BUILDING A FUTURE OF EUROPEAN SPORTS INNOVATION
Towards a reputation for innovation

Innovation has always found a place in Europe, the birthplace of the industrial revolution and countless vital milestones in the development of modern society. We have a population of more than 728 million people, with a diverse range of ages, lifestyles and health needs that are met by products and services from diverse sectors and industries across the continent. As we approach 2015, the sports industry faces a number of challenges in meeting the population’s demands for improved equipment and services. As the demographic shifts towards sedentary lifestyles and increased longevity, we must include these factors when developing new solutions for the consumer, while remaining focused on the needs of athletes in the fields of amateur and professional sports.

In order for the sports industry to meet the changing needs of a changing demographic, it is vital that we become more dynamic, flexible and innovative in our approach. Most importantly, it is essential that we work together in achieving our shared goals. Only with a co-operative spirit can we build the solid foundations of successful innovation. Only with a shared sense of urgency can we develop cutting-edge products and services. And only through active collaboration can we share the vital knowledge, research and development necessary to make Europe the centre of breakthrough innovations in the sports industry.
Advances in new technologies have helped make considerable improvements in a diverse range of equipment, from golf clubs to cycling helmets, swimwear and more. In addition, athletic performance and potential has been increased through novel approaches to health, nutrition and the treatment of injuries. As a result, modern athletes can compete to an older age, recover quicker from injury and train more effectively than earlier generations. And new technologies offer a host of opportunities for research into sport, bringing benefits to athletes from all disciplines. Motion capture, for example, provides detailed insight into an athlete’s movement and technique, providing valuable feedback on their performance, and vital clues to areas they might improve. And for sporting goods manufacturers, advancing technologies provide important insight into how they can improve their products.

We believe that the most important element of sport is the enjoyment it brings – it should be fun for everyone involved. And that includes those of us involved in sports-related business, research and technology development. It is with this in mind that the Innosport EU project partners set out to create a ‘Vision for sports in 2015.’ Together we have identified a number of major trends expected to shape the future of sports, based on consumer and market studies, as well as wide-ranging technology scans. With the co-operation of sports bodies, companies and research institutes, our consortium has developed a shared vision for the future and has identified opportunities for innovation and priorities in R&D. These are important steps on the road to realisation of our Vision, steps that can only be taken with the successful collaboration and shared understanding of parties throughout Europe.

Within the pages of this book you can read our findings and ideas, which we hope will inform, inspire and challenge you in your own endeavours. Together, we can grasp the many opportunities for innovation and business, using as a starting point the many ideas for innovative products, services and planned collaborative projects contained in this book.

We are confident that the information in this book will help you to develop your own vision for the sports sector of the future, and to identify opportunities for your business in this collaborative European setting.

On behalf of the Innosport EU consortium partners, we wish you pleasant reading and a successful and innovative future in sports!

Lenneke de Voogd and Paulien Kok
The sports market

Sport has been growing in prominence in recent years. It is being promoted as beneficial to health and as a way to maintain good social relationships. But the economic factor of sports is also important: ‘sport’ incorporates many industrial sectors and services and is a growing area for companies of all sizes. The sports market is large in Europe: in 2006 there was €45 billion turnover on sport products and equipment alone. The sector is relatively new and is generally regarded as being an early adopter of new ideas and innovations. In this respect, the number of jobs created directly or indirectly by the sports industry has risen by 60% in the past ten years and is expected to reach nearly 2 million by 2010. Analysts consider sports to be one of the most promising employment sources in the coming years.

The sports market comprises a range of sub-markets ranging from accommodation building and nutrition to shoes and multifunctional sportswear. Production of the wide range of specialised sports equipment is controlled by a large number of small manufacturers in the various EU countries. Parts of this market are covered by the larger companies and such brand names as adidas and Nike. This part of the market where the big companies operate is sometimes regarded as “the sports market”, mainly due to the huge marketing budgets these parties invest in branding their name and image. However, these parties account for only half of the turnover of the market. This means that there is also a big and growing market where high functional products and services are developed for the sportsmen. In this market, proximity to customer and understanding of their wishes is the key factor to success. This part of the market provides many challenges for European SME.

The sports market is an early adopting and global market in which one element is the high volume production of relatively simple labour-intensive sports goods (bulk products). This type of product is produced mainly in the Far East and in Eastern Europe. Another key element is an emerging sports market which is related to more intelligent and functional products open to the introduction of new technologies:

- Use of Smart materials
- New design methods
- Customised production techniques
- Integration of ICT
- Ambient intelligence and added services

These intelligent and functional products are partly produced in Europe and partly in the Far East, and seem to be a very challenging investment area for European industry. Interestingly, Europe provides excellent conditions for these types of innovative sports equipment.
The Innosport EU project is a two year European Coordination action project, supported by the European Commission (contract no: ETI-CT-2005 023416). This European project was initiated in February 2006 to investigate trends, needs and related aspects such as health and safety within the European sports industry, with the aim of identifying promising innovation opportunities. This work is supported by the European Commission.

The project aims to create an innovation-friendly environment for the sports industry throughout the EU, and to encourage technological innovation. Ultimately, the aim is to see the growth of innovative, technology-based businesses. Innosport EU achieves this objective through the effective coordination of national and EU research initiatives and a strong emphasis on networking that will bring together the needs of sports with those of knowledge organisations. This leads to new business opportunities throughout Europe. The project focuses on business creation and business acceleration and targets a group of SMEs comprising both existing and new enterprises in the EU. These are likely to be drawn from the more traditional industries (e.g. shoes and clothing) as well as from the electronics industry (sensor, MST).
Business creation
Innosport EU aims to enhance the success of innovations in sports in the future by identifying learning lessons from the experience of research projects. By investigating new approaches for innovations as well as new approaches for business creation and entrepreneurial innovation, Innosport EU highlights the benefits for the industry of becoming involved in sports innovation projects.

The European Conference on Sports and Innovation
March 2008 sees the end of the Innosport EU project and the first European Conference on Sports and Innovation, from 12-14 March in Eindhoven, the Netherlands. The conference was designed to finalise the project and to disseminate results such as the Vision for 2015 and the Research Priorities.

The European Conference on Sports and Innovation is the first of many to follow and provides an excellent opportunity for European companies, knowledge institutes and sports organisations to meet in an environment that cultivates innovative thinking, creates relationships and stimulates partnership formation. It is a working conference, during which the organisation has a number of aims:

Conference goals
• Provide information on current knowledge, trends and developments in sports.
• Share views on Sports and Innovation in Europe.
• Provide information on national and European opportunities for innovation.
• Organise workshops.
• Establish new collaborations between companies, research parties and other partners.

Innovation in sports
Sport has been growing in prominence in recent years. However, research and innovation in the sector is limited and insufficiently targeted. A long term vision for innovation in sports is needed to stimulate market-driven research and development, technological innovation and the setting up of innovative technology businesses in Europe.

To ensure a market-driven process of research and development, Innosport EU created this long term vision for innovation, based on sports needs, has been created for the branch. A roadmap has been created, defining the necessary steps in research and development in order to realise these innovations. This has resulted in a Vision for the next 5-10 years, in which research issues are focused and prioritised and chances for new business are identified.
Using technology to drive change in the sports market

Sport is a very broad term for a wide range of activities, involving many areas and different agents, and the use of technology for each one is different. In general terms, the higher the technological level of an innovation, the lower its marginal contribution. Thus, the latest innovations generate the most value in the top levels of sport practice, where existing rivalry and resource availability make the application of those innovations profitable. If athletic performance in a certain sport is achieved with the help of technology, we can describe that sport as having a technological basis.

Technology adds value to this kind of sport, and serves five main functions:

1. **Performance:** Consistent improvement in modern athletic performance has been greatly aided by continuous innovation in equipment, training, nutrition and sports clothing. Over the years, sport has acquired high levels of professionalism and commercialisation, helping it become deeply embedded in the fabric of society; a fact that only serves to increase the pressure to win. And it is this pressure that feeds the need for continued application and the search for new technologies that will assist the athlete in achieving even better results. It is difficult to imagine this positive trend changing in the future, given the relentless demands placed on athletes from competition, sponsors, trainers and the general public: the demand for enhanced performance and better results, especially from elite athletes.

2. **Comfort:** The need for comfort in sports practice can be seen to a large extent in all categories and is directly related to the characteristics of the given sport and the degree to which it is practiced. Thus, higher levels of comfort are needed in:
   • Sports demanding intense and extended efforts.
   • Sports demanding protection against the weather
   The search for comfort and wellness is not exclusive to athletes; they are important factors for every consumer of sports goods. And the growing demand for improved quality of life and enhanced performance suggest that future consumers will expect even higher levels of product comfort.

3. **Security and safety:** In risky sports, security means active and passive protection against accidents, which involves a high level of technology. This level is lower in general sports, with a focus on minimising risk of injury. With the growing trend towards ‘adventure’ and higher-risk sports, it is clear that the technological demand for developing security aspects in sports practice will continue to rise in the future.

4. **Sports management:** There is an emerging market which is beginning to extend the reach of management software adapted for sports organisations. Increasingly, developers are exploring and exploiting the vast potential of information and communication technologies to create value in several areas of the field of sports management. Technology in this field functions in a number of ways: communication, online interaction, race monitoring, results display, access control and adapted software. Increased use of technology in sports
management is due largely to the growing professionalisation of sports organisations and clubs, while the importance of broadcasting (above all, of television) to sports has contributed to improved monitoring and the technologies that enable virtual representation of athletes. Technological advances have helped create the management and communication solutions that have become increasingly commonplace in many of today’s sports-related fields. Given their increasing use and further potential, increasing professionalism, the parallel development of new technologies and the ICTs that will create new opportunities, it is fair to predict that sports management will demand a growing range of innovations and technology in the future.

5. Sports fashion: The combination of sport and fashion is more widespread than ever, which is why style and design in sports goods are just as important as functionality for the majority of market segments. In this case, technology in an aesthetic rather than functional sense is an integral part of the design that focuses on the sensation and the emotion that the product evokes. Sports fashion is a fast-growing segment that is set to continue expanding in the coming years, a trend shown by the adidas ‘Originals’, the brand’s urban fashion section, which grew by 42% in 2005 alone. The relationship between sport, fashion and technology has never been closer, a situation destined to continue in the coming years.

How the sports market can change the way we live

Innosport EU conducted a review of literature on innovation and impact dimensions, in order to establish the impact which certain actions and projects have upon relevant aspects of life. As a result, a set of indicators was developed to show the impact of sports in the following areas:

1. Innovation: differentiation, knowledge and technology etc.
2. Economic: employment, productivity etc.
3. Social: health, trends etc.
5. Environment: positive and negative aspects.

It is important to note here that further investigation than the numeral results is needed, which provides at best a static representation. Since sports is a particularly dynamic sector, it is relevant that the process described, in order to feed the indicators so they can be regularly updated.

Impact on Innovation

Technological innovation can be defined as the socially- and economically-useful application of knowledge. It is generally accepted that there are four basic conditions for technological innovation:

1. Acknowledging the existence of a need. In sports, new opportunities and needs regularly appear, but added to this are the increasingly extreme conditions where sports is practiced, conditions which must be endured by both the athlete and their sports products:
   • Temperature range: the lowest temperature recorded during climbing is -50ºC, while the highest temperature running the Sahara marathon is 50ºC.
   • Range of forces and ground reaction forces: shoes worn in the triple jump bear 15.2 times the bodyweight of those worn during normal walking.
2. Existence of effective knowledge. Sports sciences including biomechanics, physiology and psychology are traditional and consolidated fields of science with more than 30 years history. Some figures:
   • number of scientific publications dealing with ‘Sports and Immunity’ increased from around 125 in the period 1986-1990 to almost 350 in the period 1991-1995.
   • more than 1500 scientific studies published since 1990 have studied the link between physical activity and health.
3. Existence of scientists and technological researchers: There is an increasing number of centres related to sports activities, focused on top sport, sports medicine or sports education and training.
4. Economical and political support: Political: The Helsinki Report on Sport (1999) from the European Commission to the European Council states in its conclusions: “The European Union recognizes the eminent role played by sports in European society and attaches the greatest importance to the maintenance of its functions of promoting social integration and education and making a contribution to public health and to the general interest function performed by the federations”. In addition, there is now an EU unit for Sports in the EU council and 2004 was the European Year of Education through Sports.

Economic Impact

The impact of sports in economy is divided into four categories:

1. Direct economic impact on market and employment: In terms of production and sales of sports goods, industry and other economical sectors such as services, entertainment, advertising, and sponsorship.
   a. Direct economic impact on market for example the economic impact of great events: America’s Cup 2007 in Valencia generated € 3,600 million.
b. Direct economic impact on employment: 800,000 employees in 1999 in Europe are related directly to sports.

2. Indirect relation on employment of the use of raw materials and industrial supplies; The indirect and induced linkages add another 19,000 people to the direct estimate of 61,300, bringing the total employment impact of sport to 80,300 or 2.5% of the total (Hong Kong).

3. Induced by the increment of expenses of those working in the sports industry.

4. Associated due to the benefits on health saving and other related social effects (fashion trends).

For example on health saving: if an additional 10% of the adult population in Australia regularly participated in ‘moderate and effective’ exercise, AU$600m would be saved from the Government’s health budget each year.

Social Impact

Sports research is considered as a society-driven and -oriented research to offer user-oriented products and services. In this sense, the social impact can be grouped into the following categories:

- **Sports practice**: for example in Spain more than 12,000,000 practice sport (37.5% of the population) and 59% of the people walk in order to practice some physical activity.
- **Contribution to quality of life and health and safety**: the World Health Organisation (WHO) has identified lack of physical activity as one of the biggest contributors to the global burden of disease.
- **Integration**: for example the International Olympic Committee, each Olympic Games, carries out the Olympic Solidarity Programme in order to promote the participation and integration of every country.
- **People’s dependence**: Very old people improve (86-96 years old) their muscle force and thus mobility by 175% thanks to sports and physical activity.
- **Society building**: Trends generator and values transmission; 8.5 million people in Italy watched the Mont Meló Moto Grand Prix on television.
- **Education**: a great number of Masters, workshops and congresses are carried out each year all over the world.
- **Psychological health**: sport has been shown to help improve self-image.

Legislation impact

More than 200 standards have been proposed by the European Committee for Standardisation (CEN).

Environmental impact

There is a continued focus on reducing environmental impact, recycling materials where possible and employing end-of-life products in innovative ways, such as the use of 70% of recycled tyres as infill for artificial soccer turf. This is an important element to remember when developing new products for the sports market.

In general terms, it can thus be stated that:

(1) Sports can contribute to Human Development by means of its positive impact on the economy, population, education and health.

(2) Sports not only fulfils the four basic conditions for technological innovation but also offers them in a higher degree than other fields, and thus is more innovative.
Charting technological trends in the sports market

Large sports brands and companies
This segment is highly strategic for technological innovation in sports, due to the companies’ relevance to the sports market, as well as their important capacities and leading role in innovation. For these reasons, the innovative effort and results produced by these companies is granted for the future in such classical areas of innovation as equipment and sports clothing. It is unclear however, what level of innovative effort they could provide in other areas like technical performance, sport management and nutrition. In general, it is smaller and more flexible companies which tackled the most innovative research areas, with technologies that are in early stages of evolution or still in their embryonic phase. The commitment of large sports brands or companies to the newest areas of innovation in sport will be conditioned by the success of those areas, and by the companies’ willingness to diversify. Therefore it may well be predicted that these companies will continue leading innovations in more classical areas like sports clothing and equipment, as one of the most important agents in this field.

Universities and technological centres
Universities and technological centres are an important source of studies of technology application in sport, with wide and varied research branches. Sport is considered an excellent entry point for new technologies: for the value they generate, for the high possibilities of technological transfer from other disciplines and the high technological level that can be developed, all are focused in a sector with large economic relevance. However, research in Europe does have some weaknesses. In general, research in Europe is diffused, with centres not tackling issues in an integral way. The continued and growing commitment of technological centres and universities is assured, which is set to maintain maximum interest in research and development for many years to come.

Athletes and trainers
Athletes and trainers are responsible for achieving results and improving performance, making them most receptive to the use of new technologies. The functionality and benefits that a trainer gains from technology are most useful for planning and monitoring training cycles, where the ICTs are very useful. For the elite athlete, new technologies have the additional benefit of making them a trendsetter who helps popularises the technology with the general public. Aware of this phenomenon, companies make intensive use of sport stars to promote their products and technologies. Some of these technologies may still be in embryonic phase or early development, so their advance and development in the next years can mean a better functionality and so better acceptance and bigger demand for improvements. For these reasons, we can see that trainers and athletes will continue demanding more and better technology in the future. The growing pressure to win is joined to a growing interest from the suppliers of technology in supplying athletes their innovations. All this will also be favoured by the parallel development of the technologies applied to sports so that general demand will certainly increase in the future.

SMEs excel in sports innovation
Smaller companies have less available resources and less leading power, but are as committed to innovation as the larger brands. Those companies have more flexibility, and are more suited to working in the most innovative branches of the technology applied to sports. Generally, they have a less integral view of innovation in sports and a local or national focus, rather than the more preferable European focus. In spite of this, SMEs will continue leading and driving technological innovation in certain niches, with a continued commitment to innovation, and opening the market in some especially innovative areas.

Clubs and sports organisations
Sports clubs and organisations will be interested mainly in management technologies and communication solutions, whose demand will increase in the future, as we have said earlier. On top of that demand, clubs are encouraging their players and trainers to make use of available technology to drive performance improvements. That demand will depend on the general culture of the organisation and on the motivation that players and trainers have for using the technology in diverse ways. Thus, sport clubs and organisations will be an important source of demand for innovations and solutions based in technology for the future, in sport management as well as in others such as performance, security and comfort for their athletes.

Public administration
In this case, administration means the body that controls sports facilities and stadiums. Any initiative of technological innovation in such facilities must have the commitment of the administration. In their role as managers, they perform a key role as drivers in the demand for new technologies. This demand concentrates above all on technical improvements made in the sports facilities with the aim of improving their efficiency, the so-called "intelligent building" concept.
How science is shaping the sports market

There has been an analysis of the different aspects related to technology transfer oriented to improving the use and application of technology in sports. Sports equipment, especially those made for elite athletes, is an excellent entry point for new technologies. The latest technologies can be very expensive, producing minor additional improvements in performance, security and comfort when compared with more traditional technologies. However, elite athletes find enormous value in even the smallest improvement, above all in performance, due to the extreme levels of competition and the fact that they are already at the highest levels of performance. Moreover, the great value that technology has created throughout history creates a positive attitude with technologies among the users. Thus, sports equipment has incorporated technology from various fields including nanotechnology, the textile industry and above all, the aerospace industry.

Nanotechnology
Nanotechnology is a set of sciences and technologies that allow the manufacture and control of molecular structures and their atoms at the nanometre scale (1 billion nanometres = 1 metre). As an emerging field, nanotechnology has not yet had a significant impact on sport, although it is expected that the number of applications will multiply in the coming years. Currently, it has a number of multiple applications in clothing, because controlling the nanostructure of the surfaces can change the physical, chemical and biological properties of the materials. These variations of properties open a new world of possibilities for the clothing industry, and by association, the sports clothing industry. Using these techniques, intelligent materials can be produced, such as the trousers worn by Tiger Woods, which are resistant to coffee, tomato sauce and even wine stains. Moreover, nanotechnology can incorporate conductive fibres in fabrics, in order to create electronic clothing with sensors or integrated chips, or create a fabric even more resilient than spider silk, which is stronger than steel and more elastic than nylon. In addition, nanomaterials offer superior levels of light weight, hardness, resilience, flexibility, and a range of other characteristics. In cycling for example, they have been used in the production of new bikes, which are much lighter yet with the same structural strength. In golf they are used to create lighter clubs and balls that fly straighter. And in winter sports, nanomaterials are used to produce more flexible skis with better control. Nanotechnology offers potential for the development of an enormous number of applications for the sports industry, which will both enhance performance and improve comfort. Continued development in this field will contribute to the creation of innovations with high added value for the end user, and processes clearly better than the conventional.

Aerodynamics
The relevance of aerodynamics and hydrodynamics to sports equipment is proportional to the speed that is achieved while practicing, since wind resistance increases exponentially with the athlete’s speed. This is why aerodynamic design is limited to such sports as skiing, cycling, motor sports, although in sports where less speed is achieved (like athletics, skating, or swimming), aerodynamic suits are also used. Aerodynamic profiling has been introduced in helmets, suits, bikes and even skis, adding to the improvement achieved through correct posture of the user.

Materials
Innovations in materials are endless. In sports with a high technological basis, almost every important brand has developed its own material and manufacturing techniques, and the use of technology is intensive for the majority of the ranges. A lot of these new materials come from the aerospace industry, and they greatly exceed the characteristics of traditional materials in terms of flexibility, durability, strength, resilience, thermobalance and sensation. Such materials include Kevlar, carbon, graphite, vulcanized rubber, glass fibre, elastomeric materials, thermomoldable materials, to name but a few.

Design and manufacturing techniques
Modern design and manufacturing techniques have evolved largely in the last decade. Some of the materials and techniques used in the highest ranges of cycling equipment, for example, are on a par with those used in Formule 1 racing, and concepts such as biomechanics and ergonomics have made impressive strides. Other manufacturing techniques have been imported directly from the aerospace industry, with the very latest developments in Computer Assisted Design now a major component of the design process. These techniques elevate the standard of the final product features, such as flexibility, lightness, solidness, adherence and control. Examples include crossed laminations, sandwich-like materials, micro pores and strategic material placement.
Meeting the needs of a changing society

Sports must adapt to the new social environment, taking into consideration factors such as ageing and immigration. Three social trends categories are described below: individualism, new concepts and demographic trends.

Individualism
Sports involving one-on-one competition are increasingly formalised and can be seen as somewhat limiting to the participants. Many now prefer competition against their own abilities, using a stopwatch for timed trials for example, or constantly trying to better the number of repetitions in a gym situation. The trend towards so-called ‘individual sports’ is increasing, making it more and more challenging for sports federations to recruit suitable team players and athletes to shape into future national stars. An exception to this trend has been noted in the US, where personal training in small groups has become popular nationwide; this shift is expected to reach Europe in the coming years.

New concepts
Although organised sport has a growing influence in economy and the media, people are increasingly turning to other avenues and different ways to exercise:

- Wellness concept: Fitness centres are evolving to include the concept of wellness, harmony and balance. Popular pursuits include relaxing water activities, massage, aerobox and low-intensity fitness, breathing exercises and stretching.
- Shorter sessions: Lack of time is an important problem in a society that must combine longer working days with a busy family life. This can make finding time to exercise difficult, resulting in a growth of balanced exercise programs that can be done in half an hour.
- New physical activities: Increased sedentariness, the new wellness concepts, and a less competitive view of sports have contributed to a boom of low intensity physical activities and a more integral view of sport in general. This now includes fitness, water gymnastics and certain eastern gymnastics such as Tai Chi. These new concepts can also be promoted as contributing to healthier lifestyles for the sedentary and improved health for the elderly.

Demographic trends
There are a number of demographic trends identified as important to the development in the sports market:

- Ageing: The European population is ageing quickly, with improved health and longevity leading to a fall in the mortality rate. This means that there are growing audiences for new and innovative products and services targeting the elderly, whose specific sporting needs include activities with low intensity and low risk of injury. Sport is important in later life, with those leading an active life enjoying improved health, self-esteem and increased resistance to chronic diseases and injuries.
- Immigration: For decades, people have been emigrating to Europe, and in 2005 alone, more than 1.5 million people chose to make Europe their home. With the European population becoming increasingly sedentary and wealthier, there is a drop in the number and quality of indigenous athletes. There is therefore a range of benefits to be gained from recruiting the new population as potential athletic stars, as well as opportunities to develop new sports practices which make good use of their abilities. Regulatory obstacles, however, can prevent foreign nationals from competing in certain categories, though there is a growing trend toward abolishing these restrictions.
- Sedentariness: The World Health Organisation identified ten factors as key for the development of chronic diseases, five of which are closely related to physical health and nutrition. Obesity is associated to the principal chronic conditions of our time, and more than a billion adults worldwide are overweight, with at least 300 million classified as obese. In the last decade, childhood obesity in Europe has risen by almost 10%. More than 14 million children here are overweight, with at least 3 million classified obese, and their sedentary lifestyle is the primary cause of their condition. The key to reversing this disturbing trend is an increase in moderate physical activity, the promotion of cycling in our increasingly urbanised landscape, and a larger presence of physical education in schools.

Promotion of healthier lifestyles
The European Union understands the wide-ranging benefits of sport, including the immediate health benefits and the positive impact on the economy and social integration. By promoting healthier lifestyles, the EU can reduce the cost burden of medical expenses, and an international Action Plan has been developed to this effect. As a result, the sports industry will benefit from the future creation of help and support programmes.
One of the most important objectives of the Innosport EU project has been to develop a Vision on Sports in 2015. This Vision forms the basis of a roadmap defining sports needs, opportunities for companies and knowledge institutes which will help set the agenda and stimulate market-driven research and development.

A Vision for 2015

One of the most important objectives of the Innosport EU project has been to develop a Vision on Sports in 2015. This Vision forms the basis of a roadmap defining sports needs, opportunities for companies and knowledge institutes which will help set the agenda and stimulate market-driven research and development.

Vision goals
• Reduce the gap between research and industrial development by relating their joint interests.
• Target the research in sports and technology with emphasis on end-user and industrial demand.
• Provide information for the formulation of future European R&D programmes.
• Formulate research projects based on the roadmaps.

On the basis of market studies, social trends studies etc., an overview of consumer needs, trends in the sports market and developments in technologies has been created. From this the Innosport EU consortium has created a common Vision for Sports in 2015. In this, innovation in products & services related to physical activity is eminent, to:

1. Improve and maintain health in the elderly.
2. Reduce effects of a sedentary lifestyle, especially obesity in children.
3. Promote health, fitness and wellbeing for people with a busy lifestyle.
4. Enhance training in top sports.
5. Provide fun on top of effort for exercising.

These five areas represent a number of lifestyles, each of which pose their own challenges and opportunities for the future. They have been illustrated in a description of a future scenario of a family of five.

Besides these opportunities we must not forget the vast possibilities and need for innovating on current products for current markets and target groups. And considering the pressure from the industry on topics concerning waste management and use of natural resources, we must also take into account the trend towards a sustainable environment. This may be seen as a boundary condition in developing sports products from the industry point of view, but also as a market opportunity for innovations, in the eco-optimisation of sports products, given the consumer trends in this area.
Meet the Johnsons
– our sporting family

Ask five people what they think about sport and you will very likely hear five different answers. That’s because sport can mean very different things to every individual, even within the same family. Take the Johnson family as an example. Imagine a typical well-balanced and happy group of people, with hardworking parents who live with their son and daughter, and a grandmother who lives in the next town.

As you will see, each of the Johnsons has their own idea about exercise and sport. Each one has their own lifestyle challenges, and all of them understand that they can improve their wellbeing with the right support, equipment and opportunity.

As an illustration of the Innosport EU Vision, we invite you to meet the Johnsons.
Peter is 11 and has problems with his weight and self-image. From an early age he has had high cholesterol, and is classified as clinically obese. An intelligent child, he is a keen student of languages and music, which his babysitter teaches him several nights each week. Peter’s family is always busy, leaving him to spend most of the time in his bedroom, where he plays video games, watches TV or listens to music on his high-end hi-fi.

At home, Peter is given anything he asks for and is always one of the first to have the latest gadget or mobile phone. At school however, he is teased about his weight and excluded from fun in the playground; in games class, he is always the last to be chosen for team sports. Even though the school runs a training programme on healthy living and provides after-school sports activities, Peter is not a happy child.

Recently Peter’s worried parents, John and Christine, took steps to improve the situation. They find it hard to persuade Peter to exercise and eat healthy food, so they visited a doctor to explain the situation. As well as outlining a new diet, the doctor recommended a range of activity video games, which Peter can play while exercising and getting fit.

Peter and his father then went to a specialist sports equipment shop, where the assistant explained the use of different equipment, in a range of materials, designs and functions. After choosing the ideal equipment for his needs, Peter was optimistic and happy that he can combine sport and video games, and will soon be joining some of the after-school sports classes.

For Peter, sports has taken on a new and positive meaning in life.
Minerva is a talented 19 year old athlete. A member of her national track and field team, she has already represented her country in the World Junior Championship 1500m. Minerva tries hard to balance her passion for athletics with her University studies, and is supported by the Sport Adviser and Assistance Centre (SAAC). This national body provides a range of academic and sport services to help Minerva optimise her time in both these important areas of her life.

As well as a dedicated professional trainer, Minerva benefits from a sports high performance team, comprising a physiotherapist, doctor, psychologist, nutritionist and biomechanics expert. She uses the latest facilities, training technologies and equipment customised to monitor, control and improve her physical and technical performance. The centre runs parent and teacher working days, with a forum for advice on how to provide Minerva with the best support, including guidance on nutrition, psychological and social issues. She also attends academic support classes, where personal tutors provide facilities and advice on maintaining good grades, while an Internet platform enables easy contact when Minerva is competing in championships and unable to attend classes.

Thanks to this programme for elite athletes, Minerva has improved her level of sport training and her ability to focus on both tournament and academic goals. With the network of professional support and advanced facilities, she is making real progress, and is less stressed since her family now understands the challenges she faces as an elite athlete.
Christine is a 50-year old mother, wife and secretary with a busy schedule and a lot of commitments. When she is not busy at work or with household tasks, Christine prefers to go shopping or enjoy a massage or spa at the local Leisure Centre which she visits once a week. Along with friends from her local Women’s Group, Christine takes advantage of many of the facilities at the Leisure Centre, where she has a personal trainer who advises her on the right equipment and workouts for her health needs. She can also contact her trainer via Internet, but this facility is not something Christine has used often.

Christine’s doctor recently advised her to do more exercise to help prevent age-related illnesses, to minimise the impact of the menopause and improve her general wellbeing. Which is why Christine now monitors her workouts carefully, and wears the recommended sports equipment so she can exercise safely.

A few evenings each week, Christine goes for drinks with her local Women’s Group, but one of the things she looks forward to most is attending weekly dancing class with her sisters and friends. She is still trying to persuade her husband John to join her, so far without success.

For Christine, sport means enjoyable activities in good company, and she has started to learn about the importance of nutrition in sports too. Her daughter Minerva is an elite athlete, and Christine regularly attends lectures at the Sport Adviser and Assistance Centre, so she can help choose the right foods for Minerva’s career.

CHRISTINE’S STORY

Christine is a 50-year old mother, wife and secretary with a busy schedule and a lot of commitments. When she is not busy at work or with household tasks, Christine prefers to go shopping or enjoy a massage or spa at the local Leisure Centre which she visits once a week. Along with friends from her local Women’s Group, Christine takes advantage of many of the facilities at the Leisure Centre, where she has a personal trainer who advises her on the right equipment and workouts for her health needs. She can also contact her trainer via Internet, but this facility is not something Christine has used often.

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For Christine, sport means enjoyable activities in good company, and she has started to learn about the importance of nutrition in sports too. Her daughter Minerva is an elite athlete, and Christine regularly attends lectures at the Sport Adviser and Assistance Centre, so she can help choose the right foods for Minerva’s career.
John is a 50 year old marketing manager at a multinational computer company, where he has spent most of his working life. He has a packed agenda, working long hours and occasional weekends, yet still finds time to enjoy a happy home life. At his last health check, John discovered he had dangerously high cholesterol levels, and his doctor urged him to change his diet and start exercising regularly. Because John dislikes home sports, he chose not to use the treadmill and abdominal equipment recommended. Instead, his doctor put him in contact with a Personal Health Assistant (PHA) to discuss alternatives.

Thanks to his PHA, John now has a personalised detailed fitness and nutrition plan, as well as membership of a web-based ‘virtual training centre.’ The PHA also advised John on which sports gear to buy for the best comfort and protection. Thanks to the clear labelling and layout at his local sports shop, John easily found the right products, as well as a personal health monitor device to use during exercise.

At his twice-weekly gym sessions, John follows his fitness plan using the wide range of equipment available. Each one is linked to a central system that records his vital signs, such as heart-rate and calories burned, giving John valuable feedback. In addition, he spends 6 hours each week at home using a new interactive aerobic game called ‘Cholesterol Fighting,’ which he often plays online with a friend. Every month John meets his PHA to chart his progress, and John is now making great progress, thanks to the professional attention and support, as well as his own dedication to self-improvement.

For John, sport is an ideal way to enjoy life in a happier and healthier way.
Mary is a 76 year old widow, living alone in a suburb outside the city centre. Although her family moved away many years ago, she talks with her son John daily via webcam and enjoys an active social life. Most days Mary joins her friends at the local Social Centre, where they play table games and go dancing on Wednesdays. Occasionally they also meet for lunch at each others’ house.

Since her husband died, Mary has been understandably depressed and anxious. Recently this has become so problematic that Mary has been unable to enjoy her favourite hobbies: reading and sewing. In addition, she has been suffering headaches, body pain and vision loss, and her memory is not as reliable as it once was.

The doctor diagnosed arthritis and recommended a range of exercises, including swimming and a 30 minute walk every day. After discussing the situation with her friends, Mary organised a group that would walk together and exercise on their visits to the Social Centre. Unfortunately, the arrangement has not succeeded, and the walking / exercise plan most often becomes an afternoon of playing cards and eating snacks. And because she knows nobody at her new Aqua Gym classes, she rarely visits the swimming pool.

Mary’s children are concerned about her, and have bought her several sports-related gifts, including a personal health monitor, and a fashionable jogging suit from her son Paul. But because she finds it difficult to exercise in a way that she enjoys, Mary has little use for these thoughtful gifts.

For Mary, sport is a challenge, something that she would like to enjoy if she had the chance, or equipment more suited to her age and condition.
Research Themes

There are many opportunities for innovative products and services in and around the sports sector. Many of the expected innovations will help fulfil future consumer needs, reduce the impact of societal and health problems as well as environmental issues. A number of these innovations will be realised by creative application and the combination of existing technologies, materials and processes. Many others will only be possible through the creation of new knowledge and technologies through fundamental and applied research and development.

In order to identify innovation directions and priorities in research and development in the broad sector of sports, workshops and brokerage events have been held throughout Europe with a large number of companies, knowledge centres and sports bodies in the framework of the Innosport EU project. This has resulted in the formulation of four main research themes:

1. Assessment of human factors (end-user information) in sports.
2. User-centred development and production of sports products.
4. Data analysis, information exchange and services in sports.

In addition, through the dedicated working committee on research and development of the Federation of the European Sporting Goods Committee (FESI), a number of horizontal research issues has been identified, which are described in more detail in the next chapters.

But these themes are not considered to be stand-alone fields of research. On the contrary, in most cases, implementation of the proposed research priorities will only lead to real innovations if topics from several themes are combined in collaborative projects and business initiatives. This means that successful projects should combine ideas of researchers and knowledge organisations with the know-how and capabilities of manufacturing companies, as well as input from sports bodies on user requirements and desires. On the following pages you will find a number of ideas for collaborative projects related to the research themes, in line with the Vision for the sports sector for 2013.
Assessment of human factors (end-user information) in sports

In order to develop high performance sports products that are successfully adopted in the sports market, a thorough knowledge and understanding of the needs of the end-user must be gained. Research into human factors of individuals and specific target groups is necessary in the field of biomechanics, physiology, anthropometrics and motivational strategies. This will make it possible to realise innovations such as smart fitness devices with personal training programmes and technologies that are easily usable by the elderly. Opportunities for innovations may be seen in the area of modelling and simulation of the (dynamic) interaction of the body with its surroundings. This will enable the development of clothing systems for thermal management, for example. Additionally, models simulating mechanical and physical loading of the body in interaction with sports equipment (impact modelling) will give rise to innovations in high performance protective clothing, footwear and equipment.

Research Priorities
Proposed research priorities in this field of research are:

• Analysis of requirements and functionalities of new products with respect to (individual) user needs, such as force required to stimulate muscles.
• Development of motivational approaches for specific groups and individuals.
• Development of nutrition and diet approaches adapted to physical and psychological needs.
• Analysis of the effects of mechanical and physical loading, in particular injury mechanisms in the human body.
• Analysis of sensorial interaction between the body and products, such as those regarding perception.
• Identification of physical, physiological, psychological and cognitive capabilities, limitations and requirements of specific groups, such as injury criteria.
• Identification of key performance parameters and development of individual and target group performance models for interpretation of measurements.
Development of an innovative methodology and procedure for designing customised clothing and footwear attending to individual thermal performance needs for outdoor activities. A model will be developed showing the effect of climatic environmental conditions and physical activity on the user’s thermo-physiological response in its interaction with materials.
Development of an intelligent device that knows an individual’s physical capabilities for a given task, monitors the physical status of the person (position, heart-rate, temperature etc) and gives feedback and coaching addressing the individual needs. Body monitoring technologies will be integrated in a device and algorithms to translate the measured data into relevant feedback for the individual will be developed.
Development of materials and products, such as seating or grips, with changing characteristics so they can adapt their shape, feel and texture in interaction with the user thus benefiting individual performance and comfort. Requirements regarding pressure, support, friction etc. is different for each person and may change over time. Models will be developed to measure and predict this human-product interaction.
The vast majority of sporting goods are designed to meet the requirements of a large group and mass produced long before they are sold to the consumer. As a consequence, manufacturers and retailers constantly need to estimate demands in terms of consumer preferences (such as colour and style) as well as function and sizing. The fact that every customer is different and desires individualised products and services poses many opportunities for innovation in intelligent production processes for sports apparel, footwear and equipment. An athlete’s safety, in particular, will benefit from individualised protective gear. The development of advanced design tools for human product and user-interface interaction will make innovations in the area of intelligent feedback systems possible. It will also enable the redesign of products for simplification to meet the required skills of a specific target group, for example amateurs, children or certain patient groups. A further marketing opportunity is present in the development of recycling strategies for sports products, including eco-friendly production techniques, helping to meet the ‘green’ demands of the consumer.

Research Priorities

Proposed research priorities in this field of research are:

• Development of tools and methods for collaborative and cross-sectoral product development (such as textiles, clothing, mechanical equipment and electronics).
• Development of techniques for analysis of mechanical deformation and stress in movements (e.g. between foot and surface).
• Development of simulation tools for (dynamic) interaction between product and user.
• Development of virtual reality systems to recreate/simulate physical, physiological and psychological situations.
• Development of smart systems (hardware and software) for product customisation for individuals or target groups.
• Development of user-centred design methods and tools.
• Development of product-consumer interfaces and interaction design.
CUSTOMISED PROTECTIVE EQUIPMENT FOR INJURY PROTECTION

Development of systems that give optimal protection against injuries in varying human and environmental conditions, for example customised shoes for optimal interaction with a specific sports surface. Consumer needs regarding injury protection and muscle support will be determined with new simulation tools; production techniques will be developed for the manufacture of individualised protective sports gear.
Development of microprocessors integrated in sports equipment in combination with a survey instrument to monitor the product’s material and construction properties. An intelligent system will be developed that gives advice on risks and limitations of use of the sports equipment according to the status of the product regarding degradation, due to moisture, UV, mechanical deformation, in relation to durability.
The development of body measurement and design technologies and flexible, small-scale manufacturing systems for direct (3D) production of 'made to measure' tight-fit clothes, designed for a specific sport (e.g. water suits, cooling clothes).
The future of sports is characterised by a new approach in exercise and training in which an athlete or coach measures physical and physiological response, then processes and analyses the data in order to monitor progress in personal performance in order to obtain real-time feedback in visual, audio or tactile form. It is already technically possible to do this in a laboratory situation, but ideally the athlete will be monitored in real practice situations by means of unobtrusive performance measurement techniques on or around the body. This calls for small, lightweight sensor and actuator systems as well as innovative technologies for harbouring these micro-electronic devices in sportswear and equipment. For example, low-cost motion capturing systems that measure an athlete’s motion and posture in relation to speed, in combination with an intelligent response system that gives advice on how to change posture to improve performance, or materials in clothing that automatically adapt to provide the necessary support. Not only top athletes may benefit from such innovations. Amateurs of all ages will also be able to use monitoring and feedback devices for physical and mental motivation.

Research Priorities
Proposed research priorities in this field of research are:

• Development of new materials and (nano)technologies for functionalising textiles (e.g. for shock absorption, muscle stimulation, thermal regulation).
• Development of sensor technologies for unobtrusive measurement of physical, physiological and psychological status and activity of individuals.
• Development of active smart textiles and apparel systems with electronic capabilities (such as energy and data transfer).
• Development of energy-harvesting and -storage systems and systems with minimal energy consumption.
• Development of data analysis techniques for smart systems in customised devices.
• Miniaturisation of electronics.
• Wireless communication systems.
• Development of flexible displays for integration into textiles and clothing.
• Development of low cost technologies to transfer to mass market (e.g. home devices).
• Development of audio/visual/tactile/technologies for (real-time) feedback.
The development of a wearable device for children which monitors motion and physiological response. A low-cost motion capturing system will be developed as well as feedback and coaching systems, for example in the form of interactive games. This will be done according to specific strategies and approaches. The aim is to motivate the child in such a way as to stimulate increased physical activity.
The development of an advanced (electric) bicycle that can adapt to the specific needs of the rider, based on monitoring of a variety of functions. These will include mechanical load, physical state, physiological condition, mood and/or mental state. Workouts or rehabilitation programmes will be developed which may be adapted to people’s specific needs, such as the elderly, diabetics or COPD patients, and these will be implemented.
The development of a device that measures human physical parameters such as speed, heart and muscle activity. Algorithms will be developed to translate the measured data into parameters that give an indication of the mental status of the athlete, how alert he is and how well he anticipates game situations. An interface will be developed that gives the right mental stimulation at exactly the right time.
The scope of the sporting goods industry is becoming broader in light of changing consumer demands. Consumers’ interest in sports products is determined by more than the equipment, now that more and more added value is sought in services for information and communication. The need for advanced data analysis and information processing is strongly related to the foreseen innovations mentioned in earlier chapters. Advances in ICT technologies provide innovation opportunities for producers of personal monitoring devices, for example, to develop coaching services and make them available on the Internet. And social networking services may be developed to truly fulfil people’s desires to be part of a community, addressing the social aspect of engaging in sports. In the same way, the development of interactive games may add a new dimension to existing sports (products) with a potentially huge market. Furthermore, manufacturers and retailers would benefit greatly from consumer information services which will allow them to respond to the needs of the end-users more efficiently.

Research Priorities
Proposed research priorities in this field of research are:

- Development of information services related to smart systems (smart cards) for customised devices.
- Development of advanced data analysis tools.
- Development of knowledge systems with self-learning capabilities.
- Application of networks and information services (telecom, Internet).
- Development of web-based systems and services for individual coaching.
- Development of tools and methods for information exchange and communication for feedback, advice, training schemes etc.
- Development of technologies for interdisciplinary knowledge, training and information management.
The adaptation of track-and-trace technologies for use in freestyle competition sports such as gymnastics, diving and synchronised swimming. The aim is to provide judges with objective technical data on technical performance (such as height of jump, degrees of rotation). Technologies and services will be developed to translate measured data and make the information available in real-time for judging or media purposes.
The development of an information and networking system that allows ideas to be collected from a large community of people via ‘mind mapping’ on the Internet. On the basis of ‘ideas fusion theory,’ people’s needs, problems, ideas and experiences are gathered and delivered to companies who are desperate for this information to develop products according to consumer needs and desires.
Instrumentation of a sports accommodation (e.g., a stadium) to measure all physical parameters of an athlete without physical contact. This entails the development of smart sensor technologies such as video monitoring and imaging systems, radar technologies integrated into the surrounding. In order to give feedback to coach and athlete, information and communication management systems and services will be developed.
It is clear that research and development on the themes discussed in the Research Themes chapter will not be enough to make the sports sector more innovation-driven and competitive. In order to address this situation, a number of additional horizontal issues have been formulated in the framework of FESI’s newly created working committee on research and development. These outline the necessary conditions for the creation of an innovation-friendly environment, and the reduction of the gap between research and industrial development. The horizontal issues are:

1. Environmental aspects of sports products
2. Training and education
3. Knowledge transfer
4. Demographic and cultural aspects of society
People-Planet-Profit, the integration of environmental, social, and economic goals, form a key area for the future of the European sports sector. It is believed that a truly profitable sports sector in Europe needs to stand out in this respect. The goal for the future is a zero-impact strategy on environmental and human health aspects over the total life cycle of the product. This will mean that major innovations in areas such as materials, production, recycling and use of energy and natural resources will be needed.
Since innovation in products and processes are seen as a key factor in the future of European sports companies, the need for well educated personnel will increase. Knowledge areas of importance for the future will incorporate not only technical aspects but also human and environmental issues. An optimal linkage between education and business must guarantee that people in the sector can have a lifetime learning possibility in an increasingly knowledge-intensive sports arena. Training and education is not only a vital aspect for industry, but also for sports retail organisations. What’s more, effective interaction between end user and the production chain is essential for a competitive and knowledge-intensive industry.
Innovation in itself can be an isolated process. In the European sports business arena a more European approach is necessary. Centres of Excellence in research and development must be formed to address relevant innovation issues, such as human factors, materials and rapid manufacturing. Collaboration between a wide range of parties from across Europe must be enabled and stimulated to facilitate the creation of new business. An open innovation approach with direct lines of knowledge transfer must be created to stimulate the innovation climate. And access to the knowledge sources must be made easy by the operation of a sports-dedicated portal / website.
The European sports industry can thrive with an optimal fit between its products and services and the needs of the consumer / end-user. For a proactive user-centred development process, information must be gathered about the end-user. This includes information on end-user needs, statistical demographic information on such aspects as sports participation, anthropometric data and input on aspects such as injury risk, health, prevention of diseases and health treatment related to sports. A direct translation must be made of this information into the innovation and development process of products and services.
An announcement at the end of the conference marks the establishment of a European Plat-
form for Sports and Innovation (EPSI). This will enable the future implementation of the
results and instruments developed within the Innosport EU project.

EPSI is a joint organisation of European parties and strives for a more innovation-friendly
environment for the EU sports industry. It also aims to stimulate technological innovation
and the setting up of innovative technology businesses. The platform’s main goal will be
to stimulate networking between the sporting goods industry (the larger brands as well as
SMEs), high-tech companies, universities and research organisations. This will be achieved
by organising meetings, seminars, activity groups and by creating a website which includes a
shared database for information exchange.

Sharing innovation
EPSI will enable the interchange of information on innovation in the European sports indu-
stry, for example to generate ideas for new innovation projects. Working groups will be set
up around important topics in the industry, and it is important to realise that we will need a
critical mass in order to present our findings to the EU commission. In this way, our lobby
of research programmes in Europe will help provide more attention and space for projects on
Sports Innovation.

www.EPSI.eu
Together in excellence, united in innovation

This book was designed to inform and inspire innovation in the future of sports, and has at its core an urgent requirement for every European company and institute involved in the sports industry. In order for us to excel in the development and production of innovative products and services, it is essential that work in a spirit of co-operation. Even the best idea is worthless if it is never shared. Which is why knowledge-sharing and collaborative projects are the positive alternative to the isolationism that has marked our industry for far too long.

The European Platform for Sports and Innovation can only thrive if involved parties are truly committed to its success. Working together we can achieve true innovation and profit by sharing those achievements with new and developing European markets. Let us work together in building the foundations for a successful future for the sports industry and make Europe the global centre of excellence in innovation.
References

Innosport.eu

Innovation Roadmap (Innosport EU, ETI-CT-2005-023416)
Examples for demonstration and for dynamizing the sector. Impact of sports (Innosport EU, ETI-CT-2005-023416)

OECD

The Sports market
2 Vocasport report (DG Education and Culture, Contract no. 2003-4463/001-001.)
3 According to recent definitions the term “manufacturers” comprise also organisations that have engineering & sales capacity and in this sense have end-responsibility on the product but outsource production, e.g. outside Europe.

How the sports market can change the way we live
1 http://cordis.europe.eu/fp7/calls
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