

Information Technology and Organizational Effectiveness: Re-evaluation of the Radical Transformations 1980-2010

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The idea of this paper is to review and summarize the complex interplay between information technology (IT) and organization in stages that impacted radically both the organizational structure and the evolution of effectiveness and economic performance. We could identify five major stages where the underlying technology, the typical organizational structure, and the criteria of performance or business success changed, increasing the complexity of evaluation models proposed. It seemed that the effectiveness impacts of IT escalated from the individual to the team level, from the organizational to the virtual ecosystem level, and from the corporate to the national or global level. Therefore, the IT productivity paradox could not be refuted until 2003.

Keywords: organizational effectiveness, information technology, transformations, productivity paradox

1 Introduction: the question of IT and economic performance in general

For a long time, the on-going debate was about whether the IT investments were paying off in higher productivity or profitability at the company or country level. The first extensive studies in the 1980s typically found no connection between IT investment and productivity, whether it was a question of companies, industries, or the economy as a whole (Dedrick et al. 2003). The so-called productivity paradox stimulated many researchers to conduct more rigorous scientific analyses in the 1990. Several studies using larger datasets and more refined research methods revealed positive and significant impacts by IT investments at the company and country level.

Dedrick et al. (2003) refuted the productivity paradox by re-examining carefully more than 50 earlier economic studies that appeared between 1985 and 2002. In their framework for the literature study, they described the IT production system as a process converting input (typically IT and non-IT capital) to output (value-added). The production process included improvements caused by the usage of IT (e.g. quality of labor and output). Interestingly, they observed that there could be external outcomes (e.g. labor productivity, profitability, and consumer welfare). Importantly, their framework included moderators of productivity, complementary factors that had indirect effects on the outputs and outcomes. These were organization

and management principles, investment in human capital, industry organization and regulation, and government policy.

The aim of this paper is to present a new explanation for the durability of the productivity paradox, originally formulated 1987 by Robert Solow. Our approach is not quantitative, but qualitative, based on a longitudinal analysis of the radical structural changes (transformations) of major economic organizations due to implementation of successive generations of IT applications. These transformations destroyed stability of the object of economic analyses, the organization itself, and reformulated the criteria and models of organizational effectiveness.

2 Objectives and methodology

The major objective of this paper is to find evidence for our hypothesis that the radical architectural and organizational changes caused by IT had complex, interacting and delayed impacts on returns to IT investments, making firm and industry centered productivity analyses difficult and vague. Therefore, we concentrate on revealing structural (architectural) changes that happened in the mainstream business applications, organizational structure of single firms, topology and governance of firms building new economic structures induced by IT. To be proposed as a radical transformation we required that in the literature of that time period we could find

serious proposals for renewing the major paradigm of organizational effectiveness.

The methodology we apply is the micro-history approach, proposed by Cinzberg (1976) and carefully refined by Peltonen (1999). In fact, the micro-history approach is not any formal research methodology, rather a systematic qualitative approach for revealing an important phenomena by re-examining microscopic observations of single occurrences, starting points of earlier research, strategic choices made, and conclusions made. To our mind, for an experienced researcher who has been empirically studying the same set of leading corporations in different time periods and has been working on the intersection of the organization and major IT applications, the micro-history approach can offer significant ex-post understanding of even phenomena that could not be revealed by short range empirical evaluations. Taking the long time period in question the methodology required re-examination of a large number of documents presenting their time, from cornerstone research papers to articles in professional journals, not to forget materials of major talks in CIO and senior management conferences and seminars.

The methodology applied does not secure any validity or generalization of the conclusions proposed. Our country level observations, however, come from a country that was ranked in the Top 10 category in most international evaluations of the readiness of the national IT infrastructure between 2000 and 2010. Therefore, we hope that our results will increase understanding of the complexity of the economic and other impacts of IT on individuals, organizations, and national economies in the continuing progress of globalization.

3 Radical Transformations in 1980-2010

In the IT management literature one can easily find numerous stage models describing the typical role of IT in major organizations. Well known and debated examples are the stage models of Nolan (Nolan 1979), Somogyi and Galliers (1987), Galliers et al. (2005), and the layered model of Tapscott (1996). Mostly, these are interesting scenarios of the evolution of the role of IT in major organizations. As such they are not sufficient for our analyses. Our focus will be on the interplay between IT architecture and organizational structure in modifying the whole concept of organizational effectiveness, caused by the fast change of the business organization itself due to radically improved communication and information processing.

By a "radical transformation" we mean a significant structural change of the business organization caused by a new dominant mainstream IT technology implemented at a certain time period. To be "radical" in our ex-post analysis, new technical and/or organizational skills must have been required by the leading business organizations.

Based on the conditions described, in our ex-post analysis we could identify as many as six major transformations during the time period from 1980 to 2010. In these transformations, the underlying technology, the organizational structure, and the paradigm of organizational effectiveness seemed to change radically.

- 1) Personal computing (PC) revolution led into growth of knowledge work and knowledge organizations (1980-90). Centralized routine data systems started to be supported and utilized by growing number of distributed personal computers and knowledge work.
- 2) E-mail and corporate networks destroyed the old hierarchies and led into fast growth of multinational corporations (1985-90). International telecommunication changed the major way of information creation and usage in business organizations.
- 3) Structural change of the IT industry, from vertical to horizontal, enabled the birth of global software market and Venture Capitalism (1990-1995). That fueled the birth of the global capital economy.
- 4) Corporate IT infrastructure transformed application investments from radical to incremental, reduced the cost of global coordination and enabled diffusion of virtual work and organizations, outsourcing and off-shoring (1995-2000). Growth and shareholder value dominated strategies and productivity.
- 5) The web-based Internet virtualized the frictionless digital global economy, changing the closed innovation strategy to the open (source) innovation, based on networked ecosystems on underlying technology platforms. The outcome was the business model induced super-capitalism, based on production of novelty, efficiency, complementarities, and lock-in of customers (1995-2005).

The on-going direction seems to be towards mobile Cloud Computing, that will intensify the digital economy and increase the power of platform-based global ecosystems. The CC-technologies integrate global services that are usable by mobile phones, laptops, and digital screens. Value generation, hybrid business models, and ecosystem growth will very probably dominate and concentrate industries. Small national economies continue suffering.

The above transformations had their specific impact on effectiveness norms and evaluation models. In the following, we characterize the drivers of effectiveness and the types of models proposed at each major stage.

4 Concept of organizational effectiveness

4.1 Starting point: Competing values model

In the time of large monopolistic corporations many diverging approaches were proposed for the organizational effectiveness. By Quinn and Rohrbaugh (1983) an overview of these were systematically arranged into the competing values model, that represented an empirically founded logical synthesis of the work done by a large number of organizational scientists. The model consisted of four sub-models defined by the organizational focus (internal-external) and structure (flexibility-control). The four models were the human relations, the open system, the internal process, and the rational goal model.

At the time of the PC revolution in 1980s, the major effectiveness measures were typically multidimensional standard methods, e.g. the user information satisfaction (UIS), based

mainly on the human relations model. Interestingly, in his famous books Strassman (1985) argued that profitability of any single PC user could not be evaluated at the individual user's level but only at the team level. He concluded in his later book (1990) that there was no relation between spending for computers and profits, or between spending and productivity at the corporate level.

4.2 Infrastructure based layered effectiveness

In the 1990s large companies started building electronic means of communication with their suppliers, partners and customers. Evolution of the Internet enabled development of the corporate IT infrastructure from a collection of various IT technologies operating independently in large companies into a centrally managed firm level platform that consists of standard corporate applications. These were very different from strategic applications, based on the IT infrastructure, and aiming at a better competitive position of the business unit in question.

Weill and Broadbent (1998) presented the hierarchy model of impacts of IT investments, a four layer model that could be seen as three stage conversion. The common IT infrastructure business value was transformed into the business value of the unit's IT applications, then into operational business value and, finally, into financial business value. In this three stage conversion, each stage could suffer from dilutions destroying the potential benefits. Based on the differences between the types of potential benefits and life cycles of investments made, Weill and Broadbent proposed a portfolio model for managing corporate IT investments.

As a core of common IT-services, and as an engine or platform for an easy incremental development of new business applications, corporate IT infrastructure led to improved coordination of corporate operations through new technologies and also enabled global reach. This was increasingly supported by outsourcing and off-shoring of application development, business processes and manufacturing. However, because of the typically long delays in accumulation of infrastructure benefits, more sophisticated effectiveness models were required. The synergetic relationship between an effective IT infrastructure and separate business systems of a large corporation had to be taken into account. A significant theoretic model offered for this purpose was the strategic alignment model of Henderson and Venkatraman (1993), an important abstraction for understanding the interplay of business and IT at both strategic and operative (implemented) levels.

4.3 Strategic alignment as moderator of organizational effectiveness

Henderson and Venkatraman (1993) proposed a strategic alignment framework in order to model the problematic interplay of on-business and IT domains in large companies. Their key argument was the inability of companies to earn any value for their IT investments due to lack of alignment between business and IT. The alignment model required that business and IT domains were integrated (i.e. they had the capability

to cope with each other) and that both these domains had the capability to implement their strategies correctly (fit). Only under these conditions, fit and integration, could business and IT domains be aligned with each other.

In several empirical studies this author (Sääksjärvi 2000-2006) developed instruments for studying the role of strategic alignment on IT effectiveness in large corporations based on both senior managers' and CIO's perceptions of the alignment and effectiveness measures. It turned out that the alignment, especially the skill based functional integration (capability of IT and business executives to understand each other's fields) was an excellent predictor of organizational effectiveness, competing with the IT governance structure (distribution of decision power) and strategic flexibility of business systems. IT infrastructure turned out to be a significant moderator of effectiveness, indicating that structural (architectural) gains were really important for the evolving IT effectiveness in large corporations.

4.4 Virtual Organizations: layered bottom-up effectiveness

According to Mowshowitz (1999) a virtual organization is a goal-oriented enterprise performing virtually organized tasks. These are goal-oriented activities that are implemented by an appropriate assignment or reassignment. The switching principle lies at the heart of the conception of virtual organization. Tapscott (1996) described the virtual organization of the inter-networked business as a layered knowledge structure, where new corporations were growing bottom-up, from effective individuals (learning efficiency) to high-performance teams (job redesign), and these into integrated enterprises (organizational transformation and effectiveness). The final outcome was the inter-networked business (wealth creation). The Quinn and Rohrbaugh's (1983) empirically founded competing values model of organizational effectiveness can be useful also for analyzing effectiveness of virtual organizations. According to Sääksjärvi (1997) the levels of analysis could be the IT infrastructure, the individual work, the virtual team, and the virtual company. Each of these seemed to present a specific set of stability and control, cohesion and morale, productivity and efficiency, and growth and flexibility.

A flexible corporate IT infrastructure allowed radically new ways for corporations or small enterprises to cooperate with their suppliers, customers and partners. Instead of the typical top down strategy of old hierarchies, new virtual organizations started to grow from the bottom, getting in a reasonable time even a global reach. Outsourcing and off-shoring of activities, even core business processes, started to be a standard recipe for economic success.

This author (Sääksjärvi 2006) observed empirically that successful IT outsourcing in large companies was an important single predictor of the organizational effectiveness, mainly only at the operational level. Skill based capabilities of the senior executives and integration of line and IT management seemed to be the dominant predictors of the strategic effectiveness.

4.5 Platform based super-effectiveness for product and service innovations

Perhaps no other single factor had such a dramatic impact on industrial effectiveness as the idea of technology and software platforms, combined with the new open innovation strategy. Technology and software platforms changed the radical product innovation into incremental and micro-innovations, based on global platforms. A flexible product platform offers a common framework on which families of products and services can be easily created over time. A platform may be indicated in the design of a core product or service process. The architecture (structure) of a platform is the most important element. In fact, if it is well structured, the opportunities are multiplied, as a good software platform permits reconfiguration and easy substitution of, or increase in, important product complements. (Myers and Rosenblom 1996, Sääksjärvi 2002).

In fact, application of the product platform concept to generate digital (non-material) products and services opened the way for the super-effectiveness of the digital economy as a whole. Software platforms are important “generative infrastructures” of the virtual ecosystems where players who have synergetic specialist skills jointly create and distribute services, applying hybrid business models and open innovation strategy where also customers may have the role of significant innovators. As non-material products involve only negligible marginal costs, the platform strategy may generate superstitious effects strengthening the Positive Feedback effect, a phenomenon whereby the first competitor achieving the largest customer base will be the only winner. In the digital market, strong players will get from strength to strength (Shapiro and Varian 1999).

4.6 Ecosystem effectiveness in networked e-business

Amit and Zott’s value creation model (2001) was based on the virtual markets “in which business transactions were conducted via open networks based on the fixed and wireless Internet infrastructure”. Their findings suggested that no entrepreneurship or strategic management theory could fully explain the value creation potential of e-business, and therefore, integration of several theoretical perspectives on value creation was needed.

The underlying theoretical models were the value chain framework, Schumpeterian innovation, the resource-based view of the firm, strategic network theory and the transaction cost economics. The model enabled an evaluation of the value creation potential of different business models through four value drivers: efficiency, complementarities, lock-in and novelty. These were empirically founded critical value drivers of the existing market places.

Amit and Zott emphasized the distinction between a business model and a revenue model: The business model primarily referred to value creation whereas the revenue model was centered on value appropriation. By the term “value” they referred to the total value created for all parties involved in the network that a certain firm’s business model encompasses.

Value creation opportunities in virtual markets may result from new combinations of information, innovative configurations of transactions, the reconfigurations and integration of resources, capabilities, roles and relationships among suppliers, partners and customers.

5 Conclusions

The row of radical organizational transformations presented indicates that the outperforming progress of the capacity of the IT technology as such was not the primary factor explaining better organizational effectiveness and value generation of large corporations. Rather, it was the interplay between the organization and the new technology that impacted the way in which the organizations improved their global progress. The transformations seemed to lead to radically new skill requirements, new organizational structures, new innovation strategies, and new paradigm of effectiveness and economic performance. There seemed to be no maturity, rather periodical and non-predictable birth of new forms of organizational arrangements for information sharing and economic exchange.

On the basis of our observations, the impacts caused by the new technology in organizations escalated fast from the individual (PC users) level to the (virtual) team level, then to the organizational, and finally to the global networked ecosystem level. This phenomenon can be explained by the continuous change of the organization itself, apparently resulting from the interplay between technology and organization. It may be, that due to the escalation effect observed, and partly because of the strong moderating effect of the infrastructure as well as the platform investments on the economic success of corporations, the IT productivity paradox of the 1980s could not be refuted until 2003. By our ex-post observations on the evolution of the concept of organizational effectiveness itself, we characterized the radical transformations of the major measures of organizational performance, from the individual productivity to the complex value generation models in the platform induced digital ecosystems.

The improved IT enabled coordination of large corporations seemed to be the major driver of the fast, even too fast, expansion of national companies into global businesses, offshoring and virtualization. In this process, the over-emphasis on the capital value instead of corporate success seemed to lead into super-capitalism and started to ruin the earlier idea of the national information society and economy. Nevertheless, according to the recent evaluations, the Scandinavian and other European countries seem to have excellent readiness for the global networked digital economy. This is important, at the time of the booming Cloud Computing, very probably the next ecosystem paradigm for new mobile services. To be a winner is no easy mission. Coping in the open creative ecosystems requires new socio-economic skills for value generation - once again.

References

- Amit, R. & Zott, C., (2001). Value Creation in E-business. *Strategic Management Journal*, 22: 493-520.

- Galliers, R.D., Leidner, D.E. & Baker, B.S.H. (1999). *Strategic Information Management Challenges and Strategies in Managing Information Systems*, Butterworth-Heinemann.
- Dedrick, J., Gurbaxani, V., & Kraemer, K. (2003). Information Technology and Economic Performance: A Critical Review of Empirical Evidence, *ACM Computing Surveys*, 35(1): 1-28.
- Mowshowitz, A. (1999). The Switching Principle in Virtual Organization, in (Sieber and Griese, (eds.). *Organizational Virtualness and Electronic Commerce*, Simowa Verlag, Bern, pp. 9-20.
- Myers, M. & Rosenblom, R. (1996). Rethinking the role of Industrial Research. In: Rosenblom & Spencer, (eds.). *Engines of Innovation*, Harvard Business School Press, pp. 209-228.
- Nolan, R.L. (1979). Managing the Crises in Data Processing, *Harvard Business Review*, 57(2): 115-126.
- Quinn, R.E. & Rohrbaugh, J. (1983). A Spatial Model of Effectiveness Criteria: Towards a Competing Values Approach to Organizational Analysis, *Management Science*, 29(3): 363-377, DOI: 10.1287/mnsc.29.3.363.
- Reich, R., (2007). *Supercapitalism, The Transformation of Business, Democracy, and Everyday Life*, Alfred A. Knopf.
- Somogyi, E.K. & Galliers, R.D. (1987). Applied Information Technology: From Data Processing to Strategic Information Systems, *Journal of Information Technology*, 2(1):30-41, DOI: 10.1057/jit.1987.7.
- Strassman, P. (1985). *Information Payoff. The Transformation of Work in the Electronic Age*, The Free Press.
- Strassman, P. (1990). *The Business Value of Computers. An Executive's Guide*, The Information Economics Press, 1990.
- Shapiro, C. & Varian, H. (1999). *Information Rules, A Strategic Guide to the Network Economy*, Harvard Business School Press.
- Sääksjärvi, M. (2006). Success of IT outsourcing as a Predictor of IS effectiveness: Does IT Governance matter?. In: *Information Systems Outsourcing, Enduring Themes, New Perspectives and Global Challenges*, R. Hirschheim, A. Heinzl and J. Dibbern (eds.), Springer Verlag, 283-300.
- Sääksjärvi, M., Lassila, A. & Nordström, H. (2005). Evaluating the Software As a Service Business Model: From CPU Time-Sharing to Online Innovation Sharing, Proceedings of the IADIS International Conference on e-Society 2005, Malta, Isaias, Kommers, & McPherson (eds.), pp. 177-186.
- Sääksjärvi M. (2002). Software Application Platforms: From product architecture to integrated application strategy, *Proceedings COMPSAC 2002: The Twenty-Sixth Annual International Computer Software & Applications Conference*, Oxford 2002, IEEE Computer Society, pp. 435-443.
- Sääksjärvi M. (2002). Success of Outsourcing and Strategic Alignment as Predictors of IS Effectiveness. In: *Information Systems Outsourcing in the New Economy*, R. Hirschheim, A. Heinzl & J. Dibbern (eds.), Springer Verlag, pp. 311-326.
- Sääksjärvi, M. (2000): The Roles of Corporate IT Infrastructure and Their Impact on IS Effectiveness. In: *Proceedings of the 8th European Conference on Information Systems ECIS'2000*, Hansen, Bichler & Mahler (eds.), Wien, pp. 421-428.
- Sääksjärvi, M. (1998). Product Platform and IT Infrastructure in Strategic Management of IT. In: S. Urban & C. Nanopoulos (eds.), *Information and Management, Utilization of Technology - Structural and Cultural Impact*, Gabler, pp. 63-79.
- Sääksjärvi, M. (1997). Virtuality and Organizational Effectiveness: A layer framework for evaluation. In: *Proceedings of the 3e Colloque de l'A.I.M.*, Strasbourg 1997, R.Reix (ed).
- Tapscott, D. (1996). *Digital Economy. Promise and Peril in the Age of Networked Intelligence*, McGraw Hill.
- Webster, F. (1995). *Theories of the Information Society*, Routledge.
- Weill, P. & Broadbent, M. (1998). *Leveraging the New Infrastructure*, Harvard Business School Press.

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Informacijska tehnologija in organizacijska učinkovitost: ocena radikalnih sprememb 1980-2010

Cilj članka je, da predstavi in povzame zapleteno interakcijo med informacijsko tehnologijo in organizacijo, s poudarkom na stopnjah, ki so močno vplivale tako na organizacijsko strukturo kot na razvoj učinkovitosti in ekonomičnosti. Avtor opredeli 5 pomembnih stopenj, ko so se spremenili tehnologija, tipična organizacijska struktura in kriteriji za učinkovitost organizacije. Kaže, da je se je učinkovitost zaradi vpliva informacijske tehnologije stopnjevala od individualne do teamske ravni, od organizacijske do ravni virtualnega ekosistema in od korporativne ravni do nacionalne in globalne. Tako znani paradoks produktivnosti ni mogel biti ovržen do leta 2003.

Ključne besede: organizacijska učinkovitost, informacijska tehnologija, transformacija, paradoks produktivnosti