

The Last Mile of the Market:

How Network Technologies, Architectures of Participation and Peer Production Transform the Design of Work and Labour

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Abstract

The paradigm of the last mile is most significant in its embrace of complexity, self-organization and achieving ends without direct control. Network technologies, architectures of participation and peer-production challenge traditional approaches to control but enable organizations to harness new and emergent capabilities including:

- Engagement: by pursuing (work-related) interests that workers are passionate about
- Continuity of effort beyond the boundaries of particular job
- Extended Specialization: beyond the limits of the occupational structure
- Increasing productivity
- A deep culture of collaboration

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Network Enabled Capability Powers Operational Agility

Hardware to software to Everyware –the vision of the ubiquitous digital environment, where we and our things will function in an atmosphere of information. That is the vision of this paper. To truly benefit from this inevitability, we need significant change in the design principles of human organization and in understanding the cultural and institutional implications of new organizational architectures.

The advent of the networked society¹ and economy implores a paradigm shift no less than that represented by the industrial revolution and the development of Fordist and Taylorist concepts. We need: new design principles for organizational architecture and culture; new aims and new ways to achieve them; and new human resource management systems to support how people can increase their capabilities through networks.

With the emergence of Web 2.0 has arisen the concept of peer-production², demonstrating that network technologies bring not just cheaper information, but very cheap coordination³. Peer-production represents a new emergent mode of production bridging the market and the organization. The exponential increase in the range and extent of human networks presents a quantitative change that becomes a qualitative difference in capability. Knowledge management, continuous learning, operational agility and network decisioning are becoming synonymous.

But how can we design organizational structures, processes and capabilities for robust and rapid adaptation and evolution in response to novel and rapidly developing situations? How do we structure both accountability and distributed control (responsible autonomy) without further bureaucratic kludge⁴? This paper explores both the saliency of these puzzles and some possible approaches to their solution.

The concept of the “last mile of the market⁵”, is intended to evoke a sense of heresy in relation to conventional thinking of the architecture of organizations. Conventionally we understand the market as the essence of capitalism but a basic reading of Adam Smith makes clear that an effective market system is not unfettered anarchy, nor is it based on laissez-faire ideology. A market system is an exchange economy unparalleled in allocating resources (with corresponding coordination of activities). Effectiveness requires both a sound regulatory regime and decentralized self-organization: “The establishment of perfect justice, of perfect liberty, and of perfect equality, is the very simple secret which most effectually secures the highest degree of prosperity to all three classes” (Smith. 1776: 726).

The metaphor of the market is intended to represent the powerful paradigm of self-organization, enabled by network technology and peer-production and one that is most significant in its embrace of complexity and the challenge of achieving effects without direct control of all necessary resources. The phrase ‘the last mile of the market’ is an allusion to the problem of the last mile of broadband connectivity – the connection from central hubs to individual homes and therefore the next step in the extension of self-organization into the interior of the organization. It is not meant to suggest that we are approaching the final development of the market. This paradigm embraces other concepts such as heterarchy⁶, and responsible autonomy⁷.

Birth of Markets⁸

Imagine it's 1795, and you're a shopkeeper somewhere in Spain. You no longer believe, as the ancient Egyptians did, that your king is literally a god living on earth. But you still believe that he has a divine right to rule over you. You can't imagine any country being governed well without a king who is responsible for the protection and control of its subjects. You have heard of the strange rebellion in North America in which the British colonists claimed that they could govern themselves without any king at all. You've also heard about the recent bloodshed in France that ended with a group of so-called revolutionaries killing their king, replacing the government, and destroying, almost overnight, so many good things. These events seem to you like profound mistakes, foolhardy experiments that are bound to fail. It just doesn't make sense to say – as the democratic revolutionaries do – that people can govern themselves. That's a contradiction in terms, like saying that children could raise themselves or farm animals could run a farm. People can try it, you think, but it certainly couldn't work as well as having a wise and just king (Malone. 2004: 3).

For most of humankind's experience in societies, only two ways have been available to shape social and economic structures. Societies ensured continuity by organizing around traditions and customs and/or on the basis of authority and command hierarchies. Smith presented a third way – the 'market system.' It presupposed that each should do what was best for their own advantage. Thus, the lure of gain, not tradition or authority became the guide for action (Heilbroner, 1999), bringing more liberty to personal choices in areas of life. The idea of the 'lure of gain' is not reducible to simple selfishness; we can easily understand it in a broader context of self-actualization – the freedom to be motivated to extend personal effort for the advance of higher goals, better described as 'responsible autonomy'.

It was not obvious that a market system would enable a society to endure – that all work, dirty and comfortable, difficult and easy would get done. Abandoning the security of custom and command for the uncertain, perplexing and dubious "invisible hand" required a revolution sundering the mold of command and custom. Despite a general embrace of the market system, our organizations often seem much closer to a feudal control hierarchy – a command economy.

Organization as Machine

Adam's Smith's illustration of the pin factory, while beautiful as a simple description of the power of the division of labour, undermined his larger vision of the nature and power of the market system. The invisible hand not only guided the allocation of resources, it also guided the self-organizing development of the division of labour throughout a social-economy.

The pin-factory confuses the centralization of production with the market system he sought to elaborate. The pin factory is both a control hierarchy and essentially designed as a machine. The design is top-down, separating the designer (king/CEO) from the tool (machine/organization). The purpose of the machine determines the inputs and expected outputs. Although labour is viewed as an input, the worker is transformed into a replaceable 'cog' (task-specified job) within the machine and enabling it to function effectively. Efficient replaceability implies a high degree of standardization.⁹ Industrial machines for mass production and economies of scale – as long as the environment is stable.

So why were organizations designed as machine-like command economies? Two reasons (among many). Ronald Coase¹⁰ claimed that the basic economic reason for individuals to operate under command rather than in the market system – is transaction costs¹¹:

Where the cost of achieving a given outcome in the world through the price system will be higher than the cost of using a firm to achieve the same result, firms will emerge. Any given firm will cease to grow when the increased complexity of its organization makes its internal decisions costs higher than the costs that a smaller firm would incur to achieve the same marginal result. Firms will not, however, conduct activities if the cost of organizing these activities within a firm exceeds the cost of achieving that result through the market (Benkler, 2002: 32).

Second, Thorstein Veblen¹² argued that capitalism, although a new economic order, retained the social-cultural myths (mythos) of a society shaped by a long history of command as the “natural” custom. Leaders in organizations could see themselves and feel seen as, a governing elite. Thus the control hierarchy remained a fundamental frame for principles of organizational architecture design. Frames are maps that allow us to organize information to make sense of the world and are part of our discursive universe helping us to communicate to others and define cultural norms. Often we can become prisoner to our frames:

Scientists have done some fascinating and suggestive experiments with ordinary houseflies. If you capture and keep houseflies in a jar and then remove the lid after a few days, most of them will not fly away. In fact, they stay right where they are — inside the jar — even though they could escape if only they could see their way to freedom. But they seem "committed" to a lid that is no longer there. Psychologists have identified this phenomenon as "premature cognitive commitment." It is premature cognition in the sense that it occurs, more or less automatically, before we are aware of or fully understand the stimulus. It is "commitment" because we are locked into a specific set of thoughts. Like the houseflies, we give up the freedom to choose once we become committed to the nonexistent lid. The first step in challenging a commitment is recognizing that you have made it in the first place (White quoted in Lissack, 2004: from Web document Section 2.2).

The shift to a market system did not dissolve the myth of command - instead it became ‘democratized’ in that anyone could become a “Captain of Industry” and/or a Leader-Hero. The CEO as the ultimate ‘decider’ of allocation replaces a king and the custom becomes entrenched of hierarchical occupational structures and cultures. The mechanical, linear and deterministic organizations imbue their ‘parts’ (people) with a structural model reproducing itself as the primal perceptual and cognitive frame.

Hierarchy and Complexity¹³

As the scale of the organization increases (size, technologies and number of products or services), the more complicated is the task of coordinating individual activities. Complexity emerges as coordinated behaviours include many different but related activities that can be independent and/or coherent at different scales of resolution. Increased diversity requires the hierarchy to add layers of management for local control:

Each layer simplified the behavior to the point where an individual could control it. The hierarchy acts as a mechanism for communication of information to and from management. The role is a filtering one, where the amount of information is reduced on the way up. Conversely, commands from the top are elaborated (made more complex) on the way down the hierarchy. As the collective behavioral complexity at the scale of an individual increases, the branching ratio of the control structure becomes smaller and

smaller so that fewer individuals are directed by a single manager, and the number of layers of management increases. The formation of such branching structures allows an inherently more complex local behavior of the individuals, and a larger complexity of the collective behavior as well (Bar-Yam, 2006: 14).

The purpose is to ultimately *enable a single individual (the controller) to control the collective behavior, but not directly the behavior of each individual* (Bar-Yam, 2006). However, increases in size and/or variety both increases coordination costs and limits internal complexity. An implication is that collective actions in which parts affect other parts must not be no more complex than the controller him/or herself. That is, collective dynamics have to be simple enough to allow for representation by a single human being (Bar-Yam, 2006). In other words, hierarchies can amplify the scale of behavior but do not increase their complexity.

Organizations' external environments can also vary from relatively stable to dynamic and complex. If environmental complexity begins to exceed the internal complexity of the organization, then the chances of failure loom high unless the organization can increase its internal complexity sufficiently to generate successful responses to environmental demands.

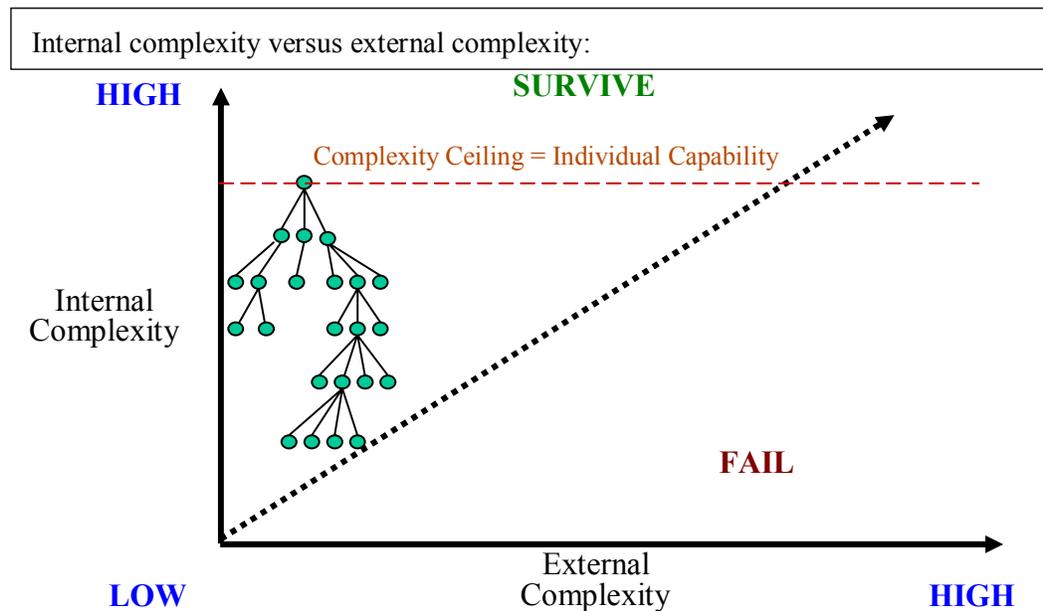


FIGURE 1: ORGANISM – ENVIRONMENT RELATIONSHIP.

When hierarchies cannot generate higher internal complexity traditional control is no longer possible (in part also due to excessive transaction and coordination costs), management becomes divorced from the functional aspects of the system, and other types of interactions must begin to coordinate activities previously handled by levels of management. Other organizational architectures are more effective with different classes of problems and different environmental conditions.

The ubiquitous frame of hierarchy makes it seem as the most natural way to organize and the only alternative is disorganization or anarchy. However, two alternatives are: Heterarchy and Responsible Autonomy. Table 1 below outlines these 'three ways things get done' (Fairtlough, 2005).

<i>Culture is structured by the conventions of coordination</i>		
Centralized		Decentralized
<i>Control Hierarchies</i>	<i>Heterarchies</i>	<i>Responsible Autonomy</i>
Traditional Military Government & Corporate Bureaucracy	Consulting Firms Research Universities Political Democracies	Free Markets e-Society and the Internet First Responders

TABLE 1 – CONTINUUM OF ORGANIZATIONAL ARCHITECTURES: three general types of problems and the corresponding type of organizational structure best suited to effectively providing their solutions.

Hierarchies are efficient and can expand in proportion to their ability to control activities. In contrast, markets arise wherever a regular group of independent decision makers gather and thus provide opportunities for individuals to exchange. Hierarchies sort out human beings into internally homogeneous and hierarchical ranks. Markets bring a heterogeneous collection of humans together where complementary economic and other needs enmesh.

Heterarchy can be defined as multiple rule, a balance of powers instead of single rule, this idea of shared rule is very old, for example partnerships.

Responsible Autonomy is defined as individual or group autonomy to decide what to do. Responsibility as accountability is not anarchy. The very word responsible implies connectedness one could just as easily use the term connected autonomy or accountable autonomy.

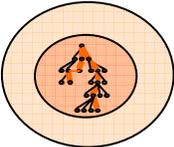
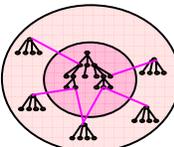
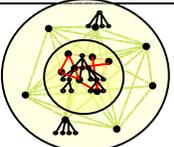
Organizational Architectures		Generalization of Relative Advantages of Different Architectures			
		Culture & Leadership	Individualization and Ability to Use Many Minds Simultaneously	Ability to Resolve Conflicts	Autonomy, Motivation, and Creativity
Traditional Control Hierarchy	Trust				
	Placed in process of execution	Centralized decision making emphasizing standardization and task accountability	Low	High	Low
Modular or Heteroarchival					
	Placed in roles and occupants	Shifting leadership depending on domain; decision rights embedded in roles	Medium	Medium	Medium
Customized/Market Responsible Autonomy					
	Placed in other's expertise	Collaborative within & across organization lines, norms – generalized reciprocity	High	Low	High

TABLE 2 – RESPONSE TYPE ORGANIZATIONAL STRUCTURES¹⁴: four environments¹⁵ and the ‘problem solving’ architectures presented above.

The Known environment is stable, problems are familiar with known responses. Cause-effect relations are repeatable, perceivable & predictable. Centralization, standardization and task accountability makes the control hierarchy the most efficient and effective.

In the complicated context, cause-effect relations span time and space. Problems are solvable through analytical, reductionist and systems thinking approaches. Solutions require constellations of expertise and decision rights are embedded in roles. The most suitable architecture is modular or Heterarchical.

In a complex environment, cause-effect relations are non-repetitive, non-linear and only coherent in retrospect. Problems need innovative solutions and agile collaboration across boundaries and norms to configure customized 'solutions'. Efforts are aimed at identifying patterns to stabilize and enhance positive patterns and dampen and reduce negative patterns.

In chaos, cause-effect relations are not perceivable. Interventions are stability-focused and crisis management is the rule. Agility is needed to shift from imposing the order of a control hierarchy to accepting modular adaptation to bringing customized capabilities.

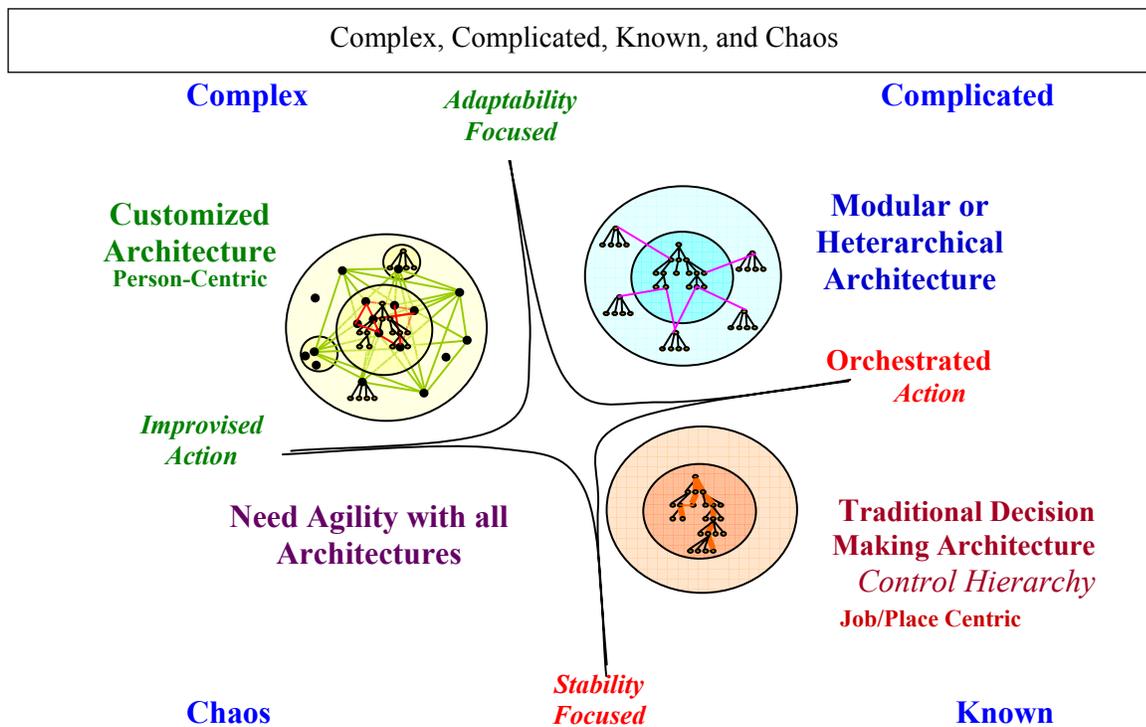


FIGURE 2: ORGANIZATIONAL ARCHITECTURE – ENVIRONMENT RELATIONSHIP

The Last Mile

According to Karoly (2007: 7), first, we see greater specialization and more worker-entrepreneurs, including a trend toward the “vertical disintegration of the firm.” That is, companies shed non-core functions through outsourcing so as to focus

competitive advantage. At the same time there is a shift in direction of more participatory “high performance” work systems where workers possess more on their core competencies. Decentralized business forms mesh with decentralized decision-making with a premium on knowledge-generation for authority, team work opportunities, and performance-based pay. Much

of this is attributable to the power of information technologies to coordinate work activity in a more decentralized manner.

But there's a further complication: the plague of eternal transformation – a shift from a constant state followed by periodic change, to constant change punctuated by periodic extreme change (Waker, 2006). Work to understand, plan and implement change within current and near-term initiatives and budgets is regularly derailed by 'emergent requirements' and tends to create a predominant crisis or 'fire-fighting' culture.

The standard model of transformation has been the freeze-thaw-refreeze approach to change management. Key to inciting change is an orientation to motivating people to accept change by engendering a tangible (and visceral) sense of crisis. However, in a dynamic complex fitness landscape, we must learn how to run the organization while changing the organization.

Another systemic challenge compounds the issues of transformation:

SOM Syndrome – Systemic Organizational Munchausen's Syndrome by Proxy.

This issue exacerbates the pressures people feel to have measurable positive impact on an organization whether focus is operational or administrative. Briefly Munchausen's Syndrome is when a person gets sick in order to get attention. Munchausen's Syndrome by proxy is when a parent makes the child sick in order to gain attention. Systemic Organizational Munchausen's Syndrome by proxy refers to the systemic incentives within the structure of an organization's career path which demands that an individual navigate a career (or have their career managed) through many different organizational positions. The career 'ladder' is generally not easy nor straight, forward or upward.

Prevention is not well suited to measurement and as such is very difficult to find a place for it in a person's performance review¹⁶. In the same vein, long-term strategy is very difficult to implement because rewards are usually given for harvesting fruit rather than planting seeds or nurturing someone else's seedlings. Solving problems and handling crises on the other hand is much more visible and measurable (even if today's band-aid is tomorrow's infection) and thus much easier to reward and recognize on a performance review. The SOM Syndrome amplifies a type of careerist and leadership mythos that requires leaders to be visible in leading change as the basis of reward and promotion. In essence SOM Syndrome entrenches an organizational allergy to prevention and long-term strategy and feeds an addiction to problem-solving and crisis management.

Peer-Production

The redesign of work process to optimize network technologies and architectures of participation can bring significant benefits including:

- Reduced transaction (coordination & control) and opportunity costs (time, effort, people, capability)
- Integrated continuous learning, enhancing operational agility and reduce training costs
- Increasing the pool of available skills, knowledge and judgment that can be brought to bear – more human capital available for productive and operational ends.

Let's try a thought experiment. Assume the integration of network technologies and peer-production¹⁷ in the re-design of work, activities and processes. We then restructure the organization by restructuring its smallest part – the job and person time. The table below lays this out.

% TIME	OWNERSHIP & PURPOSE	ARCHITECTURE
70%	Owned by job: Running the organization – being the cog in the machine	Hierarchy
15%	Owned by organization: Transforming the organization – refitting, longer term strategy	Heterarchy
15%	Owned by individual: Pursuit of personal interest as it contributes to self and the whole	Responsible Autonomy

TABLE 3: RESTRUCTURING THE ORGANIZATION FOR THE LAST MILE

The time traditionally constituted as a person’s ‘job obligation’ is divided up: 70% of the time of each of the worker ‘owned’ by their current ‘job/role’, 15% is ‘owned by the organization and finally 15% is owned by individual worker.

In this way the ‘job-cog’ is dedicated to running the organization with 70% of the person’s time under hierarchical control. Transformation and strategic requirements efforts would have 15% of the HR time creating a heterarchical structure. Finally, each individual would own 15% of their ‘job-cog’ time to contribute to peer-production initiatives chosen on the basis of their interests. This person-owned time, in conjunction with enabling technologies would create a market-like exchange economy and personnel platform – a group-forming network, and peer-production¹⁸ space – *the last mile of the market*. It is easy to conceive of a sliding scale of person-owned time based on experience and professional development. The specific portion is not important. The point is to visualize a way to create such a space and how it could be used.

The organization could achieve at minimum five major and interconnected benefits:

Engagement: The capability to pursue work-related interests that individuals enjoy or are passionate about enables interests to become expertise and creates a space for 'amateurs' (in the sense of a pursuit of that which is loved). As a consequence, a halo affect can engender a deeper engagement with the organization. Furthermore, this space can become a non-hierarchical exchange market for knowledge, skill and judgment as it is just as likely that an individual can be asked for the contribution of their expertise (another form of engagement also contributing to the halo). This exchange space allows the whole organization to reach out and ‘exploit’ the knowledge that is embedded in each person when it is required. With the group-forming capability of network technologies and peer-production one can visualize the rich and complex set of connections that foster engagement with others, with the organization enabling mentorship, rapid solution generation and getting knowledge, experience, skill and judgment – the right people connected to the right situation at the right time.

Continuity: The inevitable flow of people through the organization engenders a significant internal 'fog and friction' above and constant transformation. Enabling an easier way to remain engaged in the initiatives people are comfortable with, passionate about or expert in, the organization can obtain greater continuity of effort and corporate knowledge. This type of continuity of effort is most important to initiatives not encapsulated in a particular ‘job’ including transformation efforts. Also important is the potential for this type of continuity to provide an antidote to the SOM Syndrome because measures of performance can be obtain for contributions based on long-term involvement as well as performance limited to job-incumbency.

Extended Specialization and Enhance Generalization: When individuals are able to pursue their deeper interests and passions they inevitably develop a specialization of talent. In the exchange

space of peer-production and responsible autonomy both the division of labour and the organization's range specialization can be extended beyond what the occupational structure contains. Extended expertise is equally applicable to the current expert allowing the development of knowledge/skills applicable to wider or more specific domains. A corollary to the above is that a person can also use the whole of their experiences more generally across the organization and for the organization to more fully exploit the knowledge it has invested so much to develop.

Increasing Productivity: Like all human activity, effort and quality output is not evenly distributed. Some times of day, week, month are less productive than others. The allocation of when individual use their 'owned time' could easily be seen as using the less productive moments of the work day, in which case overall productivity could be increased. The halo effect of greater engagement can also contribute to increasing the motivation that individuals bring to the remaining 85% of their time. Another way to see individually owned time is as the creation of a self-organizing, non-hierarchical exchange space in the organization that allows rapid response as needed without bureaucratic encumbrances of authority to provide permissions, saving significant control and coordination costs. Accountability in these and all other peer-production interactions are derived from the transparency of the digital environment. The network technologies allow all involved to see what has (or has not) been done and by who.

Deep Culture of Collaboration – Achieving Goals Without Direct Control: Most organizations are less a single culture than it is an assemblage of tribes and clans, founded on silos and occupations. The development of a peer-production knowledge exchange market-like space in the formal organizational structure would enhance, deepen and strengthen the current culture in the informal networks. The informal organization is the interlocking set of relationships that connect people who share a common organizational affiliation. It is the aggregate of behaviours, interactions, norms, personal and professional connections through which work gets (or doesn't get) done. Like a market, the informal organization evolves organically in response to complex forces, like changes in the internal and external environment, the flux of people through its porous boundaries and the complex social dynamics of its members. Tended effectively, the informal organization complements the planned execution of processes that the formal organization naturally does best. It has the power to accelerate and enhance response to unanticipated events, foster innovation, and support collaborative problem-solving. In the best-performing organizations, the informal side nearly always stands out as more unique from peers than do elements of their formal organization.¹⁹

Decision-Action Dominance: Achieving greater organizational agility as a result of a more rapid search through a larger solution space and ultimately to better exploit openings, accelerate strategies and/or recover from a mishap.

Conclusion

The revolutionary nature of Adam Smith's ideas of the market system as a decentralized self-organizing approach to allocating resources and coordinating activities is also fundamental to unleashing the emerging capabilities of network technologies and architectures of participation. New architectures will not completely displace the traditional hierarchies. Rather organizations must learn how to operationally integrate the demands, opportunities, challenges and capabilities of both traditional and emerging paradigms. The concepts of peer-production and responsible autonomy represents the emergence of a fundamentally new mode of production that will ultimately enhance human and organizational capability, but only if we understand and embrace it.

To fully exploit this network capability within a social, organizational and technological context, a 'paradigm shift' is required with corresponding concepts of human resource management, organizational architectures and supporting cultures. The most important reason is to better reap the maximum benefit and return from the tremendous investment we continue to make to develop its people and human capital. Network enabled operations will leverage human capability, collaboration and virtuosity to enable intelligent adaptive improvisation and emergent innovation to achieve successful performance within a range of situations – from unpredictable complex conditions to stable predictable situations.

About the Author

John Verdon has a rich background in theoretical and applied social science research. His academic background includes an Hon B.A. in Psychology, an M.A. in Anthropology, doctoral course work in Sociology. He is currently pursuing a PhD in Philosophy.

His work experience includes 10 years of program evaluations with the Public Service Commission, and over 10 years the Department of Defence (DND) within the domain of strategic human resource and foresight research.

Current work is focused on future human resources (HR) concepts, including social, organizational and human implications network technologies, and capability for HR management and systems. To a lesser extent he has also explored the emerging impact of cognitive, biological and nano-technologies to enhance human and social performance.

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1 See Castells, 2000-2001. and Wellman, 2001, 2004.

2 See Benkler, 2002, 2003, 2006.

3 The difficulty of coordinating a team's work inspired software engineering's most famous dictum, known as Brooks's Law: "Adding manpower to a late software project makes it later." Frederick P. Brooks Jr. reached this gloomy conclusion after leading IBM's troubled effort to write software for its 360 mainframes in the 1960s. In his 1975 book, *The Mythical Man-Month*, Brooks observed that work proceeds slower on bigger teams because of "coordination costs" – the time programmers lose keeping one another apprised of their work. Rosenberg, 2007.

4 A kludge (or, alternatively, kluge) is a clumsy or inelegant solution to a problem or difficulty. In engineering, a kludge is a workaround, typically using unrelated parts cobbled together. Especially in computer programs, a kludge is often used to fix an unanticipated problem in an earlier kludge; this is essentially a kind of craft.

5 The use of the phrase ‘The last mile of the market’ is meant as an allusion to the problem of the last mile of broadband connectivity – the connection from central hubs to individual homes. It is not meant to suggest that we are approaching the final development of the market.

6 see Verdon. 2005

7 see Fairtlough, 2005.

8 Caveat. Due to time and space limitations many issues are not addressed, among these are: The tragedy of the unmanaged commons; Abundance and its implications for valuation of ‘goods’; Property Rights; and the Mercantile system.

9 A more elaborate discussion of the differences and relations between ‘position, job and occupation’ will be undertaken in a following paper.

10 Received the Nobel Prize in Economics for his discovery and clarification of the significance of transaction costs and property rights for the institutional structure and functional of the economy. Major works include: “The Nature of the Firm” 1937; “The Problem of Social Cost” 1960. <http://nobelprize.org/economics/laureates/1991/>

11 Time and space limits of this paper require me to assume that the reader is familiar with transactions costs..

12 For a concise description of Veblen’s work see: Heilbroner, Robert. 1999. *The Worldly Philosophers: The Lives, Times And Ideas Of The Great Economic Thinkers*. Touchstone.

13 The discussion on complexity is largely derived from Bar-Yam, 2006.

14 This is modified from the table from: Cross, Liedtka and Weiss, 2005.

15 The four environments and the figure are modified versions of those created by Kurtz and Snowden 2003.

16 See Taleb. 2007. for accounts of the difficulty of both measuring and rewarding acts of prevention.

17 Of course members in operations would have significantly different aims and as the scenario of Corporal Jones depicted in Verdon et al, the use of Web 2.0 – peer-production would be integrated with operational priorities and requirements.

18 For a discussion of network/Web 2.0 technologies and peer-production see Verdon, et al. 2007.

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