

Technological innovation as a mean to increase economic competitiveness

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Abstract. *Corporations must be able to adapt and evolve if they wish to survive. Businesses operate with the knowledge that their competitors will inevitably come to the market with a product that changes the basis of competition. The ability to change and adapt is essential to survival.⁽¹⁾ European Union and its member states set several frameworks to support companies to acquire knowledge and strengthen their competitiveness, as follows:*

- *National Programs for R & D funding which support national actors;*
- *Sectorial Operational Programs (either at national or regional level, in full compliance with national rules);*
- *EU programs (e.g. Competitiveness and Innovation Program – CIP, R&D Framework Programs – FP);*
- *Pan-European programs (e.g. EUREKA).*

Romania is participating to all programs and pan-European R & D frameworks. Furthermore, its innovation program within the National Plan for research facilitates company participation to knowledge development and technology development. Nevertheless Romania's Innovation performance is still at one of the lowest level in Europe⁽²⁾. The followings present how companies are considering their participation to R & D programs and the impact of an R & D project in a company.

Keywords: research; innovation; programs; projects; competitive.

JEL Codes: O32, O38.

REL Codes: 8L, 17E.

1. Aim of RDI in companies

Organisations that manage products and technologies have been built on a strong research & development base are constantly looking for opportunities to diversify into new product markets. Their strategic management activities seek to mobilise complementary assets to successfully enter those markets. In industry, research is much more generic and term and can involve both new science and the use of old science to produce a new product.

There is no single best way to manage research & development. There is no prescription, no computer model that may lead to successful RDI. Every single company or competitive environment is unique.

Some of us may believe that research is uncertain, based on exploration and unknown, therefore there is no way to manage this process. Business world showed that RDI can be managed and most of large corporations spend important amounts on this activity that could lead to top position or maintain them on those positions. In fact, during the last years, “RDI expenditures” were turned into “RDI investments”. Table 1 is presenting top 20 EU 15 companies (the 15 EU members states before the 2004 enlargement) in terms of RDI investments .

2. RDI as a driving force for economic competitiveness

There are three strategic areas of RDI in companies:

- RDI for existing business, respectively keeping up competition on and ensuring that an existing product/service is not outdated;
- RDI for new business – new business opportunities will be identified by managers and will include technology development;
- RDI for exploratory business implies continuous accumulation of knowledge also in areas that may, potentially, develop the core business.

From RDI perspective, the company’s technology base can be categorised as follows: 1) Core technologies, 2) Complementary technologies, 3) Peripheral technologies, 4) Emerging technologies. Each project within a company should not be evaluated as individual (mutually exclusive) but in competition with other projects; we may find good projects that could be cancelled or not financed simply because others (in other departments) would provide more consistent incomes. Theory of portfolio should be used in order to optimize the number of types of project that are to be funded.

Table 1

Top 20 EU-15 companies (the 15 EU members states before the 2004 enlargement) in terms of RDI investments

Rank	Company	ICB Sector	Country	R&D Investment	change 07/06	change 06/05	change 05/04	Net Sales	change 07/06	change 06/05	change 05/04
				2007				2007			
				€m	%	%	%	€m	%	%	%
Top 1000 Companies				126.358,38	8.6	6.7	7.8	5,515,078	7.0	10.6	10.5
<i>number of comp. for calculation</i>				51	50	50	49	51	50	50	49
1	Nokia	Telecommunications equipment (9578)	Finland	5,281.00	42.3	2.3	-5.3	51,058	24.2	20.3	16.8
2	Volkswagen	Automobiles & parts (335)	Germany	4,923.00	16.1	4.0	-2.1	108,897	3.3	10.7	7.1
3	Daimler	Automobiles & parts (335)	Germany	4,888.00	-6.6	-5.6	-2.1	129,436	-15.3	1.3	6.1
4	Sanofi-Aventis	Pharmaceuticals (4577)	France	4,563.00	3.6	8.9	69.3	28,052	-1.1	3.9	83.7
5	GlaxoSmithKline	Pharmaceuticals (4577)	UK	4,419.43	-6.1	10.2	8.0	30,928	-2.2	7.2	8.4
6	Robert Bosch	Automobiles & parts (335)	Germany	3,560.00	4.8	15.9	12.6	46,320	6.0	4.0	5.1
7	AstraZeneca	Pharmaceuticals (4577)	UK	3,448.55	29.8	15.0	-4.2	20,217	11.6	10.5	11.8
8	Alcatel-Lucent	Telecommunications equipment (9578)	France	3,368.00	69.4	10.9	34.1	18,005	25.2	9.5	2.5
9	Siemens	Electrical components & equipment (2733)	Germany	3,366.00	1.7	-35.8	1.8	90,348	0.5	19.2	0.4
10	BMW	Automobiles & parts (335)	Germany	3,144.00	-2.0	3.0	10.5	56,018	14.3	5.0	5.2
11	Ericsson	Telecommunications equipment (9578)	Sweden	2,911.03	2.4	4.8	4.3	19,872	5.6	17.1	15.0
12	EADS	Aerospace & defence (271)	The Netherlands	2,701.00	-5.9	21.2	3.1	39,123	-0.8	15.3	7.7
13	Bayer	Chemicals (135)	Germany	2,645.00	7.7	30.3	-21.5	32,631	2.6	16.1	-8.0
14	Renault	Automobiles & parts (335)	France	2,462.00	2.6	6.0	15.5	39,561	-2.4	0.3	0.3
15	Peugeot (PSA)	Automobiles & parts (335)	France	2,074.00	-4.6	1.1	-1.5	60,613	7.1	0.6	0.3
16	Finmeccanica	Aerospace & defence (271)	Italy	1,955.00	4.6	7.0	28.4	11,916	2.5	4.1	20.8
17	Fiat	Automobiles & parts (335)	Italy	1,741.00	8.9	2.6		58,529	14.9	11.2	
18	Boehringer Ingelheim	Pharmaceuticals (4577)	Germany	1,730.00	9.9	15.7	10.4	10,952	3.6	10.9	16.9
19	BT	Fixed line telecommunications (653)	UK	1,704.60	11.9	53.9	39.3	28,188	2.4	3.6	5.9
20	Philips Electronics	Leisure goods (374)	The Netherlands	1,604.00	-7.6	-33.9	37.2	27,037	-12.4	1.5	0.3

Table 1

Top 20 EU-15 companies (the 15 EU members states before the 2004 enlargement) in terms of RDI investments (continued)

Rank	Company	Employees		R&D/Net Sales ratio		Operating Profit		R&D/Employee s		Market Capitalisation		Capital Expenditures	
		2007	change 07/06	2007	2006	2007	2006	2007	2006	2007	change 07/06	2007	2006
		#	%	%	%	% of Net Sales	€K	€K	€m	%	% of Net Sales	% of Net Sales	
		20,297,642	4.2	2.3	2.2	12.2	6.2	6.0	4,954,856	-9.0	7.2	7.1	
		20	20	20	20	20	20	20	18	18	20	20	
1	Nokia	100,534	53.9	10.3	9.0	11.7	52.5	56.8	70,647	-14.7	1.3	2.0	
2	Volkswagen	307,589	-0.3	4.5	4.0	6.3	16.0	13.7	71,064	46.0	8.9	8.0	
3	Daimler	357,000	-2.4	3.8	3.4	6.8	13.7	14.3	45,749	-24.0	16.0	20.1	
4	Sanofi-Aventis	99,495	-0.8	16.3	15.5	23.0	45.9	43.9	65,387	-13.5	4.8	4.4	
5	GlaxoSmithKline	103,401	1.6	14.3	14.9	33.5	42.7	46.2	89,901	-9.7	7.0	6.4	
6	Robert Bosch	267,562	3.8	7.7	7.8	6.9	13.3	13.2			5.7	6.1	
7	AstraZeneca	67,900	2.0	17.1	14.7	27.4	50.8	39.9	51,319	4.4	4.0	3.0	
8	Alcatel-Lucent	76,410	-14.5	18.7	13.8	-24.4	44.1	22.2	9,859	-43.5	2.0	2.0	
9	Siemens	398,200	8.1	3.7	3.7	6.5	8.5	9.0	74,367	-3.4	3.3	4.6	
10	BMW	97,922	0.7	5.6	6.5	7.1	32.1	33.0	19,448	-26.9	24.5	22.8	
11	Ericsson	73,345	13.7	14.6	15.1	16.2	39.7	44.1	23,558	-42.1	2.3	2.2	
12	EADS	116,493	-0.3	6.9	7.3	-0.3	23.2	24.6	12,459	-23.4	4.6	5.8	
13	Bayer	105,622	9.3	8.1	7.7	9.4	25.0	25.4	42,752	5.2	4.8	5.0	
14	Renault	133,854	-0.3	6.2	5.9	7.3	18.4	17.9	17,136	-35.9	8.3	8.8	
15	Peugeot (PSA)	207,850	-1.8	3.4	3.8	1.8	10.0	10.3	8,167	-39.1	3.3	4.7	
16	Finmeccanica	58,700	3.6	16.4	16.1	8.5	33.3	33.0	8,559	2.5	5.3	4.9	
17	Fiat	179,601	3.4	3.0	3.1	5.2	9.7	9.2	14,374	-35.6	5.0	6.5	
18	Boehringer Ingelheim	39,800	3.6	15.8	14.9	19.2	43.5	41.0			6.0	5.6	
19	BT	108,500	3.1	6.0	5.5	11.1	15.7	14.5	18,699	-45.1	12.2	12.2	
20	Philips Electronics	125,656	-22.0	5.9	6.3	8.3	12.8	12.1	24,327	-20.6	2.4	2.3	

Source: The 2008 EU Industrial R&D Investment Scoreboard (released in October 2008)

It is well understood that technological developments – and we are considering only technology intensive companies, not those that use technology to support their businesses – will lead to improvement products and processes, reduced costs and, at the end, to better financial results. This will lead to development of business strategies that will incorporate RDI aspects.

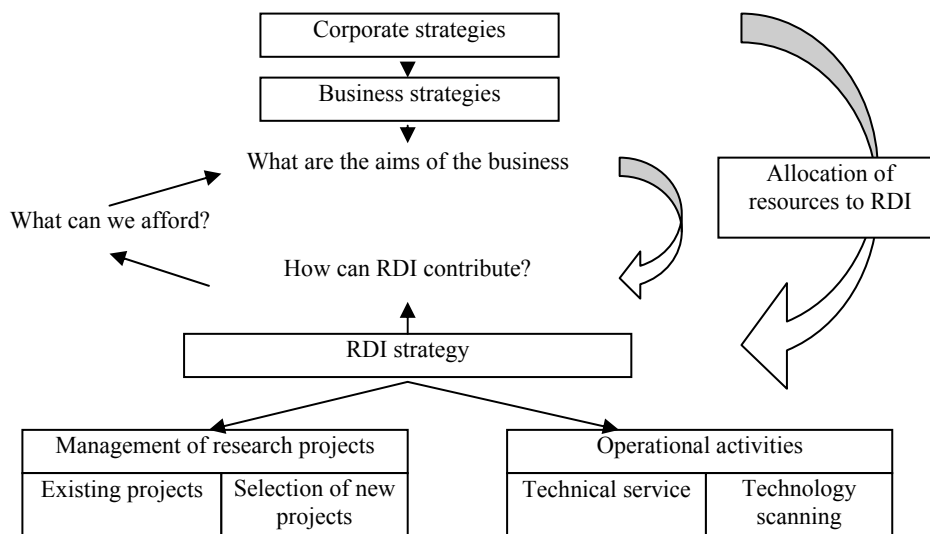


Figure 1. RDI decision making process

Most innovative firms are still waiting some time before taking to take decisions whether resources should be allocated to most promising RDI projects. This should be also influenced by a long term allocation as a disruptive environment will definitely cut any positive foreseen result, but the relationship between RDI expenditure as percentage of sales and commercial success is less evident.

RDI is not the only factor that influences the successful of a certain business. Crude oil – commodities in general – could dramatically influence the competitiveness of a certain company, but RDI will definitely sustain it.

3. Public vs. private funding for RDI

3.1. Public funding for RDI in Romania

The National Research, Development and Innovation Plan for 2007-2013, hereinafter referred to as the National Plan II – PN 2, is the main instrument by which Romanian Government is implementing the National Strategy for RDI.

In order to set up PN 2, it has been taken into consideration the role of the National Research, Development and Innovation System, respectively to develop science and technology in order to increase the economic competitiveness, to improve social quality and to enhance the knowledge with potential to be valorised and to sustain further expansion of the horizon of action. PN 2 aims to achieve the three strategic objectives of the National RDI System, as follows:

1) Knowledge creation, respectively to achieve leading edge scientific and technological results, competitive at global level, in order to increase the international visibility of Romanian research sector and subsequently to transfer results in economy.

2) Increasing the competitiveness of Romanian economy by innovation, with impact at company level and by transferring knowledge in economy.

3) Increasing quality of life, respectively to find technical and scientific methods which support social development and improve its human dimension.

Therefore, the RDI system could become the engine for knowledge development in Romania, being able to support performance by innovation in all domains contributing to citizens' welfare and in the same time to achieve scientific excellence worldwide recognized.

In establishing the programs of the NP II there has been taken into account the fact that concrete actions must be primarily undertaken in order to increase the number of researchers, to improve their performances and increase the attractiveness of the research career. For this purpose, it has been set up Human Resources Program. In order to give researchers the possibility to work using competitive equipment, to benefit of an adequate management and to be permanently connected to socio-economic requirements, Capacities program has been set up. Taking into account the importance of basic research in developing knowledge and that it provides a solid base for applied research and technological development, through ideas, but also due to the capacity of training the highly skilled personnel necessary for these activities, the Plan includes a program called Ideas. Even though for this program there have been no specific priority domains established, and the emphasis is on international excellence and visibility, on research at the boundary of knowledge, on interdisciplinary and complex research in frontier domains and participation in international networks of excellence, there are several basic research areas of special interest, with potential in Romania. By concentrating the investment in these areas, the program supports also new areas, where research teams from Romania are already collaborating internationally. The program, called Partnerships in S&T priority areas, which is the largest program in the Plan, focuses on creating conditions for a better collaboration between the different

RDI entities, companies and/ or public administration units, in order to offer solutions for issues within research areas, identified as a result of the wide consultation performed during the foresight exercise carried out during the period September 2005 – May 2006. Most of the priorities of public investment in research & development are of interest also for basic research areas. Public investment aims at developing knowledge motivated by strategic socio-economic requirements, and the research is assessed according its innovative potential. The program *Innovation* was included in the plan taking into account the importance of finalizing research activities by practical results, related to technical and technological developments. This program will support pre-competitive and competitive research projects, as well as projects for the development of the innovation infrastructure. The program *Support for institutional performance* establishes institutional financing mechanisms based on competition, which enable high quality research entities, whether public or non-profit, to implement their own development strategies in accordance with the National Strategy for RDI. The assessment of institutional performances will be performed internationally, every 3-5 years. This program will ensure resource focusing, as well as the institutional development necessary to obtain international performances.

The objectives of Innovation is increasing the innovation, technological development and production assimilation capacity of the results of the researchers, in order to improve the competitiveness of the national economy and to improve the quality of life.

4. European public funding for RDI (pan-European Frameworks for RDI)

4.1. EUREKA initiative

Created as an intergovernmental initiative in 1985, EUREKA aims to enhance European competitiveness through its support to businesses, research centers and universities which carry out pan-European projects to develop innovative products, processes and services.

Through its flexible and decentralized network, EUREKA offers project partners rapid access to a wealth of knowledge, skills and expertise across Europe and facilitates access to national public and private funding schemes.

The internationally recognized EUREKA label adds value to a project and gives participants a competitive edge in their dealings with financial, technical and commercial partners.

Through a EUREKA project, partners develop new technologies for which they agree the Intellectual Property Rights and build partnerships to penetrate new markets.

The EUREKA clusters play a key role in building European competitiveness, driving European standards and the interoperability of products in a wide range of sectors. The result is a clear demonstration of the strength of pan-European teamwork in the European research area.

The EUREKA umbrellas are thematic networks which focus on a specific technology area or business sector. The main goal of an umbrella is to facilitate the generation of EUREKA projects in its own target area.

Each year hundreds of individual projects are initiated by European companies, an increasing number of which are SMEs. These contribute to improved wellbeing, security, environment and employment in Europe and beyond.

4.2. Seventh Framework Programme for research, technological development and demonstration activities⁽³⁾

Knowledge lies at the heart of the European Union's Lisbon Strategy to become the “most dynamic competitive knowledge-based economy in the world”. The “knowledge triangle” – research, education and innovation – is a core factor in European efforts to meet the ambitious Lisbon goals. Numerous programs, initiatives and support measures are carried out at EU level in support of knowledge. The Seventh Framework Programme (FP7) is designed to support a wide range of participants: from universities, through public authorities, to small enterprises and researchers in developing countries, starting with:

- Private companies – such as small and medium-sized enterprises (SMEs), private research institutes or other industrial participants.
- Public organizations – for example, public universities, regional authorities, public research organizations (PROs).
- Individual researchers – from both the public and private sectors.
- Researchers and organizations outside the European Union – whether from candidate countries, associated states, developing countries, emerging economies or industrial nations.

FP 7 will promote excellence in scientific and technological research, development and demonstration through the following four specific programmes: cooperation, ideas, people and capacities

5. Private funding for RDI

Private companies (large enterprises) are usually financing themselves their R&D costs. The share between debt and equities are subject to complex calculations made up by financial departments. In terms of knowledge acquiring, companies are using both their own centres or in cooperation with academic environment.

5.1. Pharmaceutical industry

Innovative prescription medicines and treatments are saving lives and giving patients new hope for a healthier future.

The mission of pharmaceutical researchers is a simple one – make new discoveries to cure and better treat disease. However, this mission is anything but simple to achieve. A new medicine's journey from the laboratory to the patient is a long, expensive and uncertain one. On average, it takes 10-15 years and \$802 million to develop just one new medicine. Each of these new breakthroughs comes only through many, many failures. For every 5,000 compounds tested, only one is approved by the FDA. Those that are only do so after a series of rigorous studies to demonstrate they are safe and effective (source: <http://www.innovation.org>)

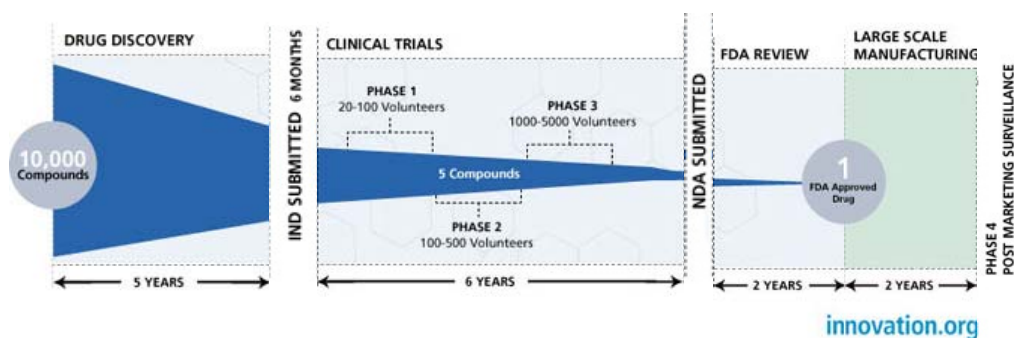


Figure 2. R&D process in pharmacology (source: www.innovation.org)

This record R&D investment reflects the continued commitment of America's pharmaceutical research companies to lead the world in the pursuit of new, life-saving and life-enhancing medicines. US pharmaceutical research companies have consistently invested around 18 percent of sales on R&D activities.

"The pharmaceutical industry is one of the most research-intensive industries in the United States. Pharmaceutical firms invest as much as five

times more in research and development, relative to their sales, than the average US manufacturing firm.”

5.2. Automotive industry

The vehicle research process varies considerably between mature markets and developing markets and even from one emerging country to another. Consumers are increasingly focused on fuel-efficient and alternative-fuel vehicles when making car buying decisions, especially in developing markets.

Forward-looking research in the automotive industry

As part of research work, it is dedicated a considerable amount of time and energy to traffic-related megatrends that will affect products and processes in the future. These include not only the increasing importance of environmental and climate protection aspects, but also the strong growth of megacities in some markets, which presents new challenges for infrastructure. At the same time, micromarkets will grow up alongside existing mass markets. A further point of focus is demographic change and the constant increase in the proportion of over-60s, who show a high degree of quality awareness, for example. In addition, customer requirements are diverging across society as a whole due to growing differences in income levels. And tomorrow's world of work will be more flexible than is the case today with regard to the tasks performed, the way in which work is organized, working hours and places of work. As a result of all these trends, products will be shaped to an even greater extent by intelligent and networked technology and ease of use by people. Driver assistance systems will bring increasing improvements in safety, while new vehicle materials will offer enhanced functionality and comfort.

6. Business case 1 – Broadband services for everyone over fixed wireless access networks – BROADWAN; project funded by European Commission under the 6th Framework Programme (2002-2006)

6.1. Introduction

The author of this work chose this project based on the following considerations:

1. It is publicly funded by European Commission, via the most important instrument implementing the EU policies, respectively the Framework Programme. In this particular case is the 6th Framework Programme which has been carried out within 2002-2006 <http://cordis.europa.eu/fp6>

2. Consortium members are both (multinational) companies such as: Telnor (NO), Alvarion (IL), THALES R&D (FR) Telecom operators such as: CEGETEL (FR), Telecom Castilla (FR), consulting companies, such as: IDATE (FR), NAVUS, academia, such as: Technical University Cluj (RO), University of Cardiff (UK), University of Salzburg (AT).

3. TEX BroadBand product developed by InterStarTech Ltd. (IL) is one of the products that have been developed as a result of BROADWAN project.

6.2. Brief description of BROADWAN

BROADWAN aims at developing broadband network architecture and technology, with a particular focus on wireless access. Broadband wireless access technology is establishing an efficient and integrated part of the global coverage of broadband fixed network, which provides converged multi-services for all.

6.3. BROADWAN objectives

The overall objectives of the BROADWAN project are:

Development of economical realistic network architecture for the provision of true broadband services for all citizens in Europe.

Positioning of European industry in the lead for next generation broadband fixed wireless access (BFWA) solutions.

Motivating advanced utilization of broadband services at all levels of society by performing demonstrations and trials in some rural areas.

6.4. Technical approach

The utilisation of broadband networks is becoming increasingly more important for the development of European society. Broadband services help and may even be absolutely necessary to maintain and increase the everyday quality of life irrespective of living area. Business, organisations, education, health care, culture, and community authorities are taking more and more advantage of broadband networks. The realisation of a European-wide broadband network is beneficial to the people as well as business and industry without damaging the environment.

Broadband technology helps European business and society in general, and radio-based technology in particular, has the potential of improving third world societies dramatically.

Efficient wireless access systems represent a possibility for ensuring that everyone in Europe is able to get access for broadband services within a reasonable time frame. Broadband radio access is a very important technology in achieving the goal of reaching all citizens. The requirement of pan-European service coverage leads to an access networking structure where wireless solutions are a necessity as well as an attractive contribution for achieving full service coverage. Seen at a global level European broadband communications industry in the lead should have a very interesting market.

Operational conditions will vary. In some areas wireless solutions will interwork or compete with other solutions, in other areas they will represent the only possibility. The radio solutions will be important for competition and represent an extension of the fixed network into the broadband nomadic and mobile domain.

6.5. BROADWAN organization

BROADWAN is organized in three main technical areas:

- Broadband access network requirements and architecture;
- Wireless access systems;
- Broadband network utilization.

The scope of the project encompasses a total solution for universal hybrid broadband access networks, including deployment guidelines and planning software, with focus on wireless access architectures and systems.

The area “Broadband access network requirements and architecture” will concentrate on topics related to user and system requirements, novel network architectures and advanced management of heterogeneous networks. The evolving broadband market will be characterised and technical-economical analyses performed. These studies will be used to identify the most appropriate network architectures, enabling widespread deployment of broadband access networks in Europe. Connection costs, available services, security and ease of use will be important factors for determining the possible network solutions, which will provide broadband connections for all (residential, SMEs, public authorities, organisations, educational institutions etc).

6.6. BROADWAN consortium

There are 25 BROADWAN partners comprising operators, industry, academia and consultancy. The partners from 10 countries represent all parts of Europe, both from north to south and from west to east. The significant numbers of SMEs are particularly focusing on broadband service provision.

Consortium partners			
Telenor	Norway	Thales Communications	France
Alvarion	Israel	Thomson	France
BUTE	Hungary	TUCR	Italy
Cegetel	France	University of Salzburg	Austria
CoRiTeL	Italy	University of Cardiff	UK
CNRS	France	Thales Research and Technology	France
IDATE	France	University of Buckingham	UK
Joanneum Research	Austria	T-Systems RIC	Hungary
Nera	Norway	Navus	Germany
Aniel	Spain	Moviquity	Spain
Rutherford Appelton Laboratory	UK	Infoglobal	Spain
TUC-N	Romania	Telecoms Connect	UK
Telecom Castilla-La Mancha	Spain		

6.7. Impact

BROADWAN results have an expected impact on several issues, in particular:

- True broadband global coverage;
- Simple architecture for effective interconnected networks;
- New and flexible end user equipment;
- New network solutions scalable for varying population densities and user demands;
- Service provision allowing and encouraging peer-to-peer capacity demanding applications;
- Fixed and nomadic users have access for all services over a single platform;
- Equipment vendors obtain a huge market for their products;
- Operators can serve customers in all regions irrespective of population density;
- Service trials demonstrate benefits and motivate rural societies to take advantage of the broadband network.

Results will be achieved through own research and in cooperation with other projects and national programs, by providing results to standardisation bodies, and addressing key policy outlined to enable Europe to be in the lead of using information technology at all levels of the society.

6.8. Conclusions

1. BROADWAN is a pre-competitive research project but is paving the way towards product development. Despite the fact that most of participants are private companies, they are entitled to receive public funds. Their activities are

not funded 100% by the European Commission but according to FP 6 rules (50% for R&D activities, 35% for demonstration activities);

2. BROADWAN is the first step towards a purely commercial project. Tex Broadband is one of the continuation of BROADWAN.

3. BROADWAN results are contributing for consolidation of an existing market. The deliverable nr. 34 “Business opportunities for broadband wireless solutions” – which is one of the most important in terms of future business – shows that WiMAX technology will be extensively used in rural areas, or low density population areas (e.g. Africa and some areas from Asia-Pacific) as WiMAX is a cheap and affordable solution⁽⁴⁾.

4. In emerging markets, WiMAX could allow operators to be freed from the crippling costs of deploying wire line infrastructures, which would in turn stimulate broadband development in urban areas” (source: BROADWAN project, deliverable 34 – Business opportunities for broadband wireless solutions). This lead to the conclusion that Tex Broadband product developed under WiMAX technology will be well accepted by potential markets, not only for domestic users but also for business and local/regional/national authorities, such as: fire brigades, police, ambulance, local/regional governments, etc.

5. WiMAX technology cannot yet be considered mature. The business models have yet to be firmly set, and it is still difficult to compare them with DSL models, which having been deployed on a massive scale. This massive deployment has in turn driven down the price of equipment – both the DSLAM and client modems – considerably over the past few years.

7. Business case 2 (RDI private funding): TEX BroadBand – a product developed by InterStarTech Romania SRL

7.1. Introduction

Inter Star Tech Ltd. decided to develop a new product which could be used by all IP Mobile WiMAX Core Network Interconnection Entity – named TEX BroadBand (TX BB), aimed to be sold in Emerging Markets. All R&D activities will be performed by InterStarTech Romanian SRL, the branch of InterStarTech Ltd. Israel.

The project’s aim is to develop a unique solution for WiMAX solution for emerging markets. The WiMAX is an innovative broadband solution which aim to be the solution for the 4th generation of the mobile networks. The project will be focus on developing inovative low cost solution for mobile WiMAX networks for interconnecting between the RAN (Radio Access Network) and the CSN (Core Service Network) with segmentation on emerging markets.

7.2. Market Study (extract from the TEX BroadBand market study performed by Inter Star Tech Ltd Israel)

7.2.1. State of the art

Although today it seems the internet is everywhere, this is far from the reality of most of the population of the world. Actually the situation is much more worst since there are large areas of the world in which people doesn't have personal phone line and in the good case have public phone in the centres of the villages. This situation is mainly common in rural areas in many places and especially in East Europe, Asia, Africa, Latin America but as well in many other places all over the world.

The WiMAX technology which gives a unique solution to bring broadband to everywhere and one network to carry quadruple services (Data, Voice, Video & Mobile services) is actually the solution to close this gap of internet to everyone and everywhere and by that mean close the digital divide gap. Currently as broadband technology we can find the cable modem internet services and the xDSL, and also in the cellular mobile network we can find the UMTS also as an infrastructure for that. The cable modem (DOCSIS) and the xDSL are usually not available in emerging markets and rural area (very high capex), and the 3G cellular networks are not offering enough bandwidth available for everyone in attractive price like the WiMAX can offer.

7.2.2. Market relevance & expected impact (economical & social)

The development of the internet connectivity, as well as its value added services is essential in today's world. However, a significant part of the world doesn't benefit this platform due to lack of infrastructure, developing countries are still behind and inability to reach remote rural areas of which there is not economical justification with traditional infrastructure, i.e. very low density of subscribers vs. high costs of cabling infrastructure (CAPEX). This is causing within countries and in between them "digital" discrimination which are badly affecting educational and business effectiveness which sometimes called as the digital divide.

The WiMAX is an excellent solution for those cases, together with the way the ASN/GW is designed to cost and effectiveness for emerging markets, it is expected to be adopted widely by operators. In some cases, governments intervene and offer financing for operators to help bridging this digital gap, which is bringing more invested money to this market.

The basic attributes of the emerging markets are as followed:

- Low GDP;
- Bad infrastructure;
- Typically low broad band penetration;
- Including markets in transition – Russia, India, China;
- All of Asia Pacific – countries, not including Japan, Singapore, Taiwan, Korea, Australia;
- All of Latin America, Middle East and Africa, Central and Eastern Europe.

7.2.3. Technological innovation and strategic relevance

Mobile WiMAX is developing the technology to fulfil the fourth generation of cellular mobility. Compared to today's third generation solutions, the WiMAX brings added value in speed, full IP based infrastructure, always on connection and service level agreement which can determine the quality of service of a mobile user. The WiMAX 802.16e standard based systems are in development by many major players in the telecom market, some of them even focus on the ASN function only, while WiMAX networks fully based on 802.16e are not yet deployed in the world. Taking part of the WiMAX revolution in providing "personal broadband" in this phase is strategic to assure a significant market share. Focus on emerging markets is even more relevant since these will be among the first markets that WiMAX technology will enter.

7.3. Economic justification of the project proposal

7.3.1. Contribution to the competitive growth of the beneficiary company

In the terms of contribution to competitive growth the following can be mentioned:

- WiMAX as a technology is defined sometimes as a Wireless DSL broadband equipment, in that respect it competes the current solutions for data broadband connectivity like xDSL and also compete with cable TV solution in bringing internet connectivity and IPTV.
- WiMAX mobile is aimed to be the forth generation mobile network infrastructure, in that respect the WiMAX will compete the 3G cellular network solution like UMTS, EvDO (CDMA200 based) and also with what is targeted to be the forth generation cellular infrastructure for mobile broadband connectivity, LTE.

7.3.2. Existence of some favourable market situations for the product/technology/ service resulting from marketing studies

As mentioned above the outcome of this project will be All IP Mobile WiMAX Core Network Interconnection Entity for Emerging Markets with mainly focused on delivering primary voice services. Currently there is no standard based technology which brings low cost broadband connectivity to emerging markets. Based on research the total WiMAX market by 2010 will be 3.2 billion USD, the part of the emerging markets in the 3.2B\$ are 1.5B\$ which represents 47% of the total WiMAX market by 2007. As mentioned above the expected market revenue of ASN/GW's by 2010 will be in the emerging markets 200M\$.

8. Conclusions

8.1. Public vs. private research

Apparently public R&D is fulfilling society needs and at the end of the day results are not important for economic environment, but the most important is to spend the approved amounts correctly. Project results seem not to be significant. It is said that publicly funded R&D is not offering competitive advantages to applicants. It has to be specified that, in this particular case, academic institutions (R&D centres, universities or state owned undertakings) are not taken into discussion as they are almost exclusively interested to publish in prestigious journals, to publish books or to be known among international scientific communities.

Companies are interested in making profits, in growth, in market shares, in a better position within the industry and, ultimately, to give higher amounts to shareholders. Are the two systems antagonists? At the first view, companies are not interested in public research as most of participants to public R&D programs are academia or NGOs. However, in industrial R&D from public programs, we can see an important number of companies. What are they looking for? Why are they subsidising their participation, as governments are not paying 100%?

BROADWAN and TEX BroadBand projects (Business case 1 and Business case 2) could be considered as representative for a trend that companies are following, respectively to access public R&D funds with a similar role as insurance policies against some risks, mainly the technological risks.

FX risks, change in commodities prices are mitigated using other means, like the use of derivatives:

- BROADWAN is a high risk project in terms of technology development and business perspectives. Even WiMAX Technology is very new and manufacturers would be ready to produce large amounts of devices, it is not sure that markets are ready to accept such an innovative product. Once BROADWAN is completed, members of the consortium are aware of important elements related to technology itself and market disponibility to receive WiMAX devices. It means that all risks are decreased and BROADWAN makes the first step forward towards definition of mature markets.
- TEX BroadBand aims to be sold to three categories of clients:
 - Individuals;
 - small companies in need of transferring large amounts of data at high speed;
 - local/regional/national authorities and governments as TEX BroadBand could be used for fire brigades, ambulances and police cars.

TEX Broadband has the advantage that is a no longer a risky project in terms of technology development and less riskier in terms of business. The financial burden is drastically diminished.

8.2. Conclusions

R&D is an indispensable necessity for innovation dynamic and competitiveness. Among other things, the long-term competitiveness of a developed country counts as endangered if (1) its industry conducts considerably less R&D than industry in other developed countries, or (2) the research profile of its industry bypasses the most promising technological areas for the future markets. companies become active abroad in R&D either (1) in order to optimize the adaptation to foreign market conditions and to increase foreign market shares (market motive) or (2) in order to access specific knowledge in specially suited locations or to generate it there (knowledge motive).

Multinational involvement in overseas research and development R&D has increased significantly during the past decade. Multinational firms from North America, Europe, Japan, and South Korea have accelerated the pace of their direct investments in overseas R&D. In addition, a number of multinational companies have established or acquired multiple R&D

laboratories abroad and are increasingly integrating these laboratories into a global R&D network.

The expansion of foreign direct R&D investments in the United States during the past decade took place amid a significant increase in global mergers and acquisitions. Foreign acquisitions of US companies have had a significant impact on the overall R&D data, both in terms of foreign R&D expenditures and FDI in R&D in the United States. Although there was a widespread surge in the late 1980s in acquisitions in all industries, such as computers, banking, semiconductors, steel, and tires, the largest impact on R&D funding and direct investments was in the acquisition by foreign multinational companies of US drugs and biotechnology firms with large R&D budgets (Serapio Jr. et al., 1999).

During recessions and crises periods, one of the measures that governments should have been taken is to INCREASE the public amounts (both in real terms and as % of GDP) for public R&D programs, and encourage companies to develop products & technologies from public funds, as many risks are considerably diminished.

Notes

- (1) According Trott, P., – Innovation Management and New Product Development, third Edition, p5, Prentice – Hall, 2005.
- (2) See The Innovation Union's performance scoreboard for Research and Innovation, 1 February 2011, available at http://ec.europa.eu/research/innovation-union/pdf/iu-scoreboard-2010_en.pdf.
- (3) The Seventh Framework programme for European Community of Atomic Energy (2007-2011) is separate.
- (4) Extract from BROADWAN D34, p. 12. “The factors that provide the market’s various players with an incentive to deploy WiMAX include the capacity to: ...Provide a lower-cost, reliable and robust solution: wire line infrastructure deployments require massive investments. WiMAX, on the contrary, can be deployed using existing infrastructures (towers, high points...) and scaled for optimal usage (calculating the adequate number of base stations based on potential market).”

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