

## *Original Paper*

# How the ICT (Information and Communication Technology) Influences Work and Private Life

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### ***Abstract***

*The purpose is about the influence of ICT on increasing the efficiency and performance of employees, the workload and the increasing complexity of the requirements and the constantly increasing pressure to perform at all employee levels.*

*The used methodology is as follows: An evaluation of the scientific literature is carried out here. The point of departure of the considerations is the fact that the ICT changes the world and with it also the professional and private life of the users.*

*The results of the analysis show a constantly changing environment, which is both cause and effect of the changes.*

*The influence of the ICT on people is given, no matter if it concerns direct users or indirect affected persons. This relationship must be realized and further investigated. Employers should generally note that the actual work changes massively for their own employees. Interestingly, it does not play a significant role in how far they systematically deal with hardware and software. Future research has to deal much more with the consequences of constantly changing boundary conditions. This includes the efficiency measurement through ICT use, which is completely missing so far.*

*The ICT has a massive impact on all people, regardless of whether they like it or not and whether or not they handle it themselves.*

### ***Keywords***

*information and communication technology ICT, consequences for ICT users*

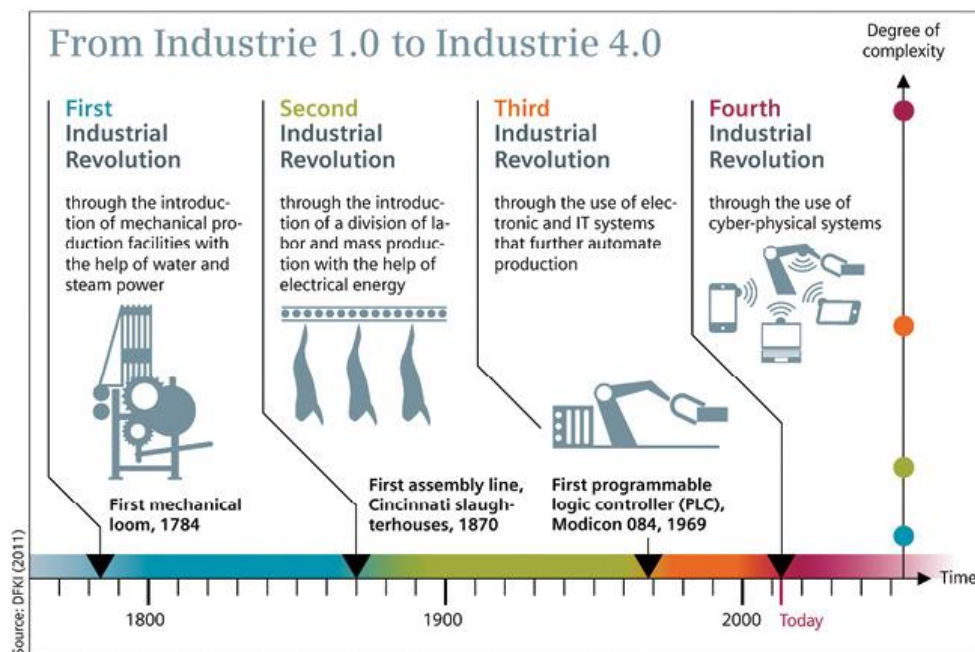
## **1. Introduction**

Today we are on the threshold or at the beginning of the “Fourth Industrial Revolution”. Expenditures on and use of ICT continue to grow at a rapid pace and affect the professional and private lives of users

and of all other people affected by the daily use of hardware and software through permanent and worldwide deployment. The following work gives a small insight into the consequences of direct and indirect ICT usage.

### *1.1 Increase of Performance and Efficiency of the Employee through the Use of ICT in Connection with Globalization*

The basis for this are intelligent networks that unite the individual areas of electronics, software engineering, networking and mechatronics. This new development, also referred to as Industry 4.0, deals with the computerization of production technology and logistics in machine-to-machine communication, as well as the Internet of Things. Here, production processes are digitized and massively accelerated (Merz, 2015).



**Figure 1. Visual Representation Including Variables such as Complexity**

Source: Internet-connected autonomous systems have jump-started a fourth industrial revolution that includes big data mining, customer-driven designs and modular assembly lines. Image courtesy of Siemens PLM Software. Retrieved from <https://www.digitalengineering247.com/article/manufacturing-in-the-world-of-industrie-4-0/>

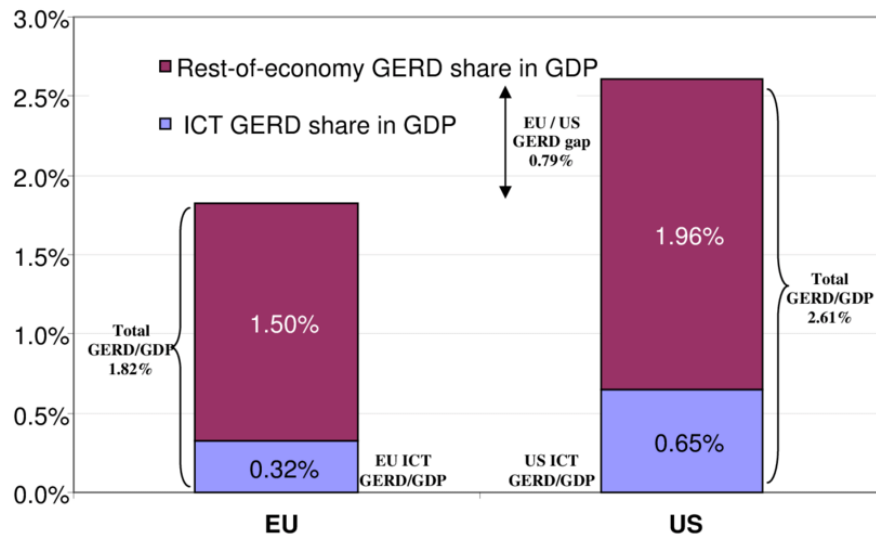
At the same time, the degree of complexity has gradually and permanently increased with each stage of industrialization. However, the basis for the “Fourth Industrial Revolution” is the entire ICT sector (Fuchs & Apfelthaler, 2009).

It can be seen from the above illustration that four demands on the economy are constantly increasing: the flexibility, the versatility, the productivity and also the complexity (shown on the vertical axis). Flexibility and mutability first dropped sharply in the first industrial revolution, then increased steadily

as the second industrial revolution took over, and in the third industrial revolution, they overtook the productivity and complexity of importance and aspiration. The measurement of power in an industrialized world is usually measured by productivity, i.e. the relation of input and output.

On the other hand, productivity and complexity are increasing steadily and increasingly (convex curve). Many studies show, among other things, that large increases in productivity were only made possible by the intensive use of ICT. It should also be mentioned that product life cycle times are constantly shortening. This reduction is particularly fast in the ICT industry. While the product lifecycle of processes or products in the ICT industry was still two to three years in the 1980s, that time has shrunk to three or six months, at least in part. The trends towards shorter throughput times in development and production, an increasing proportion of customer-specific solutions and an overall constantly growing product complexity place entirely new demands on the engineering processes and the supporting IT systems during development (Buchta et al., 2009).

The daily and systematic use of ICT has a direct positive effect on productivity the better the organization is designed to implement the appropriate production processes. For example, Harley Davidson has been able to reduce the throughput time in the production process from 26 days to 6 hours, with an unbelievable efficiency increase of more than 97%, by purposefully using new ICT systems (Römer, 2014).

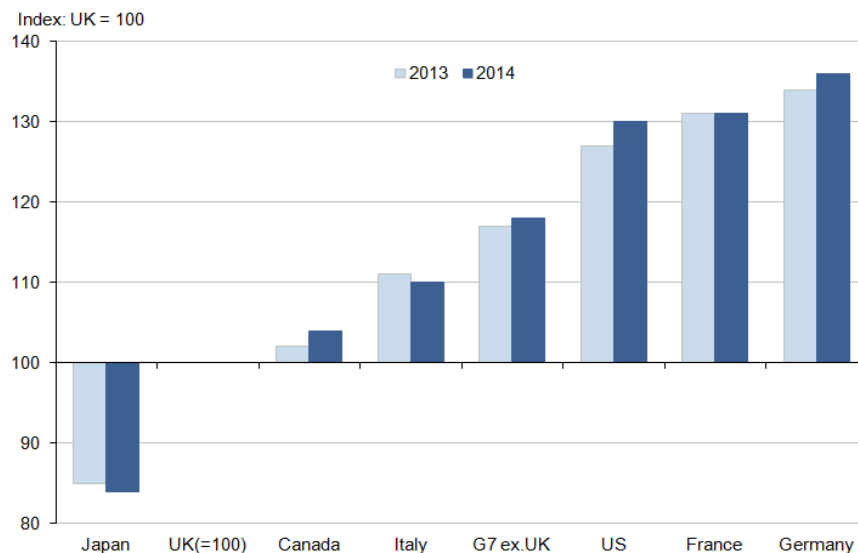


**Figure 2. The Barcelona Target: Total GERD and ICT GERD as % of GDP, EU27 and USA, 2005**

Source: Turlea, G. (2009). Retrieved from [https://www.researchgate.net/figure/The-Barcelona-target-Total-GERD-and-ICT-GERD-as-of-GDP-EU27-and-USA-2005\\_fig2\\_242547451](https://www.researchgate.net/figure/The-Barcelona-target-Total-GERD-and-ICT-GERD-as-of-GDP-EU27-and-USA-2005_fig2_242547451). Abbreviations: **gross domestic expenditure on research and experimental development (GERD)**, **GDP: Gross Domestic Product**.

The share of R & D expenditure is now around 20% within the European Union and even around 33%

in the United States, which strongly supports the immense importance of this sector (Turlea, 2009). Ultimately, however, it is necessary to point out the general problem of how the causality between expenditure in the ICT sector on the one hand and the development of productivity on the other can only be proven to a limited extent. In the German economy, productivity, as shown in the graph below, has been rising more and more slowly between 1992 and 2015 (with the exception of the financial crisis of 2008 and 2009). Nevertheless, it has ultimately risen, as the values are above 0 compared to the previous year.

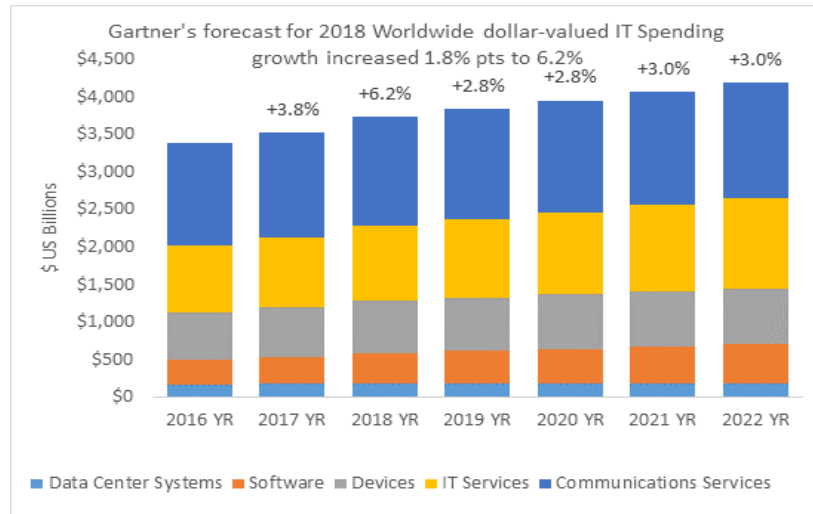


**Figure 3. Development of Productivity in Germany 2013 and 2014**

Source: Chapman, N. (2016).

At the same time, spending on the ICT sector is constantly increasing, see the following graphic from Statista. Therefore, the question must be asked whether there is any relevant causal relationship between labor productivity and ICT expenditure. This result in itself must be surprising, as ICT spending is constantly increasing. A direct correlation between the two variables seems unclear or not directly detectable.

But if so, the question remains as to whether the increase in productivity may be limited to specific activities and/or industries, as the graph of productivity development shows the entire economy. Would you, for example, Taking certain industries and/or activities out of the overview (reducing the population), where there is no relevant ICT use because they are based on purely physical work, would mean at the same time that in the other sectors/activities productivity is very good has risen. The clarification of this issue could thus be based on carrying out an empirical investigation by sector and/or activity (remaining research gap).



**Figure 4. ICT-Expenditures Worldwide**

Source: Gartner IT worldwide spending forecast. Retrieved from <https://www.gartner.com/technology/research/it-spending-forecast/> (Q1 2018)

## 2. Work Compaction and Increasing Complexity of Many Professional Activities

Beginning in the 1980s, a major structural change began, especially in industrialized countries. This immense change shaped the transformation from a production-oriented society to an information society, the use of more and more know-how and the digitization of the working world. From a technological point of view, this happened with the introduction of microprocessors that could be used to produce powerful and cost-effective computers. From the 1990s, the global networking of computers began among themselves. These two achievements fostered the resulting globalization based on a liberal economic policy with a free exchange of goods, information and finance/financial products. The speed of interactions has been increasing enormously ever since. The imprints, values and attitudes to people's careers and technology changed and are changing fundamentally and faster and more sustainably (Heinecke & Müller, 2014).

The increasing complexity of the work is both technically and socially motivated. The technical complexity is based on the increasing mechanization and rationalization of the individual work processes or the total workload itself. Here a fast flow of information forms the basis. This information flow is accelerated enormously from the traditional previous organization to the new process organization (Dedering, 2000). In some cases, the areas of responsibility of the employees also shift. The proportion of rather simple agents (same/similar work processes) is reduced by the same percentage as the number of jobs for experts (creative and/or new services) is growing. This results in a shift from simple and/or standardized work to higher value activities with correspondingly higher training requirements (Rüter et al., 2010).

A localization of original information is therefore hardly possible, so that today's communication processes run on completely different patterns than before. A good example of this is shown in the following illustration about communication in companies. The original patterns have been lost.

The complex work described is in contrast to routine activities in a certain framework in self-initiative influenced and thereby also personality. However, spatial shifts or outsourcing increase the complexity of the working world even further. Changes in the organization, or in the work processes themselves, are now taking place at a much faster pace than a few decades ago. Changes were made earlier usually one after the other, but nowadays more often also in parallel, so that several changes occur at the same time. The flexibility itself is also measured with the variety, d. H. the number of possible distinguishable states that a system can have. The more complex a process or organization is, the greater the combination of possibilities. In his paper, Bandte concludes that managing complexity among product manufacturers and service providers cannot be solved by simplification or reduction alone, but allowing for complexity in considerations and judgments in organizational design (Bandte, 2007).

Here you come to the newly created concept of work consolidation. This is defined as the amount of work done per unit of time, and most often takes place in environments/companies characterized by yield or index-based performance enhancements. This can be achieved by introducing target agreements, profit centers, or benchmarks. There, then, the work concentration and deadline pressure are particularly high (Ahlers, 2013). This is obviously in contrast to public service activities.

### **3. Constantly Increasing the Pressure on Performance and Success at All Employee Levels**

Employees are treated as capital, i.e. as human capital, by increasing the pressure to perform and succeed, which is also reflected in the English term human resources. As a rule, success as an entrepreneur is what will assert oneself with the most efficient means compared to its competitors. This is justified by permanent cost reductions, the competitive situation of competitors and also the volatile and therefore high-risk capital markets. Management by Objectives (MbO) aims to control and increase the labor productivity of employees. This usually succeeds, because the employee is usually anxious to actually achieve these goals. However, the targets set by the management are neither arbitrary nor to increase permanently. Furthermore, goals can often no longer be defined by numbers (quantitative), but also qualitative aspects are considered (Koch, 2014).

The described digitization of the economy brings with it many changes in the respective working world. This leads amongst other things to a strong increase in the areas of project work, qualification management and the constant accessibility of the respective employees to the requirements.

The clear result: Currently, there are hardly any employees in Germany who pursue a profession in which they could be 100 percent replaced by Computer & Co. According to the study, this currently only applies to 0.4 percent and thus to around 100,000 employees subject to social insurance contributions in a total of 20 occupational fields. However, as the researchers also find, there is hardly a profession in

Germany in which at least parts of the work people do cannot be taken over by computers or machines. Particularly affected by the increasing digitization are occupations in industrial production. By contrast, social and cultural service occupations (jobs in hospitals, nursing homes or museums) have the lowest substitutability potential.

According to the latest study, at least 45 percent of the workforce, i.e., around 13.2 million people in Germany, carry out an activity in which Computer & Co. could do between 30-70% of the work. At around 4.4 million, or 15 percent of all employees subject to social security contributions, this figure is over 70 percent. Here, too, according to the researchers, these values will change as a result of changes in the fields of activity and hardly lead to job losses (Dengler & Matthes, 2015).

In order to meet the increasing demands of the employer, employees have to “work overtime” and/or work on the weekends to cope with the workload. Therefore, many employees criticize the stress caused by increasing demands on performance and work pressure, collectively referred to as work concentration (Psyga.info, 2015). Among the executives there are the so-called “shock absorbers”, which cushion the pressure and the so-called “shock amplifiers”, which pass on their own pressure and their own fears more and more to the employees. As a result, the pressure itself is not gone, only others have it (Roth, 2015).

Pressure can increase the performance in the short term, but it does not affect the performance itself, or the ability of the person concerned. Also incorrect is the assumption that performance would increase permanently with increasing pressure. Although slight pressure increases the concentration, but the pressure is further increased, the performance reaches its peak and then begins to fall just as quickly (see Yerkes-Dodson curve). If the pressure is increased further, the goal is no longer achieved, but frustration and abandonment threaten. According to Mainka-Riedel (2013), this pressure is based on the information age, which poses complex demands on the employees and especially their psyche through digitization, globalization and individualization. Compared to the past, employees have to process a multiple of information in less time and fewer and fewer people have to do more and more tasks. In this way, this consolidation of work demands more mental and mental, than physical (Mainka-Riedel, 2013) employees.

But obviously there are two other factors that massively increase the workload. These are on the one hand to interruptions and the other to the so-called multitasking, where you should do several things at the same time and must and at an ever-increasing speed (keyword: increasing number of strokes). Nevertheless, humans usually work tasks one after another because the human brain is so. The more information that affects humans at the same time, the more overwhelmed the human brain is. Therefore, multitasking is both exhausting and less effective than expected. If several challenging tasks are done in parallel, you are actually losing time. So it takes much longer to write a report, if you parallel e-mails answered. Multitasking therefore slows down in many cases. It is estimated that in extreme cases, working people lose up to 40% of their working time through multitasking, since they have to correct errors that arise as a result of constant switching (Mainka-Riedel, 2013).

Another disadvantage of the modern and ICT-based working environment are the frequent interruptions to work. These include work interruptions that cannot be planned and controlled from the outside, such as telephone calls, unplanned customer visits or “short” questions from colleagues. This creates unforeseen situations that thwart your own work plan and require additional concentration and coordination. Accordingly, unforeseen pressure and stress are created for those affected, since these do not come to their actual tasks. Therefore, occupational scientists classify multitasking and work stoppages as mental stress that can lead to excessive demands. This is especially true for demanding tasks that require high-quality, creative or innovative results (Mainka-Riedel, 2013).

There is a scientific study of Johannes Gutenberg University Mainz on this topic (Baethge & Rigotti, 2013). This study came among others, to the following results: Interruptions led to exhaustion and performance losses. “Anyone who was interrupted frequently in the shift was more exhausted after work and reported a lower quality of work”. Also, multitasking (ability of one person to perform several activities at the same time or alternately in short periods of time) exhausted and negatively impacted on the quality of work. If the nurses had to do different things at the same time, they were exhausted after the shift and reported a lower quality of work. Age had no buffering effect, but increased the negative multitasking effects. Older people were more exhausted after parallel activities than younger ones (Baethge & Rigotti, 2013).

Schoenebeck (2014) comes to a comparable result regarding multitasking: “Although multitasking, the simultaneous completion of various tasks, is part of everyday life in many offices, the benefits are doubtful. A new study by Weißbecker-Klaus now comes to a sobering conclusion: Multitasking not only impairs the execution of individual tasks, but also affects the detection and processing of errors. “The scientist’s recommendations are clear”: As the current study shows, however this subjectively more efficiently experienced tendency against the background of frequent work stoppages and information overload can be connected with far-reaching consequences. Especially when both tasks require controlled processing, multitasking poses a potential risk that some of the errors will not be detected and resolved. Under existing time pressure, it will consequently not succeed adequately to adapt the misconduct to currently prevailing conditions and to learn from mistakes. Thus, in controlled, deliberate processing and attention-demanding activities, with far-reaching error consequences is absolutely not to discourage so-called multitasking. “Ultimately, then it is probably this combination of pressure to achieve certain goals, constantly changing and increasing performance requirements, the digitization of the work environment, Interruptions and multitasking, which lead to corresponding stress among employees in this area.

#### **4. Conclusion**

Obviously, there are still numerous research gaps in the assessment of whether or how the use of ICT influences professional and/or private life. However, certain facts and relationships are obvious and cannot be disputed. This includes, on the one hand, the ever-increasing pressure that companies are



exposed to due to globalization and, on the other, the employees to whom this pressure is passed on and who feel this through multitasking, or whatever, in their daily professional lives. Even if it is not possible to precisely attribute individual causes to individual episodes (for example, the number of incoming telephone calls with the number of tasks per day), the relationship itself is clear and indisputable. The ICT leads to a rapidly changing and for all concerned working world and increases the pressure and the work compression on all involved ones, both directly and indirectly.

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