



# INFORMATION TECHNOLOGY AND SOCIETY

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## Introduction

Talking about information technology I will join a huge community of people who have already spoken and written about this vast subject. The term information technology or "IT" is popular and when I looked for it in today's New York Times, I encountered the term in the sections Business, Technology, Arts, N.Y. Region and Automobiles. However, people often mistake the meaning of often-used terms and seldom know their definitions. For example, when you ask someone for the significance of IT, they will respond, "it has something to do with informatics" or "it is connected with the hardware and software". A valid definition [1] says: "Information technology (abbreviation IT) is the science and activity of storing and sending out information by using computers".

As a matter of fact "information" is a subjective term. In order to put the definition in a more succinctly manner, I would like to replace "information" with the neutral term "data". "Using computers" answers the question how the data is stored and sent. As computers can differ, I prefer to replace these terms by the more modern computer concept, namely "digitalisation".

Moreover, to include data processing in this definition, I prefer to say "moving data" instead of "sending out data", as moving also involves storing.

In review:

Def Information technology is the science and activity of moving data digitally.

## Digitalisation

The digital model consists in mapping any data to the set  $\{0,1\}$ , which means that the data will be divided into two groups according to a specified criterion. The group that fulfils the criterion is accordingly coded with a "1" the other with a "0". As there are different ways to realise the mapping depending on the method used, this gives rise to special characteristics of the model.

For example, a measuring instrument of the air traffic control could map the situation of an arriving aircraft to a "1". Of course, this information is not sufficient for the controllers to decide whether the aircraft should land or not. So, other binary numbers could indicate if it is a passenger aircraft or if it flies under a certain height, until the controllers have enough information. Therefore, one binary digit is not quite informative, but the ones and zeros become powerful when masses are combined to form significant binary words.

Representing data in binary words is called digitalisation of data. For example the whole western alphabet can be digitised using combinations of five binary digits.

Imagine yourself writing a report using the alphabet in binary representation. To formulate the report directly in binary digits is quite arduous. Best, you would formulate the report first in a preferred language and then translate each letter or word into the binary form using a translation table. Working in this manner, step by step, is advantageous because we

are used to consider using functional units. While writing the report, you might structure it in chapters, each chapter with the help of new lines in paragraphs, the paragraphs by points in several sentences, the sentences by blanks in words and the words in characters. The sense or function of the report is primarily given by the different chapters, the function of each chapter again by the paragraphs and so on. The listed units degrade in complexity and in meaning, and at the end of chain are the ones and zeros.

Therefore, as the limited meaning of a character makes us to write a text "in words", the simplicity of the digital model causes automatically layered and abstract procedures when data is digitised or when digital data is moved.

### **Consequences of the Digitalisation [2]**

Moving data in digital form shows special properties that derive from the binary representation and the layered procedures.

#### **Perfect Copy**

If you have a mechanical watch, to tell the time in any accuracy you have only to interpret the movement of the hands. But if you have a digital one, the accuracy is limited to the resolution of the watch. Thus using a digital watch you will lose information.

The mapping of data to the digital model is an operation with loss of content. But once in binary form, data of any complexity can be perfectly copied by replicating the binary pattern. Moreover, as the replication preserves the original. There is no difference between the copy and the former original. Thus, effecting a copy you get two originals.

As binary operations can be executed automatically with computers, "originals" in quantity can be made at low cost. In fact, this is just the idea of mass production. Most of the production cost is absorbed by the development of the first items and not by the reproduction itself. This property is not yet so strongly developed in the classical mass production. For example, the production cost in the car industry is still coupled with outlays for material; the costs of subsequent copies are therefore not negligible. However, as digitised data is reduced to a pertinent form, digitalisation avoids dealing with physical objects and the mass production is effectively dematerialised.

### **Independent Layers**

The way of digitising data varies immensely and is actually a physical problem, as well as a method of moving the ones and zeros.

The layered procedure consists in implementing a more powerful functional unit with some more primitive ones. During the construction, it is essential that their characteristics<sup>1</sup> are taken into account, because their features are constraints that influence the final characteristics of the new unit. For the implementation however, it does not matter how the constraints were found or what their physical reasons are.

Units that have as components the same more primitive units form together a layer.

The aim is that the function of the new unit depends not upon the characteristics of its components, but only upon their functions. So, it is possible to change the implementation of a unit to improve its function without changing anything of the other layers because the changed characteristics are not noticed.

Since this aim is seldom achieved, the different layers are not completely independent and some rules or standards are needed to guarantee that the layers match.

### **Surmounting Time and Distance**

Today's physical knowledge provides generally favourable speed-characteristics for the units, so the period of time to move digital data can be discarded or approximated to zero.

This eliminates the barriers of distance and time.

The irrelevance of distance, combined with the capacity to copy immediately and perfectly, involves easy distribution and availability of data. Therefore to be in possession of digital data is no longer special, whereas the creation of data and of new methods to move data becomes more valuable. The former sentences are not as crucial as suggested since not all the data available is useful. To pick up data of good quality is nevertheless time-consuming.

### **The Role of the Information Technology in the Society**

Each technology has its users and developers. They determine the importance and influence of technology on the consumer. To determine and group the users and developers of the information technology, special properties have to be taken into account.

### **The Digital Society**

We group by means of the term society, people that share a geographic proximity. The different meanings of "a geographic proximity" give rise to various kinds of societies. Geography is generally the study of the ways in which countries and people organise life within an area, and area can be defined as the scope of a concept, operation or activity. In

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<sup>1</sup> For example, some characteristics of the unit "character" are the type size and type style.

case of the concept of digitalisation, its range is only limited by people's capacity of dealing with digital data. Therefore, these people can be named "a digital society".

Until now, only the consequences of the idea to move data *digitally* are presented and not the consequences that it is in fact *data* that is moved.

Data is a general term that comprises for example the content of books or the values of physical quantities such as temperature. Furthermore, data is examined and used to help decision-making in all types of activities.

On the one hand, using digitalisation to move data, the information technologies dispose of the powerful-sketched properties of the digitalisation, on the other hand, dealing with data, the information technology is present in other technologies and furnishes them with the same properties. Through the digital impact on the other technologies, the information technology can revolutionise the whole digital society.

### **Development of the Society**

In order to evaluate the role of the digital society it is important to know its evolution, which depends strongly on the development of the information technology. But how far can we envision the development of a technology?

It is certainly reasonable not to believe in any euphoric promises about the information technology and admit the following hypothesis [3]: "Predicting the rate at which technologies will increase in capability, ..., is not possible over the long term.". What we can determine however is how people react now to the information technology and therefore how they influence it.

The digital society knows that it is possible to have much data immediately available. It has adapted its lifestyle according to this situation and is now dependant on data. Therefore it has become more and more demanding towards the products of the information technology, even more because it does mostly not understand the complexity of some procedures because of their layered structure. It wants the cycles of everything to be shortened and the costs to be declined. This enforces the development of the information technology and produces a veritable self-reinforcement trend.

People outside the digital society suffer less from such demands and are therefore much more critic. The information technology must be beneficial for them or simply be imperative, so that they want to belong to the digital society. On the other hand they must have the capacity to deal with digital data so that they can belong to the digital society. People do not promote the development of the information technology as long as they don't belong to it.

## **Influence of the Information Technology on the Digital Society**

Whether people are really wrapped up in the digital society depends on their capacity to deal with digital data and the influence of the information technology on the digital society. Digitalisation of data has helped to solve a lot of problems and helped to realise some great projects. For example, the whole space technology would not have been possible without computers. But a problem is seldom solved without new problems and risks creating, which are even mightier. All problems can or will never be solved.

### **Work**

The importance of data causes that the information technology is involved in every work. That's why all people get in contact with it. The changing nature of work will influence business, where work is executed, and education, which prepares for work.

The irrelevance of distance means that teams can collaborate globally and continuously. A day can be divided into three working days of eight hours. When a working day for one geographical region ends, a new one begins elsewhere. Thus, as one team returns to work, the common project has already advanced two working days.

It also gives rise to an erosion of boundaries between personal time and business time. The workers may be no longer tied to a fixed place and a fixed time. They can also work at home and organise their personal work individually. In fact, we return to the pre-industrial conditions when the division between work time and private time are barely existent.

The changes that mass production caused will be made more complete. Work done by humans will constantly evolve from reproduction to conception. A job is carried out automatically when it is more advantageous for the firm. But this does not mean less skilled work will not be available any more. The UK IT National Training Organisation has developed a reference model for the identification for jobs that exist in information and communication technologies and the skills required to perform them [4]. Through the layered procedures in the Information Technology exist different levels of accountability and complexity of work (cf. [4] *Framework categories*). However, less skilled work will be problematic because as circles of everything are shortened working tools will change fast. People, who have not yet understood the tools they have used, will have difficulties to adapt themselves. Layered structures should cope with this to make the change easier.

### **Education**

The importance of the information technology for work demands that people are prepared for it early in life. Therefore the study of the information technology should be a subject of our education. Moreover when people get into contact with it early they get used to its properties. For people that have grown up within in a digital environment the information technology is no longer a subject of discussion, but a simple fact of life. The society

becomes digital, respectively the digital society does no more notice that it is actually digital.

Information technology involves floods of data. In order to pick up the useful information, an effective data and time management is necessary. This is something that should be trained during the education.

As the information technology goes along with steady changes it is important to have a friendly attitude towards them. But normally, people don't like changes. It is up to the education to help out of this dilemma. First, it should enable us to avoid change: if you understand the principles of a mechanism it will appear to be variation instead of a change. Secondly, it should make us love change.

### **Business**

Of course, business is directly influenced by the dematerialised layered mass production of data.

The case for the market system has always rested on three implicit hypotheses: [5]

- "Call the first feature *excludability*: the ability of sellers to force consumers to become buyers, and thus to pay for whatever goods and services they use."
- "Call the second feature *rivalry*: a structure of costs in which two cannot partake as cheaply as one, in which producing enough for two million people to use will cost at least twice as many of society's resources as producing enough for one million people to use. "
- "Call the third *transparency*: the ability of individuals to see clearly what they need and what is for sale, so that they truly know just what it is that they wish to buy. "

The information technology undermines them. Cheap copies do not go well with the idea of excludability and rivalry. Neither is the immense data- flood and complexity of the goods consistent with transparency. Therefore, the information technology gives rise to a new kind of business, namely e-business. This topic is subject of vast research [6].

But the market does of course not wait until it is known how it will behave. It has produced some new concepts like Open-Source software to ensure transparency. Without excludability it's hard to get paid for your work. So other means were found to compete and to make money. It is no more only the product itself that is bought, but the whole service around it. For example, computer firms offer for their mobile products calling centres and support around the world. Or in case of software where the product is free, but advertisement is stuck on it.

Information technology helps to improve the logistics of a company because it accelerates and lightens the procedures doing a minimum with physical resources. For example, Dell Computers has reduced the inventory to pure data substituting the items by information about the item [7].

The spread of piracy and the uncertainty about privacy in the digital society, is due to the ease of copying and processing data shows up a principal question about information technology and business: Who should profit from information and for how long [8] ?

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