players)	Measure Impacted	Pricing Decision	Basic Questions	Value Proposition Reasoning
1.Customer	Quality (Revenue)	Value Based	Should we? (offer it)	Model of customer: Do customers want it? Is there a market? How large? Growth rate?
2.Provider	Productivity (Profit)	Cost Plus	Can we? (deliver it)	Model of self: Does it play to our strengths? Can we deliver it profitably to customers? Can we continue to improve?
3.Authority	Compliance (Taxes and Fines)	Regulated	May we? (offer and deliver it)	Model of authority: Is it legal? Does it compromise our integrity in any way? Does it create a moral hazard?
4.Competitor (Substitute)	Sustainable Innovation (Market share)	Strategic	Will we? (invest to make it so)	Model of competitor: Does it put us ahead? Can we stay ahead? Does it differentiate us from the competition?

Source: Spohrer, J and Maglio, P. P. (2009), Service Science: Toward a Smarter Planet. In Introduction to Service Engineering. Editors Karwowski & Salvendy, Wiley, Hoboken, NJ.

Viable Systems Approach (VSA)**:** VSA framework begins with an analysis of the viable systems in a real-world problem situation (Golinelli, 2000, 2010). VSA is an approach to study the viability of systems in a complex environment. *Viability* is both objective survival and subjective ability to respond to environmental change, where environmental change is mostly generated by other viable systems. Viability depends first and foremost on a *government capability*, for both internal self governance and external relationship governance that creates value for the stakeholders or suprasystems. In fact, each system has to attain *consonance* (a potential for value creation) and *resonance* (the realization of value creation) with its environment to be viable. In other words, the survival of a system depends on its decision-making and problem-solving *process coherence* (consonance and resonance) with the complexity and change in the environment, known as the context in VSA view that is the subjective representation of the reality created by the government.

The innovative concepts of consonance and resonance are fundamental to all VSA analysis of problem situations. Consonance means the structural compatibility or adequacy between different entities, while resonance is the outcome of the interaction between these consonant entities. In other words, the *consonance* measures the capability of the system to achieve mutual benefits (value cocreation) based on their structure (accessible resources) and the limits to sharing and coordinating information between different entities (viable systems); the *resonance* measures the results of interactions in context, producing and sharing value for and with stakeholders or suprasystems. If consonance (potential) increases with time, then so can resonance (performance).

In VSA perspective, the researcher looking at complex phenomena has to realise that he can never achieve complete and fully objective, but only approximate, knowledge (von Foerster, 1981; Golinelli, 2010, 2011). In complex environments of other entities, the search for viability means the capability of the government component of a viable system entity to make decisions on the basis of approximate knowledge. In fact, the government component of an entity has two main types of knowledge that we refer to as Decision-Making (D-M) and Problem-Solving (P-S) knowledge. D-M provides guidance about which ends ("know what") to achieve, and P-S provides means ("know how") to those ends. Both types of knowledge are the fundamental capabilities (cognitive assets) required to attain and maintain viability (Piciocchi *et al.*, 2009).

Because viable system entities change and learn, the resource allocation problem is the fundamental decision that repeatedly must be made to remain viable (March, 1991). Dealing with new levels of complexity requires new types of decision making in which we cannot necessarily use fixed models or stochastic methods to find a solution, but we need a pattern or schema suitable to a particular problem's complexity level (Barile, 2009).

A greater level of integration among viable systems derives from shared value categories. To obtain superior conditions of consonance and resonance, value categories, interpretative schema, and informative units should be shared between interdependent viable systems, as represented in figure 4.

FIGURE 4 about here

Ashby's Law of Requisite Variety (Ashby, 1956) relates to the concepts of "consonance" (structural compatibility) and resonance (mutually-beneficial outcomes). Ashby's Law clarifies how, above all in complex organizations, individualistic pressures can make it difficult to realize shared decision making (Locke and Schweiger, 1979). The viability of a system depends on its capability for synthesizing the pressures deriving from the structural and functional variety of its synergic components (consonance). In such logic, governance for consonance in human resources has to address the interpretation, mediation and synthesis of specific and partial expectations in order to guarantee efficiency, adequacy and equifinality. From a cybernetic perspective, structural diversity has to be properly aligned. Ashby's requisite variety and the reducing of "subjective drifts" (subjective goals) tend to avoid the risk of undermining mutual satisfaction by means of "retrieving order from noise" (von Foerster, 1981). Consequently, any stakeholder decisions have to take into account the mediation effect of other stakeholders' views of mutually beneficial outcomes.

***Institutional Analysis & Design (IAD)*:** IAD framework begins with an analysis of the polycentric systems in a real-world problem situation (Ostrom, 2009). Polycentric relates to formally independent decision-makers with the capability of operating independently, though as an empirical matter they may act coherently and function as a system. The IAD framework has been used to structure analysis across a broad array of policy sectors and disciplines. The IAD framework was developed by Elinor Ostrom and other scholars associated with the Workshop in Political Theory and Policy Analysis at Indiana University. The focus is on decision-makers deciding on some course of action, in situations that include: (1) attributes of the physical world, (2) attributes of the community within which actors are embedded, (3) rules that create incentives and constraints for certain actions, and (4) interactions with other individuals (Ostrom, 2005).

Ostrom (2005) states: "Broadly defined, institutions are the prescriptions that humans use to organize all forms of repetitive and structured interactions including those within families, neighborhoods, markets, firms, sports leagues, churches, private associations, and governments at all scales. Individuals interacting within rule-structured situations face choices regarding the actions and strategies they take, leading to consequences for themselves and for others. The opportunities and constraints individuals face in any particular situation, the information they obtain, the benefits they obtain or are excluded from, and how they reason about the situation are all affected by the rules or absence of rules that structure the situation."

The challenges are great and Ostrom (2005) continues: "Our implicit knowledge of the expected do's and don'ts in this variety of situations is extensive. Frequently, we are not even conscious of all of the rules, norms, and strategies we follow. Nor have the social sciences developed adequate theoretical tools to help us translate our implicit knowledge into a consistent explicit theory of complex human behavior. When taking most university courses in anthropology, economics, geography, organization theory, political science, psychology, or sociology, we learn separate languages that do not help us identify the common work parts of all this buzzing confusion that surrounds our lives. Students frequently complain — and justifiably so — that they have a sense of being in a Tower of Babel… The core questions asked in this book are: Can we dig below the immense diversity of regularized social interactions in markets, hierarchies, families, sports, legislatures, elections, and other situations to identify universal building blocks used in crafting all such structured situations?"

To understand the way frameworks can work across multiple scales, Ostrom (2005) used an analogy with maps that show relationships between named entities at multiple scales, from streets to cities to nations. Depending on the purpose, hiking, driving, or flying, there is a type of map that can support diverse analysis and design activities. Frameworks provide the language and concepts for talking about types and instances of entities and relationships. Like the Tower of Babel, students and researchers from different communities use different languages and frameworks to analyze and design aspects of complex human systems. Whether viewed as a Tower of Babel or an Elephant with Blindfolded Men, communications between specialists is a real challenge in the world today (Spohrer and Maglio, 2008).

Ostrom (2005) also introduces: "Holons: Nested Part-Whole Units of Analysis - Like good geographic maps, the IAD framework can be presented at scales ranging from exceedingly fine-grained to extremely broad-grained... Building on top of the single individual are structures composed of multiple individuals — families, firms, industries, nations, and many other units... The focal level for this book is the holon called an action arena in which two holons — participants and an action situation — interact as they are affected by exogenous variables (at least at the time of analysis at this level) and produce outcomes that in turn affect the participants and the action situation."

FIGURE 5 about here

With respect to rules, Ostrom (2005) states: "…rules as used in this book are defined to be shared understandings by participants about enforced prescriptions concerning what actions (or outcomes) are required, prohibited, or permitted… All rules are the result of implicit or explicit efforts to achieve order and predictability among humans by creating classes of persons (positions) who are then required, permitted, or forbidden to take classes of actions in relation to required, permitted, or forbidden outcomes or face the likelihood of being monitored and sanctioned in a predictable fashion…"

Ostrom shared a 2009 Nobel Prize (Ostrom, 2009). IAD has been used to analyze the problem of depletion in many "common pool resource" situations, including forests (Koontz, 2003).

3. Findings

Entity Architectures (ϵ_N)

In all the formative entity architecture (ϵ_N) sketches, there are rules governing the flows of materials, energy, information, and people into and out of geographic regions and building structures, rules governing the development and other activities of people inside the systems, rules governing relationships and interactions with others, and finally rules governing the ways to change the rules in the nested layers of government systems. Furthermore, there are rules dealing with normal operations and maintenance, rules dealing with anomalous incidents and disasters, and rules dealing with how much to invest in changing resources and relationships over time. The attributes of flows, development, relationships and changing rules are especially salient.

Nested, networked systems can be and have been analyzed using many frameworks from many disciplines. In the human-designed/evolved realm, nested, networked systems can be viewed as *holistic service systems*, such as nations, states, cities, universities, remote research outposts, hospitals, luxury hotels, cruise ships, family homes, and even space craft and space stations.

We define Holistic Service Systems (HSS) as those that provision “Whole Service” (WS) to the people inside them, and can survive for some period of time independently of all external service system interactions. We define “Whole Service” (WS) to include the provision of diverse service, such as flows (transportation, water, food, energy, communications), development (buildings, retail, finance, health, education), and governance (city, state, nation).

We can now consider attributes of HSS that might more readily enable local optimization to lead to global optimization. A first attribute of entity architectures is the degree to which the type of entity provides WS to the people inside it. A second attribute is the expected duration of HSS viability if it is cut off from all external entities. A third attribute is the degree of external relationships that can rapidly share and implement new innovations. A fourth attribute is the degree of insulations from problems that arise in external entities. For example, imagine high-tech cruise ships with on-board agriculture and manufacturing capabilities, which have communications links for sharing innovations. The high-tech cruise ships are HSS that would score well on all four attributes. Because the ships are largely independent, local innovations are likely to spread leading to global innovations.

Evidence has been found that entity architectures ($Є_N$) known broadly as nested, networked Holistic Service Systems (HSS) may have the characteristics that more readily enable local optimization to lead to global optimization.

This means that if we assume value co-creation as the mediation of the satisfaction level of these entities then multilevel governance involves the interpretation, representation and coordination of the different expectations (“why”) of stakeholders in order to define and promote a strategy able to co-create value.

Frameworks (F_N)

In all the formative complex human system framework (F_N) sketches, there is a notion of fundamental building blocks that underlie the diversity of types of organizations and institutions observed. For example, the frameworks all include some notion of what is variously called, holistic service system, viable system, and holons (in system of systems), which can operate successfully at different scales. Also, the available descriptions of the frameworks all make repeated references to integrating multiple disciplinary perspectives. In addition, the available descriptions all reference the importance of culture (Parsons, 1951; Taylor, 1971; Geertz, 1973; Schwartz and Davis, 1981; Mintzberg, 1989; Fitzimmons and Fitzimmons, 1998; Bianchini, 1999, 2000; Spohrer, Piciocchi and Bassano, 2012 - forthcoming), and the role of implicit rules.

According to this viewpoint, multilevel governance of HSS in a Whole Perspective requires cultural planning to facilitate collaborative and collective creativity and innovation (Chesbrough and Spohrer, 2006; Bassano, 2008). In this way, it is important to *empowering* social process through which people, organizations, HSS acquire competences over their own lives in order to change to evolve their own social and political environment, improving equity and quality of life (Sen A., 2000).

Of course, all the frameworks emphasize the importance of governance mechanisms, government, and rules.

For example, these same attributes might also well apply to the Living Systems framework – LST (Miller, 1978; Miller and Miller 1992).

The LST framework defines organizations as a living systems or input-output systems which are able to combine energy and information useful for their survival. This capacity is the same at each type of organization, from simple ones, as cells, to complex ones as supranational systems, in a recursive way.

Moreover, merging Service Science and Viable Systems Approach with Living Systems Theory/LST (Miller, 1978) and Institutional Analysis and Development Framework/IAD (Ostrom, 2009), Whole Service (WS) refers to the ontological meaning of service systems; in other words, Whole Service (WS) requires integration of the value propositions of Holistic Service Systems (HSS) through multilevel governance mechanisms which are in turn interdependent on the growth of the overall value co-creation inside and outside of the HSS.

In this way, HSS – as a service system that can support its primary population, independent of all external service systems (Spohrer, 2010) – refers to service systems able to produce specific outcomes for some period of time and for a particular objective. If each HSS and their sub-systems (i.e. Transportations, Water, Food, Finance, etc…) don't function independently on their own, but also function in consonance with other HSS, at the same time or different times, then multilevel governance implies a spreading capacity to put the overall value co-creation in larger and larger contexts, from whole service up to and including a complete Smarter Planet (Spohrer, 2010).

This means that the capability to co-create Whole Service (WS) depends on the capability of entities at multiple levels (government/top decision maker/policy maker) to read and interpret the context through the different eyes of each other, and find the consonant viewpoint.

Evidence has been found to support the fact that complex human system frameworks (F_N) that explicitly focus on governance of Holistic Service Systems (HSS) and the provision of "Whole Service" (WS) have the characteristics that more readily enable problem situations to be analyzed (i.e., multiple disciplines, systems, and cultures).

In a "Whole Service (WS) perspective", HSS are not closed institutions, that is closed/autopoietic systems (i.e. university for producing research and teaching within in academic perspective), but service systems able to achieve their own specific objectives as consonant and resonant components (Living Systems or Viable Systems) for the social and economic growth of the Whole Service needed by them and other HSS.

An HSS capable of WS perspective implies that the HSS have to be consonant (compatible in a structural view) and resonant (synergic in a systems view) with the context and at the same time consistent with an integration of multiple levels of governance of interactions and outcomes.

As we said, IAD framework is used to analyze the rules and the mutual influence of polycentric systems – as a whole – and evaluate the effects of the interactions on the growth of the collective as individuals and as a whole. Ostrom's polycentric system growth depends on the structural change capacity of institutions – in *IBM jargon*, the systems capacity of run-transform-innovate (Spohrer *et al.*, 2009); in *March's terminology*, exploitation and exploration (March, 1991); in *Viable Systems Approach language*, adaptation-transformation-restructuration (Golinelli, 2010) – and on the governance capacity of institutions to ensure conditions of elasticity and flexibility within the collective system (Piciocchi and Bassano, 2009).

All these complex human system frameworks (F_N) can be used to analyze the provision of Whole Service (WS) by Holistc Service Systems (HSS) at multiple levels. If value co-creation derives from shared aims (consonance), then improving consonance means maximizing value co-creation (resonance) of integrated HSS as entities that process matter, energy, information and support a wide range of human activities, including, flow, development, and governance.

In particular, according to the SSME + D and VSA frameworks, while in the SSME + D view we need to highlight that contextual internal/external interactions have to be interpreted as a system to understand how the phenomenon – develops and works, in VSA view, we know that any phenomenon – as a viable system – can be described by focusing on its static components (parts), as a components of a "whole" (structure), and interactions for survival (system). The new concept of "Whole Service" (WS) can be interpreted as the core competence of Holistic Service System (HSS) which is both *context dependent/related* and *co-created* dynamically.

The capability to co-create service depends on the capability of multilevel governance (government and/or top decision maker and/or policy maker) to read and interpret the context through different but recursive perspectives. "Whole Service" (WS) must match the context which implies achieving the consonance with the customer who receives the service and who guides and coordinates resources – national, regional and local government – in its evolution. Consonance is a concept strictly connected to some aspects of VSA (individuals, firms, organizations) included in the context. Consequently, the focus is on the capability to perceive the context providing "Whole Service" (WS) and this requires considering the following steps:

1. scanning and perceiving the context through multilevel perspectives;
2. understanding and interpreting the elements perceived as "relevant" by the customer;
3. evaluating the service as adequate/consonant to the specific context. Otherwise, the focus shifts from the structure to system, from relation to interaction, from provider to customer.

In this paper – combining both a traditional analytical approach (focus on the parts) and holistic approach (focus on the whole) – we privilege an interactional perspective and suggest an innovative methodology – based on the three frameworks SSME+D, VSA (with LST) and IAD – whereby systems context prevails over the subjectivity of the individual actors/stakeholders (single expectations). We assume service systems exist for value co-creation, and evolve to become HSS with WS as they perfect multilevel governance.

These frameworks illustrate how value is co-created through different governance interaction.

4. Practical implications

Two practical implications have been found: (1) a revised *Run-Transform-Innovate investment governance approach*, and (2) a greater need for *T-shaped professionals*, who have both deep, specialized problem-solving skills and broad, integrated complex-communications skills, across disciplines, systems, and cultures.

One of the most important and practical shared systems of rules is the one that guides investment choices of stakeholders in complex human systems. Policy makers, business executives, entrepreneurs, and individuals all care about rules guiding the best investment choices to make with limited resources and bounded rationality. The study of multilevel governance of Holistic Service Systems (HSS) resulted in Figure 6, a revised version of earlier work on investment choices (Spohrer and Maglio 2009).

March (1991) has explained that learning systems must make a fundamental choice between exploitation (sticking to routines) and exploration (changing and innovating). Sanford (2006) described Run-Transform-Innovate as the slogan that best described IBM's Business Transformation and CIO function. Each year, business units must do more with less (in many cases a 5% annual budget cut is to be expected) - so running their business with fewer resources, but hopefully improved quality of service. Run includes operations, maintenance, and incident planning and management. Transform includes adopting best practices from others (follower role), and involves internal, external, and interaction changes (Ricketts, 2007). Exploration is perhaps the most risky, and involves incremental, radical, or super radical innovations.

FIGURE 6 about here

Over time as the entity architecture of holistic service systems are better understood, it should be easier to accelerate the sharing of innovation, do more to ensure that local optimizations in fact lead to global optimizations.

These accelerated innovations should increase the length of time Holistic Service Systems (HSS) can survive on their own independent of all interactions with external service systems. Furthermore, the accelerated innovations should provide a decrease in the payback time on recycling or rebuilding infrastructure of HSS. For example, technological advances in water recycling make upgrading these systems within HSS cost effect after a certain period of time. The environmental and economical sustainability of HSS can then be ensured.

Also as the entity architectures (ϵ_N) of HSS improve and as the frameworks (F_N) improve, there will be greater and greater demand for T-shaped professionals fluent in multiple disciplines, systems, and cultures. T-shaped professionals have both depth and breadth. Of course, many other shaped professionals will also be needed (Macaulay *et al*., 2010: 729):

- Specialist or I-Shaped. An highly specialized human resource with a strong depth but little breadth to be consonant with other professionals;
- H-Shaped. A professional specialized into two knowledge areas with a sufficient breadth useful to be connected to others of the same areas (Spohrer *et al*., 2010:10);
- Generalist. An human resource without particular skill in depth, capable to operate on the basis of a sufficient breadth as a generic manager;
- T-Shaped. A professional with huge depth (as a specialist) and great breadth to be complementary with other for improving common and shared competencies;
- Π-Shaped. An hypothetical professional with huge depth and breadth able to express technical and specific skills in different disciplinary areas;
- Wedgies. A professional with medium depth and sufficient breadth to be interconnected with others.

Multilevel governance can be conceived of as a *directional process* that is *evolving processes* (Spohrer, Piciocchi and Bassano, 2012, forthcoming). For example, three viewpoints:

a) *Entrepreneurial governance*, creating new value propositions creation mechanisms;
b) *Brokerage governance*, creating new relationships and alignment mechanisms;
c) *Funding governance*, creating new shared risk and reward mechanisms.

In particular, the evolving process requires the formalization of multilevel shared governance able to facilitate the knowledge and innovative co-creation process. This shared governance supports the reduction of "dispersion" of individual strategic guide line (directional process) and induces to the modular development for improving specialization and integration (evolving process).

5. Originality/value

This paper has introduced the concept of Holistic Service Systems (HSS) and "Whole Service" (WS) to better illustrate one way that local optimization can lead to lead global optimization in complex human systems. Multilevel governance of HSS can be especially effective when entities use a Run-Tranform-Innovate investment mechanism, similar to the way IBM's organizes its Business Transform/CIO function. Also, as complex human systems frameworks improve, the demand increases for T-shaped professionals to use them to analyze real-world problems and recommend solutions.

FIGURE 7 about here

Future directions under consideration include both interviewing expert authors and text mining of the authors' relevant literature to identify attributes of both entity architectures and complex human systems frameworks, using a modified Repertory Grid Technique (RGT) to evolve a representation of the design spaces.

In sum, in the real-world human ecology, the ecology is increasing changing itself, in part through better recommendations generated by professionals using improved frameworks to address real-world problems, ϵ_N: $F_N(P_{RW}) \rightarrow \{R_\epsilon\}$. The improved recommendations suggest changes to the multilevel systems of rules associated with entity architectures (ϵ_N), resulting in more environmentally and economically sustainable solutions, which in turn help to build a smarter planet.

References

Alter, S. (2008), "Service system fundamentals: Work system, value chain, and life cycle", *IBM Systems Journal*, No. 47, pp. 71–85.

Apte, Uday M., Cavaliere, Richard, A., Kulkarni, Shailesh, S., (2010), "Analysis and Improvement of Information-Intensive Services: Evidence from Insurance Claims Handling Operations", *Production and Operations Management*, Vol. 19, No. 6, November–December, pp. 665–678.

Ashby, W. Ross. (1956), *An introduction to Cybernetics*, London: Chapman & Hall.

Barile, S. (2000), *Contributi sul pensiero sistemico in economia d'impresa*, Centro Studi di Tecniche Aziendali, Arnia, WM Stampa Editoriale srl, Atripalda (AV).

Barile, S. (2006), "Introduzione alla dinamica della varietà di un sistema vitale", in Barile S. (Ed.), *L'impresa come sistema. Contributi sull'Approccio Sistemico Vitale*, Giappichelli, Torino.

Barile, S. (2009), *Management sistemico vitale*, Giappichelli, Torino.

Barile, S. and Polese, F. (2010), "Smart Service Systems and Viable Service Systems", *Service Science*, Vol. 2, No. (1/2), pp. 21 – 40.

Bassano, C. (2008), *Creatività e configurazioni reticolari nella filiera cinematografica*, Giappichelli, Torino.

Beer, S. (1972), *Brain of the firm. the managerial cybernetics of organization*, The Penguin Press, London.

Bianchini, F. (2000), "Cultural planning and creative strategies", *Streetwise*, Vol. 11, No. 2.

Bianchini, F. (1999), "Cultural Planning for urban sustainability", in Nystro L., Fudge C. (Ed.), *City and Culture – Cultural processes and urban sustainability*, Stockholm: The Swedish Urban Development Council.

Brundtland Report (1987), Report of the World Commission on Environment and Development "Our Common Future", *United Nations World Commission on Environment and Development*.

Capra, F. (1996), *The Web of Life: A New Scientific Understanding of Living Systems*, Anchor/Doubleday Books, New York, NY.

Chesbrough, H. and Spohrer, J. (2006), "A research manifesto for services science", in *Communications of the ACM*, Vol. 49, No. 7, July, pp. 35-40.

Chesbrough, H. and Davis, A. (2010), "Advancing Service Innovation: Five Key Concepts, in Maglio, P., Kieliszewski, C., Spohrer, J. (Ed.), *Handbook of Service Science*, Springer.

Clifford, G. (1973), *The Interpretation of Cultures*, Selected Essays, New York, Basic Books.

Donofrio, N. and Spohrer, J. (In Preparation), "Research-driven medical education and practice: A case for T-shaped professionals".

Djellal, F. and Gallouj, F. (2010), "Innovation in Services and Entrepreneurship", in Maglio, P., Kieliszewski, C., Spohrer, J. (Ed.), *Handbook of Service Science*, Springer, pp. 535-559.

Edvardsson, B., Gustafsson, A. & Roos, I. (2005), "Service portraits in service research: a critical", *International Journal of Service Industry Management*, Vol., 16, No. 1, pp. 107-121.

Enright, M. 2000.Regional Clusters and Multinational Enterprises: Independence, Dependence or Interdependence? International Studies of Management and Organisation. 30(2).

Fitzsimmons, J.A. and Fitzsimmons, M. J. (1998), *Service Management*, 2 edition, McGraw-Hill.

Fransella, F., Bell, R. and Bannister, D. (2003), *A Manual for Repertory Grid Technique*, Wiley.

Friedman, D. (2008), *Morals and Markets: An Evolutionary Account of the Modern World*, Palgrave Macmillan.

Giddens, A. (1984), *The constitution of society*, University of California Press, California.

Goffin, K. (2002), "Repertory Grid Technique", in Partington, D. (Ed.), "Essential Skills for Management Research", Sage, London, pp. 199-225.

Golinelli, G.M. (2000), *L'approccio sistemico al governo dell'impresa*, Cedam, Padova.

Golinelli, G.M. (2010), *Viable Systems Approach (VSA). Governing Business Dynamic*, Cedam, Kluwer.

Golinelli, G.M., Spohrer, J., Barile, S., Bassano, C. (2010), "The evolving dynamics of service co-creation in a viable systems perspective", in The 13th Toulon-Verona Conference proceedings of the International Conference in Coimbra, Portugal, 2-4 September.

Golinelli, G.M. (2011), *L'Approccio Sistemico Vitale (ASV) al governo dell'impresa. Verso la scientificazione dell'azione di governo*, Cedam, Padova.

Gummesson, E. (1977), *The marketing and purchasing of professional services*, Stockholm: Marketing Technology Center.

Gummesson, E. (2007). Exit Services marketing – Enter service marketing. *Journal of Consumer Behaviour*, 6(2), 113-141.

Gummesson, E. (2008b), "Quality, service-dominant logic and many-to-many marketing", *The TQM Journal*, Vol. 20, No. 2, pp. 143-153.

Gummesson, E. (2009), *Marketing As Networks: The Birth of Many-to-Many Marketing*, Publishing House Djursholm, Stockholm.

Granovetter, M. (1985), "Economic Action and Social Structure: The Problem of Embeddedness", *American Journal of Sociology*, Vol. 91, November, pp. 481-510.

Gronross, C. (1977), "A service-oriented approach to marketing of services", *European Journal of Marketing*, Vol. 8, pp. 588-601.

Hakanson, L. (2010), "The firm as an epistemic community: the knowledge-based view revisited", *Industrial and Corporate Change*, Vol.19, No. 6, pp. 1801-1828.

Hannerz, U. (1998), *La complessità culturale*, Mulino, Bologna.

Hawley, A.H. (1986), *Human Ecology: A Theoretical Essay*, University of Chicago Press. Chicago, IL.

Holzner, B. (1968), *Reality Construction in Society*, Schenkman: Cambridge.

IBM (2010), Institute for Business Value on The world's 4 trillion dollar challenge.

IfM and IBM (2008), Succeeding through Service Innovation: A Service Perspective for Education, Research, Business and Government. Cambridge, UK: University of Cambridge Institute for Manufacturing. ISBN: 978-1-902546-65-0.

Kelly, G.A. (1955), *The Psychology of Personal Constructs*, Vols. 1 and 2, Norton, New York.

Koontz, T.M. (2003), "An Introduction to the Institutional Analysis and Development (IAD) Framework for Forest Management Research. Paper prepared for ―First Nations and Sustainable Forestry: Institutional Conditions for Success," workshop, University of British Columbia Faculty of Forestry, Vancouver, B.C., October 2003. Retrieved on 15.05.2011 from http://www.forestry.ubc.ca/fnconditions/_documents/TomKoontzPaper.pdf

Locke, E. A. and Schweiger, D. M. (1979), "Participation in decision-making: One more look", *Research in Organizational Behavior* , Vol. 1, pp. 265-340.

Lovelock, C. and Gummesson, E. (2004), "Whither services marketing? In search of a new paradigm and fresh perspectives", *Journal of Service Research*, Vol. 7, No. 1, pp. 20-41.

Macaulay, L., Moxham, C., Jones, B., Miles, I. (2010), "Innovation and Skills", in Maglio, P., Kieliszewski, C., Spohrer, J. (Ed.), *Handbook of Service Science*, Springer, pp. 717-736.

Maglio, P., Srinivasan, S., Kreulen, J.T., Spohrer, J. (2006), Service systems, service scientists, SSME, and innovation. Communications of the ACM, 49(7), 81-85.

Maglio, P. and Spohrer, J., (2008), "Fundamentals of service science", *Journal of the Academy of Marketing Science*, Vol. 36, No. 1, pp. 18-20.

Maglio, P., Kieliszewski, C., Spohrer, J., eds. (2010), *Handbook of Service Science*, Springer.

March, J. G. (1991), *Exploration and exploitation in organizational learning*, *Organization Science*, Vol. 2, No. 1, pp. 71-87.

Miller, J. G. (1978), *Living Systems*, McGraw-Hill, New York.
Miller, J. G. and Miller, J. L. (1992), "Greater Than the Sum of its Parts I. Subsystems which Process Both Matter-Energy and Information", *Behavioral Science*, Vol. 37, No. 1, pp. 38. 14.
Mintzberg, H. (1989), *Mintzberg on Management: inside our strange world of organizations*, The Free Press, New York
Normann, R. (2001), *Reframing Business: When the Map Changes the Landscape*. Wiley, Chichester, New Sussex.
Normann, R. and Ramirez, R. (1993), "From value chain to value constellation: Designing interactive strategy", *Harvard Business Review*, Vol. 71, N No. 4, pp. 65–77.
Ostrom, E. (1965), "Public Entrepreneurship: A Case Study in Ground Water Basin Management", *Ph.D. dissertation*, University of California, Los Angeles.
Ostrom, E. (2005), *Understanding Institutional Diversity,* Princeton University Press. Princeton, NJ.
Ostrom, E. (2009), "Beyond Markets and States: Polycentric Governance of Complex Economic Systems", Prize Lecture, December 8, Workshop in *Political Theory and Policy Analysis*, Indiana University, Bloomington, IN 47408, and Center for the Study of Institutional Diversity, Arizona State University, Tempe, AZ, U.S.A.
Parsons, T. (1951), *The Social System*, Glencoe, IL: Free Press.
Pfeffer, J., Salancik, G.R. (1978), *The external control of organization. A resource dependence perspective*, Harper & Row, New York, NY.
Piciocchi, P., Bassano, C. (2009), "Governance and viability of franchising networks from a Viable Systems Approach (VSA)", in the 2009 Naples Forum on Service. Service Dominant Logic, Service Science and Network Theory, proceedings of the International Conference in Capri, June 16-19, Giannini Editore, Napoli, 2009, ISBN13: 978-88-7431-452-2.
Piciocchi, P., Bassano, C., Paudano, E., Papasolomou, I. (2009), "The Virtuous circle of Syntropy (VCS). An interpretative chaos vs cosmos model for managing complexity", in the 2th Annual Euromed Conference, proceedings of the International Conference at the University of Salerno, Fisciano, Italy, October, 26-28th, DOI: 10.3292.
Piciocchi, P., Saviano M., Bassano, C. (2009), "Network Creativity to Reduce Strategic Ambiguity in Turbulent Environments: a Viable Systems Approach (vSa)", in the 11th International Conference on Global Business & Economic Development, proceedings of the International Conference at the University of Bratislava, Slovak Republic, May 27-30, Vol. 3., ISBN – 13: 978-0-9797659-8-8; ISBN-10:0-9797659-8-6.
Piciocchi, P., Bassano, C. (2012), "Best service? How to deliver an "empathic service" through an interactional perspective" working paper, in the 1st International Conference on The Human Side of Service Engineering, proceedings of the International Conference in San Francisco, on July 21 - 25, 2012 (forthcoming)
Powell, W. (1990), "Neither market not hierarchy: network forms of organization", *Research in Organizational behavior*, No. 12.
Ricketts, J.A. (2007), *Reaching The Goal: How Managers Improve a Services Business Using Goldratt's Theory of Constraints*, IBM Press.
Roughgarden, T. (2005), *Selfish Routing and the Price of Anarchy*, MIT Press, Cambridge, MA.
Sanford, L.S. (2006), *Let go to grow: Escaping the commodity trap*, Prentice Hall, New York, NY.
Saxenian, A. (1984), "The urban contradictions of Silicon Valley: Regional growth and the restructuring of the semiconductor industry", in Sawers, L., Tabb, W.K. (Ed.), *Sunbelt /Snowbelt: Urban Development and Regional Restructuring*, Oxford University Press, New York and Oxford, pp.163–197.
Sen, A. (2000), *Development As Freedom*, Anchor/Random House, New York, NY.
Siano, A. (2001), *Competenze e comunicazione del sistema impresa. Il vantaggio competitivo tra ambiguità e trasparenza*, Giuffrè Editore, Milano.
Simon, H. A. (1996), *The Sciences of The Artificial*, MIT Press, Cambridge, MA.

Simon, H. A. (1945/1997), *Administrative Behavior: A study of decision-making processes in administrative organizations*, Free Press, New York, NY.

Spohrer, J., Maglio, P. P., Bailey, J. and Gruhl, D. (2007), "Steps toward a science of service systems", *Computer*, Vol. 40, pp. 71-77.

Spohrer, J. and Kwan, S. W. (2008), "Service Science, Management, Engineering and Design (SSMED): Outline and References," in *The Future of Services: Trends and Perspectives*, Dieter and Walter Ganz Spath, ed. Munich, Germany: Hanser.

Spohrer, J. and Maglio, P. (2008), "The Emergence of Service Science: Toward Systematic Service Innovations to Accelerate Co-Creation of Value," *Production and Operations Management*, Vol. 17, No. 3, pp. 238-46.

Spohrer, J. and Maglio, P. (2009), "Service Science: Toward a Smarter Planet. In Service Engineering", in Karwowski and Salvendy (Ed.), Wiley: New York, NY.

Spohrer, J., Golinelli, G. M., Picocchi, P., Bassano, C. (2010), "An integrated SS-VSA analysis of changing jobs", *Service Science*, Vol. 2, No. (1/2), ISSN 978-1-4276-2090-3, pp. 1-20.

Spohrer, J. (2010), "Working together to build a Smart Planet", ICSOC (Service-Oriented Computing), San Francisco, December 8, available at: http://www.slideshare.net/spohrer/icsos-20101208-v2.

Spohrer, J. (2010), "Service Science: Progress and Directions", AMA SERVSIG, Porto Portugal at FEUP Engineering School. June, available at: http://www.slideshare.net/spohrer/service-science-progress-and-directions-20100620.

Spohrer, J., Picocchi, P., Bassano, C. (2012)., "Smart Governance to mediate human expectations and systems context interactions", working paper, in the 1st International Conference on The Human Side of Service Engineering, proceedings of the International Conference in San Francisco, on July 21 - 25, 2012 (forthcoming).

Schwartz, H.M. and Davis, S.M. (1981), "Matching Corporate Culture and Business Strategy", *Organizational Dynamics*, Vol. 59, p.33.

Sterman, J.D. (2000), *Business Dynamics: Systems Thinking and Modeling for a Complex World*, Irwin McGraw-Hill. Boston, MA.

Taylor, E. B. (1971), *Primitive Culture*, London.

Vargo, S. L. and Lusch, R. F. (2004), "Evolving to a new dominant logic for marketing", *Journal of Marketing*, Vol. 68, pp. 1-17.

Vargo, S.L. and Lusch, R.F. (2008), "Service-dominant logic: continuing the evolution", *Journal of the Academy of Marketing Science*, Vol. 36, No. 1, pp. 1-10.

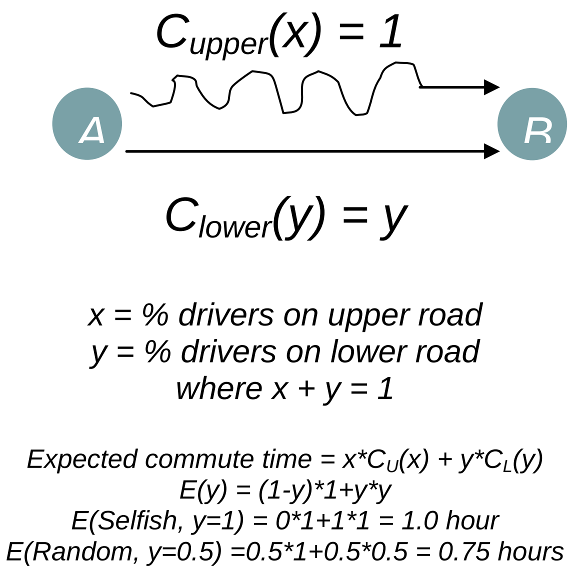
von Foerster (1981), *Observing systems*, Intersystems Publications.

Wayne, K. Hoy, Tarter, J. and Kottkamp Robert B. (1991), *Open Schools/Healthy Schools*, Sage Publications, London.

Williamson, O. (1996), The mechanisms of governance, Oxford University Press, Oxford.

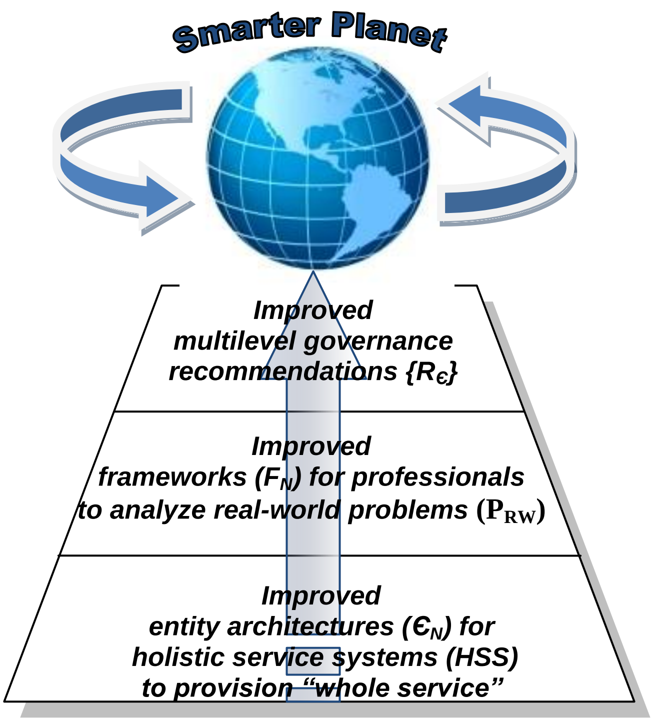
Wright, R. (2000), *Non-Zero: The Logic of Human Destiny*, Vintage/Random House. New York, NY.

Figure 1: Pigou's Example. Selfish actors all take the lower road (y=1.0), leading to congestion and a 1 hour commute time. A rule that randomly assigns half the drivers to the upper road and half to the lower road (y=0.5) improves the expected commute time to just 0.75 hours (i.e., half the drivers on the upper route take 1 hour, and half the drivers on the lower route take 0.5 hours).



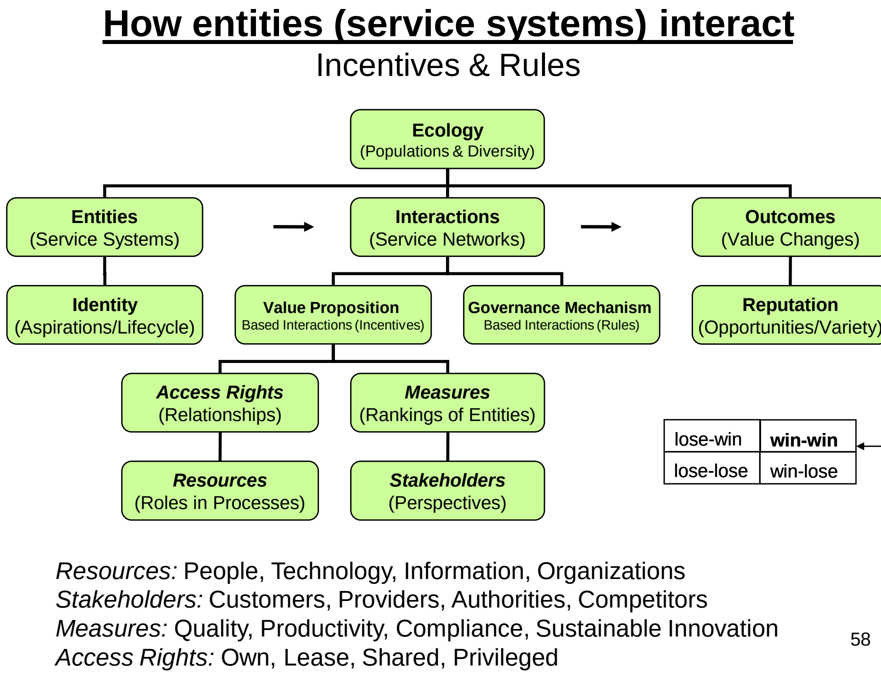
Source: Roughgarden, 2005.

Figure 2 – The Smarter Planet $Є_N$: $F_N(P_{RW}) \rightarrow \{R_Є\}$



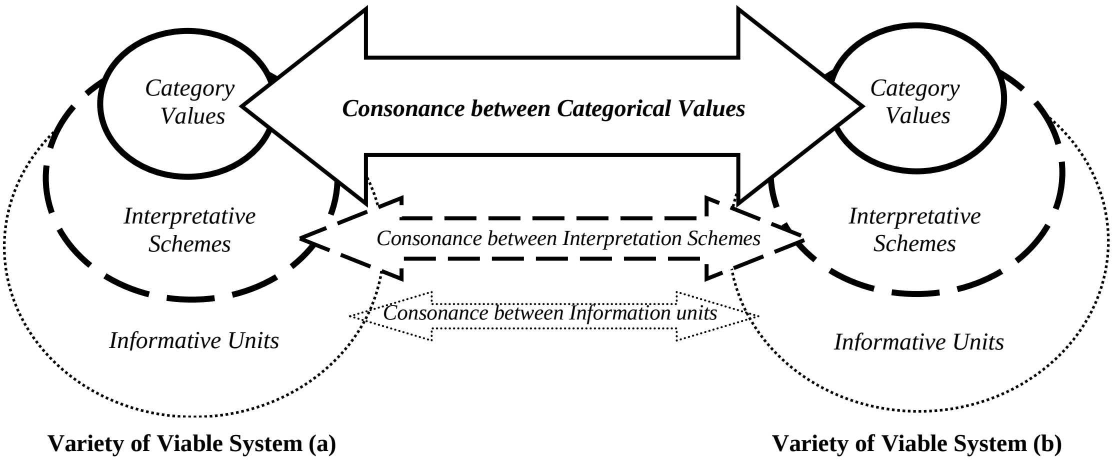
Source: our elaboration.

Figure 3 – The SSME+D foundational concepts



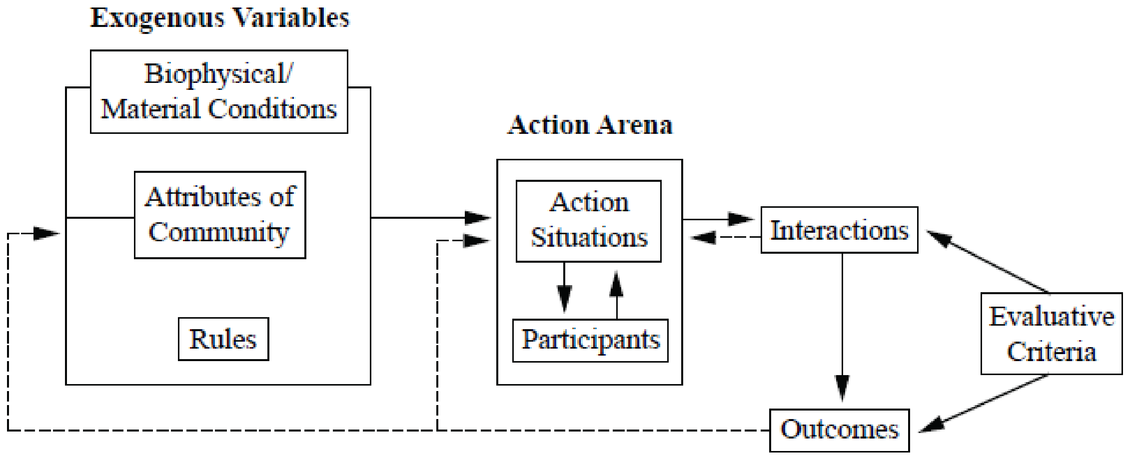
Source: Spohrer, J., ICSOC (Service-Oriented Computing) 2010, San Francisco, December 8, 2010, slide 58.

Figure 4 – The informative varieties consonance model



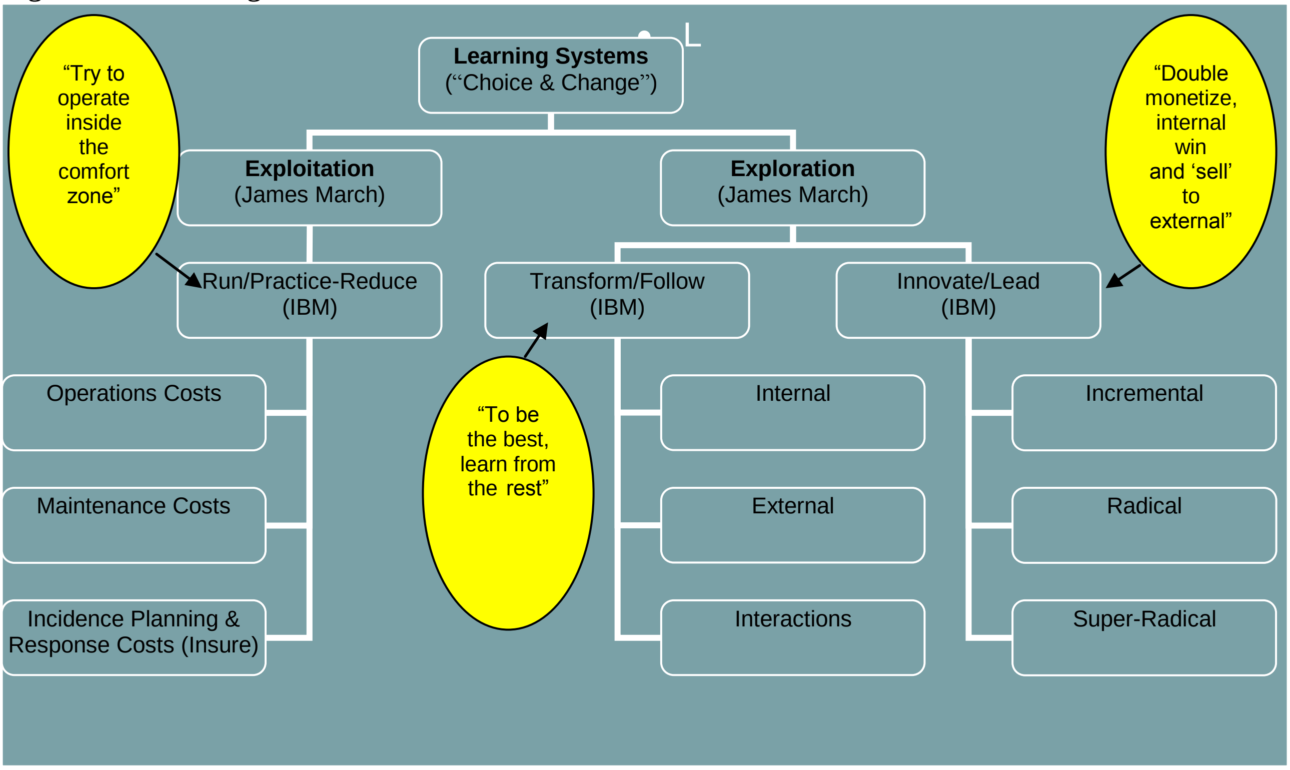
Source: Piciocchi *et al.*, 2009.

Figure 5 – A framework for institutional analysis



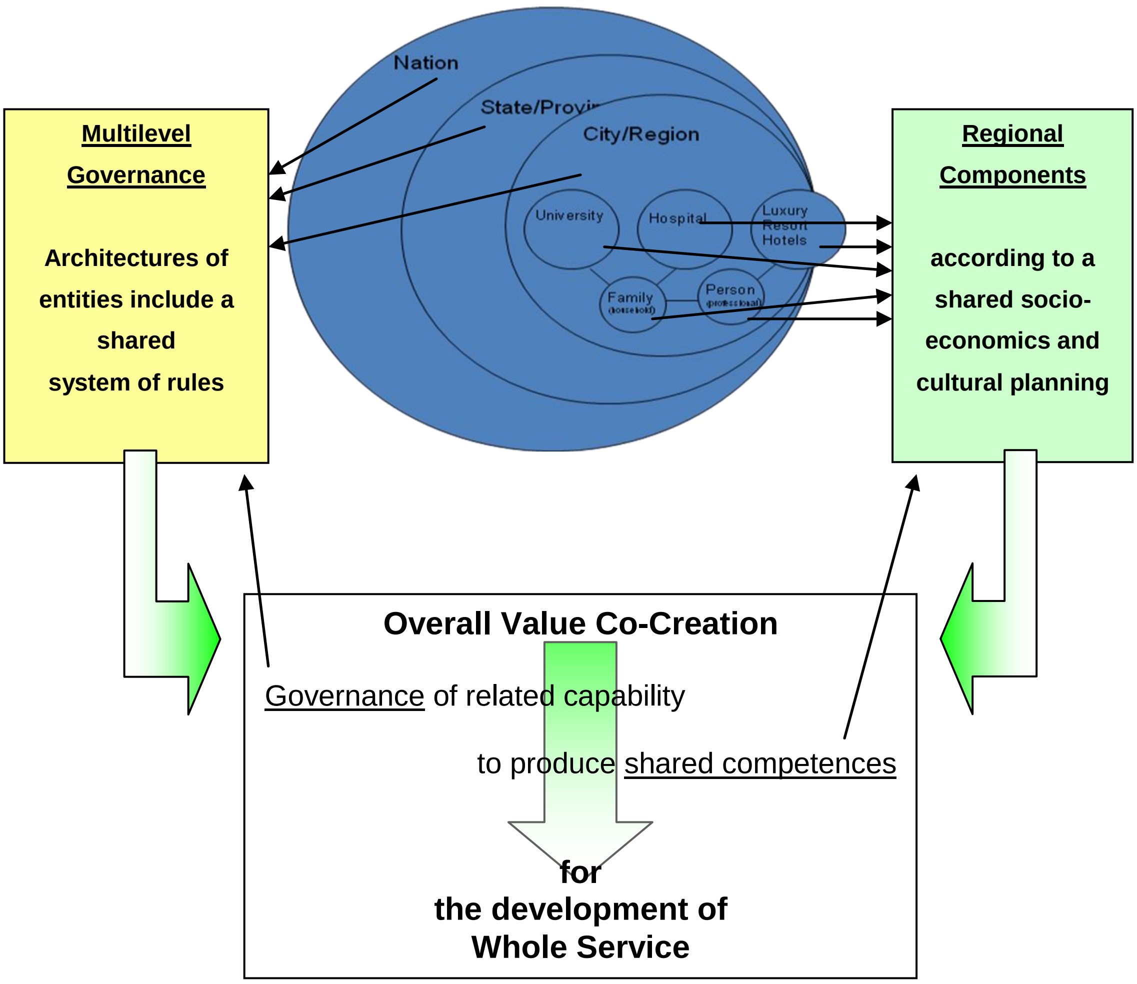
Source: Adapted from E. Ostrom, Gardner and Walker 1994, 37.

Figure 6 - Revised governance of investment choices



Source: our elaboration.

Figure 7 – Holistic Services Systems (HSS) and Whole Service (WS)



Source: our elaboration.