



Action Plan for ManuFuture-CH

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Summary

The discussion about a prosperous working place in Switzerland is also a question about the continual improvement and innovation of products, processes and services with a strong relation to the market and customers needs. These require an increased input of new technologies, methods and knowledge. Therefore ManuFuture-CH supports the activities to maintain and to strengthen the production place in Switzerland.

The ManuFuture-CH national technology platform is a joint initiative of the mechanical, electrical and metallurgical manufacturing industries (MEM-industry), the educational institutions and the social partners, endorsed by the Commission for Technology and Innovation (CTI) and the Secretary for Research and Education (SRE) of the Swiss Government.

ManuFuture-CH has three main functions:

- to place Swiss interests and needs in the EU 7th Research Framework Programme,
- to make EU-financing feasible for Swiss projects and Swiss participation in EU-projects, and
- to gain excellent manufacturing knowledge

Main focus:

Based on the ManuFuture-CH strategy paper the discussion with relevant stakeholders in Switzerland has shown that the following research areas are of vital interest:

1. *Promotion of manufacturing and entrepreneurship:*
Impact of manufacturing industry on economic and social well-being of Switzerland;
Promotion and information campaign
2. *Manufacturing Education:*
Education Programmes in Obligatory Schools and Gymnasiums; Education Programmes on University level – Education of Students; Education Programmes for Industrial Work Force
3. *Research and Development for Innovative Products and Manufacturing:*
Materials and Integrated Micro- Nano- Bio Systems; Manufacturing Systems and Processes; ICT in the real world - Automation, Mechatronic, and MMI; Recycling infrastructure and energy generation and conservation; Simulation for Agile Manufacturing
4. *New Organisation and Management Models for Manufacturing SMEs in Global Markets:*
Future business areas and models for manufacturing; Realisation of new forms of organization and management; Future monitoring and decision support system;
5. *Support Measures for Manufacturing Innovation:*
Capacity Building for Innovations; Basic conditions to improve the business environment; National Innovation Strategy

Budget:

The action plan shows an overall budget per year – after the starting period in 2007 and 2008 – of approximately 100 Mio CHF per year. About 35% of the funding should come from EU (EU 7th Research Framework Programme, and others), 25% from CTI, 37.5 % from Swiss industry (by the majority internal activities) and 2.5 % from universities. 50% of the funding will go to industry (about 32 % internal activities and 18% from EU) as well as 50% to CH-schools (ETH, universities, universities of applied science, and others).

Future steps:

The next step will be the planning and realisation of the starting period 2007 and 2008 by initiating projects between industry and academy in Switzerland by using EU and Swiss funding.

1. ManuFuture – European Initiative to secure high-added-value employment in manufacturing

The economic importance of sustaining a strong manufacturing base in Europe is indicated by the fact that manufacturing provides jobs for around 27 million people, and produces an added value exceeding €1 300 billion from 230 000 enterprises with 20 and more employees (basis 2001). Some 70% of this total derives from six main areas – automotive engineering, electrical and optical, equipment, foodstuffs, chemicals, basic and fabricated metal products, and mechanical engineering.

In Switzerland about 1 Mio employees are working in 76'000 manufacturing-oriented enterprises. The MEM-companies, namely machine, electro & electronic and metal industry, engage 300'000 employees and contribute a total turnover of nearly 60 Mia CHF or 42% of total Swiss exports. Each job in the manufacturing sector results in the creation of 2 jobs in the service sector. In addition manufacturing technology is the enabling technology par excellence for successful product development, medicinal technology, bio-technology, watch industry, precision and measure instruments, micro- and nano-technology, energy technology as well as chemical and pharmaceutical industry. Manufacturing also produces social stability by providing a range of different working places. Therefore, manufacturing is a vital and indispensable part of the Swiss economy. Without manufacturing competence Switzerland will lose its technological leadership. The leading position has to be strengthened and obtained.

A service oriented society without manufacturing is not realistic. There are too many interdependencies between new products and new services and modern solutions in producing and delivering. Switzerland is in the position of a highly developed country with leading research institutes on one hand and different networks of highly specialised SMEs on the other hand. This accumulation of knowledge and practical experiences is one of the major strengths of the Swiss manufacturing industry. The lack of EU manufacturing will erode the basis for its development.

It's becoming more and more difficult in a globalized world to keep this leading position. But European manufacturing has huge potential for generating wealth, jobs and a better quality of life it faces intense and growing competitive pressure on two fronts. In the high-tech sector, especially, other developed economies pose the greatest threat. On the other hand, manufacturing in more traditional sectors (mature sectors) is increasingly migrating to low-wage countries such as China and India. And these, too, are rapidly modernising their production methods and enhancing their technological capabilities.

ManuFuture-EU provides the possibility to rethink industrial, business and manufacturing systems so that they become more responsive to product markets. The ManuFuture-EU initiatives are strongly linked with the process of the EU 7th Research Framework Programme.

The competitive and sustainable reaction is seen within EU-ManuFuture in terms of five pillars and their associated new enabling technologies for the industrial transformation of:

- new, added-value products and services
- new business models
- new advanced industrial engineering
- new emerging manufacturing science and technologies
- transformation of existing R&D and education infrastructure to support world-class manufacturing

Goal of ManuFuture-EU:

- Restore European leadership in manufacturing

Vision of ManuFuture-EU:

- Transform manufacturing from resource intensive to knowledge-intensive
- Develop new business models and attitudes
- Strengthen links between science and economy
- Develop appropriate research infrastructure
- Adopt new approaches to education and training

Approach of ManuFuture-EU:

- define research areas for 7th EU Research Framework Programme
- support collaboration between leading enterprises and research institutions in Europe

Within the European ManuFuture Technology Platform, several national Technology Platforms already exist or are in development (Italy, Spain, Portugal, Poland, The Netherlands and Germany are well advanced at the moment). The objective is to create a sustainable network of national Technology Platforms and to utilise synergy effects on regional, national and European levels.

2. ManuFuture-CH – The Swiss ManuFuture Technology Platform

The discussion about a prosperous working place in Switzerland is also a question about the position of technology in the society and especially the continual improvement and innovation of products, processes and services with a strong relation to the market and customers needs. These require an increased input of new technologies, methods and knowledge. Therefore ManuFuture-CH supports the activities to maintain and to strengthen the production place in Switzerland and to strive for a sustainable industrialization of Switzerland in a global market.

The ManuFuture-CH national technology platform is a joint initiative of the mechanical, electrical and metallurgical manufacturing industries (MEM-industry), the educational institutions and the social partners, endorsed by the Commission for Technology and Innovation (CTI) and the Secretary for Research and Education (SRE) of the Swiss Government.

ManuFuture-CH has three main functions:

- to place Swiss interests and needs in the EU 7th Research Framework Programme,
- to make EU-financing feasible for Swiss projects and Swiss participation in EU-projects (by creating and supporting project teams and networks in Switzerland in time), and
- to gain on excellent manufacturing knowledge (to open up the access to high level networks in Europe by building up equivalent competencies in Switzerland based on a national top-down research programme)

In line with European policy, Swiss ManuFuture centres on a strategy based on research and innovation. ManuFuture-CH focuses on six complementary objectives:

1. Regain manufacturing leadership by adapting and strengthening Swiss manufacturing education at all levels in order to train uniquely qualified manufacturing personnel.
2. Regain market leadership for specific key products by supporting focussed pre-competitive mid-term (three to five years) research and development for new innovative products and for manufacturing science and technology.

3. Change the organisational and business structure of Swiss manufacturing industries, in particular SME, to increase the responsiveness and competitiveness in world markets
4. Establish an entrepreneurship spirit and obtain public and political support for manufacturing industries by actively promoting a better information exchange and debate among all stakeholders.
5. Remove administrative, legislative and cultural hurdles to socially responsible and sustainable manufacturing in Switzerland.
6. Strongly promote the interests of Swiss manufacturing industries in European circles and bring back to Switzerland 50 to 70 millions annually in EU FP7 project moneys

ManuFuture-CH is organized around an Executive Office (EO), housed by Inspire AG at IWF at ETH Zurich), a Steering Committee (SC), and five "Initiative Working Groups" (IWG). The EO handles day to day business and administrative tasks as well as the coordination of the promotion within Switzerland and EU circles. The EO and its activities are supported in the setup phase by CTI. The SC assumes the general oversight of the platform and represents it in EU circles. The SC is selected and approved jointly by SNF and CTI. The IWGs evaluate and monitor specific projects and promotes Swiss participation in relevant EU projects.

3. The alignment of ManuFuture-CH

Five initiatives corresponding to the first five objectives listed above have been defined by the SC and their content outlined by the IWG in terms of General Project Areas (GPA) and Specific Project Areas (SPA) (top-down part). Stakeholders might submit their specific project proposals to the IWG for review and approval, and funding is sought from either Swiss moneys, EU moneys or other sources (bottom up approach).

The action plan of the Swiss ManuFuture Technology Platform focuses on five complementary tasks, consistent with the ManuFuture approach and following the above described areas of action, namely:

- Promotion of manufacturing and entrepreneurship: ManuFuture-CH demonstrates to the public how a powerful production industry influences the general wellbeing in a positive way (value of manufacturing),
- Manufacturing education: ManuFuture-CH gives new impulses for further education and lays the basis for creative and innovative production experts of the future (quality of education),
- Research and development for innovative products and manufacturing: ManuFuture-CH supports the combination of technological know-how with entrepreneurship leading to high-tech production with high added value (innovative and outstanding entrepreneurial spirit),
- New Organisation and management models for manufacturing SMEs in global markets: ManuFuture-CH supports creating new organization and management models for a faster and more cost-efficient market entry, especially for small and mid-sized companies (efficiency in organization), and
- Support measures for manufacturing innovation: ManuFuture-CH develops a network which enhances innovation, speeds up technology transfer and assists companies in tax, financial and trading issues (excellent business environment).

The EU promotion and coordination will be a separate sixth task to ensure the cooperation with other research institutes and enterprises in Europe as well as to open the possibility of EU funding.

Goal of ManuFuture-CH:

- Re-industrialized Switzerland in a sustainable way
- Provide leverage and link to EU platform and FP7

Vision of ManuFuture-CH - Five initiatives:

- Promotion of manufacturing
- Manufacturing education
- Research and development for innovative products and manufacturing
- Organization and management models for “coopeting” manufacturing SMEs in global markets
- Support measures for manufacturing innovation

Approach of ManuFuture-CH:

- Definition of action plan by Initiative Working Groups (IWG) involving all stakeholders
- Build-up support among stakeholders (letters of support: see [appendix](#) “List of enterprises supporting ManuFuture-CH”)
- Work towards official recognition and secure funding

Five Initiative Working Groups have been set up including members from all the stakeholders like industry, associations, federal agencies, promotion agencies, education and marketing (see [appendix](#) with the list of personalities). The scope of each initiative, as identified by individual IWG, is presented below. A complete description of each GPA and SPA is given in Appendix:

1. Promotion of manufacturing and entrepreneurship

- 1.1 *Impact of manufacturing industry on economic and social well-being of Switzerland*
- 1.2 *Promotion and information campaign*

2. Manufacturing Education

- 2.1 *Education Programmes in Obligatory Schools and Gymnasiums*
- 2.2 *Education Programmes on University level – Education of Students*
- 2.3 *Education Programmes for Industrial Work Force*

3. Research and Development for Innovative Products and Manufacturing

- 3.1 *Materials and Integrated Micro- Nano- Bio Systems*
- 3.2 *Manufacturing Systems and Processes*
- 3.3 *ICT in the real world - Automation, Mechatronic, and MMI*
- 3.4 *Recycling infrastructure and energy generation and conservation*
- 3.5 *Simulation for Agile Manufacturing*

4. New Organisation and Management Models for Manufacturing SMEs in Global Markets

- 4.1 *Future business areas and models for manufacturing*
- 4.2 *Realisation of new forms of organization and management*
- 4.3 *Future monitoring and decision support system*

5. Support Measures for Manufacturing Innovation

- 5.1 *Capacity Building for Innovations*
- 5.2 *Basic conditions to improve the business environment*
- 5.3 *National Innovation Strategy*

The detailed description of every initiative on the level of the Specific Project Areas (SPA) is documented in the [appendix](#). It's important– in a further planning step – that every project area will be coordinated with EU activities in the 7th Research Framework Programme and with ManuFuture-EU activities.

4. The budget of ManuFuture-CH

The overall budget per year [Mio CHF] – after the starting period in 2007 and 2008 – is summarized in the following table:

Fields of Activities of ManuFuture-CH	2007	2008	2009	2010	2011
1. Promotion of Manufacturing and Entrepreneurship	2.0	2.0	3.0	3.0	2.0
2. Manufacturing Education	1.0	3.0	4.5	5.0	2.5
3. R&D for Innovative Products and Manufacturing	14.0	36.0	67.0	81.0	87.0
4. New organization and Management Models	2.0	9.0	14.0	13.0	6.0
5. Support Measures for Manufacturing Innovation	1.0	2.0	2.0	2.0	2.0
TOTAL (per year, in Mio CHF)	20.0	52.0	90.5	104.0	99.5

The Swiss ManuFuture Technology Platform will have two main sources of external (direct) financing:

- Whenever project objectives allow it funding for projects should be sought through EU funding, that is, whenever they coincide with objectives of actions launched by the EU ManuFuture Platform at the European level within the 7th European Research Framework Programme.
A major advantage within EU-financed projects is the close collaboration between leading institutes and enterprises EU-wide sharing their knowledge and experiences by lower investment of each partner.
- Switzerland-specific actions should be funded through CTI or possibly SNSF depending on the action and with a co-financing of industry of at least 50% for the whole project. This funding source is furthermore necessary to balance the differences between country specific supports in other EU-countries. Other sources, like Gebert RUF Stiftung, should be also taken into consideration.

Additional EU-money will also be possible, particularly when there are projects involving two or more nations participating in the EU ManuFuture Platform or other manufacturing nations around the world. For example, such combination funding could be possible for projects under the EUREKA programme umbrella "Factory" or projects generated under the label of the IMS (Intelligent Manufacturing System) programme or for Europe-wide initiatives called ER-Anet, launched by the European Commission in order to link the most important national R&D funding agencies around common important thematic topics that need a coordinated approach between the European Commission and national efforts.

The budget over 5 years in Mio CHF with the estimated income and expenditures is summarized in the following table:

TOTAL (per year, in Mio CHF)	20.0	54.0	92.0	105.0	102.0
Estimated income (funding coming from...)	2007	2008	2009	2010	2011
EU & International (FP7, ...) (see also <u>remark</u> below)	6.7	20.0	32.2	35.3	33.3
CH (CTI, NF, and others)	4.7	11.5	21.2	25.3	25.3
CH-industry	8.2	22.0	37.6	43.2	42.2
CH-schools (ETH and UAS, and others)	0.4	0.5	1.0	1.2	1.2
Estimated expenditures (funding going to...)	2007	2008	2009	2010	2011
CH-schools (ETH and UAS, and others)	10.0	24.5	41.0	47.0	46.0
CH-industry (own participation (Eigenleistung))	7.0	20.0	35.5	41.0	40.0
CH-industry (direct funding through EU Projects)	3.0	9.5	15.5	17.0	16.0

Remark about the EU-funding:

The budget represents only the direct EU-funding to Swiss institutes and enterprises. Due to the fact that the whole budget of the EU-projects (with different partners) is much bigger the leverage of these projects will be much higher.

Further information: www.manufuture.ch



Appendix – List of enterprises supporting ManuFuture-CH

(Status: spring 2006)

Imoberdorf AG	T. Imoberdorf
Swissmem	P. Vogel
Georg Fischer AG	K. Stirnemann
Trumpf Maschinen AG	H. Marfurt
Heidenhain (Schweiz) AG	M. Ruf
Siemens Schweiz AG	M. Würmli
Ibag Switzerland AG	U.G. Waldvogel
Steiger Galvanotechnique SA	E. Steiger
AP Technologies SA	F. Badano
IHT Industrie Haute Technologie SA	E. Burkhalter
Bobst SA	P.-Y. Müller
Léon Jaccard SA	P. Vouillot
Jean-Francois Baud	J.-F. Baud
AMG – P. Henchoz SA	P. Henchoz
Affolter Technologies SA	M.-A. Affolter
DC Swiss SA	B. Kaufmann
Alcan Engineered Products	E. Lutz
Willemin-Macodel SA	B. Haegeli
Industrie de Pierrers Scientifiques H. Djevahirdjian SA	K. Djevahirdjian
Firstec SA	J.-C. Vaudroz
Peter Hofer Moules et articles en polyuréthane	P. Hofer
Roland Perrier	M. Perrier
Plumettaz SA	G. Plumettaz
Piguet Frères & Cie. SA	P.-A. Meylan
Lemco SA	P.-C. Jaquier
ETS Meylan SA	G. Meier
Tesa SA	M. Baumgartner
La Manufacture – Ressorts CML	D. Pillonel

Metallica SA	B. Bertolli
PCM Willen SA	J.P. Dupont
Telast SA	W. Müller
P. Niklaus SA	J. Niklaus
R. de Siebenthal & Fils SA	R. de Siebenthal
STS Industrie SA	P.-A. Schopfer
UIG unin Industrielle Genevoise	N. Aune
GIM-CH Groupement suisse de l'industrie mécanique	F. Bonjour



Appendix – List of involved personalities

(Status: summer 2006)

Steering Committee

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IWG4

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Appendix – Detailed description of the Action Plan

Content:

1. Promotion of manufacturing and entrepreneurship

- 1.1 *Impact of manufacturing industry on economic and social well-being of Switzerland*
 - 1.1.1 *Manufacturing related performance evaluation system based on indicators*
- 1.2 *Promotion and information campaign*
 - 1.2.1 *Manufacturing perspective for young people*
 - 1.2.2 *Stakeholder involvement*

2. Manufacturing Education

- 2.1 *Education Programmes in Obligatory Schools and Gymnasiums*
 - 2.1.1 *“Technology and Manufacturing” at obligatory schools, at gymnasiums, at pedagogic universities, and as continuous learning modules for teachers*
- 2.2 *Education Programmes on University level – Education of Students*
 - 2.2.1 *Basic Courses in Manufacturing Technology for Students of UAS and EPFL / ETHZ*
 - 2.2.2 *Manufacturing technologies in project based modules*
 - 2.2.3 *Project bourse – platform for students and industry*
 - 2.2.4 *TOPART Seminars – Education for elite-level manufacturing experts*
 - 2.2.5 *Language skills*
 - 2.2.6 *Master of Advanced Studies for Postgraduates*
 - 2.2.7 *Monitoring industrial relevance in EPFL / ETHZ / UAS courses in manufacturing*
- 2.3 *Education Programmes for Industrial Work Force*
 - 2.3.1 *Inspiring learning environment - Use of modern technology for an inspiring learning environment for vocational training in manufacturing*
 - 2.3.2 *Life long learning in manufacturing - Support for life long learning in manufacturing*

3. Research and Development for Innovative Products and Manufacturing

- 3.1 *Materials and Integrated Micro- Nano- Bio Systems*
 - 3.1.1 *Advanced Structural Materials*
 - 3.1.2 *Functional Materials and Functional Surfaces*
 - 3.1.3 *Microsystems*
 - 3.1.4 *Nano Systems*
 - 3.1.5 *Surfaces and Interfaces Bio-Inorganic Systems*

- 3.2 *Manufacturing Systems and Processes*
 - 3.2.1 *Non-Conventional Manufacturing Processes*
 - 3.2.2 *Tools and Dies Technology*
 - 3.2.3 *Rapid Manufacturing*
 - 3.2.4 *Intelligent Flexible Manufacturing Systems*
 - 3.2.5 *Microfactory*
 - 3.2.6 *Systems for Hi-Tech Textile Industry*
- 3.3 *ICT in the real world - Automation, Mechatronic, and MMI*
 - 3.3.1 *Advanced controllers and embedded systems*
 - 3.3.2 *Innovative Sensors*
 - 3.3.3 *Infrastructure Development and Cognitive Modelling for Agile Design and Reconfiguration of Human Machine Interface*
 - 3.3.4 *Autonomous Service Robots*
 - 3.3.5 *Process & Production Automation*
 - 3.3.6 *Novel automation standards and test facility*
- 3.4 *Recycling infrastructure and energy generation and conservation*
 - 3.4.1 *Automation for reuse and remanufacturing*
 - 3.4.2 *Sustainability; Recycling, Energy and Technology*
 - 3.4.3 *Distributed Mini- and Micro- Energy Systems for Sustainable Energy Supply*
- 3.5 *Simulation for Agile Manufacturing*
 - 3.5.1 *Simulation of Manufacturing and Assembly Processes*
 - 3.5.2 *Simulation of Manufacturing and Assembly Systems*
 - 3.5.3 *Product Data Integration*

4. *New Organisation and Management Models for Manufacturing SMEs in Global Markets*

- 4.1 *Future business areas and models for manufacturing*
 - 4.1.1 *Industrial services*
 - 4.1.2 *Composition and economics of the value adding chain (networking)*
 - 4.1.3 *New interfaces and business relation adapted to customer process*
 - 4.1.4 *New Business Opportunities*
- 4.2 *Realisation of new forms of organization and management*
 - 4.2.1 *Identification & implementation of sector specific cooperation*
 - 4.2.2 *Networking in different functions*
 - 4.2.3 *Resource management in a global context*
- 4.3 *Future monitoring and decision support system*
 - 4.3.1 *Performance monitoring and risk management of SME networks*
 - 4.3.2 *Monitoring of the market / market observations*
 - 4.3.3 *Monitoring and risk management of operations*
 - 4.3.4 *Monitoring and risk assessment of resources*
 - 4.3.5 *Monitoring & realigning technology & technical processes*

5. *Support Measures for Manufacturing Innovation*

- 5.1 *Capacity Building for Innovations*
 - 5.1.1 *Design and implementation of measures to support innovation strategies in SMEs*
- 5.2 *Basic conditions to improve the business environment*
 - 5.2.1 *Improvement of business environment*
- 5.3 *National Innovation Strategy*
 - 5.3.1 *Swiss Innovation Strategy*

Action Plan for Initiative 1: Promotion of Manufacturing and Entrepreneurship

Overview

The main goal of the following project areas is to inform the population at large and all specific stakeholders about the importance and nature of manufacturing in Switzerland and of its impact on our current and future well-being as well as to motivate young people to be part of this attractive business area.

The focus mainly is on how to inform and to get involved relevant stakeholders. Especially young people have to see the importance of manufacturing for Switzerland and the multitude of career opportunities this vast field offers. We have to give manufacturing a positive image and to convince people with a relevant set of arguments.

A significant promotion and information effort is planned over the next four years, to be funded by various public and private partners.

The proposed project areas must:

- 1) lead to a positive image of manufacturing industries in order to initiate a stronger commitment for manufacturing and entrepreneurship, and
- 2) motivate an increase number of young people and students starting their career in the area of manufacturing.

Stakeholders are the MEM industry and other industrial sectors, trade unions, schools and universities (UAS, EPFL / ETHZ, and universities), federal and cantonal administration, politicians, the media

The proposed programme is structured in 2 "General Project Areas" (GPA) which are closely interlinked:

1.1	Impact of manufacturing industry on economic and social well-being of Switzerland	
1.1.1	Manufacturing related performance evaluation system based on indicators	Medium size SPA ¹

1.2	Promotion and information campaign	
1.2.1	Manufacturing perspective for young people	Medium size SPA
1.2.2	Stakeholder involvement	Medium size SPA

Total over 4 years

Budget in Total (Mio CHF)
12

¹ Small: less than 1 Mio CHF; Medium: 1-10 Mio CHF; Large: over 10 Mio CHF

Description of the Specific Project Areas
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1.1 Impact of manufacturing industry on economic and social well-being of Switzerland

1.1.1 Manufacturing related performance evaluation system based on index / indicators

Motivation

Manufacturing enterprises are often faced with mistrust. The image of being too old fashioned and unscientific, unworthy for engineers, with no more future in Switzerland, having high impact on the ecological environment, offering low salaries and demanding irregularly working times, dirty working places not suitable for mankind avoids young people to start their career in manufacturing industry as well as complicates an efficient involvement of relevant stakeholders to promote new projects and activities.

The interactions between manufacturing industry and society are complex. This fact makes the process of analysis and interpretation quite difficult. There is currently a lot of information about facts and figures in manufacturing (compare also statistics and evaluations from seco and Swissmem). A holistic approach respectively picture of all relevant interactions and impacts are still missing. In addition there is no in general accepted index or set of indicators that shows the semi-quantitative or quantitative impact on the well-being of the Swiss society.

There are already some general accepted index and indicators, such as the KOF-ETH-Index (showing the business activities) or within accounting (interpretation of balances...). In addition there are also methods, tools and experiences to interpret complex systems.

Goals

Mistrust might be eliminated by information campaigns. An effective data basis shall be the fundament of an information campaign. The project aims at developing an evaluation method, based on a set of well accepted indicators (or one index) that shows the impact on the well-being in Switzerland of manufacturing industries. These indicators should be accepted by the relevant stakeholders.

Content of the project

There are three directions of research that will contribute:

- One aspect will focus on the development of adequate models that contain the relevant impacts from and to the society. These models should be the basic for simulating further development and should support at least a semi-quantitative evaluation.
- One aspect will focus on the adaptation of sector specific areas. It's necessary to have a differentiated argumentation.
- One aspect will focus on the design and implementation of a set of indicators / index that demonstrate the benefit of manufacturing for society.

Planning information

Medium size SPA

Particular aspects

- seco needs to get involved and take a leading position in the project
- Establishing a steering committee that has to ensure the design of the monitoring system as well as the regularly collection and interpretation of information.

1.2 Promotion and information campaign on different levels

1.2.1 Manufacturing perspective for young people

Motivation

Young people in general are not sufficiently educated in manufacturing issues during the compulsory school time. Exceptions are industrial visits, special topics in school like waste water treatment and waste incineration plants or visits. It's rather the same situation at high schools.

At the end of the compulsory school time young people are introduced to different options of vocational training accompanied by short practical work. At this time young people don't have really a good understanding about the importance of manufacturing and the opportunities for their own professional life.

It's important to establish a much more positive image by providing attractive information about manufacturing and the future perspectives for their own professional life.

Goals

Young people have to be motivated for manufacturing. On the one hand attractive and easy understandable documentation with facts and figures should be worked out and distributed to interested schools, enterprises and institutions using modern technology like success stories on CD with video clips, interactive games, webpage... On the other hand possibilities should be designed and offered to interested schools and young people to show the real world of manufacturing, offering visits in enterprises or mobile exhibitions. Both activities should be conducted by national wide promotion.

Content of the project

There are four areas that specific promotion has to be done:

- Developing a concept based on a communication strategy (master plan)
- Preparation of attractive information: didactical concepts, partner form industry, collecting examples, producing text / pictures, video clips...
- Explore the real manufacturing world: Schnuppertage (students, teachers ...), articulated lorry (Sattelschlepper) / train, Bus, "sales booth" in supermarkets...
- National manufacturing day / week: "production day", "production week", ..., always with al link to: modern and attractive technologies / international relations.
(remark: enterprises should be free in organising their "open days")

Organization and project plan

This project should be a joint initiative from industry, Swissmem and schools as well as numerous enterprises that can provide the "real world"; other partner should be press and TV. A major part of this project will be self-financed by industry (internal activity (Eigenleistung) and sponsoring).

Planning information

Medium size SPA

Particular aspects

- A group of initiative enterprises should be a kind of steering committee as well as representatives from this initiative.
- SER and seco needs to get involved and should participate

1.2.2 Stakeholder involvement

Motivation

The manufacturing sector isn't recognized in general as a prospective area for Switzerland. This prejudice might lead to obstacles in the daily business. Examples are creditworthiness in the discussion with banks, attractiveness for young professionals in the context of HR, cooperation with public authorities in the context of new laws and regulations.

It's important to inform all relevant stakeholders about the importance of manufacturing in Switzerland and all the different positive impacts on the social and economical well-being. The basic of this task has to be a set of indicators / index that should be accepted by the relevant stakeholders (Link to SAP 1.1.1; see above).

The information might be provided on two different levels: a) on a general level to change the image in the society, and b) in a specific situation to convince relevant stakeholders.

Goals

Significant information about the importance of manufacturing in Switzerland should be provided in an adequate way to the significant stakeholder (except from young people; this target group is part of the SPA 1.2.1; see above).

The concept should consider that the promotion should also include recurrent measures. The idea is that after a national campaign some efforts should be done every year. This includes also activities to improve the communication year per year.

A major target group are people from politics and public administration. They should receive specific information that helps to influence their daily business.

Content of the project

There are three areas that specific promotion has to be done:

- Developing a concept based on a communication strategy (master plan)
- Developing and realisation of a nation-wide proportion and information activities, especially preparation of the specific information (based on professional analysis: compare also with the first SPA 1.1.1; see above)
- Explorative activities to support the nation-wide campaign, for example "open days of manufacturing plants", guest speaker for political assemblies, individual industrial visits...

Organization and project plan

This project should be a joint initiative between industry, Swissmem and professionals (marketing, PR) as well as numerous enterprises that can provide the "real world"; other partner should be press and TV.

A major part of this project will be self-financed by industry (internal activity (Eigenleistung) and sponsoring).

Planning information

Medium size SPA

Particular aspects

- It's important to have some key people from politics that will support the initiative especially in the starting phase.

Action Plan for Initiative 2: Manufacturing Education

Overview

The main goal of the following project areas is to develop a coherent vision of manufacturing education across the whole vocational and professional education community to provide European and Swiss MEM industries with a highly skilled and knowledgeable work force. Specific actions and programmes will aim at inducing the interest for technical phenomena in pupils and attracting them to technical professions, and at raising the status of mathematics and natural sciences in high school, thus opening the students a successful career in a technical field.

Actions e.g. are aimed at improving educational curricula on all levels and at the diffusion of information. High technology, knowledge-based products and future manufacturing rely on hard working people with a creative mind, dedicated to high quality science, innovation and high quality standards.

The proposed project areas must:

- 1) lead to high level educational programmes and
- 2) a highly skilled and dedicated work force with entrepreneurial views.

Stakeholders are mainly: MEM industry and other industrial sectors, trade unions, educational systems (schools, administration, and pedagogic universities), universities (UAS, EPFL/ETHZ, and universities), politicians, partners in countries of the EU.

The proposed programme is structured in 3 General Project Areas (GPA):

2.1 Education Programmes in Obligatory Schools and Gymnasium		
2.1.1	“Technology and Manufacturing” at obligatory schools, at pedagogic universities, and as continuous learning modules for teachers	Medium size SPA ²

2.2 Education Programmes on University level – Education of Students		
2.2.1	Basic Courses in Manufacturing Technology for Students of UAS and EPFL / ETHZ	Small size SPA
2.2.2	Manufacturing technologies in project based modules	Medium size SPA
2.2.3	Project bourse – platform for students and industry	Small size SPA
2.2.4	TOPART Seminars – Education for elite-level manufacturing experts	Small size SPA
2.2.5	Language skills	Small size SPA
2.2.6	Master of Advanced Studies (MAS) for Postgraduates	Medium size SPA
2.2.7	Monitoring industrial relevance in EPFL / ETHZ and UAS courses in manufacturing	Small size SPA

² Small: less than 1 Mio CHF; Medium: 1-10 Mio CHF; Large: over 10 Mio CHF

2.3 Education Programmes for Industrial Work Force		
2.3.1	Inspiring learning environment - Use of modern technology for an inspiring learning environment for vocational training in manufacturing	Medium size SPA
2.3.2	Life long learning in manufacturing - Support for life long learning in manufacturing	Medium size SPA

Total over 4 years

<i>Budget in Total (Mio CHF)</i>
16

Description of the Specific Project Areas

2.1 Obligatory School Level and Gymnasiums

2.1.1 “Technology and Manufacturing” at obligatory schools, at gymnasiums, at pedagogic universities, and as continuous learning modules for teachers

Motivation

Wealth of our society depends on excellent work of people in the workshops of our manufacturing industries, and on excellent work of engineers.

Nevertheless, the number of young people in education for manufacturing jobs and in engineering studies decreases.

Obligatory schools, gymnasiums and teachers' education seem to have lost the contact with engineering and manufacturing, which causes a lack of knowledge on the importance, the fascination, and the great opportunities of manufacturing and engineering in Switzerland and Europe.

Goals

Cooperation between schools, pedagogic universities, manufacturing industry and engineering professions in order to inform on manufacturing and engineering opportunities in Switzerland and Europe.

The cooperation might start on an optional basis and shall end as a mandatory item for schools and pedagogic universities.

Content of the project

There are three activities:

- Short term goal: “Technology and Manufacturing” taught by industrial people.
- Medium term goal: “Technology and Manufacturing” as separate subject at secondary and high school.
- Long term goal: “Technology and Manufacturing” as subject for teacher's education and continuous learning modules.

Organization and project plan

- Short term: Establish courses for different topics; produce teaching materials, including DVD, E-learning modules
- Medium term: introduce the subject “Technology and Manufacturing” at obligatory schools; definition content of subject; development of teaching material
- Long term: Interaction with pedagogic universities to include “Technology and Manufacturing” in teachers' education

Possible project partners: UAS, EPFL / ETHZ, Swissmem, IngCH, Association of Teachers, manufacturing industry, high technology companies

Planning information

Medium size SPA

Particular aspects

- This project shall be based on and use the experience of IngCH, who already provides technology weeks for secondary schools, high schools, pedagogic universities, and occupational counsellors, and who started an initiative for an improved integration of natural sciences and technology in basic education.
- Cooperation with teachers, secondary schools, high schools and pedagogic universities.
- Cooperation with EXPLORE-IT, a project of teachers for manual work subjects (“Werklehrer”) supported by the GEBERT RÜF Foundation in order to change content of manual work subjects, might be useful.

2.2 University level - Education of Students

2.2.1 Basic Courses in Manufacturing Technology for Students of UAS and EPFL / ETHZ

Motivation

All engineering thoughts at the end are bound to become products and need to be manufactured. As a matter of fact Swiss industries are product driven, while processes tend to play a minor role. On the other hand successful industries very often master their processes very thoroughly. This observation directly mirrors the education curriculum in UAS (Universities of Applied Sciences) and EPFL / ETH, namely that Manufacturing Education is not at the adequate level of completeness and efficiency at UAS and EPFL / ETHZ, particularly for an industrial country like Switzerland. The curricula for the engineers at EPFL/ETHZ and most UAS do not include any compulsory courses in manufacturing. Various elements of manufacturing are included in the curricula of various UAS and at EPFL/ETHZ but no Swiss institution offers a complete, modern programme on manufacturing.

Furthermore, due to the lack of coordination among the UAS and EPFL / ETHZ, the possibility to continue or complete the studies in manufacturing does actually not exist in Switzerland.

Topics of great actual importance such as manufacturing processes, process chain planning, Quality Engineering, Cost Engineering, Team Work, Communication etc. are not covered to an adequate level or not covered at all.

Goals

The project aims to review the curricula of the different schools with respect to manufacturing and

- define contents of compulsory courses in manufacturing for UAS and for EPFL / ETHZ,
- setup recommendations for a complete manufacturing education curriculum, and
- realize missing modules

The project furthermore introduces the manufacturing courses in the different schools.

Content of the project

It is necessary to perform a thorough review of the manufacturing education programmes in all Swiss educational institutions, UAS and EPFL / ETHZ. This review will allow identifying strengths and weaknesses of each relevant programme and defining the map of missing elements, opportunities and needs in manufacturing education in Switzerland. The input from project 2.2.4, more industrial relevance, will be taken into account.

With this background, a plan of coordinated and compulsory manufacturing education in Switzerland will be elaborated, where each involved institution will take the responsibility.

The existing work done in the project global education in manufacturing (GEM) will be used as a framework and starting point.

Organization and project plan

It would be ideal to have a first draft programme on Manufacturing education in Switzerland by June 2007 so that the first discussions for elaboration of a final coordinated programme could start in autumn 2007.

Possible project partners: UAS, EPFL / ETHZ, machine tool industry, manufacturing industry, high technology companies

Planning information

Small size SPA

2.2.2 Manufacturing technologies in project based modules

Motivation

Students of today mainly are educated for the engineering of products, not for the mastering of processes. In an economy which is threaded by low wage countries (LWC), process knowledge becomes more and more the key factor for success, since it is very difficult to copy processes, but very easy to copy products. On the other hand companies most drive their shop floor as a necessary evil, thus turning a negative screw. Since there is no high level production knowledge in the companies, the shop floor is scarcely appreciated. Thus there is only little invested and only cheap people are hired. These people are not able to convince someone that a shop floor needs deep and thorough attention. The end point of this development is that the old fashioned manufacturing is no more competitive and needs closure. Manufacturing processes become more and more complex while on the other hand employees in the shop floor become less and less skilled. What is needed are professionals on all levels also on high school level who are acquainted with manufacturing processes, who are able to judge, evaluate and successfully lead shop floors.

Goals

Form engineers who are able to transform a manufacturing site to a knowledge based factory. The basic idea is to bring together industry and students within projects, where accompanying relevant methods and scientific contemplation of the respective processes are educated within academia and are applied within a real shop floor in industry.

Content of the project

Necessary is to close the gap between academic learning and application in industry:

- industry must learn, that a profound understanding is necessary to create a climate for success in manufacturing
- in education more emphasis must be laid on process engineering, which is impossible without mastering the processes themselves
- more emphasis in education on design of process chains

In that projects entrepreneurialism in favour of manufacturing will be skilled, thus that students learn to find chances for “their” manufacturing in Switzerland. This means a fairly new method of teaching, since the practical process is introduced within the project course – this means necessary equipment which needs machine tool industry as project partners.

Organization and project plan

Intention is to introduce a course like this within the bachelors or master curricula beginning from fall semester 2007. It is therefore necessary to begin the detailed project course preparation in may 2007.

Calculation for a project based course with 4 ECTS-points:

- concept of the course, including the introduction of this project within the curricula of bachelor and master, Convince manufacturing companies or machine tool builders, derive suitable project ideas, Find further academic cooperation partners to increase the number of student applicants
- Work out the course, which needs to be adapted to the respective project idea, which changes from year to year, prepare the course documentation including all multimedia material
- Carry out the project course in cooperation with the chosen partner

Possible project partners: UAS, EPFL / ETHZ, machine tool industry, manufacturing industry, high technology companies

Planning information

Medium size SPA

2.2.3 Project bourse – platform for students and industry

Motivation

The today courses are often focussed on learning and practising scientific knowledge. The target is to understand the basic knowledge and to practise the theory and basic knowledge successfully on a practical example (case).

The step “applying in the real world” is often missing. Students in general are interested to work on practical projects together with industry, in the context of a bachelor or master thesis or as an industrial placement. Therefore suitable projects, possible projects from industry as well as a systematic guidance on how to work in real projects, is necessary.

The benefit of a “project agency” will be on both sides. Industry has the opportunity to receive external assistance as well as students and lecturers have the chance to improve their industrial experience.

Goals

Students should get the ability to solve new and complex engineering problems under a broad view. They should analyse and describe the real world (situation analysis, past, current and future situation), gathering and modelling complex target systems, developing carefully alternative solutions, evaluating und assessing multidimensional concepts.

The general idea is, to establish a kind of project-pool between industry and students. On the one hand there must be a team formulating interested projects together with industry (these experts might be a kind o WTT-experts (WTT = Wissens- und Technologie-Transfer) with a broad understanding of practical problems). On the other hand there is a need of professional assistance that would mean a pool of assistant / professors who are interested in guiding these projects.

Content of the project

One step will be the design of this platform:

- team of industry partners and one or several coaches (agents),
- procedures to handle the whole process from a first project idea to a relevant project result (handbook / guidance how to work effectively in this platform), and
- infrastructure to support this process.

The other part will be the successful operation.

Organization and project plan

The following steps need to be undertaken:

- to develop the platform and to establish a close network to industry
- design and implementation of the processes (on-stop- shopping for industry)
- operation

Planning information

Small size SPA

Particular aspects

- The goal of a well and professional organised project agency should be a self-supported budget after a starting phase. For the first year a deficit guaranty might be useful.
- A success factor might be probably a senior consultant, who has to manage the platform.

2.2.4 TOPART Seminars - Education for elite-level manufacturing experts

Motivation

There is a need to have well educated specialists in the field of manufacturing processes (development of new processes and technologies, application on new machines and manufacturing systems, monitoring and improvement of manufacturing technology and processes). High-level education in manufacturing requires the possibility to demonstrate latest technology and especially the possibility to make (real) experiences.

It's not possible for EPFL / ETHZ and UAS to have all attractive and relevant technology on the latest level. A close collaboration with industry is indicated.

Goals

The goal of this project is to offer to a group of students already existing seminars in industry, so that they learn in the real world the latest technologies and applications in specific areas. The benefit should be on one hand a closer collaboration between leading enterprises / motivated employees and future engineers in the area of production. On the other hand students will have a better understanding of specific production technologies (processes). The deliverables of this project will be a "dynamic" learning programme for students in production technologies which is offered for excellent and motivated students at EPFL / ETHZ and UAS.

Content of the project

The project consists of the following working packages:

- to build up a club of enterprises with at least 10 companies that offering high-level courses,
- to collect new ideas and possibilities
- to develop a (dynamic) programme consisting of different modules offered by the enterprises
- to produce additional learning materials
- to organize every year one or two courses (consisting of 6 to 10 modules)

Organization and project plan

The main task is to build up a "club" of at least 10 enterprises and to concretise the concept. A coordinator has to coordinate and organize every single programme in close collaboration with interested lecturers from EPFL / ETHZ and UAS.

Planning information

Small size SPA

Particular aspects

It's necessary to have a good coordination between enterprises, which are offering modules, and the universities. If necessary, modules and programme specific learning materials have to be produced.

2.2.5 Language skills

Motivation

There is the impression that foreign language skills are too weak after obligatory school in Switzerland.

Foreign language skills are a key issue for manufacturing technology, also for manufacturing within Switzerland and within Europe because engineers in manufacturing need to communicate with all kind of workforce people with very different functions, e.g. engineers, shop floor persons, managers and for real team work need to speak, at least to understand their language.

Students from Universities of Applied Sciences should improve their foreign language skills in continuous learning modules. Japanese and Chinese become more and more important

languages.
<p>Goals</p> <ul style="list-style-type: none"> ○ Collect information about foreign language skills in Switzerland, i.e. on the languages in Switzerland (German, French, and Italian as foreign language), English, Spanish, and Japanese. ○ Improve foreign language skills especially for manufacturing people.
<p>Content of the project</p> <ul style="list-style-type: none"> ○ Overview of foreign language skills in Switzerland and Europe. ○ Introduce continuous learning modules for foreign languages, perhaps as on the job training supported with E-learning modules. These courses shall be dedicated to manufacturing engineering people.
<p>Organization and project plan</p> <p>Short term: collection of data, evaluation of data, conclusions 12 months, 1 person</p> <p>Medium and long term goals: Realisation of specific learning modules using already existing programmes.</p> <p>Possible project partners: UAS, EPFL / ETHZ, Swissmem, IngCH</p>
<p>Planning information</p> <p>Small size SPA</p>
<p>Particular aspects</p> <ul style="list-style-type: none"> ○ Possibly supported by harmonisation programmes to be started after positive national vote from 2006.

2.2.6 Master of Advanced Studies (MAS) for Postgraduates

Motivation

Manufacturing needs a more methodological and scientific approach instead of being merely experience based. Manufacturing must develop to a knowledge based art. To increase the speed of transformation of industry today's shop floor, leaders respectively specialists shall find possibilities to attain the education needed. Thus there is a need to have a system of courses specialized to the different requirements of industry. For example for welding a post-graduate education towards a certified "Schweissfachingenieur" exists. Similar courses with fixed content shall be established for other manufacturing technologies, such as chipping with geometrically defined cutting edges, grinding, forming, automation, process chain planning, CAM, manufacturing of free surfaces, micro – and nano manufacturing, process control, laser materials processing, management of shop floors.

Goals

The project consists of setting up in cooperation between different schools a system of post-graduate course tracks in different specializations. The contents need to be defined according to expectations of industry but also with respect to future requirements which shall be defined according to strategic trends in manufacturing. Since all manufacturing will become more and more method based, the training within the MAS tracks must include theory and application. A special emphasis must be given to management. The management course shall be designed so that management staff with a clear disregard to manufacturing can be attracted and convinced to keep and modernize their shop floors. The contents as well as the multimedia documentation must be developed. A very good compendium or textbook, which may serve as an industrial standard, shall be the outcome of the course preparation. As well as in defining the contents the help of industry is necessary for carrying out the practically oriented part of the course with modern state of the art equipment. The MAS – tracks shall be paid by students or industries at least partly. The first track will not cover the costs. Therefore it is necessary to have an external funding also for the track.

Content of the project

The following steps need to be undertaken:

- find cooperation in the academic world in favour of manufacturing being interested in supporting a MAS track programme
- recruit industrial partners for the support of the courses
- define the contents of the courses from interviews with the industrial partners
- derive necessary contents from the trends in modern manufacturing
- prepare and work out complete MAS - tracks

Organization and project plan

Intention is to introduce a MAS track beginning from fall semester 2008. It is therefore necessary to begin the detailed project course preparation in fall 2007.

Planning information

Medium size SPA

2.2.7 Monitoring industrial relevance in EPFL / ETHZ and UAS courses in manufacturing

Motivation

Young engineers entering industrial companies need further education to cope with the daily business within the company. Some education they get there is company – specific and need to be taught by the company, but there can be identified a gap of skills which would be necessary for numerous companies and branches. Therefore it would be more efficient to teach that kind of topics in academia.

Furthermore there needs to be a clear development of companies towards knowledge based manufacturing and entrepreneurship, which must be carried into the companies by young engineers and their skills, which have been educated in academia. Last but not least it is impossible to form engineers who need to be missionaries for methodological access to problems solutions, who have no experience in applying these methods.

Goals

A joint project is needed to distil the requirements for the future, which has to be taught now, so that it will be available within the next five years. It could be beneficial having a permanent council, in order to identify the running changes within the market and technology.

Content of the project

Students should understand manufacturing related issues in a broader context, in order to realize and to interpret new trends. They should also know something about developing processes (problem-solving methodologies). They need to develop experience in methods, with which they begin to transform manufacturing industry. Interdisciplinary questions shall be solved in the context of manufacturing issues. That indicates different levels of teaching.

Thus as a first step the needs of industry must be distilled from their own estimation as well as of trends in manufacturing abroad. Secondly a continuous improvement of the education needs the establishment of a council that observes trends and gives impact to the change of manufacturing education. Manufacturing education must be ahead of industry, so that students enter industry with skills actually needed.

Organization and project plan

Intention is to introduce new content within the bachelors or master curricula beginning from fall semester 2007. It is therefore necessary to begin the analysis January 2007.

Possible project partners: UAS, EPFL / ETHZ, machine tool industry, manufacturing industry, high technology companies

Planning information

Small size SPA

2.3 Education Programmes for industrial work force

2.3.1 Inspiring learning environment - Use of modern technology for an inspiring learning environment for vocational training in manufacturing

Motivation

Learning games, E-learning modules, virtual experiments create an inspiring learning environment. These tools shall be applied for vocational training courses in manufacturing

Goals

Creation of a modern, inspiring learning environment for vocational training in manufacturing in order to improve the learning performance.

Content of the project

The project consists of the following working packages:

- Overview of E-learning modules, learning games, virtual experiment software, etc.
- Benchmarking of those systems for creating an inspiring learning environment, for better learning performance for people in vocational training for manufacturing.
- Selection of topics for applying modern learning support systems in vocational training for manufacturing.
- Realisation of modules with modern learning support systems.
- Testing of learning performance with and without modern learning support systems.

Organization and project plan

The following steps need to be undertaken:

- overview of learning support systems
- benchmarking of systems
- selection of topics from manufacturing
- realisation of modules
- testing of learning performance

Possible project partners: UAS, EPFL / ETHZ, Swissmem, manufacturing industry, high technology companies

Planning information

Medium size SPA

Particular aspects

- The part on realisation of modules shall be based on the work already available, e.g. from global education in manufacturing (GEM).

2.3.2 Life long learning in manufacturing - Support for life long learning in manufacturing

<p>Motivation</p> <p>Life long learning becomes more and more important, especially for manufacturing industries. However, support for life long learning is not installed as a systematic, fixed item in industry.</p>
<p>Goals</p> <p>Possible support for life long learning in manufacturing industry shall be studied, model support systems shall be realised.</p>
<p>Content of the project</p> <ul style="list-style-type: none"> ○ Overview of available life long learning support systems in Europe. ○ Benchmarking of those systems to motivate and support learning of employees in manufacturing. ○ Definition of support systems, like “Learners’ Club” [“Rat der Weisen”, “Reference People”], step-by-step job classification, learning as constant part of any manufacturing system. ○ Support system not only for large companies, but also for small and medium enterprises (SME), e.g. by implementing SME clusters. ○ Learning modules for playful learning, for fun learning, for experiments, etc. ○ Cooperation with Swissmem and unions.
<p>Organization and project plan</p> <p>The following steps need to be undertaken:</p> <ul style="list-style-type: none"> ○ overview of available systems, benchmarking of systems, definition of support systems ○ concepts for a system in large companies ○ concepts for a system in SME cluster ○ providing learning modules ○ cooperation with interested organisations <p>Possible project partners: UAS, EPFL / ETHZ, Swissmem, machine tool industry, manufacturing industry, high technology companies</p>
<p>Planning information</p> <p>Medium size SPA</p>
<p>Particular aspects</p> <ul style="list-style-type: none"> ○ The part on learning modules shall be based on the work already available, e.g. from global education in manufacturing (GEM).

Action Plan for Initiative 3: Research and Development for Innovative Products and Manufacturing

Overview

One main goal of the following project areas is to establish, in close collaboration with SNSF and CTI, a strong mid-term (two to four years) research and development programme to bridge the gap between long-term and short-term research and innovation. The focus is on strategic areas such as materials, nano-technologies, micro-electronics, and bio- and bio-medical technologies to lay the basis for new manufacturing processes and for manufacturing high value added products as well as on the improvement of new and conventional manufacturing processes and technologies currently used by Swiss SME. Therefore a specific effort will be on science and technology to support the evaluation of traditional SMEs and the development of new manufacturing-oriented SMEs in emerging high tech markets.

The proposed project areas must:

- 1) improve the position of Swiss manufactures in specific market areas with high potential and market needs (emerging markets), and
- 2) further improve the strength of Swiss manufacturers in well controlled established markets.

The following project areas should be coordinated to the ongoing efforts within the 7th EU Research Framework Programme. Therefore interested companies should be motivated and supported to be part of EU R&D activities.

Stakeholders are mainly: MEM industry, research institutions (university, ETH, UAS), Swiss R&D-funding institutions, and partners in EU countries.

The proposed programme is structured in the following 5 General Project Areas (GPA):

3.1 Materials and Integrated Micro- Nano- Bio Systems		
3.1.1	Advanced Structural Materials	Large size SPA ³
3.1.2	Functional Materials and Functional Surfaces	Large size SPA
3.1.3	Microsystems	Large size SPA
3.1.4	Nano Systems	Large size SPA
3.1.5	Surfaces and Interfaces Bio-Inorganic Systems	Large size SPA

3.2 Manufacturing Systems and Processes		
3.2.1	Non-Conventional Manufacturing Processes	Large size SPA
3.2.2	Tools and Dies Technology	Large size SPA
3.2.3	Rapid Manufacturing	Large size SPA
3.2.4	Intelligent Flexible Manufacturing Systems	Large size SPA

³ Small: less than 1 Mio CHF; Medium: 1-10 Mio CHF; Large: over 10 Mio CHF

3.2.5	Microfactory	Large size SPA
3.2.6	Systems for Hi-Tech Textile Industry	Large size SPA

3.3	ICT in the real world - Automation, Mechatronic, and MMI in manufacturing	
3.3.1	Advanced controllers and embedded systems	Medium size SPA
3.3.2	Innovative Sensors and adaptronic	Medium size SPA
3.3.3	Infrastructure Development and Cognitive Modelling for Agile Design and Reconfiguration of Human Machine Interface	Medium size SPA
3.3.4	Autonomous Service Robots	Medium size SPA
3.3.5	Process & Production Automation	Medium size SPA
3.3.6	Novel automation standards and test facility	Medium size SPA

3.4	Recycling infrastructure and energy generation and conservation	
3.4.1	Automation for reuse and remanufacturing	Medium size SPA
3.4.2	Sustainability; Recycling, Energy and Technology	Medium size SPA
3.4.3	Distributed Mini- and Micro- Energy Systems for Sustainable Energy Supply	Medium size SPA

3.5	Simulation for (Agile) Manufacturing	
3.5.1	Simulation of Manufacturing and Assembly Processes	Medium size SPA
3.5.2	Simulation of Manufacturing and Assembly Systems	Medium size SPA
3.5.3	Product Data Integration	Medium size SPA

Total over 4 years

Budget in Total (Mio CHF)
285

Description of the Specific Project Areas
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3.1 Materials and Integrated Micro- Nano- Bio Systems

3.1.1 Advanced Structural Materials

Motivation

Nanotechnology is a new approach that refers to understanding and mastering the properties of matter at the nano-scale. At this level, matter exhibits different and often amazing properties and the borders between established scientific and technical disciplines fade.

Nanotechnology offers possible solutions to many current problems by means of smaller, lighter, faster and better performing materials, components and systems. This opens up new opportunities also in the design and performance of tools and manufacturing processes.

Although this sounds all extremely promising the reality in nanotechnology at present is somewhat deflating: lots of nano-science, but only a few real products. Therefore substantial emphasis on product development is needed. For one thing always was and will be true: People do not buy technology; they buy products. For this reason have to launch a project to make this happen.

Nano-particles like carbon nano-tubes (CNT) are available today. Their use in conventional materials like polymers and metals has to be pushed by making them available in kg and tons and by pushing the production of nano-composites (with nano-particles reinforced material). The project includes also other nano particles like organic clays and organic matrix composites.

Goals

Build up and accumulate the relevant know-how in Switzerland to provide local companies with adequate quantities of these new materials at reasonable costs.

Modify existing equipment with focus on commercialisation (production of such materials as well as the application in tools and manufacturing systems)

Content of the project

Screen ongoing nano-activities and set a strong focus on making them available in commercial quantities. Provide technological solutions to produce nano-particles and/or with nano-particles reinforced materials as well as the commercial application in tools, machine tools and manufacturing systems

Organization and project plan

Identify centre (and potentially some satellites); provide resources/equipment. Identify interested companies to create a consortium (or steering committee)

Planning information

Large size SPA

Particular aspects

- Create revenues by material sale to expand activities.
- Environmental and health risks have to be addressed properly but not hysterically

3.1.2 Functional Materials and Functional Surfaces

Motivation

Materials Science and Surface treatments gain in importance. We are experiencing a rapidly growing market for innovative products made out of functional materials and/or with functional surfaces. For example the life-sciences call for disposable Microsystems-solutions in polymers or micro fluidic components fabricated in cards or compact discs. Other applications are in the field of (bio-) analytic, food industry... Many critical interfaces define the quality of the results, increase part lifetime and allow new applications unknown to date.

New application areas will open up through the modification of surfaces by micro- or nano-patterns with topological and/or chemical contrast, the so-called "lotus-effect" being a prominent example. In general, micro- and nano-patterning of surfaces allows the controlled modification of their optical, mechanical, chemical and several other properties.

Many parts and structures in components continuously become smaller and traditional tool making for replication is reaching its limits. At the same time, nano-science has discovered new properties and functions of nano-structured materials and surfaces, but no viable fabrication technologies are available yet. Both reasons suggest combining the competences in micro-/nanotechnology and materials engineering to enable advanced research and development for future nano-products.

Switzerland has traditionally a very strong position in materials science and surface treatments (Sulzer, Balzers, Georg Fischer, etc.), but Switzerland risks to lose this leading position. A high level materials and surface treatment know-how is essential for many industry sectors, e.g. machine tools, building technologies, transportation and medical industry.

Goals

Transfer existing know-how in universities and research labs to industrially interesting (low-cost, efficient and reliable) materials and surface treatments to increase the performance of the products. The focus should be on functional materials that can be adapted to the specific needs of the corresponding application (anti-corrosion, anti-friction, low-wear, elasticity, etc.).

Content of the project

The properties of materials and surfaces should be improved by adding new functions through developing new materials or composites and through the integration of micro- and nanostructures which for example can alter or optimise surface properties or add sensing functions. Screen potential scientific results in universities for industry relevance and find industrial partners interested in transferring the know-how into products. Create a close relation between academia and industry. Focus on two to three industry segments (see above).

Organization and project plan

Leader: World-class manufacturer of materials and coatings, team of 8-12 partners in industry and academia.

Planning information

Large size SPA

Particular aspects

It's important to discuss the results in the context of manufacturing technologies and the application in manufacturing processes (e.g.: further manufacturing processes without destructing the surfaces).

3.1.3 Microsystems

Motivation

At the present nano age, Microsystems could have an old-fashioned flavour, but this intelligent combination of sensing, computing has not passed out and a lot of work has to be done to introduce Microsystems in the traditional industry, for example. Microsystems include microelectronics, sensing and also packaging, which is a key point for interfacing with the real world. Switzerland is proud of its micro-technology and Microsystems technology must be sustained and is part of this know-how to be kept and developed.

Micro-systems should not be understood as MEMS or silicon based only. Most of the materials such as polymers, glass or others are part of and the most important knowledge to develop is to intelligently put together different functions in a practical and usable way.

Goals

The goal is to develop new complex components adapted to a specific functionality. In order to create drastically new products or to give a second life to existing one. The aim is to add more sensing, more intelligence in an adapted package.

For example, we are at the beginning of the chemical sensing and Microsystems were up to now not very successful, but, now, with the recent results, some reliable technical solutions appear.

This SPA includes also the question how to promote micro-technology in the traditional manufacturing industry (new processes and new products). Therefore the focus should be also on feasible manufacturing processes by reasonable cost structures.

Content of the project

The main focus of this SPA is to develop cheap sensing techniques on glass or polymers (not only silicon), in order to be able to produce on large surface. With the adequate sensitivity and reliability. An important effort has also to be done on packaging and assembly.

Organization and project plan

Identify competence centre in this domain and particularly promote micro-technology in the traditional industry. Provide financial support for SME in order to renew their product offer.

Planning information

Large size SPA

3.1.4 Nano Systems

Motivation

Nano-systems is not the scaling down of micro-systems except for nano-electronics. Most of the time it includes nano-materials like nano-particles or nano-composites giving most of the particular properties to the device. Other types of nano-systems are surface properties related giving also through nano-particles specific behaviour or special functionality.

This domain is drastically growing in US and in Europe. Many applications are already appearing. Switzerland should be leader in this field

Goals

Nano-systems need new manufacturing methods (material manufacturing, surface oriented functionality). This project can sensitise equipment manufacturers on new potential markets. The second point is to promote nanotechnology in the traditional industry. New materials (new ceramics, amorphous metallic aggregates, new functions on traditional support like paper, plastic foils, textiles, fibres).

Content of the project

Building up a national programme (follow-up of TOP Nano 21) with industrial goals. Promote nano in the industry which still has too much the feeling that it is an academic topic.

Planning information

Large size SPA

Particular aspects

- Relate with SPA 3.1.2

3.1.5 Surfaces and Interfaces Bio-Inorganic Systems

Motivation

An increasing number of high value added products of strategic importance for Swiss manufacturing industries will be at the intersection of engineering, biology, medical sciences and will involve interfaces between biological or living systems and inorganic systems. Examples include advanced prostheses, implantable sensors, or medical instruments. Such products present hard interfacing challenges and will face strict regulatory licensing rules.

Goals

The goals of this special project area are to address and solve issues relating to the biological – inorganic interface in advanced products and provide the necessary scientific and technological solutions so that these products can be safely produced, approved for sale and marketed without unreasonable delays and legal risks.

Content of the project

The project areas will include issues of biocompatibility of inorganic materials, degradation of interfaces, connection of nerves with semiconductor electronic devices, implantation of optical and acoustic sensors, manufacturing supervision and traceability of implantable devices. A very promising area of research is the development of micro- or nano-structured inorganic surfaces subsequently coated with active organic groups for analysis and diagnostic purposes. The project area includes also the development and certification of processes and materials for micro injection molding and the (additive) Layer Manufacturing Technologies for plastic, metallic and ceramic parts.

Organization and project plan

A few early projects will serve to define who the interested partners for this field of R&D are and how they can be best brought together. The project should quickly turn to specific 2 to 4 year R&D projects which can be organized along the following general topics: 1) interface development 2) interface stability and degradation 3) safety and reliability of implantable devices 4) manufacturing issues of implantable devices 5) legal and regulatory aspects of implantable devices.

Planning information

Large size SPA

Particular aspects

The input and leadership of the FNS will be crucial for this SPA. Because of the broad scope of this research area stretching far beyond the potential of Swiss R&D organization, but also because regulatory issues are worldwide, it is essential that Switzerland works at the EU level on this R&D area.

3.2 Manufacturing Systems and Processes

3.2.1 Non-Conventional Manufacturing Processes

Motivation

Innovative high value-added products integrating micro-, nano- and bio technologies are the key to Swiss manufacturing industries. These products require or will require new manufacturing processes capable of producing features of very small dimensions, with hitherto unachieved tolerances in a range of (often hard) materials and with very high quality and cleanliness standards. Mastering these processes will allow the Swiss economy to manufacture unique products at competitive prices and also to supply world markets with unique advanced manufacturing

Goals

The goal of this SPA is to develop new advanced manufacturing processes to a stage where they are ready to use in production by industry. Specific objectives are

- to develop, understand and model new advanced manufacturing processes (scientific objective);
- to develop the mechatronic systems to implement these processes (technological objective); and
- to develop the application data bases and guidelines for the industrial use of these processes (industrialisation objective).

The SPA will encourage projects to work towards each of these three specific objectives.

Content of the project

Processes under consideration include for instance: high speed micro-milling, ultrasonic machining, ultrasonically assisted machining and EDMing, laser engraving, laser assisted machining, spark assisted chemical etching, Selective Laser Sintering (SLS) and micro SLS, Selective laser melting (SLM), selective laser pyrolysis of ceramics and any combination of these processes. In most cases, adequate systems do not exist to implement these processes and development are required in positioning systems, tool and work piece holding systems, very high speed spindles, process sensors, metrology, high data rate acquisition systems and more.

Organization and project plan

R&D activities will focus on process developments, systems developments and application technology and industrialisation. Projects will be formulated principally by industry with a strong involvement by R&D organization.

Planning information

Large size SPA

3.2.2 Tools and Dies Technology

Motivation

Swiss manufacturing industry is well known for its high precision tools and dies production, especially in small dimensions, for micromechanics and watch industry. These products require or will require new machines and manufacturing processes capable of producing features of very small dimensions, with very high tolerances in very hard materials (e.g. HM, CBN, PKD, CVD and MKD) and with very high quality standards and high throughputs. Furthermore, the trend to smaller cycle times and parts with more complex geometries requires new thermal management technologies and new tool & die materials.

Mastering these processes will allow the Swiss economy to manufacture unique products at competitive prices and also to supply world markets with unique advanced manufacturing.

Goals

The goal of this SPA is to continuously improve existing and develop new advanced machines and manufacturing processes to a stage where they are ready to use in production by industry. Specific objectives are

- to develop, understand and model new advanced manufacturing processes and technologies for the machining of materials with ultra high hardness;
- to develop the machines and systems to implement these processes (technological objective); and
- to develop the application data bases and guidelines for the industrial use of these processes (industrialisation objective).

The SPA will encourage projects to work towards each of these three specific objectives.

Content of the project

Processes like grinding, EDM, laser machining, spark assisted chemical etching, laser pyrolysis of ceramics and any combination of these processes. In most cases, adequate machines do not exist to implement these processes and developments are required in machines, tool and work piece, holding systems, process sensors, complex surface metrology, process control, strategy of retrofit from measure to the process parameters.

Additional aspects are:

- repair and maintenance of tools and dies,
- integrated life cycle data base for tools and dies and automatic recognition of wear state,
- surface technology,
- intelligent process planning systems for tool and die manufacturers, and
- adaptive modular and flexible tools and dies

Organization and project plan

R&D activities will focus on process developments, systems developments and application technology and industrialisation. Projects will be formulated principally by industry with a strong involvement by R&D organization.

Planning information

Large size SPA

3.2.3 Rapid Manufacturing

Motivation

Time to market gains additional significance in the value added chain. To meet this demands new manufacturing approach are required. The production lot size becomes smaller, even down to 1 single complex part. Conventional production technologies – like tool & die – can not cope these demands anymore in sense of economics and agility. The tooling initial costs and involved risks are too high in relation to the lot size. The justification holds back innovation. The solution perspective are the use of new RM technologies; technologies which enables the production of small series in a short time to market.

Rapid Manufacturing addresses this need applying the additive layer manufacturing technologies (previously known as Rapid Prototyping). The multidimensional expansion of these manufacturing technologies opens up new chances. With 27 vendors and 50 processes with specific materials the chances are significant but the systematic search and application research is requested. With the further development of the systems and there materials there are today some advanced technologies like the Selective Laser Sintering SLS, the Selective Laser Melting SLM and the Selective Mask Sintering SMS which have the potential to fulfil these requirements. Some few early RM applications of these technologies used already demonstrate the economical and value added chain benefits as well as the unsolved problems involved.

Goals

- economical custom made products and reduced time to market
- The adequate development and enhancement of suitable process chains for various industries using the most promising state of the art technologies: SLS, SLM and SMS.
- Move the RM technology from the prototype stage to the commercialisation status
- Integrate TQM aspects in the RM process chain
- Open up new markets (topology optimized light weight parts → trabecular parts; function optimized (in contrast to conventional production technology optimized) part design → more functions per part and smaller part lists

Content of the project

Development of

- process chain: light weight design, trabecular parts, specific powder materials development like Aluminium and Titanium alloy
- Technical Plastics SLS materials technology and application (i.e. cases in PEEK or PPS and other high tech plastics)
- Functional coating and surface finishing of RM components
- Technical ceramics
- Medical Metal Implants manufacturing (TiAl6V4, 1.4401, CoCr, ...)
- Medical Biomaterials (β -TCP, and others)
- Customized implants, customized instruments for surgical and reconstruction application

Organization and project plan

This SPA will be organized in specific projects strongly industry related, treating of the enclosure modules with industry and their needs. R&D activities will focus on process developments, materials, systems adoptions and application technology and industrialisation.

Planning information

Large size SPA

Particular aspects

- The EU has recognized this trend and importance for Europe and the technologically driven advantages thus supports different recent initiatives and projects (ManuFuture, RM PLATFORM, SPADE, CUSTOM FIT).

3.2.4 Intelligent Flexible Manufacturing Systems

Motivation

Typical trends in manufacturing and assembly are the increasing number of variants of products (customized products), low or midsize production lots, shorter innovation- and lifecycles, extreme fluctuations in batch size, additional services, decreasing cost, and reduced delivery times (Just in Time, Just in sequence). These facts and trends limit high investments to special applications and require adaptive automated/manual (hybrid) solutions.

Goals

The goal of the project area is to develop flexible manufacturing and assembly solution for a variety of products based on different technologies and manufacturing processes, in high quality and integrated testing, calibration and with adequate cost.

Content of the project

The project includes concepts and methods for “breathing” production, multiple usage of equipment, and modular (lean) production. Furthermore the project includes application of additional services like product (labelling, adjustment, calibration and testing, traceability), and equipment (failure diagnosis, Machine data analysis, and traceability), a set of different assembly processes (predefined parameter, quality requirements), network of competence (Standards, suppliers, library, catalogue), and certified suppliers.

Additional aspects should be e.g.: self-diagnosis, self repair, automatic machine tuning, monitoring systems, adaptive components, new control strategies, measuring systems of TCP, lightweight structures,

Planning information

Large size SPA

Particular aspects

- Link to the activities and strategic papers of CECIMO-MANTYS is recommended.

3.2.5 Microfactory

Motivation

Future products and production paradigms will require manufacturing systems that are not only intelligent and flexible but also that can control their working environment, integrate several manufacturing and assembly processes, and track the production history of each individual product. These requirements are particularly true for products based on integrated micro nano and bio technologies.

Goals

The general goal of this SPA is thus to support R&D efforts on intelligent flexible manufacturing systems of the Swiss machine-tool industry. The specific goal is to develop a modular manufacturing infrastructure (the so called microfactory) for small products integrating micro nano and bio technologies (e.g. sensors, medical implants, micromechanical elements of ICT systems) and manufactured in small to medium batches.

Content of the project

The microfactory consists of standard enclosed workspace modules, each with controlled environment and access in which manufacturing and assembly operations can be performed with standard modular mechanical elements and robots. Workspace modules are connected by a part transfer system and the complete system is managed by a hierarchical information system that monitors processes, system status and product and part flows and generates a manufacturing data record for each product. The microfactory should typically fit in a space comparable to a laboratory workbench and should be easily (automatically) reconfigurable to accommodate new products. The SPA will address the development and integration of all the elements of the microfactory system (enclosed workspace module, transfer system, manipulators, process sensor, control and information system etc.). Several concepts emerging from the work on the microfactory will also extend to larger flexible manufacturing systems.

Organization and project plan

This SPA will be organized in projects treating of the enclosure modules, of assembly systems, of part manufacturing systems, of part cleaning systems, of supervision, control and part and process tracking systems.

Planning information

Large size SPA

3.2.6 Systems for Hi-Tech Textile Industry

Motivation

Switzerland has a long tradition in the textile industry. In the last years there has been a strong selection among the many companies, with the result that only the most innovative and competitive companies with hi-tech processes and products remained. These companies play now an important role in the worldwide textile industry.

ManuFuture should strengthen the position of these companies by transferring the knowledge from the research institutes to innovative processes and products.

Goals

The development of hi-tech textile processes and products should be supported by transferring know-how from textile-related and non-textile-related research institutes into the companies. The focus should be on the different steps along the production chain e.g. spinning fibres, coating, weaving, knitting and finishing in both clothing and technical textiles.

Content of the project

By innovation in the production process of textiles (machines, spinning systems, coating techniques...) new processes, area of applications and products should be developed.

Products like antimicrobial, abrasion resistant, electric conductive, special coated fibres and systems out of these fibres (e.g. ready knitted carbon fibres-structures for the composite-industry) must be the focus.

Planning information

Large size SPA

3.3 ICT in the real world - Automation, Mechatronic, and MMI in Manufacturing

3.3.1 Advanced controllers and embedded systems

Motivation

Production machines tend to get more and more complex, and the word “systems” becomes more appropriate to fully describe them. Among the most complex machines ever developed are the machine tools they are controlled by a numeric controller (NC, CNC) and closed loop control systems, they include a lot of subsystems and embedded systems, they have a diagnosis tool and are within limits adjustable to different working conditions. Today manufacturing systems get more and more sophisticated and require more powerful paradigms and architectures: advanced controllers and embedded systems.

Goals

The main goal of this SPA is to contribute to the progress of manufacturers of complex machine-tools and manufacturing systems that they could improve speed, accuracy and flexibility. We have 1) to identify the company trends and visions as well as market needs in terms of control and architecture and 2) to advance the state of the art in a direction specific for that. The result should consist in 1) a number of modular pieces of improved solutions, adapted to Swiss company context, along with 2) a set of requirements for yet further steps to be done.

Content of the project

In this SPA, the main thrust should be on technical informatics, kinematics, and cognitics, by people with background in control. Close cooperation should be ensured with specialists of business management. Synergies with the SPA “Novel automation standards and test facility” should be encouraged. Some simulation expertise in the team would be useful.

Organization and project plan

As recognized in Brussels as a necessity, frontier research domains such as this one require the current cooperation of actors from very different applicability horizons (ranging from short-term to long-term). In addition, cooperation with international organisations and networks is necessary.

Planning information

Medium size SPA

Particular aspects

- The small size of Switzerland is a drawback in international consortia (decision power, quantity-related issues). Therefore it is important for us to compensate this by a very high level of quality and expertise. We have to invest enough ourselves to reach this level, and then we may also benefit in a fair way the EU. Need to bring together Swiss companies involved in CNC to reach a critical size and be credible on world markets.
- Link to CECIMO – MANTYS activities is necessary

3.3.2 Innovative Sensors and adaptronic

Motivation

MEMS tackles increasing possibilities and potentials:

- cost effective manufacturing,
- new sensor principles,
- new sensor types (Gas sensors, Multi sensors, Lab-on-Chip),
- cheap high-tech sensors, and
- high-end sensors (bio med, aerospace)

Therefore usage in new application fields could be diagnosis, adaptronic, security, consumer applications, and life science.

Goals

The main focus of the project is on (multi) sensors for characteristic diagnosis in industrial environment with the following goals:

- Simple integration of elementary sensors in functional elements (embedded sensors):
 - Possibility for SMD-placement
 - Low power consumption
- Enabling of functional sensor-systems
 - Intelligent sensors (plug-work, self parameterising)
 - Standardisation
 - Communication (IO-Link...)
 - Diagnosis
 - Reliability
- Vision for sensor tasks
 - fast data processing
- low cost

Content of the project

The project includes the following issues:

- Diagnose requirements
- Design Rules for integration
- Low power elements an structures/architectures
- Simple diagnosis structures with less sensors

Planning information

Medium size SPA

Particular aspects

- Near to Core competences of sensor suppliers is needed
- Chance : standardization

3.3.3 Infrastructure Development and Cognitive Modelling for Agile Design and Reconfiguration of Human Machine Interface

Motivation

Manufacturing systems and new products get more and more sophisticated. Nevertheless, situations are becoming more complex as well, and therefore some kind of interaction with humans usually still remains required. The reason may just be that information should be acquired about current user or process needs, or it may be related to unusual conditions such as change in production, reconfiguration or recovery from errors. R&D must be performed in order to make use of most recent methods and tools in order to get stronger in fulfilling future HMI needs.

Goals

This SPA has for main goal to contribute to improving current strength of Swiss companies concerned by HMI. Concretely, basic components in terms of hardware interfaces between machines and sensory channels of humans must be identified, and in some cases reengineered or newly designed, taking also into account more demanding requirements in terms of complexity and timely reactions. Similarly, intangible elements for ICT, including more abstract concepts and common cultural references must be addressed. As a goal, solutions to be devised should simultaneously tend to satisfy a mix of local, possibly segmented, and of global requirements.

Content of the project

In this SPA, the main thrust should be on technical informatics, and cognitics, assisted by people with background in sensors, actuators, micro-technology (micro-technique) and physics. Close cooperation should be ensured with specialists of psychology, semiology and ethnology. Modular design of multi-sensory devices, complying as much as possible with current standards or proposing extensions, as well as the integration in test systems of current solutions should be done in this SPA. Perhaps more importantly even, a repository of cognitive and cultural building blocks and reference frameworks must be incrementally set-up, both for immediate profit and as case study and example for future design phases.

Organization and project plan

As recognized in Brussels, frontier research domains such as this one, require the coordinated cooperation of actors traditionally viewed on very different applicability horizons (ranging from long-term to short-term), i. e. simultaneously on the front of science, engineering and innovation. In addition, cooperation with international organisations and networks is mandatory. The effort is of long duration nature and the required budget should be on the order of 8 million francs for the time-span of ManuFuture program. IMS has no own source of funding, and EU and CH should provide the necessary means (50/50). First, credibility must be established with national means.

Planning information

Medium size SPA

Particular aspects

- The small size of Switzerland is a drawback in consortia (decision power, quantity-related issues). Therefore it is important for us to compensate this by a very high level of quality and expertise. We have to invest enough ourselves to reach this level, and then we may also expect to benefit in a fair way from the common, European means and markets.

3.3.4 Autonomous Service Robots

Motivation

Mobility is very important. While automated solutions have been successfully designed for public, well-structured environments (rail, roads, lifts and escalators) for private, domestic areas solutions have not been much feasible yet. Today the technical progress, especially in microelectronics and ICT, allow considering an application-domain of potentially huge benefit: robots for personal use and assistance. The trend towards an ageing society makes this opportunity yet more relevant.

Goals

The overall design of a cost-effective, versatile and safe service robot is a challenge. Benchmarks in real life situations are necessary in order to orient further research and development, as well as in order to gain public acceptance. Man-robot and social communication issues, as well as locomotion on natural ground and up-down stairs, are novel requirements that need be addressed. A domestic family helper or a hotel bellboy could be the model to imitate in terms of functionalities. Goals in terms of price and quality (reliability, security, etc.) should be as strictly set as for regular car and scooter industry for large quantities and could be considered differently for luxury segments (e.g. watch sector).

Content of the project

This SPA requires contributions simultaneously at a holistic, systemic level, and also in some specialized areas. Some of the latter areas already provide components functionally close to an acceptable state, but which need to be reinvestigated in view of cost-effectiveness; other areas require more basic approaches. In particular localization in space, obstacle avoidance, up and down locomotion between floors as well as vocal dialogue with humans and "natural" social behaviour are areas where more novel research need be done. Some RFID tagging and management may also prove beneficial, as well as communication and knowledge exchanges between multiple robots.

Organization and project plan

Partners should be found in academic institutions and in industry. Competences must be used or acquired in mobile robotics, real-time and embedded systems, man-robot communication and cognitics, with some elements aiming at basic functionality and others at more applied operations. Time frame should be as long as the ManuFuture initiative. Short-term efforts are repeatedly required in order to allow for incremental, iterative, realistic developments; long-term efforts need to be started immediately as well. Development of prototypes and of a test facility is natural methods to coordinate team partners and keep progress in focus.

Planning information

Medium size SPA

Particular aspects

- This project could benefit from the yearly participation of a team and prototypes to Robocup-at-home world competition. Links with research people in humanities and social sciences would be highly appreciated in this programme. Support for Robot-CH, an association aiming at fostering robotics in Switzerland in general, including the motivation and the education of the youth would be beneficial in the long-term, both for excellence of Swiss workforce and for social acceptance.

3.3.5 Process & Production Automation

Motivation

Typical trends in production automation are:

- flexibility
- increasing variants of products
 - shorter innovation- and lifecycles
 - usage of the potential of the hard- and software merge
- decreasing cost (ROI < 3 years)
- reduced delivery times (Just-in-Time, Just-in-sequence)

This limits high investments to special applications and requires adaptive automated/manual (hybrid) solutions.

Goals

Set of process- & production solution for

- product variations generated by software in late production stages
- different production processes/products based on different technologies and manufacturing sequences
- innovative process development and/or making the existing processes more robust
- with high yield results in different application
- - integrated testing, calibration (diagnosis)

Content of the project

Potential concepts and methods for:

- interface standardization
- multiple usage of equipment
- modular (lean) production (cell concept)
- how to organize breathing production?

Application of additional services:

- product: labelling, adjustment, calibration and testing,
- equipment: failure diagnosis, Machine data analysis, traceability

kit of different available & robust production processes:

- predefined parameter
- quality requirements
- set of processes (tools)
- visualization of processes (software tool)

Network of competence (Standards, suppliers)

- library, catalogue
- certified suppliers
- centres of competences as sub module-supplier

Organization and project plan

Timeframe : 2-5 years, mid- to long-term; number of Partners: ca. 8

Planning information

Medium size SPA

Particular aspects

- Near to Core competences of system integrators

3.3.6 Novel automation standards and test facility

Motivation

Automation is very important for a developed society of the type of Switzerland. And this importance is growing. Systems get more complex therefore numerous producers need to cooperate for best solutions. This requires the development of standards, as well as the tracking of property rights for incremental contributions. The situation is very difficult to master for SMEs and a collective effort for helping valorisation of innovation and appropriate defence of rights is crucial.

Goals

The goal of this SPA is to ensure that the most recent techniques and tools available for automation in manufacturing and control processes are professionally known in Switzerland and that, when necessary, extensions at international level are also made in a way coherent with national needs. A test facility must be set-up and configured, which should also help for specialist training and education, as well as for performing product and system compliance test and certification.

Content of the project

In this SPA, developments must be done in a way coherent with relevant initiatives at world level, notably within IMS (intelligent management systems) and more specifically O3NEIDA. Some aspects may include simple I/O processing or joint control but may also include much more complex processes. Repository of elementary contributions, reuse and simple integration of new components in existing automated systems must be organized.

Organization and project plan

The development and introduction of standards are typically of the domain of UAS, but close links must also be kept with other universities and industrial practice. In addition, cooperation with international organisations and networks is necessary.

Planning information

Medium size SPA

Particular aspects

Overlap with simulation GPA: more and more tools and techniques apply to virtual and simulated worlds just as equally as to real applications. In fact for a long time developments in automation have already often required the temporary simulation of target systems for efficient design, but the increase in system complexity, in (extreme project management).
By nature, this SPA should also most naturally interact with other graduate school and technology transfer activities.

3.4 Recycling infrastructure and energy generation and conservation

3.4.1 Automation for reuse and remanufacturing

Motivation

Because of the limited natural resources important materials such as precious metals are becoming rare. This leads to higher prices. Especially toolmaker and machine tool manufactures have already significant material costs and will be affected in future by rapidly increasing prices. There will be a need of a re-use und re-manufacturing systems of high valuable parts and components.

Goals

The goal of this project is to promote a deeper understanding of life-cycle-engineering within the tool and machine tool industry and to develop technology and organisational structures to lower material costs by re-using and re-manufacture high valuable parts and components.

Content of the project

Possible working packages are: Modular concepts of tools and machine tools to enlarge the technical life-time by re-using used materials; re-manufacturing concepts by using local structures (minimizing transportation and shorten service time) by using additionally the already high standard of environmental technology in Switzerland; automated re-manufacturing systems; promotion of service and maintenance concepts like “product service systems” with adapted tool and machine tool design; information concepts to ensure the date flow and quality management over all life-cycle phases of a product.

Organization and project plan

Partners might be toolmakers, machine tool producers as well as experts from material science and industrial engineering with a good understanding of life-cycle-engineering. Milestones are: A) Feasibility study with potential partners in Switzerland to evaluate the potential in reducing costs and to define the specific needs; B) Studies to develop concepts on technical, informational and organisational level including the verification in case studies; C) Promotion of the results in industry and education.

Planning information

Medium size SPA

3.4.2 Sustainability; Recycling, Energy and Technology

Motivation

We have experienced decades of free availability and low costs for commodities and energy. For several reasons this has changed and increasing costs and restrictions in availability will be more the rule than the exception. Industries that cope better with this will have a significant economic advantage.

We in Switzerland with almost no commodities have to put more emphasis in recycling (re-use of commodities) and energy efficient processes to be competitive

Goals

Provide tools and databases to quantify sustainability (e.g. methods for easy estimation of social and environmental impacts).

Choose energy intensive or environmental intensive industries and processes and go for step changes in efficiency, e.g. change to dry machining (strong link to new sensors and micro systems is recommended)

Recycling / reuse technology has to be strengthened. We can no longer accept that used electronic devices are shipped to China for manual disassembly under unacceptable conditions. Proper disassembly after use is a value we could provide in CH (and would create jobs as well).

Content of the project

Design for sustainability (build in solutions for recycling or reuse, or energy efficient solutions) has to be an integral part in the development of new processes and products.

Holistic approaches including already accepted methods and tools (like LCA (life-cycle-assessment)) have to replace current narrow view competitive thinking (Blue ocean strategy)

Provide product/process stewardship for smaller companies.

Create awards for sustainable products/processes.

Organization and project plan

We see this project as measure to help companies to address the right areas that are of broader importance to the community instead of micro optimisation on lost ground or over aged technologies.

Planning information

Medium size SPA

Particular aspects

- The hurdle to this topic has to be as low as possible for smaller companies. Otherwise we will not reach them.
- Part of it has to be a service. Part is collection of potential demand for technical solutions and help in implementation.
- The evaluation of cost and the change in cost structures are important.
- Close cooperation with already existing initiatives, e.g. WTT-consortium "Environment & Energy"

3.4.3 Distributed Mini- and Micro-Energy Systems for Sustainable Energy Supply and Use

Motivation

Energy has become a strategic resource for all world economies and the cost of energy will increasingly weigh on the competitiveness of manufacturing and manufactured products. Distributed mini- and micro-energy-systems are e.g. necessary in miniaturized and decentralised products and systems. Smaller units require other manufacturing technologies and production systems.

If it presents challenges, this situation also offers great opportunities for new high value-added manufacturing processes and products matching well Swiss manufacturing tradition and know-how.

Goals

The goal of this SPA is to support the development of energy efficient manufacturing systems as well as of new products for the distributed energy consumption and generation field.

Content of the project

Projects will cover topics such as efficient manufacturing and assembly systems, home energy savings systems (active and passive systems for buildings and appliances); distributed and / or mobile / embedded energy generation and conversion systems, energy supply and management for micro systems.

Organization and project plan

Projects will cover a broad range of interested partners with relatively different interests and dealing with different technologies. A first project will be to organize these potential partners in various interest groups that will then be able to formulate projects geared towards different manufacturing sectors and products.

Planning information

Medium size SPA

Particular aspects

The actions in this project area will be closely coordinated with the “national energy centre” and will focus only on the energy issues linked specifically to manufacturing and novel products.

3.5 Simulation for Agile Manufacturing

3.5.1 Simulation of Manufacturing and Assembly Processes

Motivation

The economic viability of the manufacturing industries depends essentially on streamlining development and manufacturing costs and on reducing time to markets. Simulation of manufacturing and assembly processes (in conjunction with systems simulation), application of virtual reality and visualization tools as well as cooperation tools for distributed working groups represent an indispensable tool in achieving these goals.

Manufacturing needs to be simulated on the process level and because of the complexity of material behaviour needs sub modelling on the basis of elementary particles, grains, atoms. The next level is the machine tool to take into account process machine interactions. Next level is the production line and for planning the total shop floor. All these levels need to interact with each other to give a realistic picture on the respective higher level. Due to shorter life cycles planning actions need to be fulfilled more often and with less manpower, thus simulation becomes an indispensable tool for manufacturing. Only with automatic and semiautomatic planning tools will it be possible to find out optimal process chains. These are the methods with which Europe / Switzerland will gain over the LWC, that the optimal point is found quick and reliable and not by trial and error and later process tuning. Simulation also reduces setup times because the prediction of the behaviour of parts and machines enables to reduce the number of tests required in advance down to one test piece and model based readjustment, after which the production runs within tolerances. Model based control also closed loop control of production systems greatly reduce iterative steps.

Much more research can be put here. This is one of the most important points in research and is one of those, where CH is clearly underdeveloped.

Goals

The goals of the SPA are to provide manufacturing industries with new or improved tools to simulate manufacturing and assembly processes in order to select process and assembly parameters optimally adapted to the manufacturing task at hand.

Content of the project

Projects will focus on modelling novel advanced manufacturing processes that have not yet be modelled and simulated extensively (for example high-speed micro milling, ultrasonic machining, interference assembling) and on improving modelling tools for well established processes. The emphasis will be to provide industry with simple easy to use decision making tools that can be used in production planning and on the shop floor.

Organization and project plan

The project has a relatively important emphasis on research and therefore will involve primarily research organizations.

Planning information

Medium size SPA

Particular aspects

- The FNS should provide active input in this SPA

3.5.2 Simulation of Manufacturing and Assembly Systems

Motivation

The increasing complexity and variety of products has demanding requirements on manufacturing and assembly systems. Due to high competition and due to the existing time pressure it is necessary to also reduce the time for a system's initial operation. Here, a simulation and visualisation of the manufacturing and assembly process offers a high potential by reducing the amount of real prototypes for a system.

Goals

The goal is to implement basic technologies and methods of virtual manufacturing and assembly systems as an important part of the digital factory. In particular, the goal is to apply and adapt above technologies to SMEs (Small and Medium Enterprises) to strengthen their competitiveness in the global market.

Content of the project

In a close collaboration with industry, suitable simulation scenarios will be elaborated. Special emphasis will be put on systems, which underlie a global development process, since they can benefit most from a prior simulation. In a next step, further application scenarios of the simulated manufacturing and assembly systems will be evaluated, such as variant management, customer support, service, training, etc. A next important step will be prototype implementations of simulated systems in industry, followed by a verification and optimisation of methods and tools. The results will disseminate to Swiss industry by publications, workshops, and seminars.

Organization and project plan

In order to guarantee a relevant outcome for the Swiss industry, research institutes as well as industries should be involved in the project. For synchronizing the work on an international basis, also international research institutes should be integrated in the project.

Planning information

Medium size SPA

3.5.3 Product data Integration

Motivation

High-productivity/high throughput manufacturing of parts is becoming more and more important in industry. The efficient use of material and equipment is a key success factor. A direct transfer of original CAD data and machine availability minimizes setup-time and reduces manual interventions.

Goals

Software and standardized interface for efficient transfer of data and centralized management of machines.

Content of the project

Development of software and definition of an industry standard (in collaboration with EU partners) for efficient conversion of product design data (CAD) data to data for running the production process. Feature recognition setup on the history data of CAD will be the first step in automatic process planning. Necessary is a closed data processing chain, where the amount of data is continuously increased, as is necessary for the resp. step of process. Manufacturing shall to run like a printing device, especially in low lot sizes and customized products.

Organization and project plan

Collaboration between partners in industry and universities. Leader: high-speed milling manufacturer, as e.g. Agie-Charmilles or automation provider, as e.g. Stäubli Automation.

Planning information

Medium size SPA

Action Plan for Initiative 4: New Organisation and Management Models for Manufacturing SMEs in Global Markets

Overview

The main goal of the following project areas is to establish new management and business models to strongly position Swiss SMEs on worldwide markets. The focus is on significant contributions to assure a sustainable development of Swiss SMEs. The organisation and management models to be sought, take into account the trend that in future much more of the value adding chain (Wertschöpfung) will take place in cooperative clusters, which need to be managed. Manufacturing industry will be converted to a knowledge sharing society.

The programme covers strategic, tactical and operational issues, aiming at the improvement of the competitiveness of SMEs. The initial phase will concentrate on evaluation of the costs, benefits and hurdles associated with various types of “coopetition” modes (network scenarios), thus facilitating the launch of networking processes in which several aspects of sharing and pooling of resources will be addressed (e.g. common administrative facilities, pooling of different manufacturing infrastructures, common sales and services infrastructure) in real market situations. At a later stage of the programme, available results will be analysed and conclusions/recommendations documented.

The proposed project areas must:

- 1) open new business opportunities, thereby enlarging the market basis and reducing the risks for SMEs, and
- 2) improve competitiveness of SMEs through the implementation of new and efficient organisation and management forms.

Stakeholders are mainly: MEM industry and research institutions (universities, ETH, UAS) as well as private and public business development organisations.

The proposed programme is structured in 3 General Project Areas (GPA):

4.1	Future business areas and models for manufacturing <i>Strategic aspects → Where to go?</i>	
4.1.1	Industrial services	Medium size SPA ⁴
4.1.2	Composition and economics of the value adding chain (networking)	Medium size SPA
4.1.3	New interfaces and business relation adapted to customer process	Medium size SPA
4.1.4	New Business Opportunities	Medium size SPA
4.2	Realisation of new forms of organization and management <i>New organisation models, realisation & implementation: → How to do it?</i>	

⁴ Small: less than 1 Mio CHF; Medium: 1-10 Mio CHF; Large: over 10 Mio CHF

4.2.1	Identification & implementation of sector specific cooperation	Medium size SPA
4.2.2	Networking in different functions	Medium size SPA
4.2.3	Resource management in a global context	Medium size SPA

4.3	Future monitoring and decision support systems <i>Efficiency of organisation & management, continual improvement: → How to monitor?</i>	
4.3.1	Performance monitoring and risk management of SME networks	Medium size SPA
4.3.2	Monitoring of the market / market observations	Medium size SPA
4.3.3	Monitoring and risk management of operations	Medium size SPA
4.3.4	Monitoring and risk assessment of resources	Medium size SPA
4.3.5	Monitoring & realigning technology & technical processes	Medium size SPA

Total over 4 years

<i>Budget in Total (Mio CHF)</i>
44

Description of the Specific Project Areas
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4.1 Future business areas and models for manufacturing

4.1.1 Industrial services

Motivation

Industry in highly industrialized countries is facing a major change from product towards customer orientation and services. Industrial services are an increasing field of activity for formerly production based industries.

The emerging concept of “Servicization” or “Servation” described in prospective studies like “FutMan” (the Future of Manufacturing 2015 – 2020) implies the recognition that functionality, not form, is the source of added value delivered to the customers. “Servation” implies completely different business models which are not only based on the sales of goods (machines, equipments etc.) but on revenues based on a long-term relationship with a customer via the provision of so called product stewardship services.

One of the strength of Switzerland is a very strong service sector, mainly in the finance, insurance, logistics and engineering consulting fields. The cooperation and cross-fertilization with these established and up-to-now successful branches will help to realize new innovative models for the producing industry. Thus, a strong competitive advantage to the manufacturing industry can be provided.

Goals

The project aims at developing tools and methods for developing, installing and running new service products for Swiss manufacturing industry.

This will increase the competitiveness of Swiss industry by creating completely new business opportunities. One important condition is the ability to control the *risk* of delivering service products. This aspect is covered explicitly.

Content of the project

There are three directions of research that will contribute:

- A prospective market study of the possible future developments based on desk research, experts and customers interviews
- Methodological projects, targeting new tools, methods helping engineer service products
- Pilot projects to bring the concepts to market in the context of specific companies

A consortium of specialists in the marketing, sales, finance, management and technical fields is required for this research project. In particular, cooperation with specialists of the service sector should be searched.

Organization and project plan

Starting point could be “service engineering”. There are several activities in Germany and Finland that could be integrated as well as results from the EU-project SusProNet. Swiss companies that are currently building up service business have to be involved. Furthermore, research partners from other areas that are already involved with service engineering could participate.

Planning information

Medium size SPA

Particular aspects

- Large interdisciplinary due to combination of service sector and industry.
- There is high potential of international cooperation, especially in the European level.

4.1.2 Composition and economics of the value adding chain (networking)

Motivation

Today, Swiss manufacturing companies are faced with relatively high fixed cost structures. This involves not only production, as it did in the past, but increasingly also the world-wide dedicated structures for sourcing, sales and services, which arise from the growing complexity of products and the knowledge base that these require. As result of the flood of available information, the amplitude of business cycles has increased and swings occur with greater frequency, so that how to lower costs rapidly, open new business opportunities and lowering risks are becoming a major challenge.

Goals

SMEs need a clear positioning in this dynamic environment. The focus in this project will be on the whole supply chain and the future value added activities of Swiss SMEs within different supply chains.

Content of the project

As a consequence, it is important to be able to perceive clearly the economics of different products / services in terms of individual functions of the added value chain – costs, profit margins, breakeven, etc. This makes it possible to analyze where business cycles can be smoothed out through inter-sector co-operation (e.g. firms from different sectors joining forces in production); or again, to determine where costs can be reduced by means of appropriate interfaces with the business environment (e.g. outsourcing in new fields such as manufacturing, engineering or R&D services), or where these costs can be made variable. This leads to new business models with improved economies of scale (higher and more regular volumes per unit, higher productivity through automation or “repeat effects”, etc) and thereby a greater chance of keeping parts of wealth creation in high-wage Switzerland.

Organization and project plan

The main steps of this project are:

- systematic analyze of sector specific value added activities and future trends (depending on sectors, market needs and production technologies), from the perspective of single enterprises and company networks, sector specific SWOT-analysis, and definition of successful areas
- critical analysis of already existing methods and tools for defining sector specific strategies in the context of Swiss SMEs
- development of a sector specific methodology for defining pro-active strategies in future supply chains for Swiss SMEs
- application and validation

Planning information

Medium size SPA

Particular aspects

SPA 4.1.2 should be seen as a super ordinate strategic project of SPA 4.2.1 and 4.2.2 and should be linked to these two SPAs.

4.1.3 New interfaces and business relation adapted to customer process

Motivation

Today's technologies allow and require B2C-processes to be reinvented for a number of reasons and in several respects. Even business models that have been in operation for a long time can be improved substantially if they are further developed in a systematic way, just as technical products and their operation is based on well-defined processes. Examples for business models that are amenable to such re-engineering are mass customization, remote monitoring, maintenance or control of products and systems, personalization, i.e. recommending products and services based on information on customers, and life-cycle management, i.e. suppliers assuming responsibility for their products along their entire life phases.

The rational design and operation of novel B2C models requires – among other things – information on customer needs and the way products are used and behave in practice. In this SPA, methods and tools are developed to survey and analyze such information.

Goals

A common aspect in all business models above is that information is collected on customer needs and the way products are used and behave in practice. This information is valuable for designing products and services in a more customer-oriented way. E.g. monitoring the state of technical components allows the reliability of components or systems to be assessed under practical conditions which is helpful in planning maintenance services and in identifying critical factors for product lifetime and hence for further developing the product. Mass customization is another example: a rational decision on the structure of the configuration space within which a customer can make his decision can only be made on the basis of a clear idea of what customers needs are. In this SPA methods and tools will be developed for designing measurement-setups and surveys and data analysis. Developing service products and pricing products and services may also be part of the project, depending on the other SPA's work programmes.

Content of the project

- Use can be made of concepts that have been developed for analytical CRM. Moreover, the project is closely related to 'Industrial services' and potentially other SPAs. These interfaces have to be clarified in the first place.
- Sectors and companies are identified where subjects as those mentioned above provide added value. All subsequent research is carried out in close cooperation with these companies.
- The topics to be addressed by the research are defined based on literature reviews and interviews. These topics are to be of a general, i.e. non company-specific nature.
- Methodological projects are carried out, targeting at new methods and tools to address the above topics.
- The concepts and tools are implemented in specific business situations. Further development of the instruments is based on experiences made in these pilot studies.

Planning information

Medium size SPA

Particular aspects

This SPA is closely connected to the 'Industrial Services'-SPA. Whereas this SPA focuses on the acquisition and analysis of data, 'Industrial Services' deals with developing and operating new service products which is partly based on this SPA.

4.1.4 New Business Opportunities

Motivation

Technological innovation needs to be refinanced by sales. Since during development of a product series, developments once made for high end products refund into lower end products it is of best efficiency to control a full line of products from high to low end.

There is a huge untapped lower-end market which Swiss SMEs are avoiding to attack because of fear that it is not their business to compete with Asian/BRIC companies. Especially the Japanese are expanding now again world-wide in collaboration with Indian and Chinese low-cost suppliers thus reducing their high cost levels. Technological innovation alone is not enough to succeed in the long-term. Swiss SMEs need a basic rethinking of how to utilise their global networking skills at its best in order to gradually increase their market shares world-wide by further 50% minimum.

Goals

In addition to the existing strategies to supply top-level products and services Swiss SMEs should also aim to supply a fuller range of solutions, including also standard level and entry level solutions at lower cost. The best approach could be to find the right partners in Asia for collaborations in the design, development and production of entry level solutions. The offering of these solutions will create new jobs in the top-level product areas in Switzerland (due to cross-selling effects). In several steps the awareness and the motivation of this approach has to be developed and then realised: Sales Plus > 50%. Clearly this approach will lead to cost reduction of the average product programme, lower risks due to market entry in Asia and bigger market share due to local presence in Asia. Thus the overall competitiveness and profits will be increased.

Content of the project

Study successful business models in CH, India and China (maybe Brazil and Russia too) in a benchmarking study comparing main criteria and ideas, then structure a methodology of how to proceed

- Create awareness, present success stories and motivate SMEs
- implement this idea in SMEs

Planning information

Medium size SPA

Particular aspects

The main risk is that some of the SMEs are not interested (especially today in the boom phase). Companies like Charmilles Technologies have proven that this approach works. But the implementation needs a most dedicated top-management to overcome strong internal opposition and resistance.

4.2 Realisation of new forms of organization and management

4.2.1 Identification & implementation of sector specific cooperation

Motivation

In a world where access to technology is not anymore restricted and Swiss company have to face competition from any country, including emerging economies, it will become more and more difficult for SMEs to fulfil customer's expectation in terms of cost/performance ratio. The size of Swiss SMEs limits their ability to watch and evaluate all new technologies, manufacturing & logistic processes and business models and to take advantage of them.. The required investment is generally too high for a single company; additionally, time and resources are also not available to them.

Therefore, cooperation among SMEs of the same sector is a promising way for saving costs, increasing efficiency and improving customer service. All kind of cooperation forms, for any function (human resources, finance, purchasing, logistics, infrastructure management, etc...), preferentially in the framework of a stepwise approach must be considered in order to take into account specific cultural and historical situations

Goals

Tools and methods for

- Analyzing sector specific medium term challenges
- Identifying cooperation opportunities
- Designing the most appropriate cooperation forms
- Progressive implementation of cooperation
- Monitoring and continuous improvement of the cooperation

The actions taken under this Specific Project Area will reduce the costs, improve and enlarge the customer service of Swiss industry. It will lead to a strengthening of the concerned industrial sectors on the world market.

Content of the project

This SPA is constituted of three main elements:

- Identification of the sector specific cooperation opportunities
- Supporting the build up of cooperation readiness (human, technological and organizational aspects)
- Implementation of cooperation nucleus for further growth

Organization and project plan

- Identify sector specific partners and cooperation opportunities, Build up confidence and prepare alignment of the partners
- Launch pilot projects (phase 1), Extend pilot projects to full scale (phase 2)
- Disseminate results to other sectors and SMEs

Planning information

Medium size SPA

Particular aspects

The SPA aims at preparing Swiss SMEs for coming challenging due to extended availability of technology and modern management methods to all parts of the world by supporting sector specific cooperation in all industrial functions. The main challenge can be expected to be related to the human aspects (confidence build up)

4.2.2 Networking in different functions

<p>Motivation</p> <p>In comparison to emerging competition from new parts of the world, Swiss SMEs suffer from their small size, sharp specialization and high costs. To keep up with the worldwide competition, cost reduction and a complete customer service are expected to be key issues. Companies of various sectors face very similar challenges and require similar support functions that contribute heavily to their cost structure. Grouping them in networks of various forms is an efficient way for 1) reducing cost and increasing efficiency and 2) extending and improving customer offer and service, thus opening new markets.</p>
<p>Goals</p> <ul style="list-style-type: none"> ○ Identify potential SMEs and establish their profiles for networking purpose ○ Design possible network structures and network operation forms ○ Prepare the networking framework (confidentiality, responsibility, intellectual property issues, etc.....) ○ Stepwise implementation with core partners ○ Extension and consolidation of the networks <p>The actions taken under this Specific Project Area should lead to the creation of strong SME networks that will increase the competitiveness of Swiss industry and allow the opening of new markets for Swiss SMEs.</p>
<p>Content of the project</p> <ul style="list-style-type: none"> ○ This SPA is constituted of three main elements: ○ Identification of the potential partners and design of the network structures ○ Supporting the build up of cooperation readiness (human, technological and organizational aspects) ○ Implementation of SME networks
<p>Organization and project plan</p> <ul style="list-style-type: none"> ○ identify potential partners and common interests, design appropriated network forms for various functions ○ work out specific technological and methodological aspects, work out human aspects and implement with core partners, Extend to other partners and assure sustainability ○ disseminate results to SMEs
<p>Planning information</p> <p>Medium size SPA</p>
<p>Particular aspects</p> <p>The SPA aims at preparing Swiss SME for coming challenging due to extended availability of technology and modern management methods to all parts of the world by supporting sector specific cooperation in all industrial functions. The main challenge can be expected to be related to the human aspects (confidence build up)</p>

4.2.3 Resource management in a global context

Motivation

The availability of resources is a key element to assure competitiveness and sustainability of companies. This however is becoming a major challenge, particularly for SME having limited access to financial, technological and particularly human resources that are needed in a global environment. Without these essential means, it will be very difficult for Swiss SMEs to face the fierce global competition.

This specific project area aims at providing SMEs with methods and tools for monitoring future resource requirements, identifying risks related to potential resource scarcity, assuring efficient resource acquisitions and improving resource sustainability.

Goals

Tools and methods for

- Monitoring future resource requirements
- Proactively aligning the resources to future needs
- Identifying and evaluating potential risks related to resource scarcity
- Efficient resource acquisitions
- Keeping and continuously improving available resources

The actions taken under this Specific Project Area should primarily reduce the risks related to the lack of resources and reduce the cost of their acquisition, thus improving the competitiveness of Swiss SMEs

Content of the project

This SPA is constituted of three main elements:

- Development of tools and methods for monitoring resource requirement and assessing risk
- Pilot implementation and validation of the methods and tools
- Dissemination of the developments to SMEs

Organization and project plan

- Develop methods for the proactive identification of future resource requirements and potential risks, develop tools and methods for the efficient acquisition of resources
- Implement and validate the methods and tools with selected partners
- Disseminate the results to SMEs

Planning information

Medium size SPA

Particular aspects

The SPA aims on the one hand at facilitating SMEs in their access to critical resources and on the other hand at assessing future risks related to resource scarcity. These two elements combined will reinforce the resilience of Swiss SMEs and contribute to assuring their sustainability. Necessary is to have or develop a strategy for SME based on trend forecasts. This must be interlinked to the innovation strategy SPA.

4.3 New monitoring and decision support systems

4.3.1 Performance monitoring and risk management of SME networks

Motivation

An effective monitoring of industrial business requires a systematic discussion and evaluation of future trends and the pro-active development and evaluation of sector, network and/or enterprise specific measures. It is important to recognise opportunities and threats emerging from changes in the existing business or from trends in the environment. Identifying opportunities and threats is particularly relevant as it informs following planning and decision making processes.

In Europe and especially in Switzerland different network and cluster have been built up in the last years. On the one hand these collaborations should be managed by goals and efficient monitoring system to open up new business opportunities; lower cost structure and lower risk (focus on the content / benchmarks). On the other hand, the monitoring system itself should be adapted and improved continuously (focus on the monitoring process itself and the link to the specific management processes in the network/cluster or in the companies).

There is a need for SMEs in Switzerland working and collaborating in networks to evaluate regularly the current and the possible future performance and risks within specific SME networks.

Goals

The goal of the project is to develop SME specific methodology for an effective monitoring of networks and companies in networks based on current and future trends.

The monitoring system should clearly show the benefit for each partner in the network as well as for the whole network itself. Especially cost reduction, higher market share and lower risks should be included.

The results of this monitoring and risk management process should also be the basic for the improvement of the network itself and its processes (maturity models).

Content of the project

The main goal of the project is to develop a methodology to measure performance and risk in SME networks and to support the process in continual finding new opportunities. Topics to be addressed are:

- One focus will be on different methodologies how to analyze and evaluate the performance and risks in SME networks (current and future situation) and how to improve the performance of networks and companies.
- One topic will be on identifying relevant benchmarks and criteria to measure and evaluate networks and clusters, defining the relevant benchmarks for different clusters and branches (and market areas) and developing a generic list of benchmarks.
- One topic will be on defining standardized processes and associated tools and methods to make the integration in SME easier.
- An additional topic will be a survey about networks, clusters and (loose) collaborations in Switzerland and other countries to identify success factors and to validate the methodology.

Planning information

Medium size SPA

Particular aspects

In this project additional aspects like risks, bigger market share, higher profit should be included.

4.3.2 Monitoring of the market / market observations

Motivation

A lot of traditional SME manufacturers are integrated in specific supply chains, mainly on TIER III and II. They usually don't have an influence on product design and the production strategies of OEM and they don't know exactly what's going up in future. The distance and the huge variety of customers (in different market areas) are and will be wide.

SMEs are faced with lowering costs, short delivery time and high quality. Depending on the specific market, the weighting of this goals are totally different. This leads often to productions segmentation (in companies and in future more and more in manufacturing cluster and networks).

In today's ever faster-moving business environment, up-to-date, well-structured market information is increasingly important. SMEs are often not in a position to provide themselves with the means and structures for this information supply.

Goals

Switzerland's manufacturing sector has, both with its "Swissmem" organisation and its various foreign trade bodies, numerous points with access to large quantities of market data and the means to furnish a targeted supply of information. There is a lack, however, of an overarching framework for a structured supply of general and sector-specific market data and of a network that links these points together.

The goal is to produce with the already existing information (and might be with additional investigations) a kind of dynamic roadmap of potential market (for SME networks and companies) as well as information about current market situations to promote pro-active behaviour.

The result might be also a kind of the already existing KOF-ETH-Index in a much more sector specific and future oriented way.

Content of the project

The main goal of the project is to develop a methodology (with at least having a segmentation from a market and technology viewpoint) to identify at an early stage market opportunities for SMEs and SME networks. Topics to be addressed are:

- tools and methods to analyse and measure market and sector specific market needs and requirements (including current and future trends)
- Based on the needs of a given specific area, the structure of the desired sector and country-specific data should be defined and the data preparation models (historical, forecasts, trends) should be developed.
- In addition, it should be shown how, by using existing structures, the efficiency of the supply and distribution of the data can be improved and where structures need to be upgraded.
- The resulting information supply, preparation and distribution system should improve the ability of networks and companies to react to market changes.

Planning information

Medium size SPA

4.3.3 Monitoring and risk management of operations (especially projects, expected orders)

Motivation

Drastically increased requirements on operational speed and reaction times lead to much more uncertainties in manufacturing than ever before. Consequently, the economic risks for manufacturing companies increase.

Operational instruments for revenue management in uncertain environment with substantial operational risks are lacking. Developing them helps to improve the competitiveness of Swiss industry and to better manage the operational risks involved.

Goals

The project aims at developing methods and instruments for revenue management with special consideration of risk management. Topics to be addresses are:

- Assessment of the risks associated with accepting/refusing customer offers, and associated decision support systems
- Risk adjusted pricing of products
- Management of risk of over- vs. underutilization of resources
- Monitoring and warning systems for risk assessment for currently processed orders ("Risk cockpit")
- Influence of new strategic options like dynamic pricing

Content of the project

- The project is focused on sectors and companies where risk management is critical for success. All subsequent research is carried out in close cooperation with these companies.
- Methodological projects are carried out, targeting at new methods and tools to address the above topics.
- The concepts and tools are implemented in specific business situations. Further development of the instruments is based on experiences made in these pilot studies.

Planning information

Medium size SPA

4.3.4 Monitoring and risk assessment of resources

Motivation

The allocation of the right resources on time and in the right “quality” and reasonable costs is becoming more and more difficult. Resources, know-ho, materials, energy and finances, are limited and often not available on the requested quality. In addition new requirements from the market, for example the standard TS 16949 and IMDS (international material information system), short delivery time, and information about the life-cycle ... should be handled with care.

New business models, new markets and new organisation models, like clusters and networks, requires better resource management on all levels (incl. IT, HR, finances, ...). Especially to lower risks and to have a better market share, there is a future need to monitor carefully all kind of resources needed by the SMEs.

Goals

The project aims at developing methods and instruments for the top management as well as different functions in SMEs to minimize risks and to lower costs and the future procurement of all kind of resources.

Based on a systematic survey the goal is to develop the following tools and methods:

- To identify the main trends and criteria and their influences on the specific resource management
- To define the relevant issues for different enterprises, clusters and branches (and market areas) and to develop a generic monitoring model,
- To define standardized procedures and associated tools and methods as well as an web based system (incl. other instructions) which allow SMEs and network leaders an easy adoption and integration

Content of the project

- The project is focused on sectors and companies where future resources will be a critical success factor. All subsequent research is carried out in close cooperation with these companies.
- Methodological basic which has to be easily adapted and integrated in SMEs has to be developed.
- The monitoring system will be implemented in specific business situations. Further development of the instruments is based on experiences made in these pilot studies.

Planning information

Medium size SPA

4.3.5 Monitoring & realigning technology & technical processes

Motivation

The speed and the variety of technological developments that are relevant to SMEs have dramatically increased. It has become very difficult for a SME to follow these developments and more specifically to proactively make the right decisions to either take advantage of new technological opportunities or to avoid losing competitiveness by failing to react to technological evolutions.

One example is the tremendous increase of IT based information systems for manufacturing. Today, an enormous amount of data is available from machine status information up to complex ERP systems. The growth rate of available data has been shown to be more than exponential. However, it is often not clear how to use the available data for realigning technology and manufacturing processes. Intelligent methods are required to transform masses of data into valuable information for humans.

Beside IC technology, new manufacturing technologies, materials and processes that appear continuously represent opportunities and threads for the Swiss SMEs. Detecting them early enough, evaluating their significance and designing the best reactions are extremely important issues for assuring the sustainability of these enterprises.

Goals

Tools and methods for

- Follow and detect technological developments relevant to SMEs
- Design appropriate reactions to avoid risks or develop competitive advantages
- Analyzing existing process data in manufacturing for improving processes
- Creating new intelligent manufacturing systems that are based on a synthesis of data management and technology
- Data based risk and quality management

The actions taken under this Specific Project Area will increase the competitiveness of Swiss industry by increasing their efficiency and improve their sustainability by reducing the risk associated to technological developments.

Content of the project

This SPA is constituted of two main areas:

- Applied projects with branch specific consortia (since processes and technology are mostly branch specific)
- Broader scope development projects for tools and methods applicable to a large range of SMEs.

Organization and project plan

- identify homogeneous branches for branches specific projects, identify general methodological and tool requirements
- launch feasibility projects (phase 1), develop main projects (phase 2)
- implement on pilot scale, disseminate results to SMEs

Planning information

Medium size SPA

Particular aspects

The SPA aims at exploiting a huge economic potential that is present already by the cheap availability of data acquisition and storage. Historically, this is a completely new situation, and few of the possible opportunities have already been realized. Thus it can be expected that the return on investment will be more-than-average in this area.

Action Plan for Initiative 5: Support Measures for Manufacturing Innovation

Overview

This project area is aimed at improving innovation and assuring excellent business performance in the manufacturing industry in Switzerland, covering various aspects from a Swiss innovation strategy to the support for individual companies. The main goals are to strengthen competitiveness of manufacturing SMEs and, thus, to facilitate successful business in our country. Cooperation with similar activities is envisaged.

Stakeholders are mainly: people from politics and public administration (on the level of Swiss government and cantons), WTT-institutions (WTT = Wissens- und Technologie-Transfer) as well as private and public business development organisations, research and education institutions (universities, EPFL / ETHZ, UAS), MEM industry, manufacturing workforce and trade unions.

The proposed project area is structured as follows with a budget for 3-4 years:

5.1 Capacity Building for Innovations		
5.1.1	Design and implementation of measures to support innovation strategies in SMEs	Medium size SPA ⁵
5.2 Basic conditions to improve the business environment		
5.2.1	Improvement of business environment	Medium size SPA
5.3 National Innovation Strategy		
5.3.1	Swiss Innovation Strategy	Medium size SPA

Total over 4 years

Budget in Total (Mio CHF)
9

⁵ Small: less than 1 Mio CHF; Medium: 1-10 Mio CHF; Large: over 10 Mio CHF

Description of the Specific Project Areas

5.1 Capacity Building for Innovations

5.1.1 Design and implementation of measures to support innovation strategies in SMEs

Motivation

Due to growing globalisation, Swiss manufacturing companies have increasing difficulties to secure their competitive advantage. A company's own systematic innovation management is needed in order to open potentials for uniqueness and growth. Although a growing number of SMEs see the management of innovation as a necessity to increase profitability and growth, only about 25 % of companies have a written document on their innovation strategy. Various studies show a positive correlation between thorough planning and growth.

Current Swiss promotion of research and technological development merely supports the actual process of innovation (i.e. R&D-projects) but not the process of planning.

Goals

The goal of the project is:

- to raise awareness for the importance of a structured planning in SMEs and to give support for individual innovation strategies;
- to support defined innovation projects, e.g. through proposing suitable and competent partners with expertise in relevant technologies and markets.

Content of the project

The focus is the application-oriented transfer of know-how and technologies through

- a network of appropriate experts;
- providing adequate tools, such as check lists, strategic guidelines etc. and supporting project realisation;
- the establishment of a pilot phase in a selected region.

Organization and project plan

- Definition of the concept and its flexible implementation (adaptation, optimisation)
- Reporting and diffusion of results

Planning information

Medium size SPA

5.2 Basic conditions to improve the business environment

5.2.1 Improvement of business environment

Motivation

A successful manufacturing industry is depending on an adequate business environment and an innovation friendly climate. Thus, regulations have to be kept at a minimum, and they should not hinder sustainability in manufacturing. One rule for the government is to maintain a solid foundation for thriving business such as e.g. reduction of costs and lowering the risks in innovation.

Manufacturing industries, especially export oriented companies do not form a homogeneous economic sector. Accordingly, members of the various subsectors may need differing conditions to optimise their potential. Thus, successful monitoring needs to be done in a rather broad spectrum of business activities.

Goals

- Detailed monitoring among companies belonging to important sub-sectors of the producing industry, taking into consideration future trends and needs.
- Definition of strengths and weaknesses of the current situation.
- Elimination of major drawbacks (e.g. lobbying).

Content of the project

- Coordination with current activities of the seco (State Secretariat for Economic Affairs).
- Definition of the methods for investigations and data acquisition.
- Comparison – especially of weaknesses – with competing (European) countries; setting of benchmarks.
- Initiatives to specifically improve current framing conditions.

Organization and project plan

Close coordination and cooperation with similar initiatives.

Planning information

Medium size SPA

5.3 National Innovation Strategy

5.3.1 Swiss Innovation Strategy

Motivation

The Swiss education, research and innovation policy is neither sufficiently adapted to present needs nor oriented towards future challenges and economic trends. A clear setting of priorities and a strategy to anticipate future trends are rather missing.

This is demonstrated e.g. by the fact that we are a leading country in terms of scientific publications and patent applications. However, we are average in implementing the knowledge gained into successful commercial products, processes and services. Various examples from the past prove that, despite the leading position in R&D, the lack of a clear innovation strategy results in a disproportionate validation of the knowledge.

Goals

An innovation strategy thoroughly based on present needs and strongly oriented towards the future must include

- the observation of global trends (awareness and receptiveness for economic opportunities for Switzerland);
- a national innovation strategy, including strategies for education and training, R&D and the needs of the exporting industry;
- the definition of strategic goals and measures in order to strengthen and secure industrial production in Switzerland.

Content of the project

Analysing the

- current situation and needs;
- political frame and R&D-promotion;
- global technology and market trends;
- societal (general) needs and trends («mega trends»);

The strategic aims and recommendations as well as the measures to be taken in order to achieve the goals will be defined.

Organization and project plan

- Selection of a competent strategic committee composed of representatives from industry, education, R&D, promoters of innovation to fulfil the tasks;
- Open discussions, workshops with opinion leaders etc.

Planning information

Medium size SPA