	I3E ***South East Europe TCP***

Final Document

30 Best Practices
SWOT ANALYSIS

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I. EMBEDDED SYSTEMS FUNDAMENTALS

Every day our life becomes more and more dependent on the embedded systems, which include not only safety-critical applications such as automotive devices and control, aircraft, aerospace and medical devices, but also communications, mobile and electronic environment, the "smart" home, cloths, factories etc. All these factors have a big influence on our society, including security, privacy and modes of working and living. More than 98% of the processors applied today are in embedded systems and are no longer visible to the customer as 'computers' in the ordinary sense.

Definition: An embedded system is a combination of hardware and software which creates a dedicated computer system performing specific, pre-defined tasks and that is embedded as a subsystem in a larger system, if it is not an independent device. An embedded system can be also defined as a single purpose computer.

Special Features: In general, an embedded system

- Is a system created to complete its specific tasks, completely or partially independent of human intervention;
- Is specially designed to complete specific tasks in the most efficient way;
- Interacts with physical elements in our environment, controlling and driving motors, sensing temperature, etc.

Most embedded systems are time-critical applications (Real-Time Constrains, RTS). That means that the embedded system is working in an environment where timing is very important: the results of an operation relevant only in case for concrete time frame. The question of time is principle. Even correct results received a little bit earlier or a little bit late are wrong.

For example, an autopilot in an aircraft is a time-critical system. If the autopilot detects that the plane for some reason is going into a stall then it should take a step to correct this within milliseconds or there would be catastrophic results. There are embedded systems which are not RTS (for example off line Palm tops).

From an implementation point of view, there is a major difference between a computer and an embedded system. Embedded systems are often required to provide real-time response. A real-time system is defined as a system whose correctness depends on the timeliness of its response. In some real-time delay in response is a fatal error, but in others a small delay is acceptable. The real-time systems can be classified as:

- Hard real-time system – systems with severe constrains of timeliness of the response. Examples are flight control system of aircraft and sensor systems in a nuclear reactors and power plants.
- Soft real-time systems – systems which tolerate small variations in response times.
- Hybrid real-time systems – systems which exhibit both hard and soft constrains of its performance.

Embedded systems could be economical, but they are often prone to some very specific problems. A personal computer may ship with a glitch in the software, and once

discovered, a software patch can often be shipped out to fix the problem. An embedded system, however, is frequently programmed once, and the software cannot be patched.

Even if it is possible to patch faulty software on an embedded system, the process is frequently far too complicated for the user.

Another problem with embedded systems is that they are often installed in bigger system for which unreliability is not an option. For instance, the embedded system controlling the car brakes cannot be allowed to fail under any condition. So, following this logic, many of the programming techniques used when throwing together production software cannot be applied for embedded systems. Reliability must be guaranteed before the chip leaves the factory. This means that every embedded system needs to be tested and analyzed extensively. An embedded system will have very few resources when compared to full blown computing systems like desktop computer, the memory capacity and processing power in an embedded system is limited. It is more challenging to develop an embedded system when compared to developing an application for a desktop system as we are developing a program for a very constricted environment. Some embedded systems run a scaled down version of operating system called a real time operating system (RTOS).

The general characteristics of embedded systems are:

- Complete a single task (usually embedded systems are not for general purpose);
- Increasingly high performance and real time constrained;
- Power, cost and reliability are important considerations;
- They are hardware & software (HW-SW) systems – software is used for more feature and flexibility and hardware for performance and security.

A detailed view on embedded systems shows that:

- The vast majority of CPU-chips produced world-wide today are used in the embedded systems and a smaller number of CPU's is applied in personal computers;
- Every year five more times software for embedded systems are developed than'regular' software. The number of software engineers designing embedded systems software rose from 2 million in 1994 to more then 10 million in 2010.

One of the commonly used classifications of embedded systems is:

- Distributed and non distributed;
- Reactive and transformational;
- Control dominated and data dominated.

Generic structure and properties:

As a structure the processor can be microprocessor, digital signal processor or microcontroller (8-bit-devices in old embedded systems and 16 or 32-bit-devices in up-to-day systems - Fig. 1). The new applications in the areas of imaging, rendering and compression, multimedia and recognition demand higher bandwidth enhanced processing capabilities, quicker response times and more efficient algorithms. There is definite requirement of processors with multiple cores that would improve the throughput of the

application while reducing power consumption, cost and operation and increasing reliability. A lot of gaming consoles and network processors use multi-core

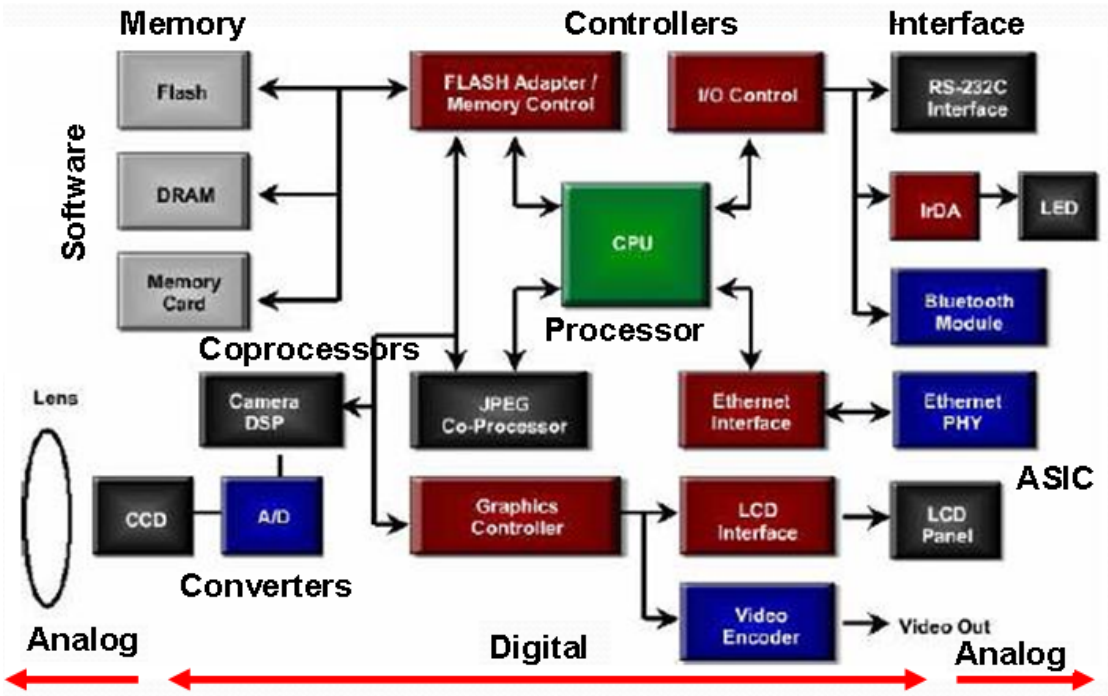

Figure 1. Generic structure of embedded system

The system has a communication path with interfacing environment. For a long time, embedded systems were mostly operating as stand-alone systems, but the situation has changed when the advent of wireless connectivity appears.

The recent trends in wireless connectivity regarding the use of the embedded systems are in the area of System-on-Chip (SoC) architecture, reduced power consumption and application of short range protocols. Generally, SoC is the integration of a microcontroller with the radio modem in a regular 64-pin out single chip, which requires few external components and the programming is simple.

The critical part in SoC is the optimization of the printed antenna with the transmitter and receiver. In the near future more widespread applications on the base of both short-range wireless protocols (Bluetooth, Zigbee, Radio Frequency Identification, Neat Field Communications) and long-range protocols (Wireless Local Area Network, WiMAX, cellular communications) will be created.

All embedded systems are processor based systems, but not all the processor based systems are embedded.

Application-specific integrated circuits (ASIC) are significant component with low power consumption, low cost and enhanced performance and with disadvantages such as higher development effort (debuggers, compilers etc) and larger time to market. Usually an

embedded system requires mechanical assembly to accommodate all the components and create a product or a complete embedded device.

The lowermost layer comprises the printed circuit board that accommodates all the semiconductor devices, buses and related electronics. The semiconductor devices may include Application Specific Integrated Chips (ASIC), Microcontrollers (MCU), Field-Programmable Gate Arrays (FPGA) or a System on a Programmable Chip Builder (SoPC).

The operating system traditionally is proprietary and significant overhead faced by manufactures of embedded systems was the payment of royalty. This has changed due to the operating system Embedded Linux with free and licensed versions, which remains an attractive choice for developer of embedded systems.

A large number of producers provide for free their source code to computer engineers or other producers. The same situation is with the Android software of Google.

The architectural layers for an embedded system are as following (Fig. 2):

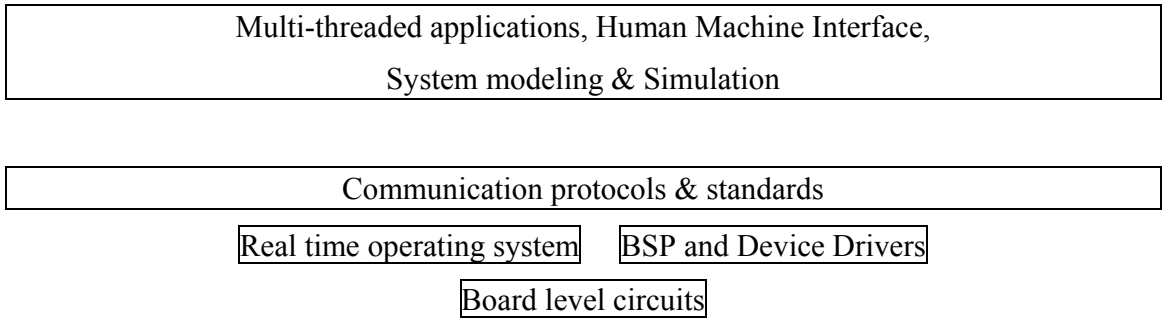

Figure 2. Architectural layers for an embedded system

The board support package (BSP) is a specific support code implementation for a given board (for example the device motherboard) that conforms to a given operating system. It is commonly built with a boot loader that contains the minimal device support to load the operating system. The uppermost layer is the application layer. We could see some principle differences in the design and application of embedded systems comparing to the general computing system. The embedded systems perform a limited set of pre-defined functions and have a limited field configuration capability.

The security of embedded systems is critical by the reason of increasing interconnected world. The security requirements for the huge base of embedded systems are restricted because of the limited memory, constrained middleware, and low computing power. The confidentiality and integrity of sensitive information is partially implemented through the use symmetric key algorithms as Data Encryption Standard (DES and 3-DES) and Advanced Encryption Standard (AES).

Unfortunately, many networked embedded systems are rather poor in the encryption to protect sensitive information. The reason for this could be resource limitations, cost restrictions, or design limitations.

Extension of a legal system onto an open network (Ethernet or Intellectual Property) could also cause security loopholes in the system, that makes the system menaced externally. The information that is not strongly protected could be read, modified and removed.

If proprietary wireless RF links are involved, the danger is further amplified. Anyone with suitable equipment can attack the system, possibly from a substantial distance given a high-gain antenna. Insufficient cryptographic protection can lead to compromises, many of which are not apparent at the time of system design. A prudent designer must consider the implications of intercepted, deleted, modified and lost information from all the components of a networked system, and take appropriate steps to protect the system against attacks. On Fig. 3 one can see the block diagram with more detailed 'typical' architecture of embedded system.

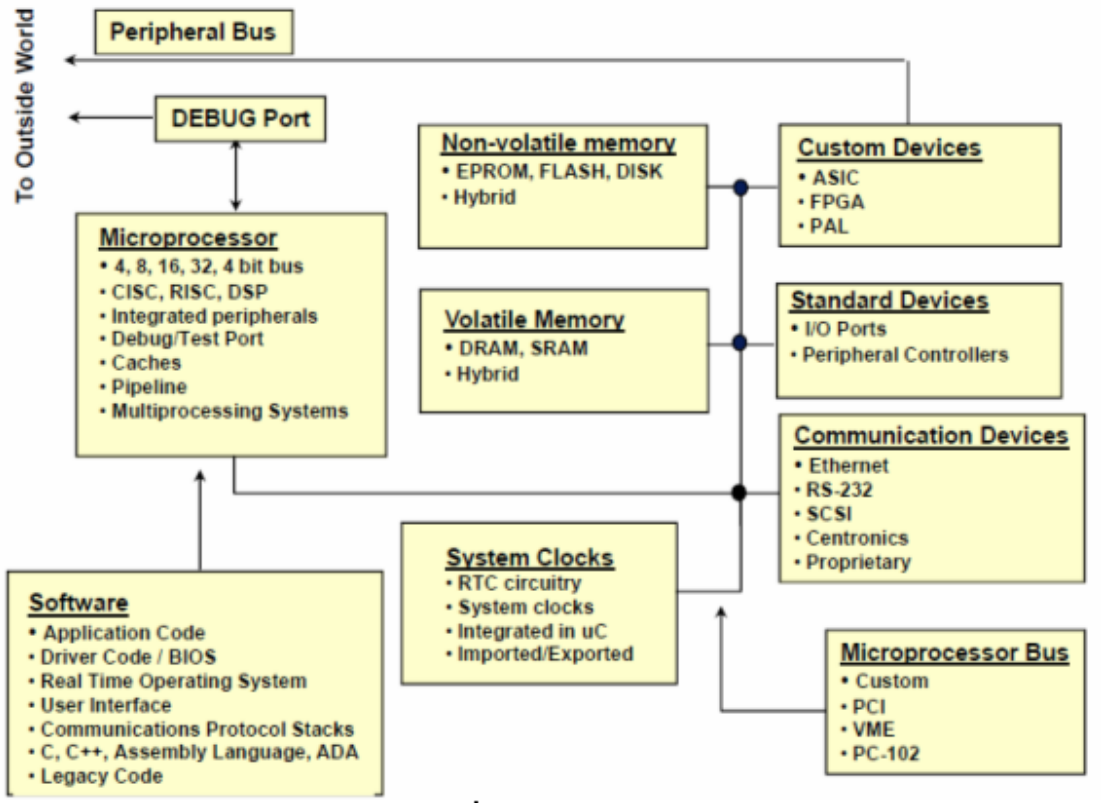

Figure 3. Block diagram of embedded system

The packaging of embedded systems is standardized, which enables them to be relatively static and simple in functionality. There is a requirement for low cost, small physical footprint and negligible energy consumption and electrical radiation. At the same time the embedded systems need to be physically rugged and impervious to external electrical and electronic interference. The embedded systems invariable have limited resources in terms of memory, central processor unit, screen size, a limited set (or absence) of key inputs, diskless operation, which play a crucial part during the design, development and testing of systems. They also require a host of diverse skill-sets related to hardware, embedded software, electronic and mechanical domains, which render further complexity to their development.

Application areas: Embedded systems can be found in an enormous range of electrical items ranging from simple, inexpensive products such a digital watch to expensive,

complex products. They become an integral part of daily life. These systems are used in smart cards, music players, routers and make part of the in automobile electronics.

Consumer products.

There are a lot of ways and different methods to use the embedded systems in different products. The use of embedded systems in electrical products can solve many problems of complexity and product size. The most obvious beneficiaries are those enterprises concerned with the production and sale of electrical devices, as the inclusion of microcontrollers to replace general purpose microprocessors can decrease unit manufacturing costs and end user prices dramatically, resulting in increased sales and an improved profit margin. As embedded systems in consumer electronics can be cited home appliances, PDAs, music and DVD players, set-top boxes, digital cameras, video games.

Telecommunications and data communications. We could mention here the router, switches, bridges, cellular phones, smart devices, networking gateways, copiers, printers, fax machines, multi-function peripherals, storage devices and smart cards.

Automation and industrial control. We could mention here building automation (heating, ventilation, air-conditioning), utility meters, special purpose controllers, networking and process control, smart sensors. In the last case the principle 'sense and transmit' is valid: the sensing is scheduled so that the device is sleeping more than 99% of the time and the current consumption is of the order of 1-2microA.

Automobiles. A modern automobile may contain dozens of embedded systems to control a wide range of processes within the car, ranging from brake balance control to air conditioning to the ignition system. Without embedded systems it would be impossible to computerize all of these features without the inclusion of mass of complicated, fault prone electronics. The only realistic alternative to use embedded systems in a modern automobile would be to install a fully functional personal computer within the car to control all of the functions currently managed by microcontrollers. While this may be feasible it would raise two basics issues:

- Size & weight: Microcontrollers are designed to deliver maximum performance for minimum size and weight. A centralized on-board computer system would greatly outweigh a collection of microcontrollers.
- Efficiency: Microcontrollers are designed to perform repeated functions for long periods of time without failing or requiring service. Other computer systems are prone to software and hardware failure as well as a whole host of other problems recognizable to the users of any home computer. Above all other considerations, computer systems must be 100% reliable when trusted to control such functions as braking in an automobile.

Some embedded systems in automobiles are electronics for security and power train, in-vehicle entertainment and infotainment systems.

Medical electronics. The patient monitoring, diagnostic equipment, surgical systems, imaging, and electronic stethoscopes.

Aerospace and military. In this area the mission- and safety-critical aerospace and defense embedded systems require stable real-time performance, scalability and high-availability facilities. An elaborated hardware and certificated software (for example based on RTCA DO-178B standard) are obligatory. In some cases a software platform backed by powerful

distributed computing is applied. As examples of the embedded systems could be mentioned the satellite systems, weather systems, flight control systems, aircraft management systems, radar, navigation and sonar.

II. BEST PRACTICE CASES

1. ECOPLUS - Technopol Program Wiener Neustadt Center for Modern Industrial Technologies

Technopol Wiener Neustadt, with focus on "Modern Industrial Technologies", represents an innovative approach to support regional development in the frame of the Lower Austria's Technopol Program.

With the objective of bridging the gap between higher education, industry and research and development (R&D) the so called "Technopol-program" of Lower Austria was founded in 2004. In order to enable a coordinated technology-oriented regional development for each of the three Technopol locations at lower Austria, one local expert per Technopol was hired. The duty of the Technopol manager was to act as a hub between the stakeholders.

The Technopol location Wiener Neustadt focuses on five technology fields such as a) materials, b) surfaces, c) medical technology, d) processes and e) sensors-actors, which are summarized as "Modern Industrial Technologies". In each of these areas at least three independent facilities with overall staff of at least 30 scientists ensure the necessary critical mass.

The aim of the Technopol manager is to double the amount of scientists from 300 to 600 at the Technopol till 2013 and to build a strong network between the thematic-linked companies, higher education and R&D facilities.

http://www.ecoplus.at/

2. IEA - TECHNO SEED - A concrete way to promote entrepreneurial initiatives in ICT field

The Techno Seed is an initiative founded by the Ministry of Economic Development of Italy with participation of University of Udine and two research centers. It has been developed in North-East Italy and is one of the 11 incubation projects founded by the Ministry. The aim is to collect good and innovative ideas in the ICT field, turn them into concrete innovations, and launch business through the creation of new enterprises. The project aims also to stimulate the development of an entrepreneurial culture and strengthen the relations between the University and the regional economic system. This initiative will make it possible an expert's team to develop an idea and transform it in into real enterprise.

The project structure has three phases:

- The first one is Entrepreneurial Training, which consists of carrying out workshops on business culture and preparation of a provisional business plan (really 32 seminars were organized with about 1000 participants). Finally, the Scientific and Technical Committee chaired by the scientific director of the project and composed of 9 members, selects 36 potential entrepreneurs.
- The second phase is Entrepreneurial Project Development, which ensures advice and support services to develop a business plan. An entrepreneurial laboratory is going to support the business plan preparation and a technological laboratory – to verify the feasibility of the idea. This phase brings to the identification of 12 new enterprises.
- The third phase "Start-Up and Incubation" foresees a possibility to use financial contribution to start the activity and to use the incubation services inside appropriated spaces – the sustaining of each enterprise was ensured with financial support of €20000.

http://technoseed.it/

3. UOM - Finland's Strategic Centers for Science, Technology and Innovation Example: TIVIT - Producing Innovations for the ICT Industry

TIVIT is abbreviation of the Finnish title "Information and communication industry and services" of one of the Finnish Strategic Centers for Science, Technology and Innovation. The Center is founded in February 2008 as a non-profit organization with the main goal to unify the efforts of 16 Universities, 5 Research Centers and 25 companies and public organizations (including Ericsson, Nokia and the Finnish Information Society). It aims to implement innovation policy in the ICT industry, to foster research and to ensure that the research results are used in the business more rapidly than it has been possible. International cooperation plays a key role in the center's activities. The companies and the institutions involved in the projects can enlarge and enrich their know-how, which in the same time can be transferred into new projects, to be copied and used in new market sectors. Each presented project must comply with 5 criteria, including: Prove of novelty and strategic impact of the research; Balance between industry and research at program level; International collaboration and impact.

The annual investments in the Center are around €40-60 million. Currently, six programs are underway: Future Internet, Flexible Services (electronic services in which the needs of local production are emphasized), Devices and Interoperability Ecosystems (new reality and networking intelligent devices and spaces), Cooperative Traffic (road traffic and traveling for the next generation), Cloud Software (Internet services and information security) and Next Media. Business concepts must be also created for increasing the pace of development of both products and services, to prepare the market for their arrival, as well as to receive feedback from the market. The research as a whole aims to meet the needs of Finnish industry and society within a five-to-ten-year period. The decisions in the Center are taken by a board composed of 12 members and 12 deputy members, all coming from industry.

www.tivit.fi

4. ISI – Syrinix

Syrinix Limited is a company established in 2004. Syrinix is a spin-out company from the University of East Anglia in Norwich. It is aware that the water leak detection and location facilitates the prevention of larger leaks and allows the water companies to intervene successfully to prevent the catastrophic failure of pipes and the subsequent loss of water and potential damage to surrounding infrastructure (buildings, roads, etc.). Therefore, the company Syrinix developed signal processing techniques and equipment to detect and locate very small leaks in large-trunk water mains. The detection stops bigger, more devastating leaks from springing up and helps water companies preventing massive loss of water and damages to roads and buildings surrounding the pipes. The company believes that the created algorithms are the most sophisticated and the most sensitive leak detection algorithms available. In the project, novel data acquisition tools were developed, which can capture and communicate high frequency hydraulic data from water mains. This enables optimal pump scheduling to be used in a low-risk manner leading to a reduction in energy consumption. Even small reductions in the use of water pumps represent significant carbon savings. The project provides an integrated solution which continuously monitors and analyses the dynamic hydraulic conditions in large diameter water transmission pipelines. The data will be used to classify and track the pressure changes in the pipes and produce a model for optimal pump scheduling, thus minimizing energy consumption. Using a state-of-the-art multi-sensor head attached to a tapping on the main, the developed system continuously monitors the section of pipes spanned by a pair of sensors. A stochastic modeling system spots new leaks and raises an alarm. The pipe can then be repaired before it fails catastrophically.

http://syrinix.co.uk/

5. ISI – INNOPOLE Regional Innovation Pole of the Region of Western Greece

The Regional Innovation Pole of Western Greece is a union of public and private sector key players in the Region of Western Greece aiming at the development, promotion and exploitation of innovation in the Region. The pole has succeeded in bringing together universities, technological institutions, research institutions, business support organizations, regional authorities and the entrepreneurial stakeholders of Western Greece in the effort to combine their capabilities and to facilitate the overall growth of the Region. The Regional Innovation Pole focuses on three axes that represent the areas of strategic importance of the Region of Western Greece: Technologies of Informatics and Communications, Safety and Technologies of Foods, Environmental Management and Protection. The tools utilized by the pole comprise 9 R&D consortia, 4 infrastructure development activities, 3 spin-off companies, 1 technological platform, 1 educational / training course, 6 horizontal activities for the development of tools and methods for the pole viability.

The Regional Innovation Pole of Western Greece was funded by the Greek Operational Program Competitiveness under priority axis 4 “Technological Innovation & Research” and measure 4.6 “Creation of Regional Innovation Poles”. The overall budget of the project amounted to 4, 39 M€ of which 25.6% was private sector participation while public expense came from the Greek state (50%) and from the European Union (50%). The project followed a public call procedure and was accepted on a competitive way.

http://www.innopolewest.gr

6. BICT - Sirma Young Spirit (SYS) -Early Stage Financing

Sirma Young Spirit program is a natural continuation of the internal R&D activities of the Bulgarian company Sirma Group. It is designed to help young entrepreneurs developing their business models in the field of Information Technologies (IT) and providing them with seed investments, which are the earliest stage in the chain of venture funding. The program is key part of Sirma's strategy to look for new business ideas and to seek, promote and develop innovations. The program encourages and supports innovative idea in the field of Information Technology if a team of 2 to 5 young entrepreneurs stands behind the idea and they are ready to work overtime and exclusively on the idea for the next 6 to 12 months without any side committed with full dedication. The main goal of the program is to help young entrepreneurs go through the first phase of development of their business models: develop an impressive prototype and business plan to attract further investment, develop an initial version of their product or try to reach the market. The implementation of each project within the program is based on the principles: strong project management and development team, strong preliminary analysis of the market to assess key product/service requirements, proper planning, adequate financing, on-time development, well prepared product/service launch, and on-going development.

http://www.sirma.bg/sys

7. ISI - Intelesens Limited Sensor Technology & Devices (ST&D)

Intelesens is a leading innovator in targeted non-invasive vital signs monitoring in UK. It develops and manufactures own products and also designs products for OEMs. The company competitive advantages are due to its non-invasive wireless medical devices combined with medical sensors and electrodes, which involves in-depth expertise including wireless telemetry, low power consumption electronics, embedded software, cardiology, body sensors and low level signal processing, screen printing solid gel electrode manufacture, science of the skin including long-term non-irritant materials, defibrillation techniques and recovery as well as medical systems approval. The company's non-invasive wireless medical devices combined with medical sensors and electrodes are ultra miniature intelligent sensors which are worn on the chest and can monitor a range of vital signs including ECG, heart rate, respiration, temperature and motion – all with hugely reduced motion artefact. Super efficient, customized patch electrodes, on-board intelligence and efficient electronics and telemetry greatly extend battery life as only the clinically significant data needs to be transmitted. The company is shipping the world's first intelligent system that monitors ECG arrhythmia event, temperature and respiration rate continuously. It is shipping an in-home foetal monitoring patch that could help expectant mothers predict the onset of their own labour as well the OEM products for monitoring of other human vital signs such as blood pressure and the physiological measurement of muscular or vascular activity.

http://intelesens.com/

8. JSI - Cardio & Brain Signals - Signal conditioning system for physiological signals

The Cardio & Brain Signals – a Signal conditioning system for physiological signals was developed by joint effort of several research institutions under the 6th framework project BRACCIA. The development team was funded by the EU and Slovenian research and development agency with the main goal to design and develop a new system for data acquisition easy-to-use and operate. The system was successfully used for a number of measurements on humans and rats during anesthesia under the project BRACCIA and by other research institutions for their specific use more specifically the Faculty of Arts at the University of Ljubljana.

The Cardio & Brain Signals is a 12-channel signal conditioning and acquisition system, specially designed for the purpose of measuring and observation of the causality of interactions between the natural biophysical oscillations during general anesthesia. The device technical design is based upon high-end A/D conversion. The obtained digital signals are preprocessed by a soft-core processor and sent via USB to a standard PC equipped with custom software for additional data processing, monitoring and storage. The fact that the signals are preprocessed by an embedded system makes it very easy to use.

The device was designed to target hospitals and various research institutions as primary customers/users. With new publications in international journals from studies performed with the Cardio & Brain Signals, the device has proven to be useful in different areas than it was designed for, and it has been internationally recognized. Its hardware could be used in different scenarios by simply modifying the acquisition software running on standard PC. Additionally, the system is easy to use by personnel with different professional backgrounds, mostly medical staff. As the device was designed with simple housing with no buttons, the operator must only attach the sensors and connect the device to the PC with single USB cable and start the software to begin recording. Additionally, the device could be powered via mains power supply or in case of bad signal quality with battery.

The project received an important feedback from a large set of measurements performed at three research institutions during the project BRACCIA. The device and the accompanying software went through several iterations where the hardware and software were upgraded to improve performance and eliminate any possible errors. Besides that, several journal papers were published from data recorded with the Cardio & Brain Signals.

http://dsc.ijs.si/en/

9. ISI - CORALIA Clusters Initiative

The Corallia Clusters Initiative is funded in the framework of the Greek Operational Program Competitiveness and the Regional Operational Programs 2007-2013 as a facilitator of innovation clusters. The initiative aims at development of innovation clusters in high technology sectors that present high potential for increasing their competitiveness, improving their position in the global market and adopting a model for the provision of high added-value services. The emphasis of the initiative is on the transformation of the Greek economy from a "low labor-cost economy" model to a "high added-value service" model focusing on knowledge economy. Corallia has already supported the development of a cluster in the sectors of nano/micro electronics and embedded systems with over 100 Greek innovation companies in these fields and about 40 academic labs and research institutions coming from industry, academic and research organisations all over Greece. The Corallia initiative is in line with the Greek policy for the promotion of clustering in knowledge-intensive and exports-oriented technology segments, where Greece has the capacity to build a sustainable innovation ecosystem and can attain a worldwide competitive advantage. During the first phase, on January 2007 was established a Microelectronics Innovation Centre in Marousi, Athens, Greece providing a reference point for all interested stakeholders involved in Nano/Microelectronics & Embedded Systems. At present, the project is at its second phase, whereas the following R&D projects have been implemented:

- action I - Support of 10 New and Very Small Innovative Enterprises,
- action II – 3 Collaborative Research and Development Projects,
- action III - State-of-the-art industrial research of 7 innovative enterprises with co-investment from private investors,
- action IV - Horizontal support of entrepreneurial development of 34 enterprises for actions like submission of patents, professional training, and participation in international fairs
- action V - for the support of mi-Cluster with 8 projects.

http://www.corallia.org/en.html

10. JSI - KIBERsik– Electricity Peak Shedding System for energy efficiency in industry

The KIBERsik system is part of SmartGrid technology and enables consumers and producers of electrical energy to become inter-active with electricity networks. It uses the technology of targeting the power consumption in fifteen-minute intervals, which considerably reduces electricity bills in a not well balanced or adapted consumption. The system can be used in all types of industries, but also other types of companies, for example in metal industry, wood industry, textile industry, glazier industry, paper industry, rubber industry, metallurgic industry, food industry, etc. KIBERsik system is already available in Mitsubishi sellers grid in Europe and South Africa. The predicted savings in electrical energy expenses, apart from other effects of the system on production costs and quality, are in average at 13% peak demand reduction and 0.9 years pay-back period with highs in energy intensive industries at over 20% reduction, and the longest paybacks registered at 2.2 years. Companies can have different contracts on supply as well as on the measurement of peaks, and the KIBERsik system covers all the possibilities enabled by the tariff system. Based on the use of advanced methods of predicting energy consumption and scheduling, the peaks are reduced by load shedding - switching off or discharging loads, by scheduling of operations and by using own electric power generation sources. The KIBERsik system is composed of one or several industrial controllers to which measurements and loads are connected, and of one or several control computers. All computers are interconnected in a network. The system was evaluated on 5 locations – by representatives of paper, paperboard, foundry and process industry and a distributor of electrical energy.

www.inea.si

11. RDF-RWG - Competence Brokering Linking SME Needs to Research Opportunities

Research-based brokering is a sub-program of the program Mobilisation for R&D-related innovation (MOBI), organized by the Research Council of Norway. A host institution for a centre usually cooperates with one or more research institutions, organisations or enterprises in respect of the establishment, operation and funding of the centre and thus form a CoE consortium.

Norway has certain advantages that can be utilized to promote knowledge development at regional level. The subsidiary goals are the following: Increase the R&D activity of SME; Improve the reception capacities of SME; Strengthen the economic competitiveness of SME; Strengthen the knowledge of new technology adopted by the SME; Strengthen the links and communication between R&D institutes and SME Support technology transfer from universities and technical colleges; Increase the knowledge of the TT-process and the methodology. The main strategy of the project is the involvement of the competence mediators who work as innovation carriers between SMEs and Research Institutes within a framework, which takes advantage of a proactive approach to transferring innovation. A representative example is the particular BP which has been designed to convince SME that R&D is a better and more profitable way of doing innovation. The Project Management involved the hire of staff as competence brokers in different geographical areas with a good background on science and applied research.

http://www.cmr.no/

12. FNBU - EuroGPS SafeDrive

EuroGPS SafeDrive is a GPS-based vehicle speed monitoring alerting system with a state-of-the-art centralized POI management, automatic Web-based POI database distribution and update into the plug-and-play GPS devices. It was developed by ICOM Ltd., which is a leading Bulgarian technology provider specialized in the field of telematic, ITS, and LBS for the corporate and consumer markets.

By further enhancing its current products offerings, EuroGPS introduces the EuroGPS eVehicle - next-generation platform, consisting of modular and extensible hardware, firmware and software modules, which enable a flexible staged approach to the implementation of a full spectrum of vehicle-centered location-enhanced applications and location-based services both in the eCall core service – this is the initial service, which includes the following: platform (combined with B-call value-added services as Road user charging) that will support:

- integration of the existing product EuroGPS TollCollect within the EuroGPS Fleet management, Asset management, and Driver Management eVehicle platform;
- integration of the existing product line EuroGPS Stolen vehicle recovery SmartTracker within the EuroGPS eVehicle platform:
- integration of the existing product line EuroGPS Fuel-consumption SmartTracker within the EuroGPS eVehicle platform;
- monitoring the integration of the existing product line EuroGPS PAYD rental, leasing, and SmartTracker within the EuroGPS eVehicle platform;
- insurance through the integration of the existing product line Speed camera EuroGPS SmartTracker within the EuroGPS eVehicle platform;
- tracking - through the integration of the existing product EuroGPS SafeDrive Digital Tachograf, Eco routing, Remote within the EuroGPS eVehicle platform;
- diagnostics and maintenance
- Driver Profiling
- Active car safety;
- Roadside Location-based marketing and assistance,
- Local search and recovery,
- Parking search / booking

http://www.safe-drive.eu

http://www.eurogps.eu

13. ECOPLUS - Mobile Asset Management Platform

The system called Geospatial Inventory of Telekom Austria represents a complete, efficient and extensive mapping of all electrical installations (infrastructure like network, real estate, customer, etc.) in an IT system with spatial correlation. The information for installations is provided in a standardized form and can be retrieved via a desktop or web application. In some circumstances it is necessary to retrieve this information via a mobile phone, smart phone or a PDA, which refers especially for outdoor staff like maintenance technician or customer service. The challenge of this project is to gather and provide information out of the GSPI system via well-defined web services and web applications to a mobile device. In the project a prototype was developed to make use of the Network Information System assisted mobile support fault management in telecommunications. In order to use the application, the field staff agent will navigate with the web browser of the mobile device to a specific URL. Then, he authenticates with username, password and security token and goes to a very simple constructed website, where he can retrieve pending failures and navigate to the switchboard or use the search box to look for a specific switchboard. The search function also allows the use of wildcards. The results provide a preliminary overview of the found control points and their most important attributes. By clicking on the link, the full details of switching points are displayed. The new platform not only relieves the indoor services, but it also would improve the overall service, e.g. faster processing, higher quality of service, etc.

www.fotec.at

14. UOK – MikroElektronika

The MikroElectronika firm is one of the leaders on the market in Serbia for development boards for 8, 16 and 32 bits microcontrollers, compliers, peripherals as ADC, DAC, interfaces RS485, CAN et Ethernet, for displays (LCD, GLCD, TFT, IrDA, LIN, Zigbee) as well for MP3, motion sensors, digital potentiometers, radio identification, drivers for stepper motor. The firm's programmers create firmware for microcontrollers in C, Pascal and BASIC as well as in Delphi and C++ for Windows operational system. The company has distributors in over 38 countries over the world – Europe, India, Brazil, Russia, Middle East. Additionally, the firm has published several articles in some of the most popular electronic magazines in several languages, which are available free for download.

One of the recent projects of the company focused on releasing new line of compact, mobile, light and easy to connect multimedia board for PIC microcontrollers with incorporated TFT display with touch screen, audio codec and storage peripherals. The firm's production facilities are equipped with true hole and surface mounting device assembly technology. Around 98% of the parts are exported in more than 25 countries. The firm sells around 300 products annually and has annual income of approximately 2 million Euros.

http://www.mikroe.com

15. RDF-RWG - PFAU-Program for the financial support of start-ups from Universities in North Rhine-Westphalia (NRW)

In the modernisation of any economy small and medium-sized technology-based and know-how-based enterprises have particular importance. The promotion of start-up activities from universities and R&D institutes is an instrument that speeds up technology transfer from the scientific to the business community. The main promotion goal is to develop innovative products, processes and service ideas into a marketable product or service by using existing state-of-the-art facilities at the universities and R&D centers (laboratories, equipment, and ICT infrastructure). The PFAU-Program for the financial support of start-ups from Universities in North Rhine-Westfalia targets graduates from universities and researchers whose last university degree (diploma or PhD) was completed at the latest three years prior to application. With a population of 18.1 million inhabitants and a labor market of 8.3 million employees, the North-Rhine Westphalia enjoys an excellent R&D infrastructure consisting of 63 technology parks and centers, 59 universities and technical colleges, 55 research institutes and 31 technology transfer agencies. However, the problem there is that a very small number of innovative firms are launched every year and less than 0.5% of all university graduates set-up a business on their own.

Subsequently, the promotional measures are expected to motivate graduates (up to three years after graduation or PhD) to consider starting a business on their own as a serious option (besides academic career or working in a firm). These measures, together with the great achievements of new technology and university research, triggered the state interest to invest in coupling scientific knowledge from university research with marketable products. This will help to develop innovative ideas into full valued products and processes by using state-of-the-art infrastructure and facilities at the universities and R&D centers. Other goals are related to the promotion of R&D by turning innovative ideas into marketable products, processes or services.

http://www.zenit.de

16. OEAW - Foundation of Spin-Off Company from Research Group at University

Key success factors of this good practice are the way of preserving the relationship between the company and the university to jointly pursue the research and product lines, the stable financing with owns capital and the mutual benefits for both parties. The Spin-Off Company was founded by a Research Group at Vienna University of Technology in a niche-market for design and development of embedded systems for industrial electronics and similar conservative markets, and focused also on the transformation of research results into end-products. The research group has been active in digital as well as analog FPGA (Field Programmable Gate Arraw) design, PCB (Printed Circuit Board) design, and embedded software development. Very important for the foundation of the company was the broad orientation of the research group in terms of application areas and the holistic system design.

Since the founders of the spin-off company had a very restrictive investment policy only based on own funds external initiatives influenced the contextual environment of this best practice rather marginally. Nevertheless, in the described case this shift of personnel did not weaken the research activities at the university on topics relevant for both parties, and thus, did not burden the relationship between the company and the university, due to the size of the research group and they continued the cooperation after the spin-off creation. An important characteristic of almost a decade long success is the continuation and open communication within the partnership between the university and the company that allows talking freely about common goals, but also to discuss and accept the inherently different goals of the two partners. Industrial research centers are used if very specific knowledge is required.

http://www.oregano.at/ger/index.html

17. UOM - NORDITE Program

NORDITE program for funding of research in the area of embedded systems is issued on behalf of VINNOVA Sweden, the Research Council of Norway and Tekes, Finland. The program aims to promote increased co-operative research in the fields of technology development for shortwave radio, wireless sensors, short range wireless networks and RFID or MEMS utilizing RF technology and to assist Swedish, Norwegian and Finnish research institutes and companies to further develop and demonstrate their technical expertise in that area. The program was running from 2005 to 2010. It addressed industry, research institutions and universities and was implemented in a form of two calls for proposals for funding of joint projects of industrial and academic partners from at least two, preferably three countries. All results from the research projects were made publicly available on open project web sites. In the first part of the NORDITE program, out of 23 proposals six projects were funded: Wireless sensor and actuator networks for measurement and control, RFID project, Wireless Interference-limited High-throughput Access Technologies and Applications, RF MEMS Steerable Antennas for Automotive Radar and Future Wireless Applications, Cross-Layer Optimization in Short-Range Wireless Sensor Networks and Printed RFID project. In the second part (NORDITE2), some projects have been prolonged and some new added.

www.tekes.fi

www.vinnova.se

www.forskningsradet.no

18. UOK - Virtual Manufacturing Support for Enterprises in Serbia

Virtual Manufacturing Support for Enterprises in Serbia was implemented within EDEP program **"**Support to Enterprise Development and Entrepreneurship Program" with realization period from December 2006 to September 2007.

Partners in the realization of this project were:

- Mechanical Engineering Faculty, University of Kragujevac, Project Leader, one of the most distinguished and the most prestigious educational institutions in the field of technical sciences, modern scientific-educational institution
- Faculty of Technical Science – University of Novi Sad – Novi Sad (FTN) , with experience in a number of international projects such as: TEMPUS, FP6, Bilateral projects etc.
- Regional Economic Development Agency for Sumadija and Pomoravlje Ltd, Kragujevac (REDASP), with intensive experience in developing and providing supporting services to SME sector in the region.

Overall project objectives were:

- To contribute to Serbian enterprises efficiency, quality, and technology potential and overall competitiveness, both national and international by: Stimulating establishment of permanent linkage of R&D institutions and enterprises; Introducing routine of financial participation and implementation of innovations.
- Significant reduction of time and costs in the development of new and improvement of existing products and technological processes in domestic companies by introducing innovative technologies.
- Virtual manufacturing system, which represents integrated computer-based model for product design and manufacture process simulation, as well as rapid manufacture of prototypes and reverse engineering, is applied.

www.wbc-vmnet.rs

www.ctc.kg.ac.rs

19. ISI – UltraSOC

UltraSoc Technologies (UST) was founded in 2006 as a spin-out from the University of Kent and became a joint spin-out with the University of Essex to exploit the research carried out by Professor Klaus McDonald-Maier with Dr Andrew Hopkins and their team.

The development of the technology platform builds upon EPSRC (Engineering and Physical Sciences Research Council) funded research work undertaken by Dr McDonald-Maier and his group at the University of Kent as well as funding from the South East Proof of Concept Fund. UltraDebugTM is being designed to offer advanced source-level debugging with superior trace and trigger facilities. It is detailed operation and interactions at the most critical points in time and for extended profiling durations. Finally, the development of the technology platform to a licensable product is assisted by an investment of £2million provided by Octupus Ventures. Afterwards, the company tried to make its business plan and technology known to the market by participating into various competitions which resulted in attracting private investors. Though still in early development, the first industrial Multiprocessor SOCs have been already used in embedded systems for advanced entertainment and communication platforms and can be found in a set of devices, such as cell phones or portable multimedia players. The company claims that when completing UltraDebug will provide superior, application-level, debugging facilities, enabling the embedded systems industry to create more advanced and reliable products in markets such as automotive and consumer devices. The company tried to publicize its technology and business plan by participating into several competitions. This attracted private investors and finally, UST raised £400,000 of equity investment from the South East Seed Fund, managed by Finance South East, and the Iceni Seedcorn Fund.

http://ultrasoc.com

20. FNBU - IMS-BAS embedded systems

This best practice presents Innovative technology solutions for the formation of high-quality castings using the methods of casting and low pressure casting of gas pressure in the IMS at the Bulgarian Academy of Sciences (BAS).

The complex approach for producing castings of high-quality covers: prediction of the product quality and process parameters by modeling; alloy and melt quality control; smooth filling of the mold cavity; fast cooling for achieving fine grain structure; controllable directional crystallization; elimination of non-metal inclusions and porosity; control of the whole process, reproducibility of process parameters and product quality.

The structure of the project includes:

- Engineering team;
- Management department;
- Quality control department;
- Marketing department;
- Implementation department,
- Team for CAD-CAM Design, for simulation of the process of casting formation and for the optimization of the process of casting formation and casting quality.

The research activity, in particular, comprises studies of the crystallization processes, structures and properties of new metal and non-metal materials, counter-pressure casting of ferrous and non-ferrous metals and alloys included, plastic working and welding processes, physics, physical chemistry and heat treatment of new alloys, amorphous and microcrystalline metals and alloys, ecological technologies, machines and equipment for the production of the new materials and products thereof.

www.ims.bas.bg

21. ONPU – Innovation technological centre of St. Petersburg state electro technical institute, St. Petersburg, Russia

The Technology Park of St. Petersburg State Electro Technical University "LETI" (**TPEU**) was established at 1991 with purpose to create favorable conditions for development, and activity of small firms, for acceleration of industrial development of scientific research and design works, inventions and discoveries made by scientists, teachers, postgraduates and students of LETI, and for creation of competitive technologies, products and services on a commercial basis.

The TPEU activities are concerned in the following areas.

- Involve in the process of creating and disseminating scientific and technological products of scientific staff.
- Creation of new jobs for the scientific and engineering personnel in the field of knowledge-intensive business – the number of employees is 360 persons.
- Transfer of technology from the university to the industrial sector.
- Raise the funds for the development of innovation.
- Promote of international scientific cooperation and technology transfer.
- Develop education and training of entrepreneurs in the field of economics, management and marketing.
- To form of territorial innovation system, focused on the effective use of scientific and technological potential of the region.

TPEU provides a range of services for the universities' research teams on the creation and promotion of competitive scientific and technological products. Between 2003 and 2010 four international projects are realized and one continues until 2012. At present the TPEU includes:

- 45 small firms working in the field of knowledge-intensive business and innovative business support, for example with small-scale production of x-ray radiographic equipment for industrial and medical diagnostics, of measuring systems and of magnetic resonance equipment for scientific research, monitoring technology, and biomedical applications.
- Scientific and Production Centre (SPC) which carries out functions of business incubator.
- Innovative Technology Centre (ITC).

The sustainability of the BP is provided by state financial support and a broad partnership with Russian foreign organizations. TPEU actively cooperates with companies and technology parks in England, Finland, Germany and China.

http://www.eltech.ru/english/index.htm

http://www.eltech.ru

22. ONPU - “Slalen” innovation centre

Innovative center SLALEN - is a public non-profit organization specializing in innovation management and technology transfer, IPR protection, evaluation and promotion of innovations, established in 2006 with the support of Co. Ltd Domstroy, Dnipropetrovs’k. The main aim of **IC SLALEN** – is to attract funding for innovative ideas, engineering and to take them to internal and external market**. IC SLALEN** uses in their work approach, based on supporting the chain “theorist – researcher-practitioner – researcher-engineer – technologist-production worker – marketing – seller” and at the same time luring in this process administration, press, bank and auxiliary manufacture. **IC SLALEN** combines perspective technologies and inventions with people, companies and banks which has money and are ready to invest in the development.

The main objectives of the IC SLALEN are:

- Promotion technologies in the market. International partners provide the ability to use the searching system via Internet to promote developments of Ukrainian scientists and inventors in the world market of innovative products;
- Search for an investor is one of the most important aspects. IC SLALEN joins advanced technology and inventions with the people and banks that have money and are ready to invest them into the development process;
- Creation of Ukrainian innovation portfolio;
- Uniting an inventor and investor;
- Developing mechanism for financing innovative projects and technology. Transfer into the industry;
- Popularization of innovations in Ukraine.

IC SLALEN co-operates with universities, academies, research institutes and inventors from all Ukraine in different fields of science and techniques.

www.innocentr.com

23. UOK - Vlatacom Document Reader–Handheld

A handheld, battery operated, rugged zed device was developed by Vlatacom and offered to the market for verification of travel and personal documents, reading of biometric data and identification of persons holding these documents. The device includes the specialized optical scanner for e-Passport full page scanning with white, infrared and ultraviolet illumination, suitable for integration in such handheld device. It is the first on the market and is a great innovation in the field of biometric verification devices. The main use of the device is in public safety sector, mainly for border control management in buses, trains, at airports, and similar environment valid worldwide. The device will be very useful considering the increasing mobility of people and the present lifestyle. Similar existing devices on the market do not satisfy the needs of end-users, in terms of functionality and performance. In most cases, the equipment for the border control including the handheld document readers is procured within the public tender procedures. The government authorities responsible for border control, immigration control, and similar, are usually entitled for procurement of these equipments. The project was started and has been run with company's own resources and finances. The intellectual property rights related with the innovations were officially protected through the national and international registrations.

http://vlatacom.com/

24. BICT - Inland AIS System Implementation

The implementation of the AIS network on the Croatian section of the rivers Danube and Drava started in March 2006 and ended in March 2008. It was carried out by CRUP Ltd. and was 90% co-funded by the European Union in the frame of INTERREG IIIA Slovenia-Hungary-Croatia Neighborhood Program and other 10% was ensured by local funding.

Through the use of innovative IT that contribute to faster, efficient and more reliable information flow between relevant authorities (Customs, Border Police, Water Police and Calamity abatement services), as well as private companies working in inland navigation sector (ports, freight forwarders, fleet operators, etc.), the AIS network implementation contributed to the improvement of the cross-border transport networks. In particular, it ensured simplifying cross-border procedures, increase of navigation safety, much faster reactions in calamity cases, better integration of inland navigation into modern transport networks, availability of ship, crew and cargo information, thus leading to increased use of IT systems, sustainable transport development, modal shift of cargo from road to inland waterways and protection of the environment.

Target groups of the project were public authorities dealing with the inland waterway transport, navigation safety and environmental protection, as well as the private sector involved in inland navigation such as ports, freight forwarders, fleet operators etc. The main objectives of the implementation of inland AIS network were improvement of cross-border mobility and accessibility in the border region on the Danube and Drava rivers waterways and the development of accessible information and communication technology that will have a future use in the social and economic life of the defined area.

www.crup.hr

25. IEA - BASILICATA INNOVAZIONE

BASILICATA INNOVAZIONE Italy, Basilicata Region, Potenza Basilicata Innovazione was developed due to an accord between the regional government and AREA Science Park, the science and technology park of Trieste, signed in June 2009 with the aim of providing the regional territory with a permanent body to give services and instruments to sustain the enterprises competitiveness and to valorize the research.

The main services offered by BASILICATA INNOVAZIONE Italy include:

- Information about patents and documents;
- Use of an innovative instrument of Business Intelligence that allows to evaluate the potential market of the product/service object of the idea;
- Studies and analyses about the state of the art of technologies and markets;
- Studies targeted to evaluate the financial-economic reliability of the future partners;
- Analysis of the needing and of the innovation gap;
- Analysis of the business efficiency (through benchmarking tools);
- Definition of the innovation path, planning the innovation project;
- Solutions for the innovation of the product (materials, techniques etc.);
- Training workshops;
- Assistance in the creation of an enterprise, etc.

Basilicata Innovazione offers an integrate system of activities and services for the development of the technological innovation and the valorization of research for entrepreneurs and researchers, to support them in all the phases of the innovation process.

http://www.basilicatainnovazione.it/

26. ECOPLUS - Energy Harvesting for Mobile Eco-Efficient Wireless Sensor Networks

Within the national funded FIT IT Embedded Systems project ECO-SENSOR, the project partners from Austria (Profactor, Pöttinger, University of Linz, Exler Elektronikentwicklung) break up the critical dependency of remote wireless sensor networks from traditional battery technology. Based on the concepts of retrieving electrical energy from vibrating machinery and enabling ultra-low power wireless transmission of arbitrary sensor information, the design of this embedded modular base unit opens a variety of technological challenges going far beyond the state-of-the-art. Since ECO-SENSORs are energy-autonomous, no additional energy has to be provided for both, sensing operation and wireless transmission. The ECO-SENSOR project enables the reliable integration of dense wireless sensor networks for optimal condition monitoring and process control, accelerates engineering and integration times by totally eliminating wiring efforts, increases operational machine safety, dramatically reduces machine break-downs and maintenance costs and allows for accessing sensors in otherwise not reachable areas.

The resulting prototype was able to supply the WTU and the sensor during working conditions. Projects at the international level will be initiated in the near future and will lead to consistent development of the base technology with respect to requirements from different applications.

www.profactor.at

27. TUCN - TrackGPS Business

TrackGPS Business is a vehicle tracking system developed by AROBS Transylvania Software in Romania, which helps thousands of fleet owners to drive down operating costs and increase earnings. It offers live vehicle tracking, fleet maintenance and risk management information to fleet operators of all sizes. Over 500 companies with vehicle fleets in Romania benefited of reduced costs and increased productivity and over 9,000 vehicles of all types are being monitored at the moment. The system uses the most advanced tool for fleet maintenance cost control: real-time GPS tracking and GPRS data transfer as well reports and vector maps which offer information about vehicles' location on the map, covered distances, number and duration of every stop. It gives a full range of detailed reports: daily activity report, speed report, digital tachograph and vehicle history report (tire and oil change, service). The possibility of generating consumption reports guarantees a better fleet control. TrackGPS Business is a WEB-based vehicle tracking software which can be accessed from any computer or PDA with Internet connection. It has an easy, intuitive interface which requires minimum PC knowledge. Almost all of the cities around the world have to face the increased rates and the daily congestions. Fleet tracking and management software helps the organization of more efficient and also safer vehicle traffic. Guiding the vehicle fleets reduces the transportation costs. The guiding system reduces the driver's knowledge requirements related to city/town map. This allows shorter driver accommodation with the changes in infrastructure.

www.arobs.com

28. JSI - Vacuum pressure control at the plasma annealing and cleaning machine

This best practice presents the research and the development of the system for vacuum pressure control for plasma annealing and cleaning machines produced by an Austrian company. These machines are used in the process of production of wire and related metal products (metal strips, etc.). The machines simultaneously clean, anneal and cover wire surface in one single wire pass by using plasma. Vacuum pressure in plasma reactor is an important process parameter, which must be held within tolerances in order to guarantee stable plasma operation and wire quality. A control system is needed, which keeps pressure in tolerances by controlling the operation of vacuum pump and vacuum valve. The goal is to achieve low pressure deviation from the set point and fast response to the various kinds of process disturbances. In the project, software tools (programming blocks, configuration tools) and documentation are developed, which will significantly simplify the implementation of the predictive control to different kinds of closed loop control problems including vacuum pressure control of plasma machines. The project results are transferable, since the platform is designed to be applied to different kinds of technological processes.

http://dsc.ijs.si/en/

29. ECOPLUS - Frozen Food Temperature Monitoring during Transportation and Storage

Frozen Food Temperature Monitoring during Transportation and Storage presents a best practice in maintaining high quality of transported foods. As of January 1st 2010 the owner of a catering or gastronomy company has the obligation to record the temperature of his short-life food products during transportation and storage without a gap and has to keep the recordings for more than a year. The challenge was to develop a concept and a functional model which retrieves temperature readings from temperature sensors in refrigerating plants, analyze the recordings for eventual abnormalities to generate an alarm and archive the recordings in a database for a continuous report. The industrial partner of Fotec owns some branches of school buffets in which it is not possible to lay electric cables from a centralized temperature recording system to the temperature sensors themselves. Therefore, the company which?… developed a concept and a functional model which retrieves temperature readings from temperature sensors in refrigerating plants, analyze the recordings for eventual abnormalities to generate an alarm and archive the recordings in a database for a continuous report to keep the recordings for more than one year. The temperature recordings are stored in a central database via the internet for all branches of a customer. The user has the ability to configure threshold values for each temperature sensor and regarding to this generates notifications per SMS or e-Mail to immediately notify himself, a guarantor and/or a maintenance technician. In addition, the user can generate a complete record which includes all events and/or temperature readings. For these cases, it is possible to use temperature sensors with internal storage capabilities and an USB connector. This system is norm conform with: DIN EN 12830, DIN EN 13485, DIN EN 13486. The involved company benefits from significant results, in terms of quality of products, new products and technologies.
www.fotec.at

30. TUCN - Rehabilitation of a Network of Water Wells for Capturing Raw Water - Automation System for Monitoring and Command

This best practice describes a successful implementation of a project resulting from the collaboration between local authorities and governmental authorities in Romania. The funding of the project was supported by EU grants and co-financed by the local authorities from Satu Mare. The R&D team was a consortium of 3 partners (SME) from Romania and Hungary.

The objective of the project was to extend the infrastructure regarding the drinking water, due to the population growth that was not previewed when the existing infrastructure was first developed. The approach was to rehabilitate the water wells network for water collecting and to create a system for the monitoring and control of the whole process, with the purpose of increasing the capacity of delivering the raw water to the Station for the Treatment of Drinking Water, which delivers drinking water to the city and to the surrounding smaller towns.

As a result of the successful implementation of the project were ensured a minimum flow of 1200 m^3/h and a substantial improvement of water quality delivered to the Treatment Station, by reducing the suspensions in the water.

The reason to initiate this project was the necessity of developing the infrastructure for regarding the drinking water and for the used water of the Satu Mare city and its neighborhood.

This was necessary because the population grew up, the region developed economically and the existing infrastructure was no longer able to sustain the number of private and public consumers. This was the reason for the local authorities to initiate a program for developing this infrastructure. The R&D team was a consortium of 3 partners (SME) from Romania and Hungary.

www.technosam.ro

III. INNOVATION SUPPORT STRUCTURES AND EMBEDDED SYSTEMS PRODUCTION

The analysis of the 30 best practices shows that they could be divided into two major groups:

- The first one includes the BPs of governmental and non-governmental structures and organizations oriented toward innovations support in the field of embedded systems and industrial informatics named Innovation Support Structures.
- The second one comprises of different projects for implementation of industrial informatics and companies for production of embedded systems named Embedded Systems Production.

This categorization is shown in the following table.

Innovation Support Structures	Embedded Systems Production
1. Technopol_ECOPLUS	4. Syrinix_ISI
2. Technoseed_IEA	8. Cardio&Brain_JSI
3. Finland_TIVIT_UoM	10. KIBERsik_JSI
5.Regional Innovation_INNOPOLE_ISI	12. EuroGPS_FNBU
6. Sirma_BICT	13. Mobile Asset_ECOPLUS
7. Intelesens Limited_Sensor Technology_ISI	14. MikroElectronika_UoK
9. CORALIA_ISI	19. UltraSOC_ISI
11. Competence and Inovation_RDF_RWG	20. IMS_Innovative technology_FNBU
15. PFAU_RDF_RWG	23. Vlatacom_UoK
16. Foundation_OEAW	24. Inland AIS_BICT
17. NORDITE_UoM	26. Energy Harvesting_ECOPLUS
18. Virtual Manifacturing_UoK	27. TrackGPS_TUCN
21. Innovation technological centre of St. Petersburg state electrotechnical institute, St. Petersburg, Russia_ONPU	28. Vacuum pressure_JSI
25. Basilicata_IEA	29. Frozen Food_ECOPLUS
22. “Slalen” innovation centre _ONPU	30. Rehabilitation_TUCN

IV. SWOT Analysis

A SWOT analysis is a subjective assessment of data. In this chapter the common weaknesses of the selected 30 best practices among the 100 good ones are analyzed. In order to make any kind of analysis we need to consider the fact that those 30 best practices are quite different one from another. However, we may group them in two large domains – Project/Product oriented and Organizations that promote and support activities in the area. Based on this criteria, the best practices were divided into two groups. In order to make our analysis more precise these 4 best practices could be placed in both groups.

STRENGTHS

Strengths of Innovation Support Structures

As it was mentioned already, the 30 best practices are divided into two types of domains:

- Innovation Support Structures – these are practices that explain different R&D and project management and support structures of companies, associations and universities. Their primary purpose is the aggregation and concentration of high-end know-how, leading professionals and production companies that will support the development of large-scale national and international projects in the field of embedded systems.
- Embedded Systems Production – this group of best practices includes examples of various companies that design and produce specific embedded systems, industrial informatics applications or the entire production process automation, monitoring and control. The scope of examples covers: manufacturing systems in the heavy industry, environment monitoring and ecology, wearable medical and sports devices, data login applications, different types of navigation and position control equipment, etc.

Typically most of the practices from the first group are successful performance of R&D activities. Many of these practices represent entities and organizations working in close cooperation with nationally-known universities and associations. Some programs provide information on the long-term activity in the field of embedded systems and industrial informatics: Competence Brokering Linking SME Needs to Research Opportunities, TECHNO SEED, Finland's Strategic Centers for Science, Technology and Innovation, CORALIA Clusters Initiative, PFAU-Program for the financial support of start -ups from Universities in North Rhine-Westphalia etc.

About half of the practices covered in the group of **Innovation Support Structures** highlight the involvement of a large number of employees (over 20-30), some organizations engage more than 500 employees in associated partners. In practice, all of these practices actively cooperate with universities, thus creating conditions for continuous improvement of their staff, as well as recruitment of new staff. Over 40% of research teams have specific responsibilities. Many of the organizations develop another major activity which may be of interest for many small and large scale companies in the sector of industrial informatics. The R&D process exposes the commercial value of novel ideas. Larger organizations

cooperate with several technological institutions, where at least few organizations exist as a part of them and posses specialized laboratories and companies producing embedded systems.

Some of the organizations try to impose a new business model with the dominant participation of universities and scientific organizations, by simply looking for long-term projects with clearly explained financial mechanisms and well-described long-time development policy (20 years). All these show a properly selected and time-adaptive R&D policy with developmental potential and creation of innovative business-oriented products and services. Cooperation of the (combination) of institutional, university and business participants is a guarantee for establishing of stable business models able to apply for funding under the larger European and national programs. Some organizations have partnerships with organizations with 10 - 100 employees.

All projects have the perfect on-line portfolio, that will make much easier the promotion of their business and make it easier to find partners in the implementation of larger cooperative projects. Most of these organizations have quality control certificates and contacts with institutions and laboratories to verify compliance and ensure high quality of end production and management processes inside the organization.

Strengths of Embedded Systems Production

The group of best practices that describes the design and producing of end products or services uses diverse business models and financing mechanisms. Most of the best practices mention a large amount of private investments. Some practices, however, combine good business policy and close cooperation with universities and scientific institutions: Syrinix, Cardio & Brain Signals, IMS-BAS embedded systems. The diversity of applications and projects varies greatly, from small embedded systems for personal use such as Cardio & Brain Signals, to highly scalable enterprise applications such as IMS-BAS embedded systems, Inland AIS System Implementation, TrackGPS Business and EuroGPS SafeDrive.

Most of the companies use their own operating staff dealing with the development, implementation and marketing of final products. Some of the presented examples show well-acquired business models. Most of the companies and joint ventures already have customers in more than one EU country. The selected best practices show the system integration solutions that have already had transnational applications. Over 50% of the solutions described comply with the recommendations for reduced power consumption i.e. are green devices. We can conclude that most of the projects use equal amounts of public and private funding. The majority of funds to which these practices have had access were used for training and development. Some of the applications and products indicate potential for the development of applications and a wide range of services that can be developed and implemented in this sector. The range of applications includes: medical systems, production transportation monitoring, large scale industrial systems, navigation devices, different ecology applications, etc. Almost all companies in the region use producing facilities located in their own countries. This shows the potential of individual economies in the field of embedded systems and the production of specific and unique industrial informatics solutions. Normally most of the practices that are closely integrated with universities and academies have been presented on the market since more than 10 years.

WEAK POINTS

The weak part of the SWOT analysis has been conducted in a way to find a pattern that can be avoided by any beneficiary of the project and its outputs. Each one of the two groups was analyzed and some common weaknesses were found. Those could be further grouped as follows:

- **Financial** – Lack of funding diversification is the most common weakness of most of the best practices. In both cases, organizations supporting a specific business area or development of real products/projects, a strong dependence on one major source of funding could be noticed. The funding usually is provided by the government, an EU funding agency or another way of public funding. Since research and innovation cannot be carried out without funding, the funding diversification could be considered as the biggest weak point of most of the selected best practices.
- **Political** – Taking into account that the financing of best practices strongly depends on governmental or EU funding, the dependency on the current politicial situation in the local country or on the EU administration can be outlined as a second serious weak points. Unfortunately, only a few of the selected best practices have a wide market success, not only locally, but also in other countries, and are independent of the local political situation.
- **Organizational** – Many best practices have organizational weak points. Under this category could be listed the lack of premises, technical facilities, equipment, as well as the heavy dependence on other organizations (e.g. Universities, investors, partners, etc.).
- **Marketing** – Another common weak points is the marketing approach of best practices. Their products usually suffer from a lack of a plan for entering the market, insufficient visibility and disputable international recognition. Only some of the products/projects have reached the market at all, and even fewer have gone beyond the prototype phase and have reached any market success. The fact that many of the best practices are promoted by clusters or other business support organizations also shows that the latter do not perform well enough. Therefore, most of the best practices have, unfortunately, limited appreciation and recognition at European level and are even less recognized worldwide.
- **Social** – Only a few of the best practices have created new working places (jobs) and have an impact on the labor market. In fact, some of the best practices are struggling to survive the financial crisis, which influences also the new jobs offers.

Innovation Support Structures

In the first place as a common weakness that applies only to Innovation Support Structures is the weaknesses related to process/program management. BPs in this group are usually clusters, centers of excellence or programs. In order to be successful, all of them need to collaborate with many other stakeholders from their specific sector and to be able to handle

a large volume of requests coming from different sources. The most common problem weakness, subsequently, is the lack of capacity of these organizations to work in such conditions. Another common weakness is the lack of enough networking activities in the field of the organization. In fact, many of the BPs have limited dramatically the number of activities and events during the last year. A common weak point is the lack of international transfer of locally gained knowledge. Several programmes achieved good results at home, however, they did not take advantage of the opportunity to transfer the local experience at international level. As a weak point characteristic only for that group can be pointed out the lack of information about the patent rights of the promoted products / organizations / projects. Another weak point is the lack of multilingual information on the web page of TECHNOSEED. Here is the place to mention that most of the BPs use the web space very well and there is plenty of information about them there.

Embedded Systems Production

The first common weak point of embedded systems production is the fact that most of the products in that group are in a trial period or have not reached the market yet. This is quite common for most of the product/project BPs. It seems that for most of them there are no plans for entering markets and insufficient investment has been done in that direction. Another typical weak point for most products/projects in this group is the fact that product/project parameters were not described correctly or the description was quite limited. In general, for some of the BPs it is necessary to put more effort in the direction of product documentation and presentation. This could be highlighted as the most important weak point from a technical point of view. Without proper documentation or presentation nothing could be successful in the open market. Another specific weak point of this group is the lack of comparison between the product and similar products. Nowadays, the strong open market competition among different products/projects requires a clear understanding of their competitive advantages compared to other products in the respective area. Without such a comparison entering any market will be difficult. Some of the BPs seem to have a very small number of employees and in general it seems that there is a lack of qualified personnel in the area. Almost none of the BPs can claim that they have more then 100-150 qualified team members and researchers.

In conclusion we may say that despite the relatively large number of weak points, most of them are quite common to most BPs. These weak points could be well defined and corrected in the future. The specific weak point are in particularly important for the BP itself and also for other companies working in the area. Hopefully, the project outputs will be successfully used for eliminating such weak points (weaknesses) in future.

OPPORTUNETIES

Innovation Support Structures are practices that aim at facilitating the transfer of know-how, knowledge and skills in the area of industrial electronics and embedded systems. These activities are generally oriented towards raising the level of enterprises, especially SMEs.

The successful implementation of these projects requires establishing well-balanced R&D teams, feedback from enterprises, including the Academy-University segment in the process, proper network, etc.

The scope of the project is of particular importance - what impact it has on the region and its relationship to the national strategy and the EU strategy.

A general overview of the 15 practices within this subgroup shows that regarding opportunities, the projects satisfy the above mentioned requirements.

The selected practices in general indicate a strategic alignment within the EU framework, the relevant country strategy, as well as alignment with the strategy of the relevant region.

The best practices Technopol Program Wiener Neustadt Center for Modern Industrial Technologies, Finland's Strategic Centers for Science, INNOPOLE Regional Innovation Pole of the Region of Western Greece and NORDITE Program are developed in accordance with the EU strategy.

The projects Innovation technological center of St. Petersburg state electro-technical institute, St. Petersburg, Russia and Slalen innovation centre cover segments of the relevant national strategy.

The best practices Technopol Program Wiener Neustadt Center for Modern Industrial Technologies, INNOPOLE Regional Innovation Pole of the Region of Western Greece and Basilicata innovazione have a strong impact on the regional development.

Many practices have created a solid base for high-tech development and intensified local industry in the relevant region (Technopol Program Wiener Neustadt Center for Modern Industrial Technologies; TECHNO SEED; INNOPOLE Regional Innovation Pole of the Region of Western Greece; CORALIA Clusters Initiative; Virtual Manufacturing Support for Enterprises in Serbia).

Many practices show an existence of permanent relation between R&D institutions and enterprises. A strong cooperation has been created between Universities, R&D organizations, and companies to further exploit the potential to create innovative products in these fields of common interest. In addition, a smooth transition of aggregated knowledge into successful businesses could be noticed (start-ups and newly established SMEs). (e.g. Technopol Program Wiener Neustadt Center for Modern Industrial Technologies; IEA - TECHNO SEED; INNOPOLE Regional Innovation Pole of the Region of Western Greece; ISI - Intelesens Limited Sensor Technology & Devices; PFAU-Program for the financial support of start-ups from Universities in North Rhine-Westphalia (NRW); OEAW - Foundation of Spin-Off Company from Research Group at University; NORDITE Program; Virtual Manufacturing Support for Enterprises in Serbia, Competence Brokering Linking SME Needs to Research Opportunities, Innovation technological centre

of St. Petersburg state electro technical institute, St. Petersburg, Russia, Slalen innovation centre).

Some practices provided an opportunity for transfer outside the specific region (Technopol Program Wiener Neustadt Center for Modern Industrial Technologies; INNOPOLE Regional Innovation Pole of the Region of Western Greece; Basilicata innovazione).

For four practices is suggested a possible transfer in SEE region and participation in EU international projects (Sirma Yung Spirit; Foundation of Spin-Off Company from Research Group at University; PFAU-Program for the financial support of start-ups from Universities in North Rhine-Westphalia (NRW); NORDITE Program).

There are some specific opportunities such as:

- Improving the level of services that support awareness of SMEs (Virtual Manufacturing Support for Enterprises in Serbia);
- TECHNO SEED has a partnership with the ACHIEVE network which assembles about 20 European incubators specialized in ICT. This network is funded by the European Community and is coordinated by the Cambridge University;
- Good opportunities due to the investment of Sirma Young Spirit in young active entrepreneurs in the field of Information Technologies (IT) and their initial support with the necessary seed fund (Sirma Young Spirit -Early Stage Financing);
- In certain areas such as building and construction, there is a high economic activity and the presence of SMEs is very favorable (Competence Brokering Linking SME Needs to Research Opportunities);
- Developing of more efficiently monitored health care in hospitals and home settings (Intelesens Limited Sensor Technology & Devices (ST&D).

In conclusion, we could say that all examined practices offer great opportunities for technology transfer, regional development and exchange of know-how.

Embedded systems subgroup. The practices presented in this subgroup aimed at creating innovative products and target-oriented systems in the **Embedded systems** area.

The successful output of these projects requires establishment of well-structured R&D teams, a clear funding, appropriate area of operation, innovative approach (covering the above listed requirements in the general case is more or less described in the Strengths of reviews), as well as the availability of a market niche, applications in various fields, ability for incorporation into larger systems, etc.

A general overview of the 15 practices within this subgroup suggests that regarding opportunities, the projects satisfy the above- mentioned requirements.

The reviewed practices in general indicate the opportunity for application in various fields (Syrinix; Cardio & Brain Signals - Signal conditioning system for physiological signals; KIBERsik– Electricity Peak Shedding System for energy efficiency in industry; Mobile Asset Management Platform; IMS-BAS embedded systems; Vlatacom Document Reader–Handheld; Inland AIS System Implementation; Energy Harvesting for Mobile Eco-

Efficient Wireless Sensor Networks; Track GPS Business; Vacuum pressure control at the plasma annealing and cleaning machine; Frozen Food Temperature Monitoring during Transportation and Storage).

Many practices show that their products have a potential market (Syrinix; Cardio & Brain Signals - Signal conditioning system for physiological signals; KIBERsik– Electricity Peak Shedding System for energy efficiency in industry; EuroGPS SafeDrive; Mobile Asset Management Platform; UltraSOC; IMS-BAS embedded systems; Inland AIS System Implementation; Energy Harvesting for Mobile Eco-Efficient Wireless Sensor Networks; Frozen Food Temperature Monitoring during Transportation and Storage;)

Some practices demonstrate opportunity for incorporation into larger systems (Syrinix, Cardio & Brain Signals - Signal conditioning system for physiological signals; EuroGPS SafeDrive; Inland AIS System Implementation; Energy Harvesting for Mobile Eco-Efficient Wireless Sensor Networks; Track GPS Business; Rehabilitation of a Network of Water Wells for Capturing Raw Water).

Two practices have a strategic partnership with leading companies in the field (MikroElektronika; IMS-BAS embedded systems).

There are some specific opportunities such as:

- Future development and production of modern and useful products is expected (MikroElektronika);
- Syrinix technology enables very important savings of water distribution system. Up to 30% of water is nowadays lost due to water leakage (Syrinix);
- New medical products and systems could be developed on the base of existing devices (Cardio & Brain Signals - Signal conditioning system for physiological signals);
- An increasing level of automation and implementation of embedded systems in SEE economies (UltraSOC);
- The device is necessary in many critical places for fast and secure verification of documents and persons (Vlatacom Document Reader–Handheld);
- The impact of the project will be an increase in the number of workplaces in the area and, consequently, raising the standard of living of the population, which made this solution attractive for other cities (Rehabilitation of a Network of Water Wells for Capturing Raw Water).

In conclusion, all examined practices offer innovative products with good market prospects and opportunities for application in various fields.

THREATS

Threats for Innovation Support Structures

Financial limitations

17 threats in total were identified by the reviewers, summarized as follows:

- Lack of financial resources;
- Public funding will be affected by the financial crisis;
- Possible country stagnation, and uncertain future sources of founding;
- Insufficient funds to finish the BP;
- A great part of the financing of the project depends on government and EU funding;
- Possible lack of financial resources for the future development of the BP;
- Lack of clear description of the financial mechanism which would support the activities of the already developed structures;
- Lack of local institutional support;
- The amount of future financial contribution of the stakeholders is not defined or certain;
- Poorly defined interaction model with other existing funds for regional development and advancement.

Competition problems

The reviewers cited 8 threats, summarized as follow:

- International competition;
- Competition from big players;
- Uncertain competitiveness and advancing of the companies, created by the BPs;
- More attractive proposals from other regions or countries;
- Potential vulnerability of the whole venture due to its dependency on the brokers' capacity and on the available networking activities;
- Possible difficulties in the mass production of the developed products;
- Human capital deficit;
- Possible concurrence with other interactive tools and administrative bodies that provide the same services;
- Need for better cross border cooperation.

Market demands

All 5 threats are: global market uncertainty, poor marketing plans and decisions in the future, non-acceptance in the market), small spin-off companies are fragile, dependent on their major customers, and can easily disappear in case of a crisis, no strategic planning for creating high technology clusters with the aim of market penetration.

Legislative effects

All 3 threats are: new government regulations, substantial governmental support and coordination is required, which is the national policy concerning the relations between academia and the enterprise sector and whether this policy impose barriers in the future.

Human capital problems

There are 5 threats: critical mass in terms of partners and resources should be guaranteed, the friendly environment at university may disappear, and the diffusion policy of the innovation culture in the regional territory may not be capable of overcoming the arisen obstacles, the small size of the company cumbers in the competition with much larger market players.

Others

The reduced role of basic research can undermine the basis for future development, the possibilities to support an extremely large variety of projects may lead to lack of competence in some cases, too many different views can cause diversions from the strategic line, university authorities do not consider it important to promote to students' efforts to create startup companies.

Threats to Embedded Systems Production

Financial limitations

The reviewers mentioned 7 different threats concerning the financial support of BPs, which can be summarized as follows: today's economic crisis, significant financing resources are needed for BP realization, insufficient financial funds for opportunities realization, BP involves capital investments that can be overlooked, the particular project ideas and solutions depend directly on European funding to be initiated, not clearly defined issues about the requested funding for the future commercialization of the BP.

Market limitations

18 threats in total are pointed out by the reviewers, summarized as: possible market failure, applicability of the product and the market demand are limited, despite a huge market potential, some vendors are very conservative, the device may not reach the market, large players in the market, lack of a strategy for widening the BP market, without considerable marketing and promotion efforts the results of the BP can never be transformed into a product, there is a lack of a business plan to entering the market, there is not a vision about

the proper product price on the market, Google Earth services competition on an European level, industrial partners should consider enhancing the range of services in order to enhance market penetration.

Recession problems

Only 3 remarks by the reviewers: recession leads to limited resources for company development and to the decrease in demand in emerging markets in the SEE region. In some cases a problem may arise - users' employees would want to boycott the use of tracking device in order to prevent them from being tracked.

BP realization

Here 5 threats are mentioned which are summarized as follows: the verification and validation of the BP must have been a big challenge, the modifications of the developed BP control could be complex and difficult to realize, no plan for implementing partnerships through vital contracts, the developed BP can become obsolete, unreliable or insufficient, there are possible contradictions between legislation in different countries, the potential unauthorized access to the system by hackers.