BIOART (Innovative Multidisciplinary Curriculum in Artificial Implants for Bio-Engineering BSc/MSc Degrees)

WP1. National report (Belgium)

1. Trends in biomedical engineering industry in Belgium.

1.1 Introduction:

The Belgian healthcare system is facing major challenges.

- There is the aging population and a growing number of chronically ill people, both significantly increasing the need for care.
- Many elder people want to stay in their home as long as possible, thus requiring more help (in people and technology) to stay independent and self-supporting.
- There are ever higher quality requirements, a growing shortage of healthcare professionals and increasingly critical and vocal healthcare consumers.
- There is the rising cost of healthcare (technology costs, pharmaceutical costs, growing quantity of participants in the system).

Thanks to advances in medical technology and digitization efficient solutions are made available to address these challenges.

This translates in new technological solutions and innovations and a boom of health-technologies over the last past years: medical implants and aids, medical tools, hearing devices, diagnostics devices and apps, pharmaceuticals…

As elder people want to stay at home longer before going to an elderly home, a number of solutions for providing comfort for them is another area of technology: surveillance, stair elevators, keeping-company solutions….

To provide all these necessary devices, more effort needs to go in this specific branch of engineering.

Buzz words and trends in the Benelux health-tech ecosystem are: medical devices, hospital networks (size up the players), in vitro diagnostics (IVD) and personalized medicine, eHealth,

digitization of healthcare, Artificial intelligence in diagnostics and care.

This list clearly shows what the fields of interest for an educational curriculum leading to a specialist in biomedical engineering.

Biomedical engineering is the multidisciplinary field concerning engineering research, developments and applications in (bio)medicine. It advances knowledge in engineering, biology and medicine, and improves human health through cross-disciplinary activities that integrate engineering sciences with the biomedical sciences and clinical practice. Some of the well-established specialty areas within the field of biomedical engineering are: bioinstrumentation, biomechanics, biomaterials, bio-informatics, system physiology, clinical engineering, ergonomics and rehabilitation engineering.

Biomedical engineering is a young field of engineering, relatively small compared to the traditional engineering fields, like electrical or mechanical engineering. At the same time is also a more comprehensible and multi-disciplinary field than the traditional mechanical or electrical engineering field. This multi-disciplinarily approach demands for newer combined curricula.

Due to these challenges in society the bio-medical engineering sector in Belgium is a growing and high tech sector which urged politicians and universities to give priority to a renewed and global approach.

1.2   Demands for bio(medical)engineering education

As research and development in biomedical engineering is complex and multi-disciplinarily , it is difficult to cover all necessary knowledge and skills in one engineering study. The future challenges that biomedical engineers are expected to solve are very diverse and are expected to increase further with new, emerging and disruptive technologies and changing demands of the health sector.

From the fields of interest or priorities put forward by the experts, it is clear that that biomedical engineers is professionals with very diverse areas of expertise. Buzz words as connected care (digital, mobile, smart), big data and artificial intelligence and medtech. Thinking about connected care is all things related to tele-health and monitoring from a distance (sensors, healthcare IoT), apps and prevention systems. With big data and artificial intelligence areas of technology of image recognition, pathology recognition and expert systems are touched. Medtech covers all technology areas ranging from 3D-printing (orthoses, skeletons, phantoms) over chirurgical robotics and implants to CRISPR-Cas-systems and genome sequencing. The range is enormous and will not be covered in one degree of engineering.

Biomedical engineers need to have a profound knowledge of fundamental engineering and physical science. On top they must be able to apply this knowledge to solve problems of medical and biological origin (living materials), which all require a multidisciplinary approach.

This is reflected in the different bio-medical engineering degrees, which consist most often in a number of general engineering courses and next a huge part of elective courses, so that each student can more or less find an appropriate set of course that fits best the disciplinary field in biomedical engineering that is closest to his interests.

1.3 Belgium.

The growing importance and opportunities in the biomedical sector was discovered by the universities which installed new branches of engineering studies to cover the needs on the emerging industries.

In Belgium bio-medical engineering education is the exclusive field of universities, where they connect closely in multidisciplinary studies with the university hospitals. As in Belgium there is a system of comprehensive universities (covering all branches of study: humanities, medical, sciences and engineering in one university), it is obvious that the connection between engineering and medicine is easier.

Besides bio-medical, there is a huge interest in bio-technology and pharmaceuticals which both look more to the "life" side of the problem, while bio-medical looks at the technology side of the matter.

There is no specific training on undergraduate level or for technician in the bio-medical field. These technicians generate from the general mechanical/mechatronics/electronic undergraduate studies.

2 Biomedical (engineering) industry in Belgium.

Bio-medical industry in doing well in Belgium: this shows from the industry growing, for the number of startups and from predictions on the future of the industry.

The estimated turnover of the sector is roughly 3.5 billion EUR (excl VAT), offering employment to about 17000 FTE.. ("The Belgian Medical Technology Industry, Facts and Figures 2018")

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As many countries in western Europa, bio-medical industry is also important and booming. Belgium always was a country with a strong pharmaceutical industry, of which Janssen Pharmaceutica (part of Johnson&Johnson) probably is the most well-known company.

These interests makes that there is 2 different branches in industry: the bio-technology industry is clustered under the (bio)chemical industry (www.essenscia.be), while the bio-medical industry is categorized as part of the high-tech industry. The federation of bio-medical/medical industry is BeMedTech, gathering 80% of the companies in the market (www.bemedtech.be).

beMedTech is the Belgian federation of the medical technology industry and has more than 200 affiliated companies. Its members are manufacturers and/or distributors and are divided into five product segments: in-vitro diagnostics (IVD), consumables, implants, medical investment goods (MES) and Extra Muros solutions, including Digital Health. Together they represent over 500,000 technologies for an annual turnover of € 2.4 billion not including export and they account for approximately 16.820 FTEs in Belgium. beMedTech estimates that the total medical device industry has a turnover of about € 3.5 billion and employs about 20,000 people.

In October 2016 the "Pact on Medical Technologies" was signed between Maggie De Block, Minister of Public Health, and beMedTech. The pact was a result of intense and constructive discussions between the federation and the 3 main administrations (Federal Public Service Health, the reimbursement agency National Institute for Health and Disability Insurance (NIHDI), and the Federal Agency of Medicinal and Health Products (FAMHP). The pact resulted in an agreement to work around 32 topics. The objective was clear: through agreements, laws and rules provide the highest possible guarantee to safe and accessible medical devices. One of the topics is "Training and Education of healthcare professionals on medical devices". In this project cooperation is needed between beMedTech, FAMHP and the universities.

Bio-medical and bio-technological startups make out the major part of the startups (source Sirris-data-scout), even more than Fintech. There is an important amount of organisations which promote, stimulate and support these startups (e.g. Voka Health Community, MIC Vlaanderen, Impulse Brussels innovation; Leuven Mindgate; BlueHealth Antwerp, Agoria Health, Caring Entrepreneurship Fund, MedTech Flanders, Flanders Care, Le WeLL,...)

According to Jobat (Belgian journal which monitors the labor market) the success of the industry is visible in the present demand for labor force, but also for the future.

According to predictions, the 10 most wanted technical profiles in the future include: Technologist medical imaging and Bio-medical engineer.

As such, the strive of the universities and industry to collaborate and to provide more studies and trainings in this direction is considered positive and wanted.

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