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The 3rd Kobe University Brussels European Centre Symposium

Green Innovation & Life Innovation

- for sustainable growth and society by Japan-EU collaboration -

Thon Hotel EU

6 December 2012 Brussels, Belgium

FUKUDA Hideki
President
Kobe University

The 3rd Kobe University Brussels European Centre Symposium

Preface

I am pleased to deliver this report on the 3rd Kobe University Symposium *Green Innovation & Life Innovation for sustainable growth and society by Japan-EU collaboration* which was held in Brussels on 6th December 2012.

The key concepts: “Green Innovation and Life Innovation” are what the Japanese Government set in their “New Growth Strategy” and they are also used in the EU’s Horizon 2020. The notions represented by the words “Green” and “Life” must be at the heart of our own lives and societies’ too; preservation of the environment and continued improvement in our day to day lives are absolutely vital if our societies are to flourish.

The role of universities in the resolution of the challenges we face, as well as the betterment of societies is more crucial than ever before. The issues we are facing in the 21st century are complex and contain multiple dimensions so that a single scientific approach is no longer realistic. We, Kobe University, are tackling these issues by promoting interdisciplinary approaches to help solve the problems facing us all as inhabitants of this planet. Kobe University is proud of the close collaboration currently taking place in the humanities, social sciences, natural sciences and biomedicine. The sessions in this symposium can be seen to further embody this spirit.

I hope the presentations and subsequent discussions in the symposium have brought you some ideas for closer, more effective collaboration between Japan and the EU and I believe that it will lead to sustainable growth and society.

The 3rd Kobe University Brussels European Centre Symposium

Green Innovation & Life Innovation

- for sustainable growth and society by Japan-EU collaboration -

Date & Time:
6 December 2012
9:30 - 18:00

Venue:
Thon Hotel EU
Rue de la Loi/Wetstraat 75
B-1040 Brussels

Organiser: Kobe University
Co-organisers: EU Institute in Japan, Kansai
The European Economic and Social Committee
Supported by: JETRO Brussels
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- for sustainable growth and society by Japan-EU collaboration -

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Innovation of Health Engineering for Ageing Society

Dr. Hideki Fukuda
President of Kobe University

Distinguished guests, ladies and gentlemen, it is a great pleasure for me to welcome you to the 3rd Symposium of Kobe University Brussels European Centre.

Today, we have many distinguished guests in attendance, and I would like to express my sincere gratitude in particular to honorable guests, His Excellency Ambassador Kojiro Shiojiri, Mission of Japan to the European Union, and Mr. Isi Saragossi, the Director responsible for International Cooperation of Directorate-General for Research and Innovation in the European Commission. Moreover, we have in attendance prominent researchers from Belgium, Germany, and Sweden; I am most grateful for everyone's participation today.

The themes of this symposium, "Green Innovation and Life Innovation" are two of the major concepts suggested by the Japanese government in its New Growth Strategy as well as by the EU in Horizon 2020. Under the agreement on science and technology, Japan and the EU have been cooperating in the fields of science, technology and innovation by promoting research collaboration in areas of mutual interest and benefit.

Kobe University has been participating in the current Framework Programme, FP7, in the fields of nano-technology, disaster management and aquaphotomics. By establishing Kobe University Brussels European Centre, we are enhancing the strong ties with European institutions in the fields of science and technology, as well as social sciences and humanities.

In this respect, we will introduce today the outstanding research projects in the areas of health and environment, which are being undertaken at our university and other collaborative universities. In this symposium, we hope to share the latest research and pursue further collaboration with our European partners in order to achieve yet further advancement. The areas we cover are:

- Radiation dose reduction as a common issue in clinical medicine, including advanced technology for diagnosis.
- The ageing society from a social sciences perspective
- Bio-production, and
- Health engineering for ageing societies

This research has been identified as being of common interest to both Japan and the EU. I very much hope this symposium will lead to further collaboration between us and thereby contribute to social development and sustainable prosperity in our respective societies.

I thank you all again for participating in today's Symposium.

H.E. Mr. Kojiro Shiojiri
Ambassador of Japan to the European Union

Dr. Hideki Fukuda, Distinguished participants, Ladies and Gentlemen,

It is a great pleasure to be here today for the 3rd Kobe University Brussels European Centre Symposium. I would like to extend my appreciation and congratulations to those who have realised this event. Today's themes of sustainable growth and society are high priorities for Japan. I hope each of today's sessions will give new momentum to Japan-EU collaboration in these fields.

The history of our societies is the history of overcoming the difficulties we face. Japan has being moving forward by overcoming difficulties. Currently we are facing huge challenges. The most essential is how to revitalise our society and economy. I believe that this revitalisation is the best way to honour those who lost their precious lives and loved ones in the 3/11 disaster. The disaster brought about a new focus, and opened our eyes to new challenges. Japan is now on a path to find a new paradigm. In this pursuit Japan will tackle the urgent issues of responding to climate change, realisation of a low carbon economy, the challenges of an aging society and maintaining the workforce. With these in mind, we face a fundamental question, how do we turn our difficulties

into strengths? In answering this question, Green and Life Innovation will play a central role. And moreover, joint collaboration will ensure its success.

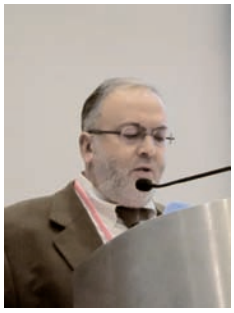
Cooperation between Japan and the EU needs to reach for a higher level, to ensure that the common challenges we face are answered by common solutions. Our level of ambition must respond to the challenge of realising sustainable growth and society. I believe that Japan-EU collaboration can bring about the innovations we need to overcome the difficulties we face. As many of the sessions here today will discuss, the importance of innovation in all areas is paramount to developing a sustainable economy and enriching our lives. Progress is being made on all levels of Japan-EU cooperation. Last week, Japan and the EU opened negotiations on a comprehensive EPA and Global Partnership Agreement. These agreements will act as the pillars on which our relationship can continue to build. By deepening our relationship and focusing on innovation in all fields, we will ensure sustainable growth into the future.

We have a lot of room to work together in and this symposium will bring forward new opportunities for collaboration in Green and Life Innovation. My wish is for all Japan, all the EU, all academic, researchers and innovators of Japan and the EU to come together with new wisdom, so that we can reach higher. From this perspective, I am looking forward to the discussion of this conference.

Thank you.

Mr. Isi Saragossi

Director responsible for International Cooperation of DG RTD, European Commission



Ambassador Shiojiri, President Fukuda, Distinguished Guests, Ladies & Gentlemen,

It is an honour and a great pleasure for me to open this Symposium, on behalf of Commissioner Geoghegan-Quinn. I would like to extend a warm welcome to our distinguished Speakers and to our Participants, all of whom are actively committed to fostering science and technology dialogue between the EU and Japan.

Kono kaigi e yôkosso! (welcome to this conference)

This is the third such Symposium organised by Kobe University European Centre. We are very grateful for this initiative, and for this opportunity to hear (and share insights and experience with) leading European and Japanese specialists and policy makers.

This is a very timely meeting.

As you know, exactly one week ago, the Foreign Affairs Council of Ministers decided to give the European Commission the ‘green light’ to start negotiations to conclude a Free Trade Agreement with Japan. This is a crucial step in our bilateral relations. It is also a crucial step in our relations in science, technology - and, particularly, in innovation. STI-related issues will feature prominently in these discussions, and on the agenda of the forthcoming EU-Japan Summit.

This is also a very appropriate meeting.

The two challenges addressed today “Green Innovation” and “Life Innovation” are two core areas of the “4th Japanese Basic Plan for Science and Technology”, published last year. They are also the “grand societal challenges” identified in Horizon 2020. Two “grand challenges” which Europe and Japan have to face in common. Two challenges which will require full cooperation between Europe and Japan if we are to address them successfully.

I would like to congratulate Kobe University for convening this event, and for the key role it plays in promoting EU-Japan science and technology cooperation.

As you know [and as was just mentioned by Ambassador Shiojiri/President Fukuda] Kobe University is the first (and so far the only) Japanese University to have an overseas office in Brussels, the Kobe University Brussels European Centre which covers the whole of Europe.

The opening in March last year, just days before the terrible tragedy which struck Japan, was impressive. You will remember that EU Council President Herman von Rompuy, who visited Kobe University the year befor

personally opened the new Centre, and gave an inspiring speech. Let me repeat some of his words “With this opening Kobe University is creating a new hub for our relationship. A new and strong knot combining all the threads that link our two societies”.

Kobe University’s Centre in Europe plays a key, and very original role, in EU-Japan research cooperation. Not only by organising policy and brokerage events like this Symposium today. But also by designing, together with leading European Universities, very focused and personalised research projects for its best post graduates.

I would like also to stress the role which Kobe University plays as a valued partner for European research in Japan itself. Kobe University belongs to the “EU Institutes in Japan”, which plays a very active role in disseminating information on European research to Japanese universities and research organisations, as well as in seting up joint project between EU and Japanese universities and research centres.

It is also a key partner of our Delegation in Tokyo, regularly contributing to its conferences and workshops, such as the recent workshop on standardisation, and the highly successful EU-Japan conference in October on Active and Healthy Ageing. And I am happy to salute here today several of the speakers who took part in both these events, in particular Professor Luo Zhiwei.

We welcome such commitments to Europe and European research.

Japan and Europe should develop a strong strategic partnership in research and innovation.

The EU-Japan S&T Agreement which was ratified last year provides a solid foundation for our cooperation. Currently, Japanese research organisations participate in 56 research projects in FP7. A number of coordinated calls have been successfully launched, in key areas such as ICT, energy, materials, and aeronautics research. Key priority areas for reinforced cooperation have been identified by both sides, at the last Joint S&T Committee meeting including active and healthy ageing (a key topic of today’s conference), low carbon technologies and critical new materials.

But we can, and should do more.

There is room for enhancing considerably the scope and impact of our cooperation – and to bring it to a level commensurate with our respective roles in the global economy, and in the field of science and innovation.

We face the same societal challenges. We share many values, including regarding the conduct of science. We also are working to establish stronger economic relations.

We should make optimal use of all relevant programmes and instruments on both sides to enhance and focus our cooperation, based on the principles of common interest, mutual benefit, and reciprocity. And the new FP Horizon 2020, with its increased emphasis on international cooperation, will provide excellent opportunities to reinforce our cooperation - and to turn our present partnership in a true “strategic partnership”.

We were very pleased and encouraged during recent meetings we held in Japan with various Ministries (MEXT, METI, Cabinet Office) and research organisations, to observe a renewed interest for Europe, and a clear will to cooperate more and better in research and innovation.

This conference will contribute to reinforcing our dialogue, and should help identify concrete and ambitious projects for future cooperation. We hope Kobe’s example will inspire other Japanese organisations and help convey the message that in Research and Innovation, Europe is “Open for Business”!

Domo Arigato Gozaimas! Thank you.

Session 1 10:00 - 12:30 Netherlands III

Radiation Dose Reduction Strategy and its Application as Low-dose CT in Future

10:00 Prof. Hajo Zeeb, Institute for Epidemiology and Prevention Research BIPS
"Basics and Overview of Medical Radiation Doses"

10:35 Prof. Yoshiharu Ohno, Kobe University
"Radiation Dose Management and Dose Reduction Strategy in Clinical Practice"

11:10 Dr. Wolfram Stiller, University Hospital Heidelberg
"Low-dose CT and Computer-aided Diagnosis in the Abdominal Field"

11:45 Assoc. Prof. Sumiaki Matsumoto, Kobe University
"Low-dose CT and Computer-aided Diagnosis in Chest Field"

12:20 Discussion

"The 3rd Kobe University Brussels European Centre Symposium" was held at Thon Hotel EU in Brussels on December 6, 2012. In this symposium, we have a session entitled "Radiation Dose Reduction Strategy and its Application as Low-dose CT in Future". In this session, four speakers have lectures, and discuss with audiences from EU.

The first speaker is Prof. Dr.med. Hajo Zeeb, MSc from Bremen Institute for Prevention Research and Social Medicine (BIPS). He had a lecture entitled "Basics and Overview of Medical Radiation Doses", and present importance of radiation dose reduction, the current situation of radiation dose issue in medical field, and necessity for radiation dose reduction for public health. The second speaker is me, Prof. Yoshiharu Ohno, M.D., Ph.D. from Kobe University. I had a lecture entitled "Radiation Dose Management and Dose Reduction Strategy in Clinical Practice", and present state of the art CT radiation dose reduction strategy, recently developed reconstruction technique for further radiation dose reduction, and its' application in chest CT imaging. The third speaker is Assistant Prof. Dr. Wolfram Stiller, Diplom-Physiker from Heidelberg University. He had a lecture entitled "Low-dose CT and Computer-aided Diagnosis in the Abdominal Field", and present state of the art CT radiation dose reduction strategies, recently developed CT reconstruction technique for further radiation dose reduction, and its' application in abdominal CT imaging. The final speaker is Associate Prof. Sumiaki Matsumoto, M.D., Ph.D. from Kobe University. He had a lecture entitled "Low-dose CT and Computer-aided Diagnosis in Chest Field", and present state of the art computer-aided diagnosis (CAD) and influence of state of the art CT radiation dose reduction technique to CAD in chest CT imaging.

We hope this symposium will contribute future collaborations between Kobe University and EU institution, and obtain fruitful results in near future.

Prof. Hajo Zeeb
Institute for Epidemiology and Prevention Research BIPS, Bremen, Germany

"Basics and Overview of Medical Radiation Doses"

Modern medicine contributes a major share to the overall radiation dose of the population, and this share has been increasing in the past decades. Even if most radiological investigations are justified and contribute to the health of patients, there is a need to aim for the lowest possible doses while maintaining or even improving the quality of radiological images. Computerized tomography is of major interest in this regard as it delivers radiation doses to the patients that are much higher than conventional X-ray in many cases. The presentation looks at the current international trends in medical radiation doses and provides some insight into new epidemiological data on potential long-term risks associated with medical diagnostic imaging, predominantly computerized tomography.

Yoshiharu Ohno, M.D., Ph.D.[1, 2]
[1]Advanced Biomedical Imaging Research Center, Kobe University Graduate School of Medicine, Kobe, Hyogo, Japan
[2]Division of Functional and Diagnostic Imaging Research, Department of Radiology, Kobe University Graduate School of Medicine, Kobe, Hyogo, Japan

"Radiation Dose Management and Dose Reduction Strategy in Clinical Practice"

CT is a powerful tool for the examination of chest and abdominal diseases because it can depict the disease process far more clearly than chest or abdominal radiographs, and more information than conventional angiography. Technical developments in CT scanners have enabled larger volume coverage with higher resolution and lower noise, but this has led to increased radiation exposure. Previous studies in the United States, United Kingdom, Germany, and Japan have shown approximately twofold increases in the number of CT examinations performed in the last a few decades. Currently, the issue of radiation dose reduction draws wide attention. However, application of reduced-dose CT techniques in clinical practice varies among institutions, which illustrates the lack of a standard protocol for effectively reducing radiation dose to patients in clinical settings.
To show the available data on reducing radiation dose exposure in routine chest and abdominal CT protocols, I will introduce 1) important techniques and factors followed by a review of previous studies of CT radiation dose reduction, 2) results from our international and domestic multi-center studies, 3) newly developed techniques and 4) future applications for CT developing at Advanced Biomedical Imaging Research Center in Kobe University.

Dr. Wolfram Stiller, Dipl.-Phys.
Department of Diagnostic and Interventional Radiology, University Hospital Heidelberg

"Low-dose CT and Computer-aided Diagnosis in the Abdominal Field"

The contribution of CT examinations to collective effective dose caused by all diagnostic procedures involving patients' exposure to ionizing radiation is ever increasing, leading to high interest in its reduction. With regard to radiation dose reduction, abdominal CT examinations pose a challenge inasmuch as the organs and structures of the abdominal region feature inherently low differences in contrast rendering their differentiation difficult, while ionizing radiation is highly absorbed by the dense structures located in this body region. Therefore abdominal CT examinations are normally associated with rather high doses. However, low-dose abdominal CT is still feasible and applicable for clinical conditions which imply an increase in contrast of abdominal anatomy either artificially by using

contrast-enhanced CT for imaging vascular structures or the intestines, or for lesions with inherent high-contrast like renal concrements or metastatic skeletal invasions. Apart from these applications new iterative image reconstruction techniques enable abdominal CT imaging at lower doses while preserving diagnostic quality and confidence. Since the amount of image data generated by CT examinations is very large and requires scrutinous review, computer-assistance for supporting radiological diagnosis and clinical decisions could prove to be valuable. To date, approaches to computer-aided diagnosis on the basis of abdominal CT imaging include the automatic identification of colorectal lesions in virtual coloscopy as well as the automatic segmentation of hepatic lesions or of the liver's vascular system.

Sumiaki Matsumoto, M.D., Ph.D.[1, 2]

[1]Advanced Biomedical Imaging Research Center, Kobe University Graduate School of Medicine, Kobe, Hyogo, Japan

[2]Division of Functional and Diagnostic Imaging Research, Department of Radiology, Kobe University Graduate School of Medicine, Kobe, Hyogo, Japan

"Low-dose CT and Computer-aided Diagnosis in Chest Field"

Over the last two decades, the technology of CT (computed tomography) has made great improvements. Recent multi-detector-row CT scanners offer remarkable speed of scanning, spatial resolution, and anatomic coverage, allowing for quick acquisition of high-quality 3D CT data of a body part or even the whole body. And nowadays such 3D data can be processed by specialized computer systems aimed for computer-aided diagnosis. Computer-aided diagnosis in radiology can be defined as a diagnosis made by a radiologist who uses the output from a computerized analysis of medical images as a "second opinion" in detecting lesions, assessing extent of disease, and making diagnostic decisions. In the sub-field of chest radiology, lung nodules and pulmonary emphysema constitute important targets for computer-aided diagnosis, because any non-calcified lung nodule may be a manifestation of lung cancer but can be overlooked by radiologists and it is impossible for radiologists to quantitatively assess the extent of emphysema without the use of image processing. This lecture focuses on our approach to computer-aided detection of lung nodules and quantitative assessment of emphysema, in the contexts of global attention to lung cancer screening using low-dose CT and the recent trend towards radiation dose reduction using new iterative reconstruction algorithms.

Session 2 10:00 - 12:30 Netherlands II

Social Aspects of Life Innovation on the European and Japanese Societies

10:00 Prof. Masahiko Yoshii, Kobe University
"Overview of the Lost Two Decades and the Ageing Society in Japan"

10:10 Prof. Naoki Mitani, Kobe University
"Ageing and Employment Policies in Japan"

10:40 Prof. Yuki Sekine, Kobe University
"Social Security in an Ageing Society: Challenges and Responses"

11:10 Ms. Laure Batut, European Economic and Social Committee
"Social Innovation and Active Ageing"

Discussant: Mr. Georgi Stoev, European Economic and Social Committee

The 3rd Kobe University Brussels European Centre Symposium was held at Thon Hotel EU in Brussels on December 6, entitled "Green Innovation and Life Innovation – for sustainable growth and society by Japan-EU collaboration." Session 2 was a workshop titled "Social Aspects of Life Innovation on the European and Japanese Societies" held from 10:00 to 12:30.

This workshop was organized in continuation to the conference on the ageing society, jointly held by Kobe University, EUIJ-Kansai, and the European Economic and Social Committee (EESC) in Brussels in March 2012. The aim of the workshop is to discuss positive aspects of an ageing society including the advancement of assistive technology and the new market needs instead of the burden on social welfare or the downside of the labor market.

The main themes of session 2 were social welfare systems and the labor market which Kobe University and EUIJ-Kansai have been studying for years in collaboration with EESC. With more than twenty researchers and experts in attendance, the overview of changes in the labor market and social security policy in Japan was presented, which was followed by the recent trends such as increase in contractual employment and long-term unemployment within younger generation. The session was concluded with a shared understanding that we should explore economic opportunities and newly emerging needs in the ageing society and need to revitalize the younger generation. The session was followed by an active exchange of opinions and constructive discussion. The assistive technology for ageing society was discussed in session 4.

Prof. Dr. Masahiko Yoshii

Dean of the Graduate School of Economics, Kobe University

"Overview of the Lost Two Decades and the Ageing Society in Japan"

As Japanese GDP of 470 trillion yen in 2011 was almost the same level as that of 1990-91, we can say that Japan cannot recover from the lost two decades, and its future is still not bright. The stagnated situation, of course, comes mainly from the economic reasons: demand and supply sides. But, the decreasing and ageing demographic structure is further complicating the problem. For example, a huge increase of the social security costs becomes more and more difficult to be sustained by the decreasing labor force. Nonetheless, we would like to focus on the encouraging side of the ageing society. Developing nursing technologies will create a promising industry. More and more elder people spend their ample money for travelling abroad. We should turn our attention to these aspects, thinking up new ideas to overcome negative aspects of the ageing society in Japan, and be a promoter of these new and creative ideas and technologies.

Prof. Dr. Naoki Mitani

Graduate School of Economics, Kobe University

"Ageing and Employment Policies in Japan"

Japan is challenged to prepare for the rapid ageing and declining population. Given the high labor force participation rate of the elderly, Japan has made efforts to promote employment for older workers by encouraging employers to retain older workers longer, through the extension of mandatory retirement age or continued employment since mid-1970's. The recent regulatory measure to extend continued employment until 65 years old for all mandatory retirees has significantly raised the employment rate of older workers, but it has brought the debate over the trade-off of employment between older workers and youth. Youth employment situation has deteriorated sharply after the Bubble Burst, especially late 1990's-early 2000's. With the stagnating economic growth, the dualism of the Japanese labor market has proceeded. Typically, the non-regular employment provides with fewer opportunities of training and lower wages. Consequently, the increase in non-regular employment among youth results in fewer marriage and further decline in fertility rate. Under the Japanese employment system, the lump-sum hiring practices of new school-leavers and placement by school had played important roles for relatively better performance of the Japanese youth labor market. The government is trying to restore these traditional institutions and to implement new measures to cope with increasing joblessness and employment instability among youth.

Prof. Yuki Sekine

Graduate School of Law, Kobe University

"Social Security in an Ageing Society: Challenges and Responses"

Japan's population has reached an ageing pace that is threatening its future well-being by inflating social security costs to an extent increasingly difficult to control. Successive governments' strategies have mainly focused on active ageing policies, counting on Japan's large pool of healthy and motivated "senior citizens", extending their employment possibilities and accordingly, seeking their extended financial contribution to social security costs. In recent years, public and academic debates on the concept of an « age-free » society, which is not only new in our country, but also largely contradicts our traditional employment practices, are also increasing. On the other hand, the trade-offs between older and younger generations, be it on their share of the labour market, or of social security duties and rights, constitute important concerns on tackling the challenges of ageing. The newest government has adopted in 2012 a series of reforms under the frame-

work of a “Global Reform on Tax and Social Security”, which aim at regulating labour market practices and social security costs sharing that have affected the younger generations over the last years, as well as securing new ways for financing the future needs of our society with a concern to the burden put on the current and future youth.

Ms. Laure Batut

European Economic and Social Committee

“Social Innovation and Active Ageing”

Challenges for labour law and social security law

Economic stagnation in aftermath of 2 lost decades is still affecting social security – pension fund investment return.

Employment promotion policies focusing on older workers as pension age raised to 65 – had an effect on youth employment. Early retirement has never been a policy choice in Japan. Ratio for youth unemployment relatively is low and only recently has become a policy issue. Psychological/sociological aspects in youth unemployment include high psychological pressure education/labour market and rigidities in labour market that affect companies and labour law. Youth feel there is no second chance as the perception of gloomy prospects has come up due to aging society. Moreover, it appears that easy access to casual work in the service sector and comfortable short-term-work are also among them.

Leading to un/under employed youth

The labour law reform in late 80s/90s managed workforce which caused business demands for deregulation and blame for this phenomena. Two important laws have been introduced and contributed to precarious labour market: 1. Interim labour law; This has led to interim workers replacing regular workers as shown by statistics. Measures taken to avoid this have not worked.

2. Law on the stability of employment in 1947; This was to prohibit employment agency activities, but slowly was watered down. This has all led to an under-protected pool of workers.

Japan’s lifetime employment was once praised as a key to its success, while it is still accepted in the bigger companies and still protected in law. However it is declining in quality. Companies are investing less in on-the-job training. Wages are lower and essentially quality is not what it was.

Leading to polarisation of labour market

LDP has not performed well since winning power in 2009. However, under Prime Minister Noda, good reforms have been made to protect interim workers: The maximum duration of 5 years has been regulated for fixed term labour contracts.

Social security challenges

Obvious challenges to control finance without raiding contributions or cutting benefits. Solving the problem, “Working poor”, needs to share the burden between young and old. Old people’s health costs have been increased and may lead to ending of certain subsidies and increase of VAT (probably to 8% or 10%). Income tax may also be raised to 45% and inheritance tax includes fewer exemptions.

Japanese health care requires equal access and should focus on prevention. When you reach 40 you begin contributions for elderly health care. When you reach 65 you start benefitting; 50% funded from insured and 50% from the government. In terms of workers’ insurance, casual workers are not covered. The system was never designed for this kind of worker.

Increasing ageing population is a rough challenge but could be a chance for economy if considered as active part of the whole society.

Session 3 14:00 - 18:00 Netherlands III

Innovative Bioproduction for Sustainable Society

14:00 Opening: Prof. Akihiko Kondo, Kobe University

14:05 Dr. Hideki Fukuda, President of Kobe University
"Innovative Bio-production in Kobe: iBioK"

14:15 Prof. Akihiko Kondo, Kobe University
"Production of Bio-based Chemicals and Fuels from Biomass"

14:40 Prof. Ken-ichi Yoshida, Kobe University
"Bacillus subtilis Cell Factory for scyllo-Inositol Production: Discovery of an Inducible NADPH Regeneration"

15:05 Assoc. Prof. Tsutomu Tanaka, Kobe University
"Bio-based Chemicals Producution from Oligosaccharides by Engineered Bacterial Cells"

15:30 - Coffee Break -

15:50 Prof. Dr. François Reniers, Vice-president of GREENWIN
"Overview on Biomass Research in French Speaking Part of Belgium"

16:00 Prof.Em. dr.ir. Erick Vandamme, Ghent University
"Biomass Research in Ghent University"

16:10 Prof. Dr. Jozef Anné, KU Leuven
"Greener Industry with Improved Production Strains for Heterologous Proteins Using Streptomyces Lividans as a Model"

16:35 Prof. dr. ir. Wim Soetaert, Ghent University
"Bio Base Europe: Open Innovation and Education for the Biobased Economy"

17:00 Dr. ir. Inge Van Bogaert, Ghent University
"Engineering of Candida Bombicola for the Production of Tailor-made Biosurfactants"

17:25 Prof. Dr. Philippe Dubois, Vice-rector of University of Mons UMONS
"Bio-sourced Lactic Acid-based Polymers: From Reactive Extrusion to High Performance Materials"

17:50 Summary

The theme of session 3 was Innovative Bioproduction for Sustainable Society. Participants were researchers from Kobe University, Ghent University, KU Leuven, Université Libre de Bruxelles, and University of Mons. President Fukuda began the session by introducing Kobe University's collaborative research project "Innovative BioProduction Kobe." Then distinguished researchers made presentations on various bio-production projects and educational programmes undertaken in the EU nations led by Belgium. The session became an opportunity for the participating researchers to find many common interests with other researchers and seek ways to collaborate with each other.

Hideki Fukuda, Ph.D.

President of Kobe University

"Innovative Bio-production in Kobe: iBioK"

To build a sustainable, low carbon society, shifting Green Innovation from the oil-refinery to bio-refineries must a key area of research. "Bio-refinery" is a excellent technology to produce biofuels, bio-plastics, bio-fibres and bio-chemicals from biomass using carbon dioxide as a recyclable resource. iBioK has pioneered "BioProduction", which can produce fuels and chemicals from cellulosic biomass. A big paradigm shift made possible by the iBioK project is the changing from oil-dependent target products produced from oils to bio-based products.

Introducing bio-based products into markets from iBioK achieves green innovation by shifting from oil-based products to bio-based products. iBioK is concerned with the following three areas; bulk chemicals such as "Biofuels and Biochemicals", "Bioplastics and Biofibers", and "BioFineChemicals" with high additional values. Alcohols, diols, organic acids, diamines, amino acids, aromatic compounds have been produced as biofuels, biochemicals, bioplastics and biofibres with significant impact. Value-added sugars, functional inositols, peptides, phospholipids have also been produced as BioFineChemicals. As a fundamental technology, biomass resouces, cellulases, bioreactors and separation processes have been developed to widely diffuse iBioK BioProduction.

Establishment of Bio-production can generate huge, novel markets through a number of target products. IBioK can potentially have a large impact on reducing oil dependency, biomass conversion, reduced CO_2 emissions, agricultural production, forestry and fishery industries.

Akihiko Kondo, Ph.D.

Professor, Department of Chemical Science and Engineering
Director of Biorefinery center, Kobe University

"Production of Bio-based Chemicals and Fuels from Biomass"

To build an energy and material secure future, we must pioneer the next generation of renewable fuels and chemicals using environmentally-friendly production process. To meet this goals, we have promoted many kinds of research projects related the field of bioproduction. One of the key technologies is cell surface display, which is a powerful tool to engineer and functionalize many microorganisms. Using the technology, various kinds of functional proteins such as enzymes can be expressed on the cell surface without loss of their activities. The other key technology is synthetic bioengineering, which is also powerful tool to engineer the metabolic pathway for efficient and robust Bioproduction from biomass.

Metabolic profiling and flux analysis allow to pathway optimization and pathway design for biofuels and biochemicals production. We established the whole metabolites analysis system based on systematic bioengineering, which can accelerate the development of product yield, production speed, and the tolerance against some inhibitor. We should proceed with bioproduction research and practical realization more and more, to build sustainable society.

Ken-ichi YOSHIDA, Ph.D.
Professor of Applied Microbiology, Department of Agrobioscience, Graduate School of Agricultural Science, Kobe University

"Bacillus subtilis Cell Factory for scyllo-Inositol Production: Discovery of an Inducible NADPH Regeneration"

Inositol stands for a class of compounds forming nine stereoisomers through epimerization of the six hydroxyl-groups. *myo*-Inositol (MI) is one of the isomers, most abundant in nature, and supplied cheap from phytin in rice-bran. Some of the other isomers are rare and thus very expensive but reported to possess interesting biological functions for the treatment of diseases difficult to treat. For instance, *scyllo*-Inositol (SI) is undergoing clinical investigation for the treatment of Alzheimer's disease, as it has received fast track designation from the U.S. FDA. We demonstrated that manipulating the inositol metabolism in *Bacillus subtilis* enabled an efficient cell factory to covert cheap MI to valuable SI, by which almost 50% of MI initially contained in the medium was converted to SI after 48-h cultivation. Transcriptomic analyses were performed to understand the efficient bioconversion to reveal that a global change in metabolic pathways might occur to fulfill the demand of required coenzyme regeneration.

Tsutomu TANAKA, Ph.D.
Associate Professor, Department of Chemical Science and Engineering, Graduate School of Engineering, Kobe University

"Bio-based Chemicals Producution from Oligosaccharides by Engineered Bacterial Cells"

We demonstrated direct assimilation of cellooligosaccharides and xylooligosaccharides using beta-glucosidase (BGL) and beta-xylosidase co-displaying *E. coli*. After screening active BGLs, Tfu0937, which is a BGL from *Thermobifida fusca* YX, was successfully displayed on the *E. coli* cell surface and directly assimilated cellobiose as a carbon source. Then, we screened for a suitable XYL for xylooligosaccharides assimilation. Active XYL was successfully displayed on the *E. coli* cell surface and directly assimilated xylooligosaccharides as a carbon source. Finally, we created BGL/XYL co-displaying *E. coli* and successfully demonstrated co-assimilation of cellobiose/xylooligosaccharides mixture as carbon sources without carbon catabolite repression. The engineered *E. coli* is a candidate for a platform of bio-chemicals production from biomass, and biochemical production is demonstrated. In addition, using similar approaches, we created BGL-displaying *Corynebacterium glutamicum* and demonstrated Lysine production from cellobiose directly.

Prof. Dr. François Reniers

Dean of the Faculty of Sciences, Université Libre de Bruxelles
Vice-president of GREENWIN

"Overview on Biomass Research in French Speaking Part of Belgium"

Biomass is seen nowadays as a new renewable source of chemicals, materials, and energy. However, it is only one component of a new approach of chemistry and industrial processes, that focus nowadays on concepts such as life cycle analysis, recycling, cradle to cradle, energy efficiency. A brief overview of the status of research involving biomass, and more generally sustainable chemistry, in the French speaking part of Belgium will be presented. The different funding agencies and their basic rules will be explained. The overview identifies the actors (university laboratories, research centres, private companies). Some recent research projects will be highlighted.

Prof.Em. dr.ir. Erick Vandamme

Centre of Expertise -Industrial Biotechnology and Biocatalysis, Dept.Biochemical and Microbial Technology, Fac.Bioscience Engineering,
Ghent University, Ghent, Belgium

"Biomass Research at Ghent University"

At the Centre for Industrial Biotechnology and Biocatalysis (InBio), improved processes are being developed for the conversion of renewable resources into various biobased products, such as prebiotic oligosaccharides, pharmaceutical glycosides and glycolipid surfactants. These goals can be achieved thanks to the collaboration of three research professors, i.e. Tom Desmet (biocatalysis and enzyme engineering), Marjan De Mey (fermentation and metabolic engineering) and Wim Soetaert (process integration and scale-up). In addition, state-of-the-art tools are available for biotechnological research, including a high-throughput screening platform, software for *in silico* modelling and a range of fermentors with automated process control.
Recently, a Multidisciplinary Research Platform (MRP 'Ghent Bio-Economy') has been established at Ghent University that wants to bridge the gap between plant ('green') and industrial ('white') biotechnology. To that end, 12 different laboratories have joined forces to integrate the different steps of the biobased economy, i.e. from the primary production of plants, over the (bio) chemical conversion of biomass, to the management of waste streams and the recycling of nutrients. Besides the sustainable production of biofuels, biochemicals and biomaterials, the project also aims to alleviate the problem of CO_2 emissions by storing the unconverted biomass in the soil in the form of biochar.

Prof. Dr. Jozef Anné

Laboratory of Molecular Bacteriology, KU Leuven, Belgium

"Greener Industry with Improved Production Strains for Heterologous Proteins Using Streptomyces Lividans as a Model"

Both in molecular and medical research and in the bio-industry, recombinant protein production is an important tool, for which several prokaryotic and eukaryotic expression systems are available or being tested. Among the bacterial systems applied as platform for the production of biopharmaceuticals and for industrial enzymes, *Streptomyces* is considered an attractive host, because several strains have inherently a high secretion capacity and low endogenous protease activity. While several proteins are secreted to commercially acceptable levels using this host, some others are poorly secreted, indicating the need for further optimization. Bottlenecks can be located at different levels, ranging from transcription and translation of the heterologous gene to the secretion process and the secretome-metabolome interactions.
To get a better insight in possible bottlenecks, a systems

biology approach could be helpful to identify genes/proteins with key roles in protein secretion and their interrelationship with cell growth, secretion stress control and energy production/consumption. Such information permits targeted manipulation of specific genes or metabolic pathways for a better energy generation, and hence to make the system more sustainable.

Prof. dr. ir. Wim Soetaert
Centre of Expertise for Industrial Biotechnology and Biocatalysis (InBio.be)
Ghent University, Faculty of BioScience Engineering

"Bio Base Europe: Open Innovation and Education for the Biobased Economy"

The bio-based economy is strongly developing today as a consequence of the strong price increase for fossil resources such as petroleum, the drive towards sustainable production processes and to reduce the emission of greenhouse gases such as CO_2. The combination of these factors causes a strong penetration of biobased products and processes in a multitude of industrial sectors, particularly in the chemical industry, the energy sector, and the agro-industry. As a consequence, the transition from a fossil-based economy to a biobased economy has clearly begun.

The development of the biobased economy is seriously handicapped by a number of problems. First of all there is a serious gap in the innovation chain, caused by the lack of pilot and demonstration facilities. These facilities are required to scale up a process from a laboratory setting to an industrial production plant. The lack of pilot facilities for biobased processes seriously limits most industrial and academic players to realize their plans and to valorise their knowledge. As a second problem, there is a general shortage of well-trained process operators with experience in biobased processes. Apart from a generally decreasing interest for technical professions by youth, the problem is reinforced through the lack of specific training facilities for biobased activities.

Bio Base Europe is a joint initiative by Europe, Belgium and the Netherlands to alleviate these problems. They have united their forces in order to speed up the development of a sustainable biobased economy in Europe. Bio Base Europe has built research and training facilities for the biobased economy with an overall budget of 21 M€. The Bio Base Europe Pilot Plant is a flexible and diversified pilot plant, capable of scaling up and optimising a broad variety of biobased processes up to the multi-ton scale. The pilot plant contains fermenters and chemical reactors up to 15 m^3 scale, as well as a large variety of equipment for biorefining and up- and down-stream processing. The pilot plant is a one-stop-shop, capable of performing the entire value chain in a single plant, from the green resources up to the final product. The Bio Base Europe Pilot Plant is a completely independent facility that is operating according to the open innovation model. As such, the Bio Base Europe Pilot Plant is open to all players of the bio-based economy that can use the equipment to develop biobased products and processes. The Bio Base Europe Training Center houses a number of training facilities for biobased activities, and is operating according to an open education model. Companies as well as schools can rent these facilities for tailor-made training programs of their personnel or students.

Bio Based Europe is an important building block for the development of the biobased economy in Europe. This research and training infrastructure is expected to improve economic growth, innovation and sustainable development. This will lead to a strong innovation dynamic, a flood of new projects, diversified contacts, networking and collaboration and in general a reinforcement of the open innovation and education model for biobased activities.

More information on Bio Base Europe can be found on www.bbeu.org

Dr. ir. Inge Van Bogaert
Centre of Expertise for Industrial Biotechnology and Biocatalysis, Ghent University

"Engineering of Candida Bombicola for the Production of Tailor-made Biosurfactants"

The yeast Candida bombicola is able to synthesize and secrete one of the most promising biosurfactants or biological surface active agents: sophorolipids, and this at economical relevant yields of over 400 g/L.

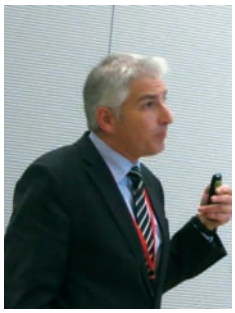
Just like their chemical counterparts, biosurfactants such as sophorolipids find applications in the food, pharmaceutical, cosmetic, and cleaning industries. Furthermore, sophorolipids display specific biological properties. Biosurfactants produced by fermentation offer a worthy alternative to traditional surfactants, which are typically derived from non-renewable petrochemical resources and may cause environmental problems due to their ecotoxicity and poor biodegradability.

The large majority of the research on sophorolipids is conducted on optimization of the feeding strategy and fermentation parameters, while the clarification of the biosynthetic pathway remains mainly neglected. Yet, insight in the biochemical process is a fundamental prerequisite for profound understanding, controlling and engineering of the production process. Therefore, we de novo sequenced the full genome of the yeast and set up extensive transcriptomics and proteomics experiments. This among others resulted in the identification of the six sophorolipid core enzymes and research is ongoing on their regulation and expression profiles.

Finally, now the sophorolipid biochemical pathway is identified and characterized, genetic engineering strategies can be applied in order to produce new-to-nature biosurfactants with novel properties, in this way broadening the application potential of biosurfactants. Several examples will be discussed.

Prof. Dr. Philippe Dubois
Laboratory of Polymeric and Composite Materials, Center of Innovation and Research in Materials & Polymers, Materials Research Institute, University of Mons UMONS

"Bio-sourced Lactic Acid-based Polymers: From Reactive Extrusion to High Performance Materials"



Bio-sourced polymers, so-called bioplastics, are currently receiving considerable attention for applications such as packaging films as well as textile fibers, and more recently, as nanocomposites for durable technical applications in automotive and electronic industries.

Polylactic acid or polylactide (PLA) certainly represents one of the most investigated and industrially developed bioplastics. However, the use of PLAs is still restricted by their relatively high production cost and limited mechanical properties compared to commodity (petro) plastics. In this contribution, we will show how reactive extrusion (REx) technology can serve on the sustainability and future growth of high performance bioplastics like PLAs. First continuous PLA production through catalyzed ring-opening polymerization will be presented. Subsequently, in order to better suit their properties to specific applications, chemical modification of PLAs by reactive extrusion (e.g., internal plasticization via *in situ* reactive grafting) will be discussed. Furthermore, PLA-based nanocomposites have been prepared starting from various (functionalized) nanoparticles such as organo-modified nanoclays and zinc oxide nanoparticles. In order to reach high thermo-mechanical, antibacterial, UV absorption and gas barrier properties, it is required to properly control the interfacial compatibilization between the finely dispersed nanofillers and the polyester matrix. This is precisely where REx can be useful paving the way to applications as high performance films and fibers.

Session 4 14:00 - 18:00 Netherlands II

Innovation of Health Engineering for Ageing Society

14:00 Opening: Prof. Zhiwei Luo, Kobe University

14:05 Prof. Masatoshi Takeda, Osaka University
"How to Cope with Rapidly Aging Society -Prevention and Early Intervention against Alzheimer's Disease-"

14:45 Assoc. Prof. Lena Rosenberg, Karolinska Institutet
"Technology in the Hands of People with Dementia and their Significant Others"

15:25 Prof. Rumi Tanemura, Kobe University
"How Can We Support Elderly People with Cognitive Impairments?"

15:55 - Coffee Break -

16:10 Prof. Yasuyoshi Yokokohji, Kobe University
"A Survey Method for Identifying the Real Support Needs of People with Early-stage Dementia for Designing Assistive Technology"

16:40 Dr. Bernard Pauwels, In-HAM vzw
"From 'Doing the Things Right' to 'Doing the Right Things' in Assistive Technology for Elderly"

17:10 Dr. Emmanuel B. Vander Poorten, KU Leuven
"Novel Technologies for Navigation Assistance of Robotic Wheelchairs in the EU-funded Project RADHAR"

17:30 Discussion
"International Cooperation for Innovation of Health Engineering"

The session 4 titled [Innovation of Health Engineering for Ageing Society] was organized in three parts. The first part focused on the elderly people's cognitive function disorder, where Prof. Masatoshi Takeda of Osaka University gave his comprehensive overview on "How to Cope with Rapidly Aging Society, -Prevention and Early Intervention against Alzheimer's Disease-", followed by the presentation by Assoc. Prof. Lena Rosenberg from Karolinska Institute on "Technology in the Hands of People with Dementia and their Significant Others" and Prof. Rumi Tanemura of Kobe University's research on "How Can We Support Elderly People with Cognitive Impairments?" from Japan side. The second part targeted on health engineering, here Prof. Yasuyoshi Yokokohji of Kobe University reported "A Survey Method for Identifying the Real Support Needs of People with Early-stage Dementia for Designing Assistive Technology", and from EU side's Dr. Bernard Pauwels's speech where he pointed an important view on "From 'Doing the Things Right' to 'Doing the Right Things' in Assistive Technology for Elderly" and Dr. Emmanuel B. Vander Poorten in KU Leuven published his recent research on "Novel Technologies for Navigation Assistance of Robotic Wheelchairs in the EU-funded Project RADHAR". The researchers from life science and engineering were then had a hot discussion related to the further "International Cooperation for Innovation of Health Engineering". The session received active questions and comments on how to promote the cooperation between EU and Japan for the aging society. The session also accepted attentions from EU's government, industries as well as universities. After the session, Prof. Yokokohji, Prof. Tanemura and Prof. Luo from Kobe University also visited a practical society near Brussels, where the welfare technologies were produced and applied and the society was enjoyed by people with Disabilities.

Masatoshi Takeda, MD, PhD

Professor and Chairman
Department of Psychiatry
Osaka University Graduate School of Medicine

"How to Cope with Rapidly Aging Society -Prevention and Early Intervention against Alzheimer's Disease-"

Experience of donepezil, galantamine, rivastigmine and memantine has now demonstrated limited clinical usefulness to most of Alzheimer patients, because the patients may show the cognitive decline below the baseline after one year continuous use of these symptomatic drugs. Disease-modifying drugs to slow down or suppress the pathological process of the disease is highly expected. The development of disease-modifying drugs, however, has not been successful despite of the continuing endeavor in these 20 years. Many compounds, including gamma-secretase inhibitors, gamma-secretase modulators, and BACE inhibitors, all failed to produce good results in clinical trials. The results of the clinical trials of immunotherapy for Alzheimer's disease was released last summer with disappointing results. Considering these situations, there is a pessimism concerning the development of disease-modifying drugs under the present system of the clinical trial.

New style of clinical trials of disease-modifying drug for Alzheimer's disease is proposed and discussed, in which the reduction of the conversion rate from MCI to dementia, or even from preclinical stage to MCI could be used as the primary outcome of the clinical trials.

Establishment of biomarkers for early detection of possible patients is necessary and our data of APLP1 and APLP2 peptides will be discussed as the surrogate marker for pathological gamma-seretase activity.

Lena Rosenberg, Ph.D., OT (r)

Assistant Professor at the Division of Occupational Therapy, Karolinska Institutet, Stockholm, Sweden

"Technology in the Hands of People with Dementia and their Significant Others"

This presentation summarizes research findings from our research team concerning the use of everyday technology and assistive technology. In this research, the person using the technology is in focus as an active agent and user, rather than the technology per se. Since persons with mild/moderate stage dementia and mild cognitive impairment (MCI) often live in their ordinary home they will encounter a variety of technologies that are needed in daily activities at home and in society.

Technology is generally seen as a resource in our societies, however, our studies have shown that persons with dementia and MCI might have difficulties in technology use and this will in turn affect their possibilities to perform activities in daily life and to participate in society. In an attempt to facilitate participation in valuable social activities for people with dementia we have recently developed a design concept for an easy to use videophone. Moreover, our studies have shown that becoming a user of assistive technology is not self evident but takes place in a process where the person with dementia makes decisions that will be decisive for becoming a user of assistive technology or not. This process is also influenced by the views of the person's significant others and the professionals involved. Finally, in order to use everyday technology and assistive technology learning is required. This is known to be difficult for people with dementia and therefore we explore how they solve problems or maintain their knowledge of technology use, and how they learn new.

Prof. Rumi Tanemura
Graduate School of Health Sciences, Kobe University

"How Can We Support Elderly People with Cognitive Impairments?"

In 2012, the population aging rate has become 23.3% and one out of four Japanese people are elderly. The population aging rate will be estimated at 39.9% and one out of 2.5 people will be older than 65. So we have to think about 'how elderly people can live in their own house while keeping healthy?'

Our research purposes are 1) Prevention and maintenance, 2) Support for their living in their own homes for very long, 3) Participation in society by the elderly.

1) Prevention: We have developed a program for prevention of dementia. 92 participants had agreed to join our study. We have administered our program to participants for 3 months. Though there were almost no variations in cognitive functions, changes of oxyHb were recorded by using a functional near-inframed spectroscopy (fNIRS) during this program. 2) Support: Karolinska Institutet and Kobe U are investigating how elderly people use everyday technology (ET) at home, with the ultimate aim of developing a home care system using sensors for elderly people with dementia. We have researched their daily life using Everyday Technology Use Questionnaire (ETUQ). 92 elderly people had agreed and participated in our investigation.

Most elderly people have trouble with TV remote controls, stoves and microwaves. So we developed an easy remote control as assistive technology.

Prof. Yasuyoshi Yokokohji
Graduate School of Engineering, Kobe University

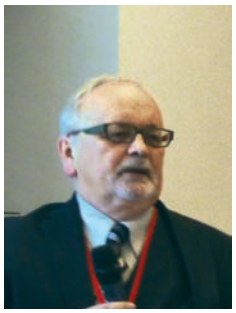
"A Survey Method for Identifying the Real Support Needs of People with Early-stage Dementia for Designing Assistive Technology"

In the area of welfare engineering, various technological research and developmental efforts have been made to support people with dementia. However, it is not clear if these efforts are based on the real needs of these people. When providing support to people with dementia, it is essential to know exactly what their real needs are. Nevertheless, it is not easy to obtain appropriate answers from these people by simply asking "How can we help you?" In addition, it is unlikely that answers from these people will cover all of their support needs.

In this talk, a survey method for identifying the real support needs of people with early-stage dementia for maintaining social living is presented. In order to extract support needs systematically from people with dementia, all of the activities of their daily lives are identified at the beginning of the interview. Then, the interviewer begins by asking what factors are bothering or confusing the patient so that the support needs can be identified naturally. Potential support needs can also be elicited by paying attention to the gap of the feelings of confusion about certain tasks between the patient and the caregiver and/or to the gap between the predicted support requirement and the actual one evaluated by the patient.

Dr. Bernard Pauwels
Advisor care innovation, Sirris
advisor care innovation, In-Ham vzw
Owner, TeWeAD

"From 'Doing the Things Right' to 'Doing the Right Things' in Assistive Technology for Elderly"



In-HAM has evolved from testing and demonstrating of new and existing assistive technology, towards personal advise on which assistive technology to use and advise to the industry and research teams on what technology to develop, up to the current project of assessing the needs of the elderly at home and picking out and trying out the assistive technology that will really matter in the ability to stay independent.
The innovation process in the care sector seems to be slow. However many projects and developments are started but end in most cases once the pilot project is over. Over the years In-HAM has seen many attempts that failed for different reasons. Based on that observation we now start an in depth "needs first" approach, to make assistive technology innovation successful. We want to explain why we believe that this approach will matter in the success rate of care innovation.

Dr. Emmanuel B. Vander Poorten
Department of Mechanical Engineering, KU Leuven

"Novel Technologies for Navigation Assistance of Robotic Wheelchairs in the EU-funded Project RADHAR"

The ageing population poses a great challenge to our society. Already now the number of healthcare workers is lagging behind; unable to meet the demands from the growing group of people that are restricted in their daily life by physical or cognitive limitations. Assistive technology could come here at the rescue, provided its implementation is sufficiently generic. Solutions must be versatile, scale to a very heterogeneous user group and should require only minimal adjustment by and attendance of healthcare workers. In this talk the approach that is proposed and developed in the EU-funded RADHAR project is introduced. RADHAR focuses on navigation assistance of powered wheelchairs with users ranging from children with cognitive and physical disabilities towards people suffering from MS. By developing novel technology to observe and understand the user's surroundings, the context, and by developing techniques to learn the user's navigational behaviour, RADHAR estimates the true navigation intentions of the user. The system then steers the wheelchair along safe trajectories that match the estimated intentions. Since user behaviour varies over time and from subject to subject, RADHAR continuously learns and updates its understanding of user and context and without input needed from healthcare workers, adapts its behaviour automatically to match these variations, providing navigation assistance tailored to each specific user at each instant in time.

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