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*Editors*

# Digital Excellence

University Meets Economy



Springer

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# Foreword

Innovations should have the goal to better address customer requirements than current solutions, leading to new or improved products, services, processes or structures. The contributions in this book emphasize the point that innovation within an economic context does not solely concern companies and their customers; integrating research institutions and universities enhances the scope of creativity to not only produce concrete innovative ideas and projects, but also to develop procedures and techniques to put new ideas into practice. “Digital Excellence” will help universities to gain insight into practice, while providing companies immediate access to innovative concepts.

December 2007

Juergen Brettel  
*CEO, Experton Group AG*

# Preface

The expansion of information and communication technology is a global phenomenon. Firms, government agencies and individuals benefit from faster hardware, more powerful software and growing digital networks which facilitate productivity growth and innovations. Research and development activities are crucial for achieving excellence in innovations and in the development of new concepts which can be used to create new markets. Cooperation between universities and other R&D facilities with dynamic ICT firms has become a natural element of the early 21<sup>st</sup> century. The internationalization of innovation projects is a further element of digital dynamics. A crucial driver of product innovations and process innovations is the expansion of digital networks and the availability of more computer power plus complex software. An important feature of digital dynamics is that it has created a worldwide network of service providers and users which reinforces globalization. In enlarged and more competitive markets digital innovations on the one hand will play an increasing role, on the other hand avoiding a digital divide within society and across countries is an important challenge.

Leadership in research requires a special framework, an adequate institutional environment and top motivation on the side of an international research team guided by a top researcher. The R&D efforts described and the lessons drawn by Nobel laureate Wolfgang Ketterle are quite impressive and underline the importance of internationalized innovation projects and adequate investment in R&D facilities as well as the role of academic inheritance and dedication to demanding projects. These insights should encourage policy makers in Europe to create adequate conditions for top research which is

indispensable for technological leadership and for realizing the Lisbon Agenda goal of making the Community a leader in the global knowledge society.

Paul Welfens analyzes the role of information and communication technology in achieving higher growth in Europe. The ICT sector itself is characterized by high productivity growth and innovation dynamics. Moreover, the fact that ICT is a general purpose technology which affects all sectors and indeed stimulates adjustment and innovation in the whole economy adds to the economic relevance of ICT. Not all sectors seem to be able to equally exploit the opportunities of the digital revolution. The fact that ICT is largely knowledge-intensive and strongly represents intangible assets raises serious challenges for policy makers which are crucial for higher growth and more jobs – a crucial topic in many EU countries.

E-commerce is a rapidly growing field with many applications. Dominik Haneberg looks into electronic ticketing. The author looks into the advantages for both the customer and the supply side and selected projects which stand for modern electronic ticketing.

Bernhard Mautz puts the focus on location-based ticketing in public transport. Mobile ticketing indeed has become a major field of modern mobility concepts and the Federal Government has supported several projects. User mobility, device mobility and service connectivity are three key aspects.

E-commerce is growing and the mobility of users increasing, this creates many new opportunities and challenges in a flexible knowledge-intensive economy. Matthias Book, Volker Gruhn, Malte Hülder and Clemens Schäfer discuss various key aspects of mobility in e-commerce and emphasize that pragmatic solutions will have to be developed.

Powerful computers and software whose prices keep falling have created new opportunities to get a stereoscopic view of a product in the near future and to make progress on the way to “Design to Demand”. This is shown by Oliver Gaube in his analysis of future

trends. Individualised products will become an increasingly relevant innovation in markets as users will be able to influence the geometric shape of a product through the internet. This will influence competition in a crucial way.

In an increasingly networked society information security is a key concept. Georg Rock and Gunter Lassmann focus on the topic of secure biometric identification systems. Biometric systems are discussed in general and the security functions of secure biometric identification systems are analyzed. This report on the Verisoft project – a research project funded by the German Federal Ministry of Education and Research – gives new insights into a critical area of the knowledge society.

Digital economic modernization is not only an element of progress in OECD countries but in Newly Industrialized Countries as well. Brazil has become an important player in many knowledge-intensive fields; in software the country has particular potential which has not been fully mobilized yet. Michal Gartenkraut, Yoshihiro Soma and Luciano Lampi present key projects of the Technological Institute of Aeronautics, which has been a major driver of digital modernization in Brazil. There is a wide array of modern IT applications where government initiatives have played an important role.

Security is a crucial feature of the internet society, but many users are not really aware of security problems and adequate approaches in coping with the challenges: “Phishing” has become a major problem for both firms and individuals, meaning that sensitive data has been lost. Sascha Hanke and Tobias Schrödel demonstrate how easy Phishing can be and which basic precautionary measures should be considered by computer users.

In every society the health care system is of particular significance for the people and advances in medical research are an important element for progress in the health care system. Developing advanced hospital information systems – facilitating electronic health records – is an essential element for progress in medical treatment. Günter

Gell and Thomas Ritter report about the experiences in Austrian clinics. The insights offered are of general relevance for health care modernization OECD countries and in ageing societies progress in this sector will become quite important.

Government programmes can often be improved through modern software and adequate algorithms. Petra Steffens and Gerhard Geißner report on an interesting project realized by the Fraunhofer Institute for Experimental Software Engineering which has developed a new geographical information system. This system is designed to support the process of subsidy application in the federal State of Rhineland-Palatinate where subsidies are allocated to owners of vineyards and other farmers under certain conditions. The contribution demonstrates how important modern software can be in raising the efficiency of government.

The networked economy offers a broad range of fascinating applications of digital innovations and in the digital world economy diffusion of new ideas and solutions as well as awareness about key problems are crucial for decision makers, researchers and users of digital services. We are grateful to all participants at the T-Systems International University Conference 2005. This event has brought together leaders from academia, the business community and government – all with a true spirit in favour of progress in the digital society. Discussing crucial topics and issues in a rapidly growing digital world will remain an important challenge for those interested in innovations, digital networking and economic progress.

Wuppertal, December 2007

Prof. Dr. Paul J.J. Welfens  
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# Welcoming address

T-Systems university conferences are an important contribution to a better understanding between university and industry. Their great importance is that they bridge the gap between researchers and business managers by providing workshops and dialogue sessions in which both can discuss R&D topics and new product developments. It gives participants the opportunity to sharpen their mutual understanding of R&D work and of their quite autonomous approaches and timelines. This is a very important point, because a stronger co-operation between science and industry is of vital significance for both economy AND society:

The age of intelligent products and services and flexible businesses has begun, and business is now mainly being driven by scientific and technological progress, especially in communication technologies. Moreover, in the "network society" most aspects of life, such as politics, social welfare systems, citizen's initiatives and personal relations, are being influenced by technology and changed in style and structure.

In the case of research, new forms of so called "Mode 2 Knowledge Production" have been postulated which are initially motivated by specific products and applications – in contrast to traditional "Mode 1 Research" where research goals were deduced from individual scientific disciplines.

What does that mean for us, for politicians, businesses and for research institutions?

- For a regional policy strategy, we all know that effective promotion of a region as a business location depends more on an



attractive R&D environment than on classical parameters like cheap land for new plants.

- On the other hand, for companies like T-Systems and Deutsche Telekom, intense co-operation and good contacts with top researchers are of vital economic importance.
- Last but not least, research institutions have to legitimise their role more than ever to get public funding; and their real contribution to innovation in their region and beyond are strong arguments here.

Co-operation between science and industry is the crucial point, but it is usually a difficult topic to discuss. Why?

As far as my experience as former chancellor of the Technical University of Aachen goes, scientists have no reservations about stronger co-operation with industry. But there are still obstacles to joint activities, such as different institutional settings or working cultures, or missing links between basic and applied research.

## What can the political sector do?

Our role is to create an adequate legal and organisational framework for regional innovation.

- In NRW, we hear daily of discussions about the relocation of industry jobs to low-wage countries. With a view to long-term job creation, we want to make better use of our powerful public R&D structures, generate innovation and become more attractive to modern industries. For some time now, individual research institutions in North Rhine-Westphalia have therefore been brought together to form 'clusters' where information is exchanged and co-operation with the private sector is encouraged. This is something we want to intensify, and we also want to use a powerful overall organisation to efficiently market the huge skills we have in NRW.

- Several months ago, triggered by the change of state government in North Rhine-Westphalia, administrative structures began to be geared more towards innovation. For the first time, a new cabinet department dedicated to innovation was established, replacing the former Ministry of Science and Research, and including parts of the old Ministry of Economic Affairs.
- This has enabled us to develop and consistently implement a regional R&D strategy and to put different programmes and actions together in a more efficient manner.

Most importantly, this will change the mindset of the state actors: the research funding experts have to take the interests and speed of business into account, the economic experts will appreciate the importance of scientific institutions for regional development.

- We also have to review a number of bureaucratic rules: a new higher education act is designed to free universities of unnecessary red tape, enabling them to improve co-operation with the private sector. Universities will then be free to adopt legal structures best suited to their purposes; rules on company ownership will be relaxed, and more leeway has been given to the area of human resources management.

## What can the industry sector do?

It, too, can make a contribution to strengthen national or regional innovation strategies.

- In my view, long-term aspects, such as the intensity of research in a region, should be given a greater role in strategic company decisions about product portfolio or the choice of production site. I am certain that this would also make good commercial sense for many enterprises.
- Another point is, that we need more companies with open minds towards new forms of public-private partnerships. T-Systems, for example, has embarked upon a joint-venture with the

DLR research centre providing IT solutions from a private company. The Degussa corporation has made considerable investment in setting up a ‘Science to Business’ centre for nanotechnology and nano-materials in a joint endeavour with universities in the city of Marl.

Deutsche Telekom, as the parent company of T-Systems, has also worked towards sustainable improvement of ‘innovability’ in Germany, and I would like to use this occasion here to express my gratitude:

- The *Deutsche Telekom Stiftung* trust fund was set up early 2004 with a view to intensifying the transfer of knowledge and ideas among government, community and business by providing support to promising young researchers in telco-related fields, and to promoting natural sciences at school.
- 2002 saw the completion of a framework agreement between the State of NRW and Deutsche Telekom on co-operation and shared funding (50/50) of projects clearly related to new fields of business. I would be very interested in putting the promotion of research activities more at the focus of this co-operation.
- T-Systems also has expressed its interest in strategic partnerships with R&D institutions. During the last T-Systems University Conference in 2004, T-Systems signed the first partnership agreement with a German university, the University of Wuppertal. I am sure that similar partnership arrangements will follow, hopefully many of them involving universities in North Rhine-Westphalia.

I believe these few examples are sufficient to show that, whilst things are moving, a lot remains to be done to strengthen innovation in Germany.

December 2007

Dr. Michael Stückradt  
Secretary of State in the North Rhine-Westphalian  
Ministry of Innovation, Science, Research and Technology

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# University meets economy

*Ellen Walther-Klaus*

T-Systems

**Abstract.** *In Germany, as in the USA, it is becoming more and more apparent that there are numerous advantages to be gained by both sides when the economy and publicly financed research institutes work together. The cooperation ensures that innovative concepts, solutions and products can be tested in the field as early as possible, and both partners can help to make new ideas ready for market: an optimal solution, not only for business and scientist but also for potential customers. However, it is important that there is an intensive dialogue between everyone involved right from the start. These types of partnerships will only come to life if customers, business and research discuss with one another on a regular basis.*

*If companies want to be successful both locally and internationally, then it has become more and more essential that they prove their flexibility in all areas. Their position must not only be permanently reassessed and realigned but changing markets require continuously new products, solutions and concepts. In light of this, it is absolutely essential that specialists from research institutes, universities and businesses work hand in hand. However – as the first projects in Germany have shown – something like this can only be successful when the cooperation between a university and a company is more than a simple exchange of opinions. A partnership such as this is only sustainable when it leads to marketable solutions and products.*

## **1 An exchange of ideas supports innovation**

It is not only in the USA where this strategy has been successful. There have already been numerous positive examples of this type of business-research cooperation in Germany. They have meant, for example, that numerous innovative solutions and products with real chances on the market have already been developed in research laboratories and through joint seminars. However, just having the idea is not enough. In order to really be successful with an innovative idea it has to be developed into a marketable product, and this is where the companies play a role. They provide the necessary know-how, the contacts and the financing required to realise the ideas and finally put them on the market.

But companies not only benefit from the development of new products and the researchers' ideas. They also regularly develop new approaches to solutions and product ideas themselves, and these must then be tested for their suitability, before they can be successfully marketed. Many companies cannot afford this type of testing, often because they are tied by annual reporting and turnover figures and the long-term testing of innovative products does not fit in and is too time consuming. Universities are different. Not only do they have the necessary know-how, but they also have the relevant time framework to carry out this evaluation. The work can thus be spread between all partners; a win-win situation for both.

Another important aspect: companies are generally oriented towards their customers and their specific requirements whilst researchers in universities are in a better position to follow up supposedly "absurd" ideas. If a structured exchange of opinions and experiences takes place between business and research, then joint prototypes can be developed. And these – after a suitable evaluation – might even have what it takes to become a hit.

If management concepts and technology are successfully linked with one another, all parties can benefit from the situation. However, the added-value does not necessarily have to become financially appar-

ent. The advantage might well be in being able to advertise with the name of a famous university or well-known company and thus attract further partners or potential customers and students, or simply improving one's own image.

And, that this is not only abstractly theoretical has been clearly shown in existing cooperations. For example, in 2005, T-Systems International signed a partnership contract with the University of Wuppertal; and both sides are still benefiting from it. Students at the University of Wuppertal can use internships, work in project groups or write their undergraduate dissertations at T-Systems thus equipping themselves for the working world and making initial contact to potential employers. The company benefits from the students' ideas and research projects. A further advantage for T-Systems: because the students come to the company from an external research institute, they have an unbiased view of the company and can thus often develop new approaches to solutions that would probably not have been possible from inside the company.

Added to this, the cooperation allows the students to try out the market feasibility of their ideas at a well-known enterprise. The best innovations are not worth anything if, for what ever reason, they cannot be put into practice. Several innovative ideas for products or solutions which have emerged from university laboratories in the last few years have failed for just this reason.

## **2 Economy and research have joint interests**

However, and this is the other side of the coin, neither universities nor companies are in a position to fall into "innovative romanticism", since every new idea which changes existing structures means that researchers and the company are leaving familiar territory, with all its advantages and disadvantages. This means that researchers' solutions may, for example, initially appear to be very promising. However, under closer scrutiny, it becomes apparent that



these ideas have not (yet) been thought through and cannot be successfully marketed. And vice versa, a company may have developed what appears to be a successful solution for its customers, but a scientific evaluation will show that the concept is not sustainable. These are blows which are not always easy to overcome in a partnership between companies and research institutes.

So that these knock-backs neither cause a problem in a cooperation nor stop either side from continuing their work, it is a great advantage when the partners jointly decide before hand how they are going to deal with possible problem areas and develop suitable approaches to solutions. It is undeniable that entrepreneurs and researchers have very similar interests – even if they both appear to tick slightly differently.

### **3 Innovative romanticism versus professionalism**

Previously, research was the prerequisite for innovation. Pure scientist had ideas, applied scientists developed prototypes and industry and “Mittelstand” (SMEs) manufactured the product. This division of work was effective for decades in the engineering, chemical and automotive industry. German research and development operations were structured accordingly. In the information, nano- and biotechnology worlds, however, research and development are much more concurrent. Development has become a companion to research. Germany has not yet effectively responded to this. R&D cannot be considered to be research *or* development.

Innovative ideas are important and vital in the process of inventing new products and solutions and in improving their market positions. However, the process is only complete when ideas lead to functioning prototypes, and these can then really be manufactured. And this is precisely where a successful partnership between research and business can start. The economy needs research with its creative heads and research needs the economy in order to go into serial pro-