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# TOWARDS THE ECO ERA: IT DRIVEN BUSINESS TRANSFORMATION

## 1. INTRODUCTION

Information Technology (IT) has come a long way. The first electronic computer in the 1960's had the size of an entire executive office but less computing power than the average modern calculator. And handheld Smart Phones have more computing power than most family PCs. More fundamental than the technology itself, however, is the role IT plays in business: from a purely support tool, IT has changed into a strategic weapon. In Western society IT has become of crucial importance to economic growth, but also to the way we keep in touch with our colleagues, friends and family. Nevertheless, the role IT plays still changes. And there is a complex connection between the development of this technology and the way in which businesses and society integrate IT into their Strategy as well as everyday reality.

This paper describes a model of how businesses and IT align and interrelate. The author explains how, over time, IT has supported business functions, processes and strategies, and finally suggests that we are entering a new era in which IT plays a major role in supporting all aspects of our life: the Eco Era.<sup>1</sup>

## 2. THE EVOLUTION OF INFORMATION TECHNOLOGY

Over the past years, we have moved from the industrial age to the information age. This process has for a great deal been driven by rapid continuous innovation in the IT-producing industry, which has been able to sustain a development unequalled in the history of technology. There are three major IT evolution drivers.<sup>2</sup>

- > Processor and memory power increases in accordance with Moore's Law (1965), which states that the number of transistor circuits on a computer chip doubles every 18 months.
- > Memory costs decrease: the price of storing one megabit fell to one ten thousandth from the mid-1970s to the mid-2000s.
- > Communications capabilities expand; the total available bandwidth has continued to triple annually in the United States and Europe.

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1 The term Eco Era was first mentioned in Han T.M van der Zee (2000), Business transformation and IT: Bundling and unbundling business and Information Technology.

2 OECD (2001a), Science, Technology and Industry Outlook, Drivers of Growth: Information Technology, Innovation and Entrepreneurship, OECD.

What business effects do these technological developments impel? Increasing competition, continuing degasification, higher performance levels, globalization, and liberalization are just a few examples of the immense changes many organizations face today. They are forced to reorganize and reprofile themselves continuously and organically, meanwhile changing functional hierarchies into flexible, high-performance network organizations. IT has proved to be an important factor in the change process. Organizations use IT not only to strengthen operational efficiency and effectiveness, but also to respond quickly and constantly to customer needs and competitive pressures with IT-enabled products, services, and distribution channels as well as IT-enabled links with customers, suppliers and other stakeholders.

In the late 1970's, Richard Nolan, professor emeritus of Harvard Business School, proposed a model to describe how organizations deal with the increasingly vital production factor that information IT proved to be.<sup>3</sup>In the 1990's, he completed his Stages Theory.<sup>4</sup>

### 3. THE NOLAN STAGES THEORY

In this section the Nolan Stages Theory will be briefly outlined (Figure 1). It describes the process through which organizations move from the industrial age, via an intermediate distributed IT phase, to the present network age. Nolan's first change takes off from a context in which organizations have been structured according to a hierarchic pyramid model. Top-down management and functional divisions characterize this; both between organizations and between their separate departments for purchasing, production, logistics, etc.<sup>5</sup> The curve starting there describes the purely administrative automation in traditional, hierarchical, functional organizations. Essentially, IT involved the replacement of human activity with computer transactions, thus rendering the relevant business functions more efficient. In fact, cost reduction was the main topic of interest, and automation made it possible.

Technological developments didn't stop there, though. Soon, information technology was not used only to improve all kinds of business functions but to interconnect them as well, which led to the rise of process-oriented organizations. Business processes were redesigned, from product design and manufacturing to the provision of services, and then quickly outgrew the usual strict divisions between functional business units. Eventually they even crept across the borders of integrated businesses. Thus information technology enabled business chains to integrate.

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3 Nolan, R. L., 'Managing the crisis in data processing' in Harvard Business Review 57-3/4, 1979.

4 Nolan, R. L. & D. C. Crosson, Creative destruction; A Six-stage Process for Transforming the Organization, Harvard Business School Press, 1995.

5 Van der Zee, Han (1999), The fabric of the 21st century: Exploring the virtual network organization, Nolan, Norton & Co. Annual 1999.

The second Nolan curve, then, represents the Information Technology Era, characterized by the use of distributed information technology. In this stage, which is now gradually coming to its end, traditional 'pyramids' were reorganized into process-driven organizations, a transformation for which business process redesign (BPR) techniques were preferably used. Thus the blurring of organizational boundaries, already begun by applications outgrowing their former strict divisions, became even more evident. As a consequence, the IT Era was a transitional phase only, heralding the next.

This next stage is called the Network Era. This is the phase into which most companies are now emerging. Its defining aspect is the mutual interaction between processes and technologies.<sup>6</sup> Communication and the distribution of knowledge and information feature at centre stage. The Internet, extranets and intranets are interwoven with all aspects of doing business and with practically everything in and around it: with customers, suppliers, partners and complementors; with supra-organizational business processes and joint business activities; and with the structure of the business network. Yet above all, information technology is interwoven with business strategy.

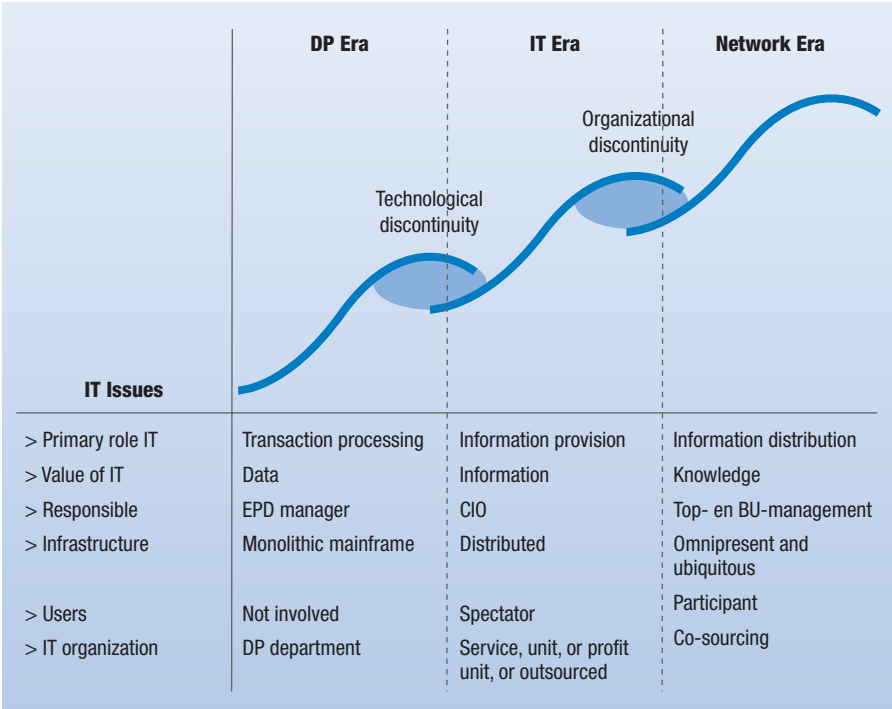


Figure 1: Discontinuities throughout the Nolan Stages of IT growth

6 Van der Zee, Han T.M and Mutsaers, E.J. (1997) 'The Evolution of Information Technology, Nolan Norton & Co.

## **Jumping the curves**

The curves in Figure 1, representing the three eras, do not completely connect. These developments apparently aren't as smooth as we might like. Indeed, all businesses going through these stages face discontinuities. Naturally, 'era' and 'discontinuity' are relative concepts. Each era involves its uncertainties and difficulties too. Yet the characteristic of developments within a certain era is the relatively large degree of consent on the direction in which the solution should be found. The organization's ability to learn has done its job. Between the stages, however, things are different. Such periods may be recognized by organizations concentrating on how to use IT differently so as to squeeze significantly more out of it. Figure 1 therefore pictures these discontinuities as moments of deliberation.

The first of these discontinuities was largely technological in nature. In other words, the most urgent issues arose in the area of technology. By contrast, organizational issues characterize the second discontinuity. The technology required is available and so the most pressing issues present themselves in the domain of business and organization. Doing business in the Network Age requires completely different working methods and new ways of dealing with customers and suppliers. Therefore, new organizational models are developed.

## **4. CURRENT TECHNOLOGICAL DEVELOPMENTS**

Today, most companies are working their way into the Network Era. New developments render IT being part and parcel of both product and user experience. IT continues to influence business strategies and our society as a whole. Computers are integrated in all kinds of products in such a way nobody regards them as computers anymore – they have become so numerous as to fade into life's background. The total amount of PCs, smart phones, PDA's and other devices with computing power increases very fast. Today, even cars have become computers.

### **Smart cars**

Since 2000, the average automobile contains between 20 and 80 microprocessors. The Mercedes S-class, for example, contains 63 microprocessors, the BMW 7-series 65. There is a microprocessor in each headlight and another in the rear-view mirror. Airbags generally each have their own microprocessor too. Volvo S70 limousines contain not one but two CAN busses, connecting the microprocessors in the mirrors with those in the doors and the transmission. This enables the car to tilt its side mirrors down and inwards when the driver shifts to reverse. Likewise, in modern cars the brakes (the anti-blocking system of which has the most accurate speed information at any time) communicate with the radio, which adjusts its volume according to the speed. Connect the airbags with the GPS receiver and a built-in

cell phone, and after a serious accident the car will autonomously call for help, reporting its exact location. If the car is stolen, it can call the police and report exactly where it is and where it is going. Today, a contemporary, class A car contains more software (measured in lines-of-code) than Windows/XP.

Nevertheless, there is a clear trend to embed IT functionalities in products, in order to make things easier for humans. This enables products to interface both with human beings and with other devices, resulting in smart homes, offices and cars.

### **Clothes tags**

Another example of ubiquitous computing is the pilot project with radio frequency identification (RFID) tags Benetton ran recently.<sup>7</sup> All items and the boxes in which they were shipped were tagged, allowing Benetton to track clothes from production to sales. Thus, IT was used to bundle products with processes and business. Chips remained active after sales, so they could be used to track returns as well. By eliminating the need to scan barcodes every time products were moved to different points in the supply chain, Benetton increased order accuracy and reduced labour costs. Stores receiving boxes of mixed goods could quickly scan all items into their inventory, without manual counting and verification. Despite the project's economic and technological success, however, Benetton decided not to continue the experiment, because its customers were concerned about their privacy.

As the Benetton example shows, bundling information technology and products is possible from a technological point of view, and it can be economically profitable. But the social complexity it involves – matters of confidence, trust, security and reliability, as well as the perceived safety of using such devices – is harder to manage. In the example of the smart cars, the information technology used to make driving safer can also be used to follow the drivers' movements. Smart is the right word, therefore, not just for ubiquitous computing but even more for the way in which we must deal with it.

Increasingly, information technology devices are capable of wireless communication. The communications portability that is thus made possible is one of the conditions of ubiquitous computing. But the main consequence of the rise of wireless networks is the unbundling of products and individuals from physical infrastructures, which changes traditional infrastructures into wireless local area networks (WLAN).

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<sup>7</sup> Radio frequency identification, or RFID, is a generic term for technologies that use radio waves to automatically identify individual items.

Wireless communication technology raises many questions. As with ubiquitous computing, security and privacy are the consumer's first worries. Technologically, interference and interoperability are the main issues.

### **Benefits of Wireless Local Area Networks (WLAN)**

Quantifying the benefits of wireless networking is a quite challenge.<sup>8</sup> The following list of advantages, which influenced Intel's senior business executives and their decisions, may serve as an indication:

- > wireless workers maintain more frequent contact with customers and colleagues;
- > increased wireless connectivity makes faster decision-making possible;
- > employees with WLAN enjoy greater flexibility to work almost anywhere, anytime;
- > a widening deployment of public WLANs provides employees with opportunities for additional flexibility and productivity;
- > WLAN leverages the value you already receive from your investment in high-performance mobile PCs;
- > new wireless standards incorporate security measures that are stronger than initial out-of-the-box solutions.

## **5. BUNDLING IT WITH BUSINESS STRATEGY: TOWARDS THE ECO ERA**

Today, IT supports not only internal business processes but the communication and transactions with suppliers, customers, and intermediaries and other parties and individuals included in the network as well. The technological innovations described above make it even possible to bundle products and services with IT.

This represents a fundamental change. In the near future, everyone and everything will have their own computer, and be capable of communicating anything with anyone, any time, any place. In fact, everything and everyone will become a computer – without the negative robot connotations one might have, of course. Rather than those hopelessly outdated, text-oriented keyboards, user interfaces will be used that are capable of transmitting to all senses – speech, hearing, seeing, taste, smell and touch. Embedded software will bring not only machines but also people up-to-date. Hospital visits won't be necessary to obtain the latest software releases for hearing devices or pacemakers, a quick download via the nearest peer-to-peer network will suffice. Face to face conversation? Unnecessary. Texts, images, sound and feeling will be electronically transferable.

Utopia or reality? Technological advancement, at any rate, will not be the limiting factor. The IT and biotechnology industries are way ahead. The realization of

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<sup>8</sup> Intel Corporation, Cahner's In-Stat Group, Gartner

examples such as these will depend on the limits set by people and society, not by technology.

From a business perspective, products, services and experiences will continue to be combined in ever further detail. 'One-to-one marketing' is becoming a reality, just like 'markets of one', in both sales and employment contexts. Clear organizational boundaries will disappear, even further than they already have for companies emerging into the Network Era. In companies' production, sales, distribution and after-sales service processes flexibility and scalability will become core competencies. The e-business hype is dead; long live the s-business (smart business) hype: the seamless integration of products and IT.

Summing up, we believe a fourth stage has followed the three described by Nolan, a stage we propose to call the Eco Era, since it signifies a more organic and fluid composition of society, economy and business, and the involvement of everyone and everything involved (Figure 2).

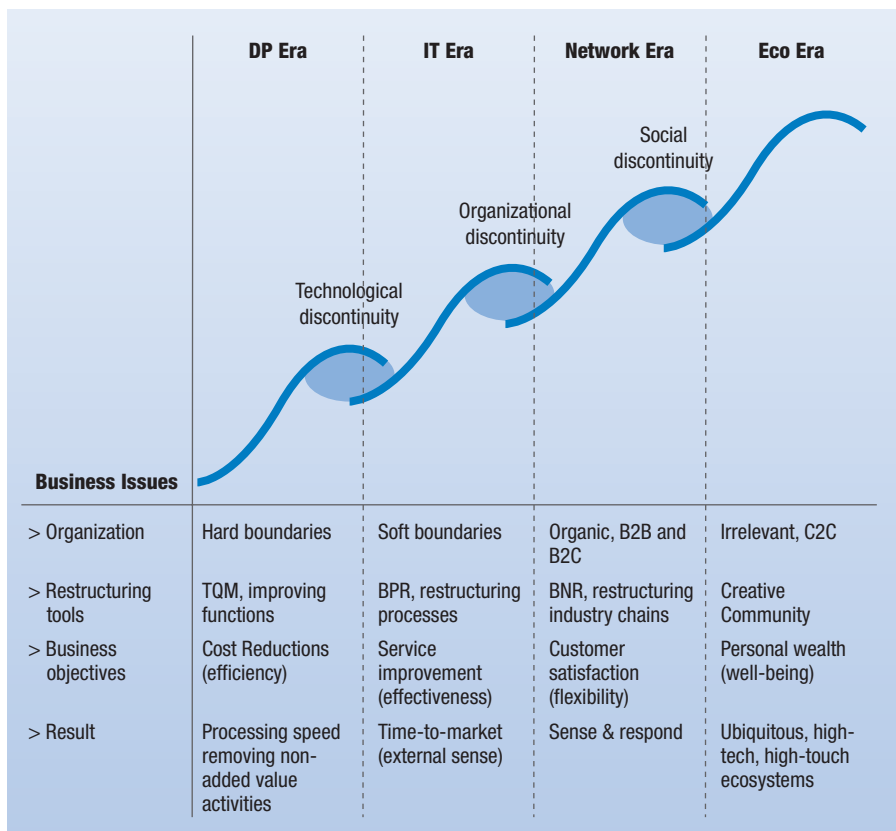


Figure 2: Adding a fourth stage of growth to Nolan's 3 Stages of IT growth

## 6. A NEW ERA, A NEW DISCONTINUITY

Many organizations are still struggling with their emergence into the Network Era. Is it realistic already to begin discussing a new order that will follow it? Considering the impact of the new technological developments we described on business and society, we believe it is. Exactly what this Eco Era will look like we cannot yet say. This will become clearer in the next several years, though. And we are certain it will involve organic temporary groups made possible by a further bundling of IT and products and an ongoing unbundling of infrastructures and organizational structures.

Like the earlier stages, the Eco Era will be preceded by a discontinuity. But it will be neither purely technological nor organizational in nature; primarily, it will be a social change. The more individuals and companies participate in IT innovations, the greater will these innovations' value be for everyone. However, these technological innovations will not be equally available to everybody. The difference between having access or not having access to IT is already gradually creating a 'digital divide' between those benefiting from its opportunities and those who do not.<sup>9</sup> In the Eco Era this divergence will only grow. Therefore, the 'digital divide' is an issue of importance for more than just individuals and companies. Governments, too, will become involved, since their promotion of IT will influence the degree to which IT is accepted and used, as do sector-specific factors and company size. This holds for the employees' organization, but also for the people living in the Eco Era.<sup>10</sup> IT awareness, 'management' competence and the sense of responsibility in households and various communities, enterprises and governments will therefore determine how successful we will be in overcoming this social discontinuity. And thus, the remaining questions are: Who will govern IT from now on? Will this be government, politicians, or even mightier powers? Let's at least pray that IT will be dealt with appropriately in a very complex, changing, but social and human, and in any way an exiting world.

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9 OECD (2002), Technology Outlook: ICT's and the information economy.

10 Porter, M.E., and Stern, S. (2001) 'Innovation: Location Matters', MIT Sloan Management Review, p28-36.

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