OTTO VON GUERICKE UNIVERSITÄT MAGDEBURG

EIT FAKULTÄT FÜR ELEKTROTECHNIK UND INFORMATIONSTECHNIK

Alumni of vocational education as a new target group for higher continuing education Chance and challenge for universities

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Agenda

- Research Background (InnoProfile projects TEPROSA & INKA)
- Methods
- First research Results
- Summary and perspective

InnoProfile project TEPROSA

- TEPROSA = Technology platform for the product miniaturization in Saxony-Anhalt (Federal Ministry of Education and Research)
- Project time: 01.10.2006 – 30.09.2011 (5 years)
- Assignment of innovative processes and technologies in the field of:
  - Microsystems technology (MEMS = micro-electro-mechanical systems, MOMS = micro-opto-electro-mechanical systems)
  - Packaging
  - Injection molding to create molded interconnect devices (3D-MID = three-dimensional molded interconnect devices) and ceramic elements (CIM = ceramic injection molding) in connection with miniaturization technologies
  - Reliability

InnoProfile project INKA

- INKA = Intelligent/smart catheter (Federal Ministry of Education and Research)
- Project time: 01.06.2008 – 31.05.2013 (5 years)
- Development of catheters for minimal endoscopic surgery (minimally invasive surgery) with the help of miniaturization technologies especially for:
  - Neurological inventions and spinal column inventions and tumor therapies
  - Surgical interventions by the control of X-ray equipment for radiography
  - Surgical interventions by the control of magnetic resonance tomography (MRT)

InnoProfile projects TEPROSA and INKA

- There exists similarities and comprehensive objectives between both projects:
  - Enhancement of collaboration between science and business (university and especially local SME)
  - Establishment of a technology and education platform
  - Transfer of knowledge and technology
  - Human resource development, personnel qualification and recruiting young talents for enterprises (especially local SME)

Micro Systems Group at the OvGU Magdeburg

- Core competence “MEMS on MID“ with technical infrastructure
  - MEMS clean room (class 100) with MEMS-Prototype-Line
  - CMOS clean room (class 10) with CMOS-Prototype-Line
  - Design- and simulation platform (Software & Hardware)
  - Packaging platform with MID- and CIM-Prototype-Line
  - Reliability platform with (environment & structure)
- Course of studies “Bachelor/Master of Science for microsystems”
- 11 vocational trainees “Microtechnologist”

Vocational education “Microtechnologist“

- Microtechnologists produce in proceduraltechnical processes micro technical products (e.g. airbag sensor, hard disk reading head)
- Microtechnologists work in the production, engineering or research and development sector of enterprises and research institutes
- Duration of training: 3 years
- Two focus points
  - Semiconductor technology
  - Microsystems technology

Vocational education “Microtechnologist“

- **Semiconductor technology**
  - Production of semiconductor products (e.g. solar cells, LEDs, ASIC = Application specific integrated circuit) by the use of sputtering, coating, structuring, etching, doping and assembling technologies
- **Microsystems technology**
  - Production of electronic component and device carriers and microsystems (e.g. airbag sensor, mobile phone antenna) by the use of coating, etching, assembling, lithographical, bonding, sealing, brazing and soldering technologies

Vocational education “Microtechnologist“

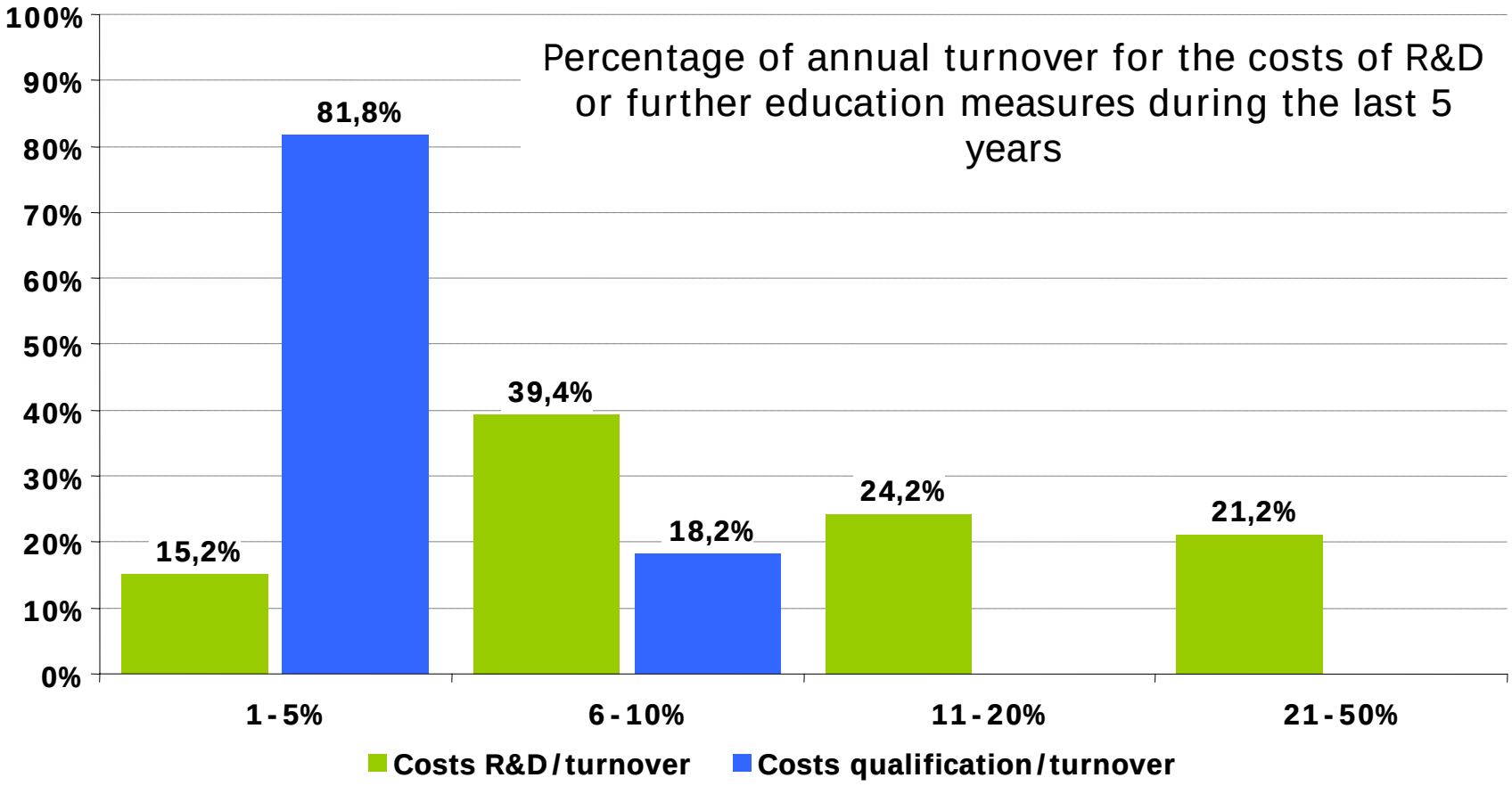
- Profile vocation with requirements from different fields:
  - Mathematics, physics, chemistry, biology
  - Electric technique and electronic, industrial process and control
  - Mechanical Engineering, Informatics, material technique
  - Technical mechanic, construction, engineering
  - Project management, quality management
  - Micro mechanic, micro actuators and micro sensor systems
  - MEMS technologies and processes
- “Who plans to work in the field of [Micro Technologies needs a comprehensive knowledge of engineering and technology and also comprehensive knowledge of chemical, physical and biological processes.” (Heimer & Werner 2004)

Impressions vocational education “Mikrotechnologist”

Research methods

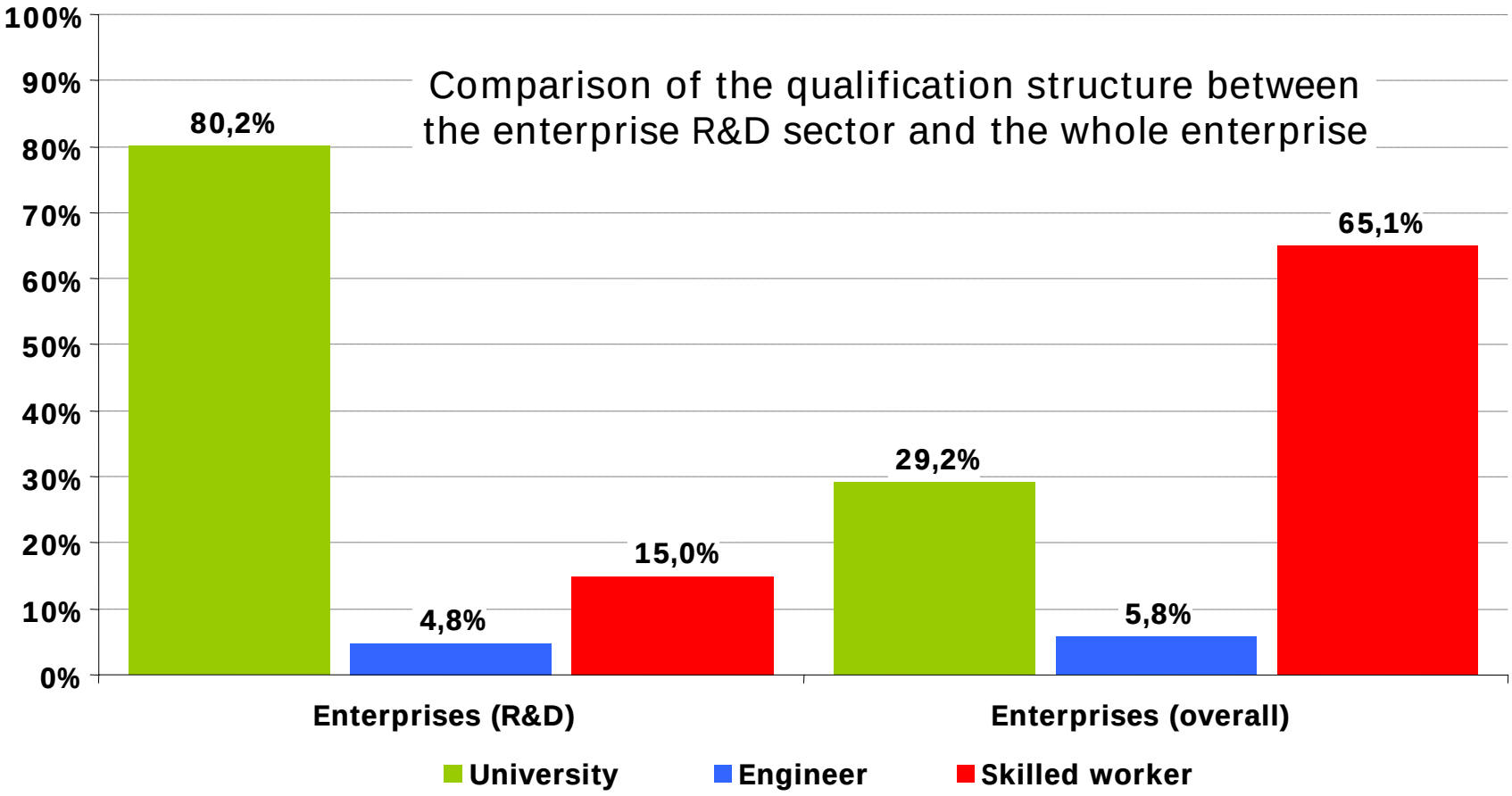
- The investigation of the requirement profiles for further educations at universities for the micro technologies science-based on the following research methods:
  - qualitative (archival analysis , expert interviews, strategy meetings, fireside chats, group discussions)
  - quantitative (online questionnaires)
- Representatives of the management and human resource development board of enterprises (automotive, electronic industry, process technology, bio technology, communication industry, medical technology) from Saxony-Anhalt, Saxony and Thuringia
- First results science-based on 32 strategy meetings, 3 fireside chats and 114 evaluated online questionnaires

First Results



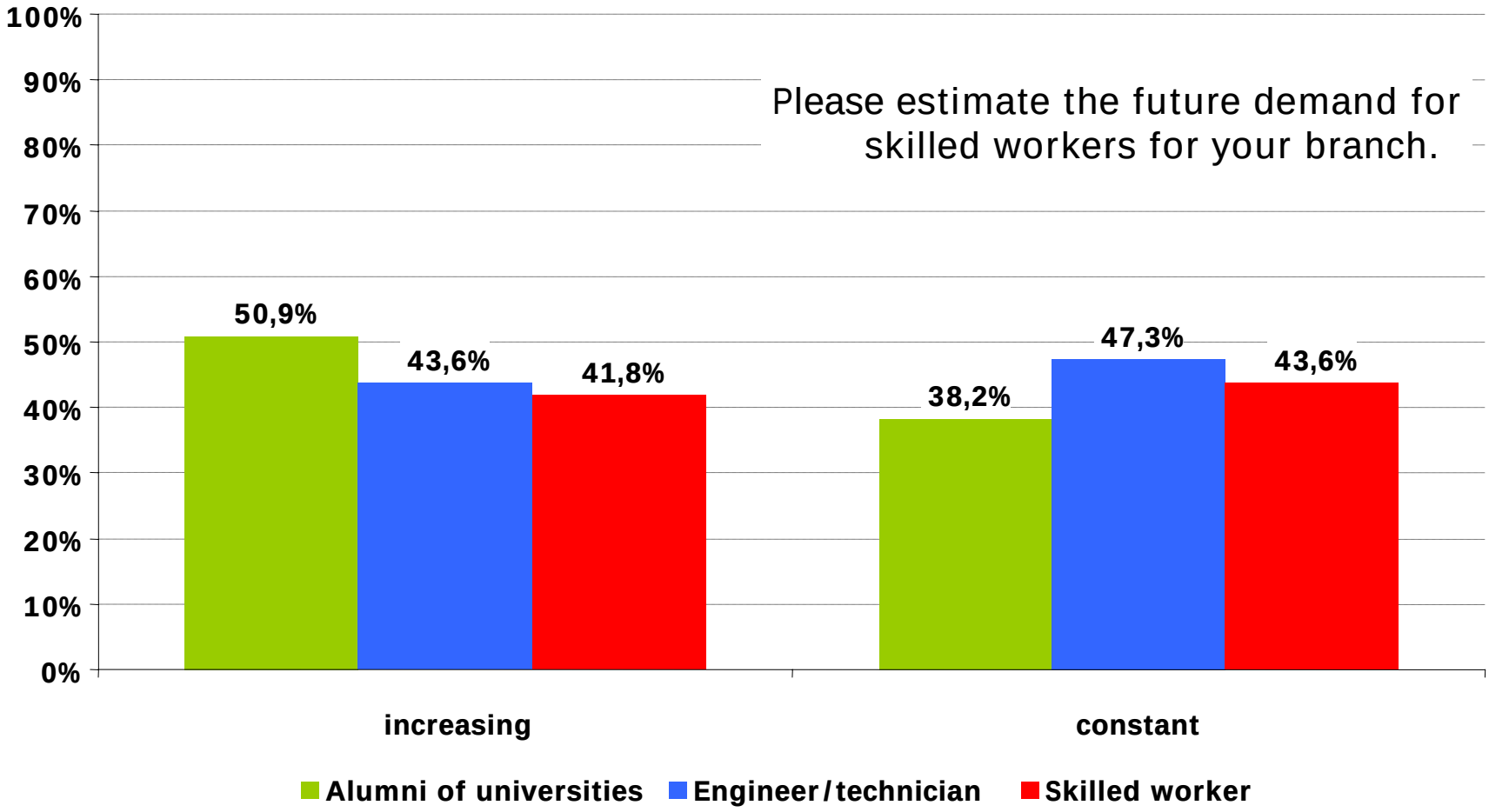
Ø Annual turnover = 9 Mio. EURO

First Results

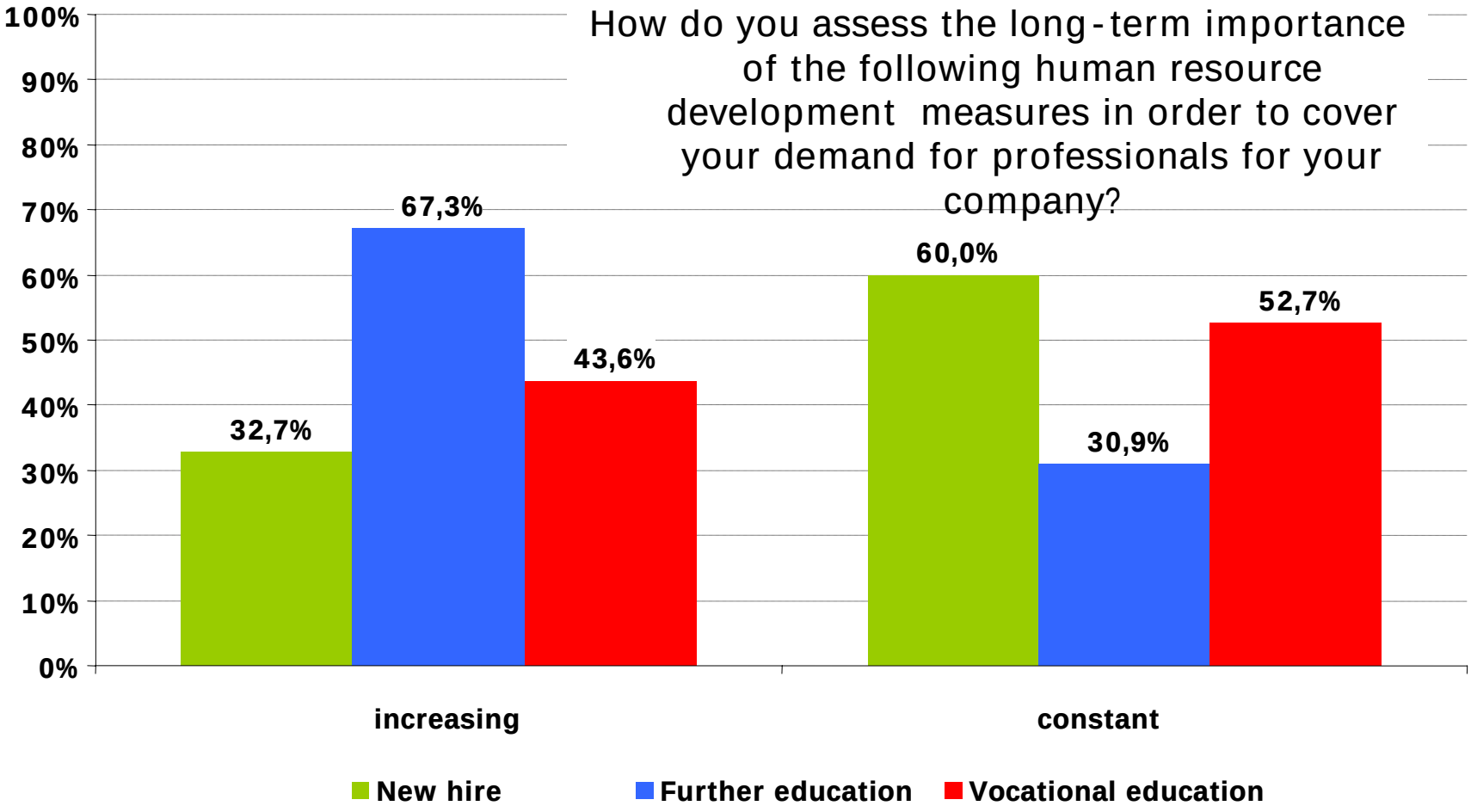


Ø Number of employee = 75 employee

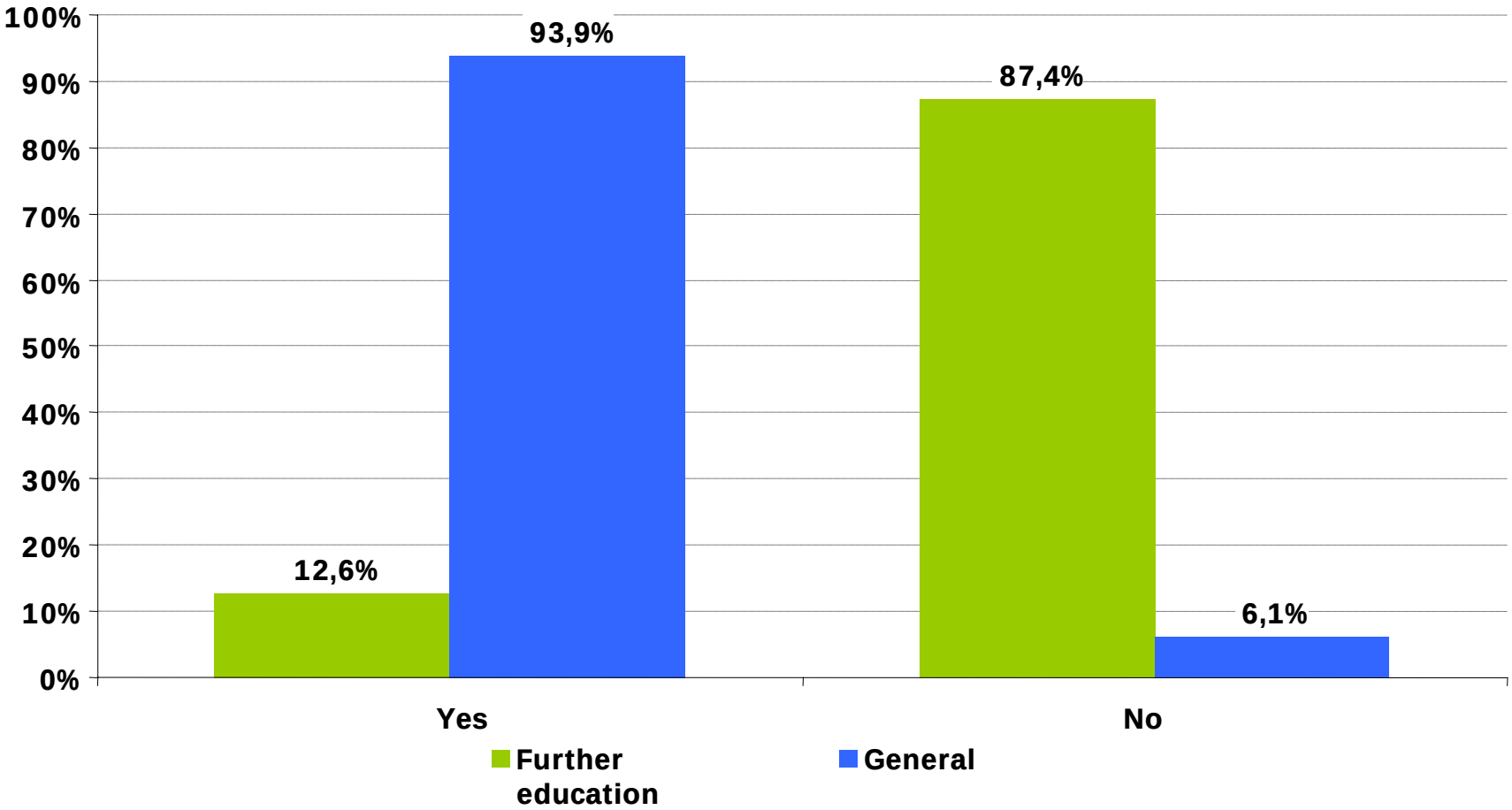
First Results



First Results



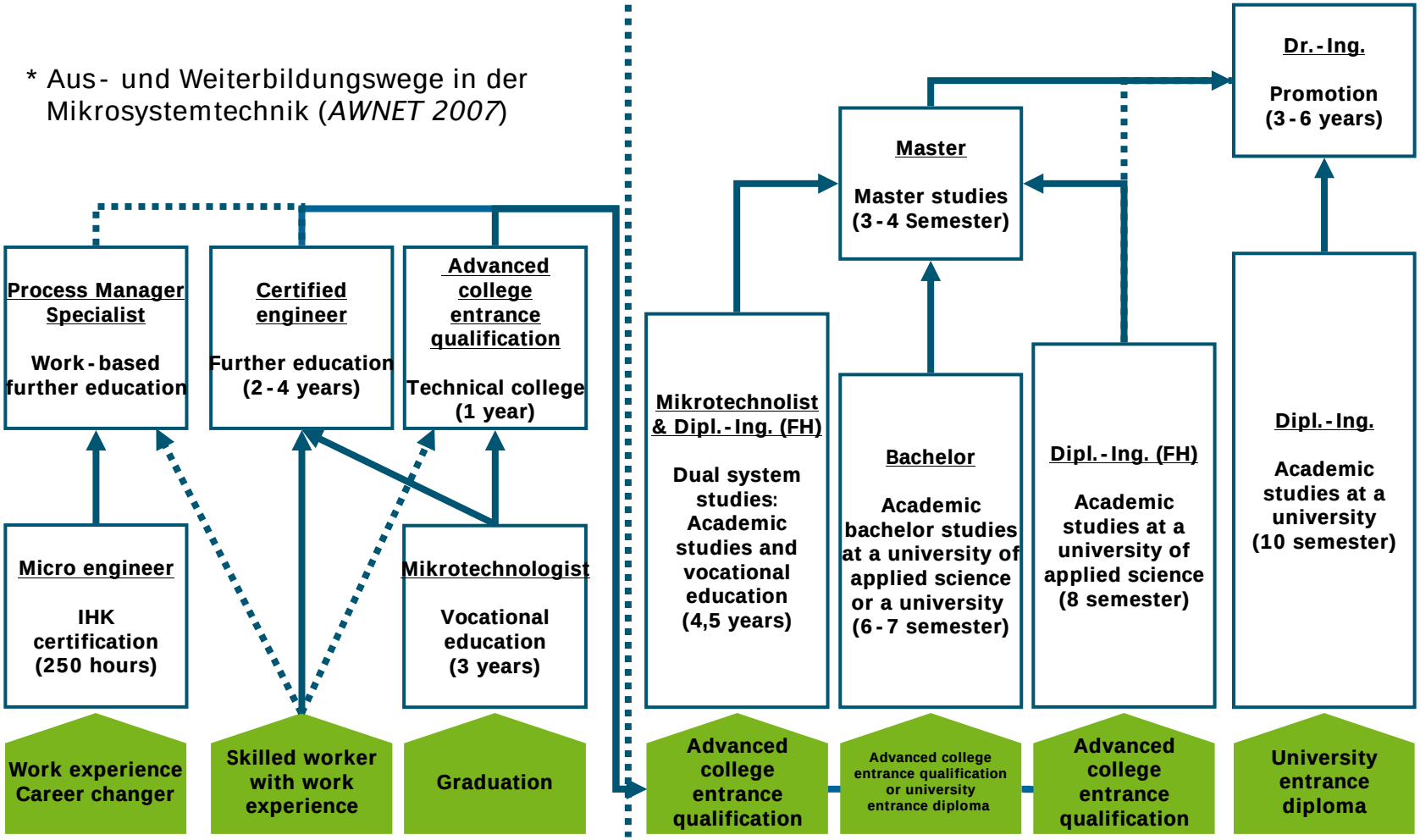
First Results



Do you have experience in cooperation with universities?

How does it look in practice?*

* Aus- und Weiterbildungswege in der Mikrosystemtechnik (*AWNET 2007*)



Vocational educations with micro technological contents

Biologielaborant	Fertigungsmechaniker	Papiertechnologe
Chemikant	Industriemechaniker	Physiklaborant
Chemielaborant	Lacklaborant	Systemelektroniker
Chirurgiemechaniker	**Mikrotechnologist**	Systeminformatiker
Elektroniker	Mechatroniker	Verfahrensmechaniker
Feinwerkmechaniker	Pharmakant	Werkstoffprüfer
Biologisch-technischer Assistent	Chemisch-technischer Assistent	Physikalisch-technischer Assistent

First results – Problem statement

- Micro-, bio- and nano technologies are key technologies and an very important for future innovations (VDE-Study "Micro technologies 2010" & VDE-Study „Key technologies 2010")
- Percentage of graduates (2011: 25-34 years old, 25,7%) far below the OECD average value in Germany (permanent challenge of qualification on academic level)
- Increasing demand for specialists and executive staff in direction with the current deficit of qualified staff (demography) especially for key technologies (e.g. micro systems technology)

First results – Problem statement

- New challenge for SMEs for its personnel policy in order to cover its deficit of qualified staff with its own personnel (demand for further education programs)
- Companies need and require customized further education programs (current and existing higher further education models do not achieve the professionals in the enterprises)
- Further education demands of companies are rather short-oriented and have to be focused on the implementation of specific products or processes (fast and non-bureaucratic implementation)

Requirements for higher further education

- Reducing the deficits of classical further education (practical relevance , individualization, up-to-dateness, development of self-learning skills, providing of social and methodological skills)
- Company-specific further education offers need a high level of individuality, up-to-dateness, flexibility and transparency (adaptability for specific, operational, time-varying demands)
- Opening of higher further education programs for a wider traget group (alumni of vocational education) and deduction of vocational competences, individual certificates and informal competences for new vocational or academic degrees
- Higher further education needs a high level of:
  - Worked-based learning
  - Individualization and flexibility
  - Modular structure and sustainability

} **Blended Learning**

Blended learning

- Blended learning (hybrid learning) describes the didactical chance between phases of attendance, phases of self-learning and phases of reflection by the use of new media. (Meifert 2008; Hallet 2006; Wiepcke 2006; Sauter, Sauter & Bender 2004)
- Blended learning in educational research refers to a mixing of different learning environments. (Meifert 2008)
- Blended learning combines traditional face-to-face classroom methods with more modern computer-mediated activities. (Sauter, Sauter & Bender 2004)
- Blended learning methodology mainly consist of mobile learning, classroom learning and online learning.

Characteristics and advantages of E-learning

- Triple-A (A3, Anytime, Anywhere, Anyone)
- Individual learning: e.g. learning at their own speed, learning contents, sequence of the contents, flexible methodologies and didactics
- Multimediality: different learning media for different learning types
- Forms of communication: Synchronous and asynchronous communication
- Forms of learning: Cooperative and collaborative learning
- Spatially independence: Learning contents available everywhere
- Temporally independence: Learning contents available everytime

Characteristics and advantages of E-learning

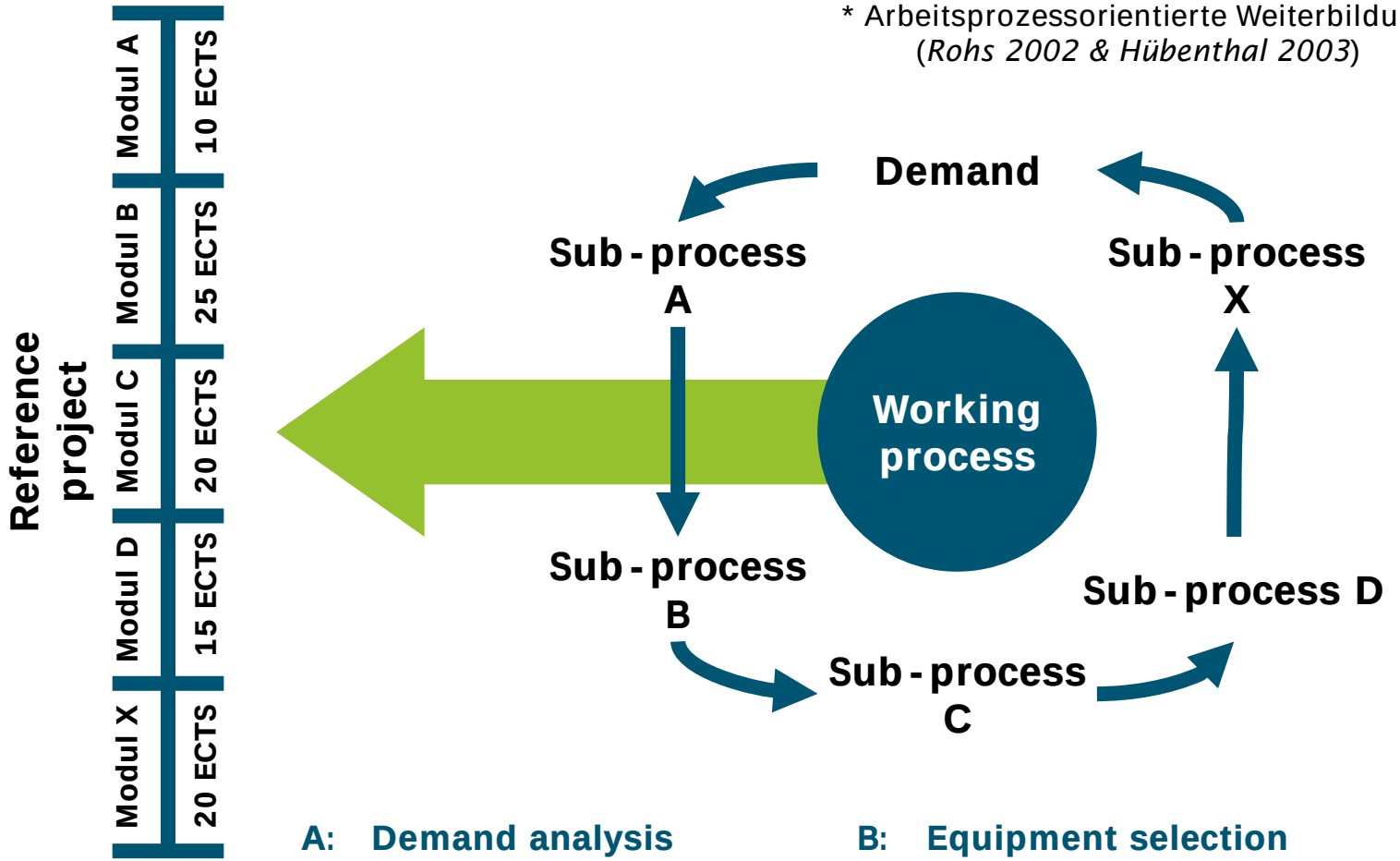
- Flexibility: As needed integration in occupational or private life and time individually processing (self-directed and lifelong learning)
- Hypertextuality: Networking of information and contents, which promotes collaborative work (cooperative and collaborative learning)
- Interactivity: User are able to elaborate and change contents, which promotes an active participation in individual learning process (higher level of adaptability and up-to-dateness)
- Distribution capability: Easier, more comprehensive and faster provision of contents and information
- Reusability: Easier archivability of contents and easier adaptation in other learning scenarios

Worked-based learning

- Alignment of further education measures more closer to the working processes of the number of participants (Rohs 2002)
- Combination of working and learning as well of formal and informal learning processes (Rogalla 2005)
- Ideal case: Learning process = working process
- Definition of learning contents by identification of relevant working processes and deduction of an individual worked-based further education curriculum with (microtechnological) reference projects
- Further education by a practical, work-based and activity-based working or development project (transfer project), which corresponds to the identified reference project in level, complexity and completeness (Rogalla 2005; Rohs & Mattauch 2001)

How might this look like in practice?*

* Arbeitsprozessorientierte Weiterbildung
(*Rohs 2002 & Hübenthal 2003*)



A: Demand analysis
B: Equipment selection
C: Planning start - up
D: Delivery and start - up
X: Process Enablement

Individualization and flexibility

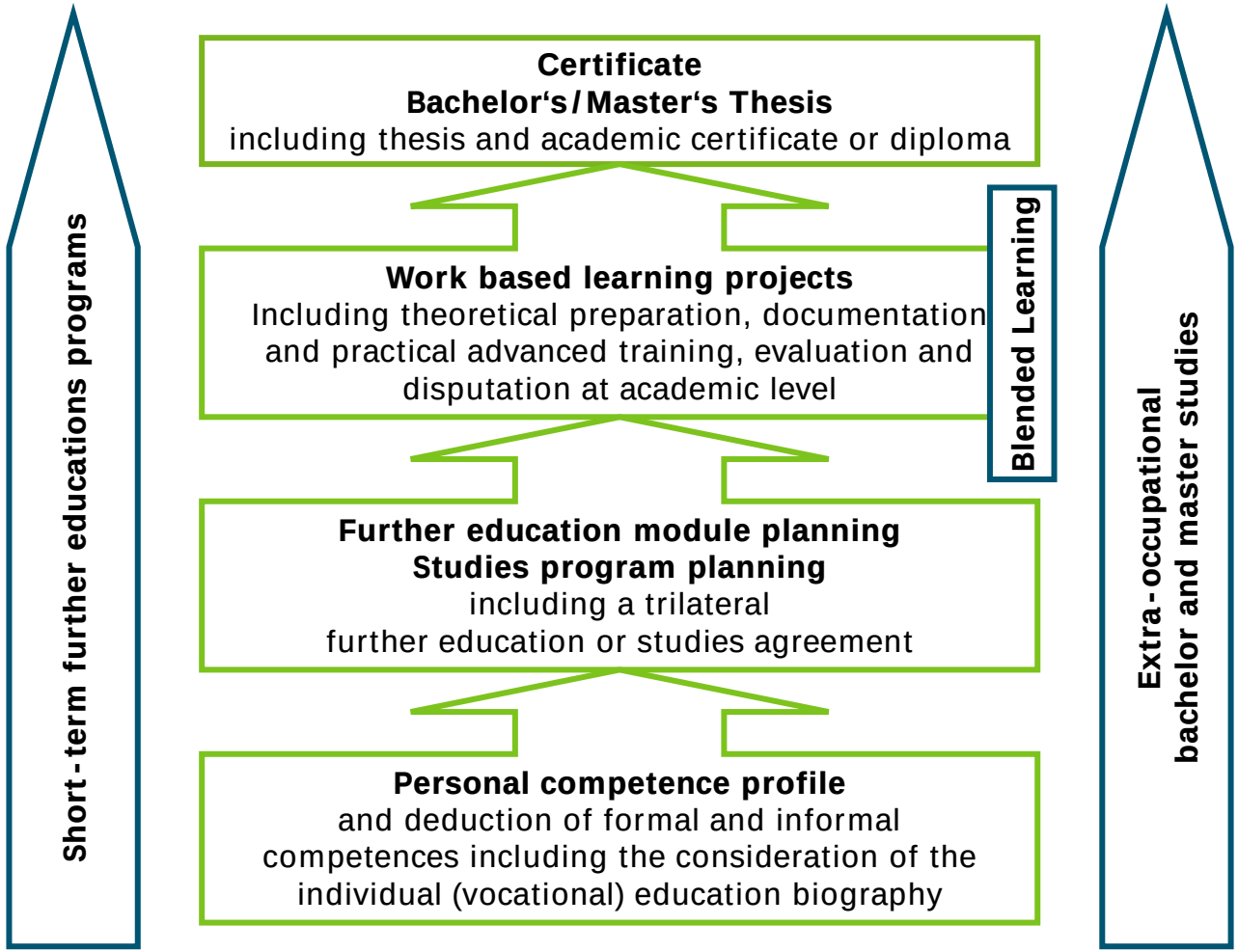
- Review of deduction of existing vocational competences and informal experience by an individual competence appraisal/check (Hartmann & Stamm-Riemer 2006)

- Deduction of a participant-specific further education roadmap by consideration of the individual (vocational) education biography (formal and informal competences) including a trilateral further education or studies agreement (Reinmann-Rothmeier 2003)

- Blended learning as method mix for the methodological and didactical combination of classroom and online learning by using modern communication technologies and new media (Sauter & Sauter 2002)

- Spatially and temporally flexibility and independence: All learning contents, modules and materials are available for everyone everywhere and everytime

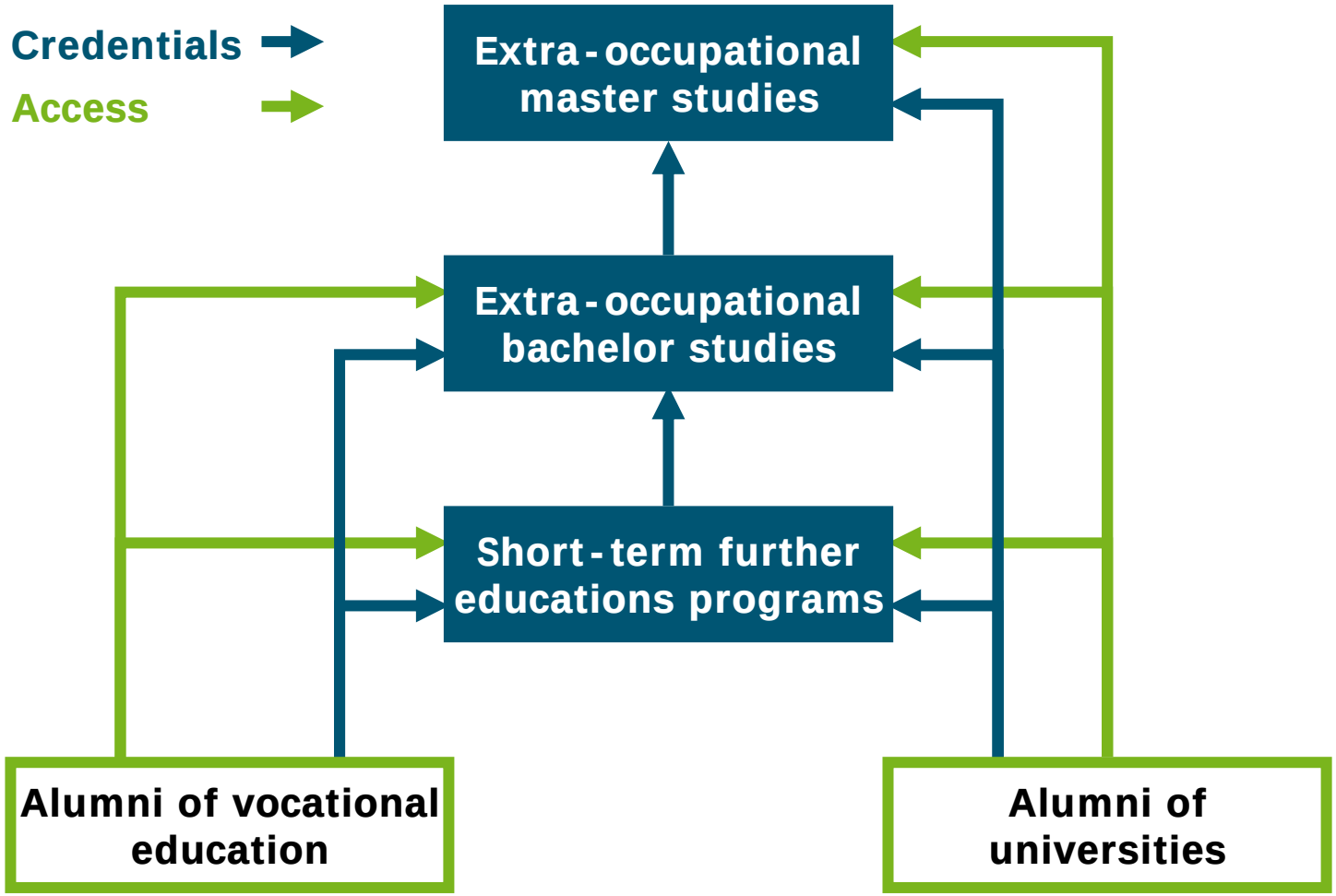
How might this look like in practice?



Modular structure and sustainability

- Each module is self-contained with regards to content self-contained and individually certifiable
  - Creditability for later extra-occupational or further education bachelor or master studies or other further education an qualification programs
  - Exchangeability and up-to-dateness
  - Higher level of an temporal and organizational flexibility
  - As needed integration in the occupational or private life and time individually processing
  - Possibility, especially for companies, to train its employees in further education programs according to specific operational demands and market requirements
- Integration in the process of life-long learning along the whole (vocational) education biography
- Transparency between vocational and academic education

How might this look like in practice?



Summary and perspective

Target groups for higher further education in the center of excellence

Alumni of vocational education

- who have already completed a vocational education (possibly also further education degrees, e.g. master craftsmen, engineer, MBA) and have professional/vocational experience

Alumni of universities

- who have already gained professional experience in a company and are looking for a further higher education program (e.g. at the instigation of the employer or own interests)

Summary and perspective

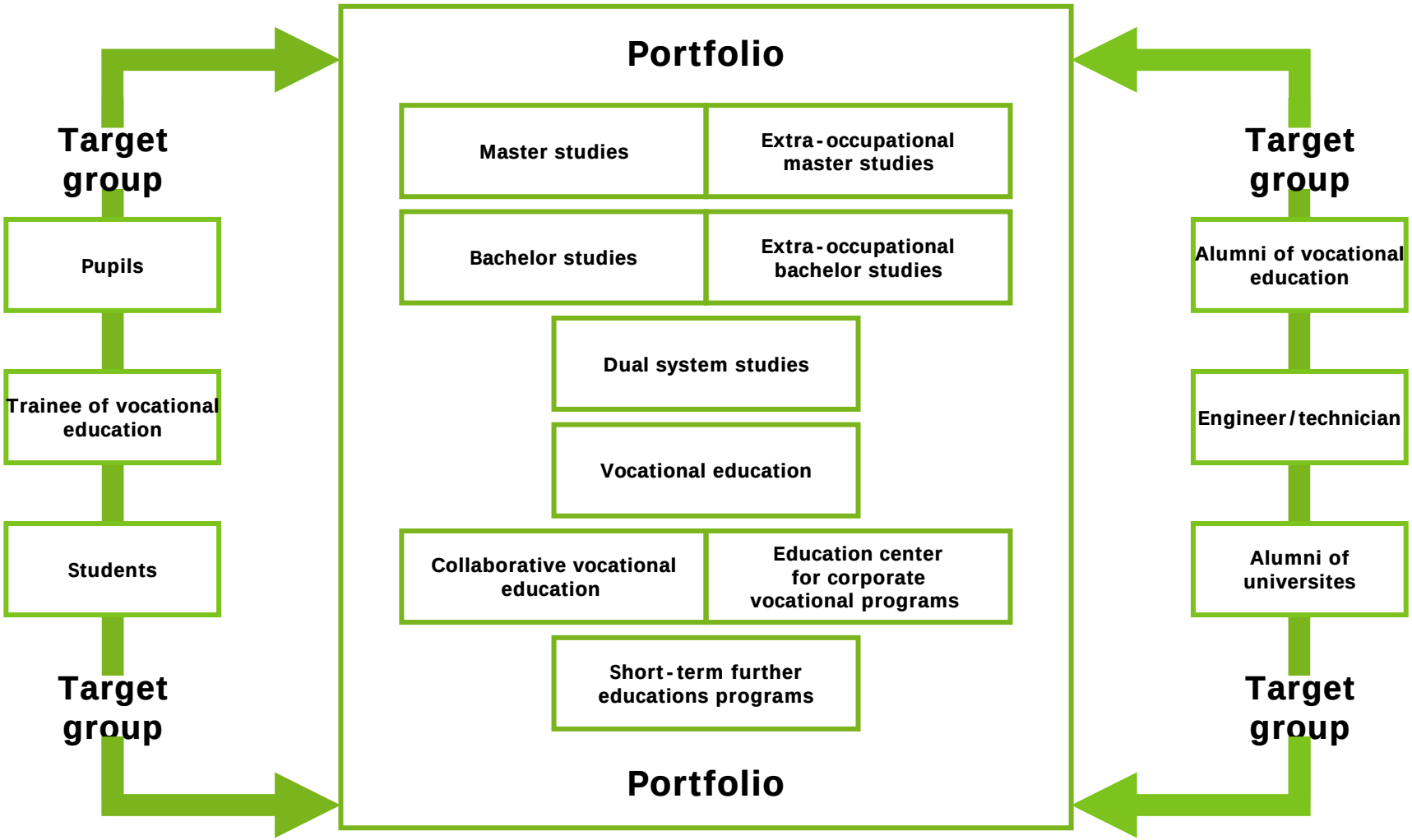
Portfolio of higher further education at the center of excellence

- **Short-term further educations programs** (certificate of attendance or university certificate)
  - Important: These certificates have to be creditable for possible later extra-occupational or further education bachelor or master studies in order to ensure the option of an academic graduation

- **Extra-occupational bachelor studies**, especially for alumni of the vocational training system, but also for job-related successful college dropouts

- **Extra-occupational master studies**, especially for alumni of the extra-occupational bachelor studies or other bachelor studies

Perspective: Center of excellence micro technologies



Summary and perspective

Short-term further educations programs

- Workshop “3D-MID – Product integration in the third dimension“
- Workshop “MEMS – Technology – Packaging – Reliability“
- Workshop “CIM – Ceramic injection molding“
- Workshop “Ultra sonic sensors“
- Interdisciplinary workshop offers (PM, QM, QS, etc.)

Vocational education

- Microtechnologist, focus microsystems technology
  (6 vocational trainees)
- Microtechnologist, focus semiconductor technology
  (7 vocational trainees)
- Collaborative vocational education (in process)
- Education center for corporate vocational programs (in process)

Summary and perspective

Bachelor studies
- Information and microsystems technology

Dual system studies
- Information and microsystems technology
- Industrial engineering and management for electrical engineering , information technology and microsystems technology

Master studies
- Medical systems
- Information and microsystems technology (in process)

Extra-occupational studies
- Bachelor studies microsystems technology (in process)
- Master studies microsystems technology (in process)

Summary and perspective

- Thank you very much for your attention!
- Which kind of experience do you have with alumni of vocational education as a new target group for higher continuing education?

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