ORGANIZATIONAL TRANSFORMATION IN THE DIGITAL ECONOMY
- Tutorial Paper -

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***Abstract*-This work sets the vision for organizational transformation that will secure competitive advantage in the digital economy, as the border between society – market - organization becomes more permeated to facilitate new types of assemblages of 'meshworks' within and across organizational boundaries. We argue that network technologies are feeding the emergence of architectures of participation, protocols of collaboration and the development of new concepts of how work can be accomplished – notably responsible autonomy and peer-production. The concept of eNetworked ecosystem is used as metaphor for the need to embed responsible autonomy within the organizational structure via a new type of personnel platform and space for non-hierarchical (impersonal) exchange and collaboration which mirrors 'the invisible hand' of Adam Smith. Assuming that the transparency of the digital environment will provide for dramatic and ubiquitous accountability of action we consider the parallel with the transparency of "good enough" information carried by the price mechanism that allows people to respond to price through the 'invisible hand' of the market. We show how the melting of traditional constraints (e.g. geographical, transactions costs, coordination, job as identity, knowledge scarcity, etc.) makes room to a revolution in all social and political institutional frameworks via the integration of responsible autonomy within a more complex organizational architecture. This new mode of production capitalizes on the transparency inherent in the digital environment to set the conditions for responsible autonomy as foundation for a broader and more equal market for many more people to exchange anything, with anyone, anytime thus generating a ubiquitous expectation that the right individual (customer, employee) can connect to the right situation (product, job) at the right time. We conclude that the simple capacity to do more enabled by the transparency of the trusted situational awareness that allows decentralized action to be incorporated with agility of response through more relaxed organizational policies - will continue to be a force of change fuelled by the 'organizational survival' drive to adapt and thrive in the complex and turbulent operational environment of the 21st Century economic reality.**

Keywords. eNetworked ecosystem, architecture of participation, power law, peer production, responsible autonomy, human capital, social capital, digital economy

I. INTRODUCTION

Fuelled by information technologies and communication networks (in short - ICT) the world is shifting from the industrial revolution to the 'networked society and economy' in which the (no longer effective) Fordist and Taylorist models are seamlessly being replaced by new design principles for organizations, new aims and new ways to achieve them. With this new human resource management systems are currently emerging to support how people can increase their capabilities through collaborative networks.

The explosion in size and complexity of ICT systems in all domains of society: production, healthcare, education, defence, business, energy & environment, etc has opened the door to entirely new forms of social organization. The eSociety is characterized by a high degree of decentralization stemming from myriads of artefacts and humans (the world of atoms), connected via computing hardware and software elements (the world of bits) in unprecedented techno-social systems. The linkages and interdependencies between people, sensors and systems give rise to new models and patterns fundamentally challenging the traditional 'top-down management' ways by which we ran (and are still running) our lives and work in the 'world of atoms'. From the 'command economy' - to the 'eNetworked industrial ecosystem' [19], the World is seamlessly shifting to embrace the power of decentralized 'peer-production' and 'emerging leadership' supported by network technologies and architectures of participation enabled by the two merging worlds, and by this enormous capacities for innovation in the eSociety are only now starting to be revealed. Built on the network economy with the capabilities of informatics, the digital economy is as much about the 'awakening' to these new possibilities, as it is about overcoming the transformational challenges disruptive of the old ways, as the 'invisible hand' of ICT is fundamentally shifting our society. And above all – it is about finding the right balance between

old and new that would enable us to navigate most successfully through the trials and tribulations of today's (mostly unforgiving) economic realities.

II. On Power Laws and Productivity: Peer Production and Responsible Autonomy

While institutions are the 'rules of the game' that impose constraints on human interaction, organizations are 'the players' in the game [12]. The interaction between the rules and the players is what fosters institutional change out of the institutional framework conjoined with the other standard constraints of economics and the physical environment. Organizations on the other hand bring individuals with some common interest together into groups, whether economic organizations such as firms, unions, cooperatives, or political ones such as parties, agencies, governing bodies, or social ones such as religious bodies, clubs and associations. The accretion over time, by dominant economic and political actors, of beliefs into an elaborate structure of institutions (as sets of rules of the game) that determine economic and political performance creates a so-called 'institutional matrix' [12] which determines what varieties and number of organizations can arise. The economies of scope, complementarities, and network externalities of an institutional matrix make institutional change overwhelmingly incremental and path dependent. However it is individual innovators that seek to induce institutional change through efforts to change the rules – directly through political and other influence means or indirectly by technological, economic or social means or by (either deliberate or purely accidental) efforts to change the effectiveness of enforcement. This creates a tension within the institutional matrix and its severe constraints (path dependencies) on the choice set of political/economic actors when they seek to improve their positions [12]. This tension brings about an adequate context of competition which stimulate organizations to change and consequently to induce institutional change.

Network technologies and architectures of participation offer a new mode of production that suggests not the mere transformation of the existing institutional framework, but the emergence of a new one, which can be coined within the generic framework of 'power-law relations', also known as the '80-20 rule'. Characteristic of many naturally occurring phenomena, the 'rule' states that, for many events, 80% of the effects come from 20% of the causes (this is a rule of thumb, rather than a 'law' and in fact many classes of phenomena can be found to fit more as 90/10, 70/30, and 95/5 "rules"). The important point is that a sort of clumping – few large versus many small relationship between elements or factors is what does occur in most phenomena. To understand the 'power law' distribution and its meaning as it relates to 'the networked economy', increased productivity and architectures of participation, consider the shift in productivity (in this case measured in sales) between an ordinary book shop and Amazon.com. Fig. 1 presents the classic sales profile of many types of goods. For the book sales example, the power law graph in Fig. 1 demonstrates the ranking of the sale of books. To the right is the long tail, to the left are the few that dominate (the Head). The graph in fact provides the 'natural' incentive structure (institution) guiding business to aim for 'mass producible' 'blockbuster' type products in order to leverage the industrial capabilities of mass production, or to also develop a niche specialty that could attract enough customers to create a niche market for some of the long tail type products. This of course posses a dilemma for any retailer with limited shelf space: can they afford to stock too many books from the long tail area?

The dilemma can be presented as increasing costs of coordinating sellers in the long tail with interested buyers in the long tail. As the organization tries to link (coordinate) more sellers with buyers the costs of negotiating, transacting, holding inventory and coordination increase in a power-law curve (Fig. 1, red curve). The figures depicting the power law relationship are derived from those presented by [1], [14], and [15].

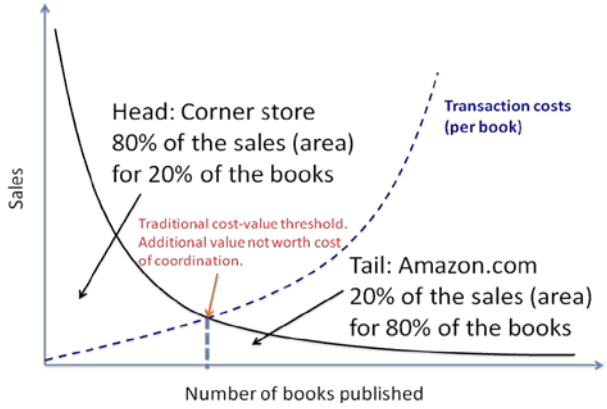

Fig. 1. The Long Tail of Book Sales

The intersection between decreasing sales and increasing costs represents an organizational threshold, beyond which the traditional organization can no longer be viable and thus represents the institution shaping traditional hierarchic organizations.

The interesting experience of Amazon.com in developing an eNetworked business model for book sales was that once the network was built, transaction/coordination costs decreased significantly and as the network grew they totally collapsed. Amazon discovered that they were able to make as much or more money in the long tail (in aggregate) than they were making in the head of the curve (as [1] says in the title of his book - The Future of Business is Selling More of Less). The ease of linking sellers of unique products (a book only one person would be interested in buying) with customers interested in those products was essentially an unanticipated costless additional capability that eNetworks enabled. Although sellers cannot generally make a living by selling from the long tail (unless they significantly increase product price) - the long tail does create or enables a larger, richer and more diverse market to arise where none had existed before.

This new ‘eNetworked market model’ provides a very low barrier to entry and a competitive/collaborative arena offering the possibility to move up toward the head of the curve and achieving mass market. It mirrors a model (Fig. 2) for specialized divisions of labour with a completely new incentive structure that is not tied by geographical or the traditional transaction cost constraints.

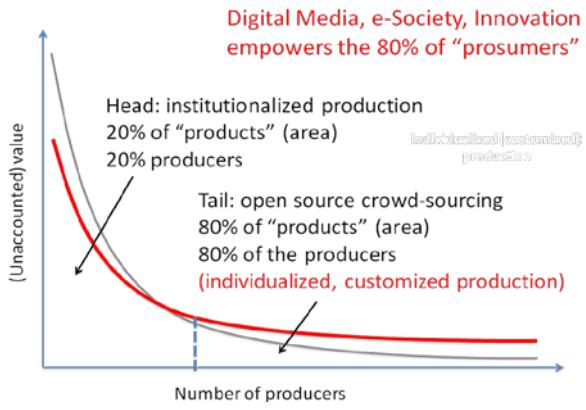

Fig. 2. The Long Tail of Coordination and Transaction Costs

To illustrate the market-labour parallel consider the two classical examples: Linux versus Microsoft Windows (MW) and Encyclopaedia Britannica (EB) versus Wikipedia. If we assume that productivity follows the same type of 20-80 rule than we can imagine people interested in developing an encyclopaedia or an operating system will follow the same rule. In Fig. 2 the left box represents the traditional organization such as EB or MW - they will hire the most productive people within the constraints of the cost-value threshold (perhaps in this case more like 1 to 5% of the most talented people available). The right box illustrates how Linux and Wikipedia are leveraging network technologies and architectures of participation to capitalize on the whole curve of potential productivity by reaping the aggregated value of the many people who only make one contribution, in addition to the traditional model (left box). We refer to this ‘aggregate value of the many’ as ‘peer production’ [4] [3]. It is in the right box (aka ‘long tail’) where organizations are able to harvest the immense productive capacity stemming from the intrinsic motivation of the many (peer production).

Microsoft had examined the efforts behind the development of Linux and scoffed that the overwhelming majority of contributors had only made one contribution. Assuming that one contribution was essential (such as fixing a serious security bug) the questions is: how much is that worth? Could Microsoft afford to hire someone to work in their organization and do nothing for three years until she/he fixed one bug? Even if this was priceless and worth three times the money they paid the person, would their business model allow this? Would they tolerate this type of worker? (This scenario was adapted from [15]). What the Linux ‘long tail’ eNetworked productivity model unleashed was the potential contribution of millions available to it, without significant additional transaction and coordination costs (Fig. 2).

In the case of Wikipedia, the capacity to fix errors and keep articles up to date far exceeds the capacity of EB to do the same. For instance, EB’s most recent edition (the 15th) was published in 1985 – Wikipedia didn’t even exist until 2001 and is now the world’s largest encyclopaedia, with over 11 million articles in 250 languages and all accomplished because of the self-organization enabled through relatively costless coordination and the transparency of the wiki medium. In fact, Wikimedia has enabled a large number of related projects including Wiktionary (wiki-dictionary), Wikibooks (making public domain and creative commons books available online), and Wikinews (the collaborative reporting and summarizing of news from a neutral point of view).

Of course one may argue that peer production can lead to anarchy in an organization if left completely without the damping effect of the ‘command-and-control’ element. Indeed – what we seek is the balance between the complete autonomy of ‘bottom-up peer production’ and the strict hierarchical coordination that hinders individual contribution through overly restrictive policies. What is essential in this regard is to determine how to relax organizational policies to leave room for responsible autonomy to grow institutional capability by involving the talents and skill sets of its individuals as best as possible [19]. The concept of responsible autonomy [8] is an important aspect in determining how much one can relax institutional policies within an organizational context where an individual or group has the autonomy to decide what to do along with the corresponding accountability for the outcome of decisions taken. Rather than leading to anarchy, autonomy as accountability acts as a positive force growing the capacity of the organization through self-organization by clustering resources around emerging and unexpected goals. In the context of the digital ecology, the inherent transparency of the digital environment provides for both the clear boundaries of accountability and the medium for agile self-organization. The very word ‘responsible’ implies connectedness and accountability to the whole organization as in a holonic organization [20] [19]; thus, one could just as easily use the term ‘connected autonomy’ or ‘accountable autonomy’ or holarchy when referring to what we term here ‘responsible autonomy’.

III. Unleashing Organizational and Human Capital

A. *Limitations of the Hierarchical Organization Productivity Model*

Consider the power law in Fig. 3 to plot skills-to-jobs’ distribution in an organization. Lets regard the left box (the ‘head) in Fig. 3 as illustrating the 20% of jobs that use 80% of human capital (aka all the talents, skills and abilities that a worker could contribute), whereas the right box (the ‘long tail’) would represent 80 % of jobs using only 20% of

available human capital (or less). We acknowledge that most people would feel very fortunate to have a job that actually was able to utilize at least 50% of their skills, knowledge, dexterity or judgment. Although designed to use 100% (or more) of our time, jobs are not designed to engage our full interests, passions, knowledge, or capabilities, etc. This is how, by fitting people as best as possible into jobs (cogs-in-the-machine [19]) the organizations waste the chance to make the best of their employees and with this they miss the chance to perform up to their full potential capacity.

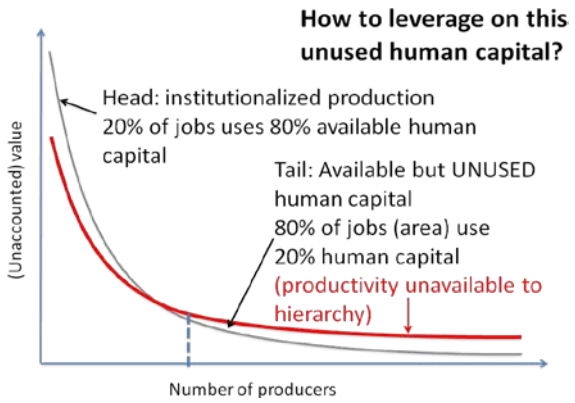

Fig. 3. The Long Tail – Collapse of Coordination Costs

This makes our point that due to coordination costs implicit in the control hierarchy approach to organizational architecture [19] the organization looses or wastes a considerable amount of human capital because trying to use it would exceed the traditional cost-value threshold. The industrial (command economy) model [19] tends to reduce the human to only those abilities required to fulfill the function of a particular 'cog' (job) that the organization/machine' requires. Consistent with this approach the terms – labour, personnel and resource, all reduce people to a sort of homogeneous quantity (within a generic occupation/career structure), thus, a quantity of labour put to work, a labour force, a resource base, etc. – all composed of standard components.

While the concept of capital also implies some sort of a 'homogeneous mass' - it carries the general understanding that it must and should be invested maximally in order to obtain the most productive return. If we understand human capabilities (skills, dexterity, judgement, knowledge, talent, etc.) and people-based organizational capabilities (culture, ethos, reputation, etc.) as capital, then it follows that we are responsible to explicitly determine the extent of our capital, how well it is used, and what investments we need to make to grow more and improve the return on the capital we have. In this way, people and their development are integrated not as a cost, but as fundamental assets which require investments to protect these assets. If we accept that each person always has much more capability (human capital) than required by their incumbent job, then we must also accept that the 'machine-organization' will not use the optimum capability of its people. With this, the major rule of economics, aka the requirement to use capital as productively as it can be used (or as Adam Smith put it: be perfectly crazy' [16]), proves impossible to achieve within the framework of the industrial organization which is inherently incapable of putting to optimum productive use a large portion (perhaps the even the greatest portion) of its human capital, as Fig. 3 clearly illustrates.

B. How the Capacity of Organizations Increases in the eNetworked Industrial Ecosystem

Human capital and the productive power of human effort are both dependent on the division of labour. The relationship between the division of labour and human capital is 'complex' in the sense that, while essentially all people are more equal than unequal, small differences in their particular skill set and abilities, which influence their interests and thus their contribution, translate into big differences in the accomplishments of an individual within the organization, through the action of comparative advantage. By allowing the inclusion of communication of ideas, concepts and intangible qualities that are the superlative goods of the network society and economy – as capital within the work exchange, the eNetworked ecosystem is contributing to the production of wealth (abundance of choice and availability of goods and services) and by this it enables the increase, refinement and enhancement of human capabilities.

One positive factor of the control hierarchy of the organizational structure and processes is that it contains the problem-space to a more manageable size and thus reduces uncertainty and increases order. However this is achieved at the cost of restricting the solution-set by limiting the use of human capital to the structural architecture of the division of labour realized by jobs. This makes any hierarchical organization a system of exchange inseparable from and synonymous with the development of the architecture of systems for the division of labour rather than for stimulating individual capability and talent. The most important value proposition of the eNetworked ecosystem stems from the collapse of communication/coordination costs (and thus the emergence of a new set of rules enabling exploitation of 'the long tail' capabilities, which result into a new kind of institution) related to the capacity to use to the maximum the human capital by linking the right person to the right situation at the right time, Fig. 3. The first emerging institution that the digital economy has produced in the 21st Century - the eNetworked ecosystem - is based on a set of rules that unleash the capacity of people.

C. On Network Technologies and Architectures of Participation: eNetworked Ecosystems as Emergent Complex Organizations

Bureaucracies sort out human beings into internally homogeneous and hierarchical ranks – creating standard competencies, frames of reference, etc. and therefore shaping the human to fulfill a role within a constrained set of capabilities. The situation is similar when one considers the relationship between the occupational structure (related to an

organization's technological framework), career structure and organizational architecture [19]. Occupational structure is as well about the development of standardized parts that are geared to the particular organization-as-machine with the purpose to give authority and opportunity to individuals within the chain-of-command to creatively express their will within the constraints of the organizational structure.

The market model characteristic of the digital economy on the other hand brings a heterogeneous collection of humans together for impersonal and potentially productive exchange in a way that fosters the emergence and self-organization associated with complexity. Three important factors are key to harnessing complexity —connectivity, diversity of agents, and rate of information flow [13], Fig. 4 [6]. Connectivity is fundamental to the formal and informal way that things get done. Organizational change requires change in the patterns of internal and external relationships together with the development of new patterns. In hand with greater internal complexity [2] is the need for more diversity of all kinds (cultural, intellectual and emotional) to increase the 'possibility space' which an organization can explore. This resonates as well with Ashby's 'Law of Requisite Variety': The larger the variety of actions available to a control system, the larger the variety of perturbations it is able to compensate. With connectivity and diversity the flow of information springs creatively and innovatively.

Although stable control hierarchies in stable environments can be sustained with a sluggish flow of information, in complex operational environments organisations require much more flexibility and spontaneity to be able to incorporate the unexpected and thrive on it, which is only possible through a vigorous and much richer information flow.

By providing a mode for new organizational forms and an incentive structure for their proliferation, eNetworked ecosystems enable for their individual members a richer variety of associations which reduces their isolation and increases their opportunities for self-actualization driven by intrinsic motivation. The richer the variety of association and self-organization (complexity) available, the richer are the types of expertise and divisions of labour that can develop, the richer the exchange that can ensue - which in turn provides a richer experience where working for others becomes a known and thoughtful ethical mode of life – creating the organization that creates the member and thus embodying the ground of and for responsible autonomy.

With this, the key knowledge challenge is to capture the uniqueness of each person in the context of a complex, evolving organization. How can one select the right people today when as an organization facing the fast pace of today's challenging economic realities one cannot know what they will need people to do in the near future. Occupations that may be vital to an organization today may not even exist in 10 years. On the other side occupations that are not even imaginable today may be vital for an organization in 10 years. Many occupations will need additional, fewer or different sets of skills and knowledge.

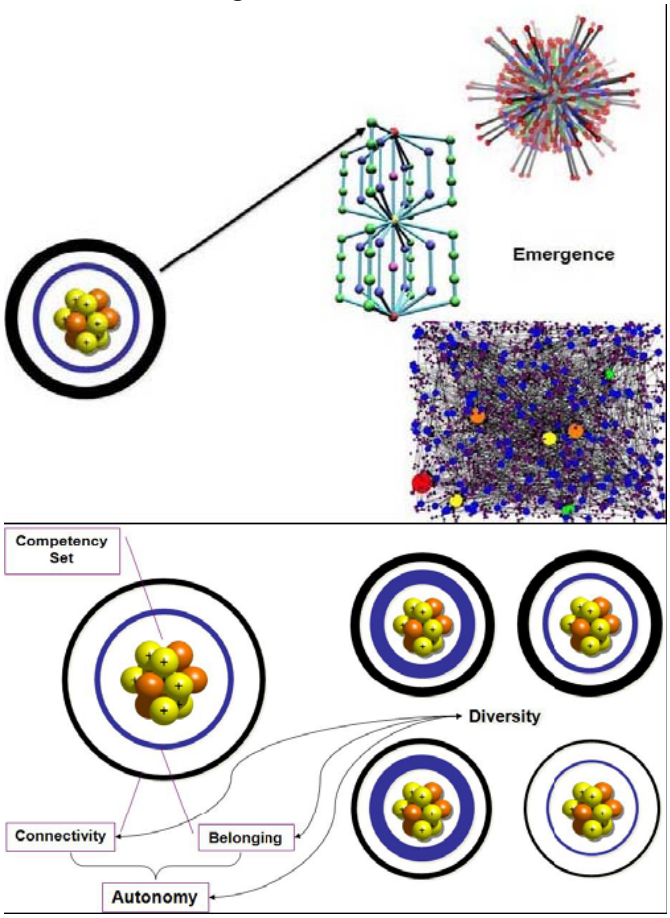

Fig. 4. Organizational parameters enabling responsible autonomy in the eNetworked ecosystem (from [6])

In order to fully leverage the power of networks and fully use the human capital we will have to enable a type of personnel platform where each individual's passions, interests, talents, expertise are made available to the whole organization and where the individual can choose to contribute their his abilities in a way that enables much longer continuity of effort than is now possible within the framework of 'filling jobs'. We name this organizational platform architecture of participation because and define it as the design of system structures to optimize user participation and contribution, by minimizing any barriers to entry [18]. Our choice of the term is aligned with the ideas articulated in Mitch Kapor's maxim, "architecture is politics" [9] which point to the need to pay attention to the architecture of systems if we want to understand their effects. Network technologies and architectures of participation enable the capacity to connect the right people to the right situation at the right time in conjunction with universal access to information. From this synergy emerges the augmentation of individual intelligence through collective capability where any individual can tap into required expertise through

networking (connecting the right person to the right situation at the right time).

The term 'architecture of participation' coins the novel phenomenology transforming human interactions in the eSociety that, in the digital economy allows for a real free market of ideas, in which anyone can put forward a proposed solution to a problem. The solution has a life of its own in the particular eNetworked community: it either becomes adopted, if at all, by acclamation and the organic spread of its usefulness, or it naturally dies by lack of interest or effect on the particular community of interest. It is the architecture of participation what fuelled Wikipedia and Linux and what organizations can build on in the digital economy to increase their productivity and competitiveness by unleashing the full potential while stimulating creativity and innovation of their workforce.

IV. Network Culture: The Paradigm Shift from Hierarchy/Individualism to Ecosystem

A. *Education as Responsible Autonomy: How Architectures of Participation are Transforming the Individual*

The traditional paradigm of education/training generally implies that it is a solitary pursuit (rather than a social one). For example, we are generally taught to "do our own work" in school which involves consulting the text book (written by an expert) or asking the teacher/instructor. These assumptions constitute how valid knowledge is transferred and thus continue to be 'the norm' in today's organizations, particularly in strong hierarchical ones. In this sort of context knowledge is handled like a 'thing' given by those who know to those who don't know. Managing knowledge as if it were a material subject to scarcity implicitly creates a "knowledge poor society" culture [22] rooted the "knowledge is power" paradigm.

From school to the virtual classroom, eLearning is fuelling one of the most radical revolutions in education, replacing the traditional teacher-driven supervised learning environment by the learning focused student-driven environment which leverages on web-based individualized content. By 2020 almost all the knowledge will be available on-line. Today' students are not only online researching instead of reading a book in a library - they are also simultaneously instant messaging, 'twittering' and 'facebooking' with peers while studying. This intrinsically fosters a change from solitary studying to a collective, hive-mindish mode of learning, where learners are continually shifting from questioning to answering, from learning to teaching. Enabled by architectures of participation students are transforming themselves into self-organized networks where collective productivity and intelligence is the central aim. This trend however has either been invisible, been ignored, or worse has been sanctioned against, because it doesn't match the testing discipline – where individuals are tested on linear, focused, and solitary understanding, in order to produce the standardized individual cogs to function in an organizational and economic 'machine'. Several issues arise, which need to be addressed if we want to unleash the power of eLearning: What is the role of the school as place for learning? Is learning to be regarded as a universal right and accessible irrespective of geography with open educational resources accessible to everyone from everywhere? Will the discovery of knowledge be self-directed, dictated strictly by individual interest, or will new forms learner focused, mentor guided frameworks emerge from hybrid environments yet to be developed? What can governments do to sponsor such efforts? How can public-private partnerships foster new learning architectures?

With the advent of the network society and the acceleration of science and technology progress, several assumptions about the relationship between organizational structure and education and training are being challenged including:

1. *Place-Centric to Person-Centric World*

In the past decade, with the cellphone emerging as a 'remote controller for life', we have shifted from a society where individuals operated from a single front door, mail address and house phone number to multiple email addresses and mobile phones. While the 'place-to-place' paradigm fostered dispersal / fragmentation of individuals within organizations, the 'person-to-person' paradigm fuelled by network technologies and architectures of participation enables the shift to a personalized world coined 'networked individualism' [23] [24] the implication of a network society on the formation of individual and social human identity, reflective of people connected as individuals (rather than as representing an organization), individually using networks for information, collaboration, orders, support, sociability, and sense of belonging. Employees in networked organizations have multiple and shifting work partners, and partial involvements within dispersed work relations that can often extend globally. For the Google generation and beyond, their lived experience will increasingly embed an expectation of being ubiquitously connected to the right situation at the right time.

2. *From Training to Learning-How-To-Learn*

In the eNetworked ecosystem the power shifts from a 'static' knowledge as 'possession' to the dynamics residing in the process of learning and the ability to create knowledge (it's no longer knowledge that is power, but the ability to create knowledge and learn is power, with emphasis on learning how to learn assigning power to those with that ability). Strengths for the future will lie in one's ability to search, sort, validate and synthesize knowledge. Inherent in the networks will be the need to share and an emphasis on deep collaboration.

3. *From Authority-Down to Collaborative Ecosystem*

Traditional education is top-down, from authorities who know to those who don't. However the pace of change and the accelerating growth of knowledge will require openness to a more bi-directional exchange of knowledge (for example

the grandchild teaches the grandparent about the internet and the grandparent teaching the grandchild about the critical review of information accessible via the internet). In the eNetworked ecosystem new knowledge and information can be brought to the learning situation from everyone involved.

B. Culture of Collaboration in the eNetworked Ecosystem

A barrier to embodying a true synergetic ecosystem is the concept of contract (as specifiable exchange) embedded in every 'job-as-cog' of the hierarchical organization. The emphasis on job (as contract) engenders a corresponding emphasis on job-security and psychologically reinforces identity development linked to securing the ongoing existence to the job. Although there are many other factors involved, the human concern with job security and the associated investment of self in occupational 'identity' contributes very significantly to the barriers of cultural change.

Commitment on the other hand, is a more general way of securing of a motivational relationship based on upholding certain values and rights and provides a more general foundation for investment of individual identity that can be more amenable to cultural change. Architectures of participation create an overlay network culture [17] (organizational culture) that, through motivation of the involved individuals bootstraps through the barriers imposed by the formal organization to enable synergetic collaborations in which each individual contributes their very best, thus boosting not only the operational agility but as well the creativity and innovation capacity of the overall eNetworked ecosystem. Architectures of participation make room for applying the revolutionary nature of Smith's ideas of the market system as a decentralized self-organizing approach to allocating resources and coordinating activities [16] to harness complexity and more fully capitalize on the full spectrum of human capabilities in the eNetworked ecosystem. Like a market, the eNetworked ecosystem evolves organically through the complex social dynamics of its members. The possibility of a non-hierarchical exchange space enables a type of informal culture and bonding that nourish the soil for the roots of organisational identity to grow stronger, while integrating diversity and the responsible autonomy essential to the overall mission success. The development of a peer-production knowledge exchange market-like space in the formal organizational structure endowed with architectures of participation enhances deepens and strengthens the current culture in the eNetworked organization.

C. The Paradigm Shift

The eNetworked ecosystem represents a platform for the ongoing evolution of responsible autonomy that mirrors what was practically born with the advent of democracy and the market system. We see this evolution in the accelerating development of the internet itself and upon which other Web 2.0 architectures of participation (Wikis, Twine, Twitter, Facebook) are currently being built. Although Wikipedia is the most famous, Wikis are flourishing in the corporate and government world these days. In Canada the federal government recently initiated GCpedia, in the US there is "Intelipedia" a national security wiki along with "Diplopedia" for the Secretary of State.

These developments have led to the emergence of a new network economy [10] in which products and services are created and value is generated by means of large and/or global social networks. The value is both created and shared all members of the network rather than by the industrial type economy where the ownership of property (physical or intellectual) arises from a single enterprise. This network economic structure [21] blurs the boundaries between an enterprise and its environment giving rise to a global interdependent economics that begins to be referred to as 'the digital economy', characterised by a shift from processing atoms to processing bits [11] - a shift from dealing with mass, material, physical transport, to dealing with the weightless, virtual, informational, instant and global access. From the hierarchical organization of the 'command economy' to the 'eNetworked industrial ecosystem' [19], the World is seamlessly shifting to embrace the power of decentralized 'peer-production' and 'emerging leadership' supported by architectures of participation that are merging the two worlds of 'atoms' and of 'bits'. The enormous capacities for innovation in the eSociety are only now starting to be revealed [7]. The Digital Economy is a natural development of the unfolding power of eNetworked ecosystems on the foundation of the emerging Web 2.0 architectures of participation, triggered by the need to harness increasing individual human capital through responsible autonomy to increase the competitiveness and effectiveness and ultimately 'organizational survival' [5] of the complexities and challenges in the new world development.

V. CONCLUSIONS

As organizations learn how to operationally integrate the demands, opportunities, challenges and capabilities of network technologies and architectures of participation - the traditional cultures, concepts and paradigms will seamlessly transform. These emerging architectures will of course not completely displace the traditional hierarchies – rather they offer a fundamentally new platform for the coordination of human capability. Just as the industrial age created new ways of managing people and designing the work process, network technologies are creating a 'digital environment' which fosters new ways to harness human effort and calls for an economic philosophy of the virtual and digitally intangible based on peer-production as a synergetic 'force multiplier'. The concepts of peer-production and responsible autonomy that we have briefly outlined will play a key role in this new mode of production rooted in architectures of participation as platforms of near costless coordination which maximize organizational capability.

The value proposition of the digital and networked economy stems from the need to maximize the return on society's tremendous investment in human capital. The 21st century economy will be one that is fundamentally based on

unleashing human capital as the most powerful argument pleading for organizational transformation. Network technologies and architectures of participation that are laying the foundation for the eNetworked industrial ecosystem [19] open the possibility for a radical transformation of production. However cultural change can be difficult due to the natural resistance to radical attempts to transform. Institutions spawn organizations which depend on the perpetuation of the originating institutional frameworks for their continued survival [5] - and will therefore expend considerable effort and resources preventing change which the organizations perceive as threatening.

The personnel management system although conceived as a machine-like system within a machine-like organization is at heart a stubbornly complex system simply because it is about harnessing people and developing their capabilities. Understanding the personnel management / human resource system as a complex system has significant implications, including how we will conceive and transform: occupational and career structures; training, development and learning (as the development of human, social and cultural capital); recruitment; and the incentives inherent to retention, compensation, recognition and reward. It is entirely plausible that by 2015 in North America, Europe and Japan, there will be more higher-skilled jobs than people to fill them. But more important is the unknown ratio of new occupations to obsolete occupations or the necessary ongoing up-skilling, de-skilling and re-skilling of surviving occupations. Today's new-hires will be filling occupational work not yet known with technology not yet discovered. To cope with this challenge human resource management must facilitate the development of an organizational architecture that enables the employees to more completely marshal the human capabilities available – connecting the right person to the right situation at the right time. The challenge of the digital economy concerns how organizations will harness the power of network technologies to in turn harness the full productive capabilities (the human capital) of their personnel thus enabling organizational/operational agility that will make them resilient to the chaotic dynamics of today's economic environment.

We are currently developing in the Adaptive Risk Management lab at UNB an agent-based modeling platform that enables the deployment of various architectures of participation based on which we can conduct social network analysis revealing the network people are actually using to get work done, to elicit contribution to ongoing work and projects and to exert influence, including the issues of boundary as the understanding of how people can come to be included or excluded. Our future work will focus on a deeper investigation of social, cultural and human capital in identifying the types of work amenable to peer-production, network individualism as well as how transparency as transformational force fuelled by the 'need-to-share' displaces the 'need-to-know' in order to make information and knowledge accessible for timely operational agility enabling organizational adaptation.

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