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The role of universities in sport ecosystems

Towards triple and quadruple helix models for sport policy developments

SHARE initiative

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Authored by

ECORYS

and coordinated by

KEA EUROPEAN AFFAIRS

Directorate-General for Education, Youth, Sport and Culture
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Table of Contents

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1. Introduction

This research paper aims to consider the role of higher education sport departments in shaping local policies for sport and physical activity. Universities are part of triple and quadruple-helix models, and are often at the crossroads between innovation policies, youth and education, and taking an active role in the socio-economic fabric of European cities and regions. The following section will be mainly aimed at defining the role of universities in triple and quadruple helix models of innovation, while section 3 will explore the interactions between universities and the other actors of the triple and quadruple helix models of intervention. Finally, sections 4 and 5 will provide an overview of the main categories of interventions for universities in the sport sectors, including relevant project examples, and a summary of the main findings of the paper.

2. Defining triple and quadruple helix models for sport policy developments

Both triple and quadruple helix models are based on the idea that "innovation is the outcome of an interactive process involving different spheres of actors, each contributing according to its 'institutional' function in society".[1] In this context, the triple helix model is based on the interaction between governance, academia and industry, while the quadruple helix model "moved from the concept of knowledge economy of the Triple Helix to the concept of knowledge society/democracy achieved with the addition of a fourth sphere" (i.e. civil society).[2]

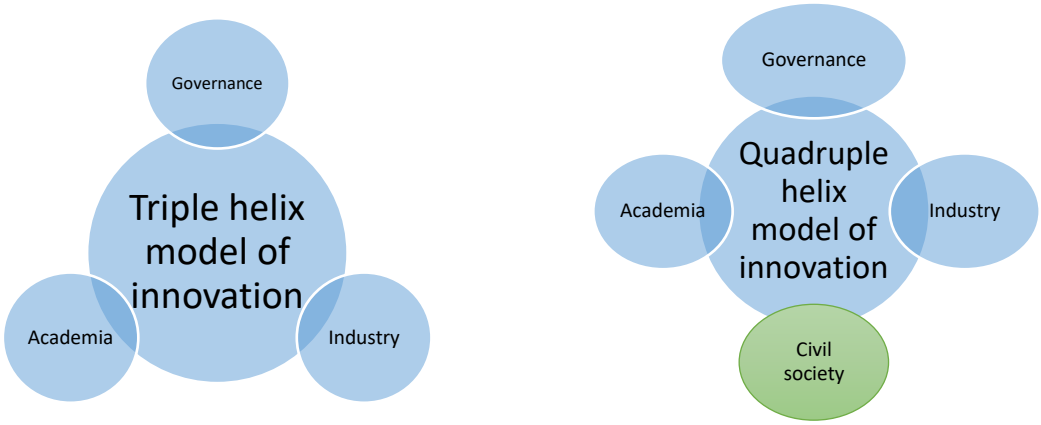
The triple helix model of innovation refers to constant interactions between academia, industry and governments to foster entrepreneurship, innovation, social developments and economic growth through research and innovation. This model can be defined as a theoretical framework of interactions between the three different actors, each representing a different helix of the framework. To this model, it has been later added a fourth helix, where the research and innovation component is carried out by key local actors from government, research and scientific institutions, companies and citizens, thus engaging in bottom-up collaborative processes in innovation policy and challenging the traditional top-down policymaking process.[3] In this regard, the main difference between triple and quadruple helix models of innovation lays in the involvement of the fourth helix, and thus civil society organisations, in bottom-up collaborative processes to foster innovation in specific social or economic domains, as also illustrated in the figure below.

[1] Cavallini, S., Soldi, R., Friedl, J., & Volpe, M.,'Using the quadruple helix approach to accelerate the transfer of research and innovation results to regional growth', Consortium Progress Consulting Srl & Fondazione FoRmit, 2016, available at: https://cor.europa.eu/en/engage/studies/Documents/quadruple-helix.pdf

[2] Ibid.

[3] Dettenhofer, M., Doussineau, M., & Arregui-Pabollet, E. (2019). An Analysis of University Governance Dimensions in Academic Research and S3 Innovation Performance. In Smart Specialization Strategies and the Role of Entrepreneurial Universities (pp. 153-185). IGI Global.

Figure 2.1: Triple and quadruple helix models of innovation



Both triple and quadruple helix models are relevant in understanding how public and private organisations interact in value-creating processes to transform various inputs into valuable outputs for themselves and others.[4] In particular, universities may initiate hubs, incubators, clusters and programmes aimed at stimulating entrepreneurship; they may host and organise local events; develop local partnerships to set up training courses; and the expertise of their staff is often mobilised by cities and regions in developing specific policy initiatives and investment projects.

In the context of triple and quadruple helix models, universities have increasingly developed their role as economic actors in their own right. The economic dimension is particularly relevant in the context of collaboration opportunities between universities and industry, with this collaboration being intentional and inter-organisational. In fact, research collaboration allows for the exchange of new and complementary knowledge and skills that cannot be transmitted through market-based transactions.[5] In addition to this, research collaborations between the industry and academia in the sport realm are also enhanced by "the increased value of (science-based) knowledge and information, the increased costs of scientific equipment, and the insufficient government funding".[6]

In this regard, local sport policies can be initiated and shaped through the establishment of networks and clusters of different actors that come together to boost innovation in the sport sector with universities playing a key role. Such policies may be concerned with fostering participation in physical activity, enhancing the performance of athletes, developing skills and expertise and contributing to sporting infrastructural developments.

In recent years, the European Commission has put forward Living Labs as a "potential solution for the European Paradox, or the imbalance between Europe's ability to generate new knowledge (exploration), and the lacking valorisation of this knowledge (exploitation)".[7]

[4] Hasche, N., Höglund, L., & Linton, G. (2019). Quadruple helix as a network of relationships: creating value within a Swedish regional innovation system. Journal of Small Business & Entrepreneurship, 1-22. Available at: https://www.tandfonline.com/doi/pdf/10.1080/08276331.2019.1643134?needAccess=true&

[5] Barney, J. (1991). Firm resources and sustained competitive advantage. Journal of Management, 17(1), 99-120.

[6] Rahm, D., Kirkland, J., & Bozeman, B. (2000). University-industry R&D collaboration in the United States, the United Kingdom, and Japan. Dordrecht, Netherlands: Springer Science & Business Media.

[7] https://ec.europa.eu/jrc/communities/en/community/tto-circle-community/article/living-labs-bridging-gap-between-open-and-user-innovation

In this context, Living Labs have been defined as "an organized approach to innovation consisting of real-life experimentation and active user involvement by means of different methods involving multiple stakeholders".[8] This means that through the Living Labs approach it is possible to facilitate the exchanges and collaborations between the different actors of the quadruple helix models, thus also putting forward a well-planned panel management process. This process ensures that the role of stakeholders "is carefully planned and executed to consider also the wider network and interactions with other stakeholders who need to be involved, how, when, where and their role in the panel".[9]

In the following sections, the paper will explore the role of sport science departments in the context of triple and quadruple helix models, looking at how they might interact with other relevant stakeholders to shape local sport policies and support their broader economic and social impacts. It will then go on to identify the main areas of intervention for universities within 'sport ecosystems' before presenting some good practice examples, models and initiatives in the field of sport.

The research is limited to the role of university sport science departments in shaping local and regional sport and physical activity policies within the EU. This geographical scope also gave us the opportunity to assess to what extent university sport departments might be considered as key actors in the development and implementation of regional smart specialisation strategies. The paper is based on a literature review of selected academic documents and publications. A mapping exercise was also completed to provide concrete examples of the social and economic domains through which sport departments can shape local policies in collaboration with other actors. The reviewed projects have then been developed in the form of case studies (section 4) or included in Annex I.

3. Universities in sport ecosystems

This section explores the role of higher education sport departments in developing programmes and tools for sport intervention. It explores how sport departments, in collaboration with other actors and innovators, can foster regional and local development. In the context of triple and quadruple helix models, universities become part of a system characterised by the interaction of different actors in supporting social, technological and economic development. These also include actors from government, industry and civil society.[10] The helix models emphasise the importance of an ecosystem that aims to foster growth and innovation but can also help to support different social outcomes. In this regard, the potential of sport ecosystems is being increasingly recognised at the European level as a key driver for innovation and growth at different levels[11], namely for its economic dimension of sport and its socioeconomic benefits.[12][13]

[8] Schuurman, D. (2015). Bridging the gap between Open and User Innovation?: exploring the value of Living Labs as a means to structure user contribution and manage distributed innovation (Doctoral dissertation, Ghent University).

[9] http://eu-macs.eu/outputs/livinglabs/panelmanagement/#:~:text=Quadruple%20helix%20stakeholder%20engagement%20is%20a%20central%20factor%20in%20Living%20Labs.&text=Facilitating%20exchanges%20and%20collaborations%20between,than%20focusing%20on%20the%20few.

[10] Ibid.

[11] European Commission, 'Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions Developing the European Dimension in Sport', COM/2011/0012 final, 2011. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52011DC0012.

[12] Conclusions of the Council and the Representatives of the Governments of the Member States, meeting within the Council, on the economic dimension of sport and its socioeconomic benefits (2018/C 449/01). Available at: https://eur-lex.europa.eu/legal- content/EN/TXT/PDF/?uri=CELEX:52018XG1213(01)&from=GA https://eur-lex.europa.eu/legal-content/GA/TXT/?uri=CELEX:52018XG1213(01)

[13] Conclusions of the Council and of the Representatives of the Governments of the Member States, meeting within the Council, on sport as a driver of innovation and economic growth (2014/C 436/02). Available at:

The application of the helix models in developing sport ecosystems shows how the different actors within the system can achieve mutual benefits. Universities support sport organisations to foster technological innovation in their sport domain and local authorities as they might contribute to promote healthy lifestyles and create employment or business opportunities.[14]

In this context, the role of sport universities becomes crucial in orchestrating the work and boost innovation through quadruple helix models and sport ecosystems. In particular, in the recent years, research in the field of sport mainly focused on boosting innovation in different fields. For instance, sport research can contribute to the development of products and services that might have a significant impact on improving and maintaining health in the elderly, reducing effects of sedentary life, enhancing training in top sports and encourage social inclusion.[15] In addition to this, it is important to also consider the key role of research in sport ecosystems to achieve innovation that meets the needs of the evolving sports market and in line with sustainability goals. Finally, the research component in the sport ecosystems is also crucial to correctly use and integrate data to achieve innovation to drive changes in the sports market.[16]

The growing importance and stronger emphasis on research in the sport sector in Europe is also demonstrated by the increasing number of organisations that contribute to foster research and raise awareness on the role of sport universities and departments in boosting innovation in the fields mentioned above. While some organisations might be more academically oriented,[17] some others also contribute to provide raising awareness and networking opportunities, as well as to disseminate research outputs.[18]

In this context, it is also important to mention the role of the European Network of Living Labs (ENoLL), an open-innovation ecosystem aimed at boosting co-creation approaches, integrating research and innovation processes in real life communities and settings. The organisation includes over 350 Living Labs and operate as intermediaries among citizens, research organisations, companies, cities and regions for joint value co-creation, rapid prototyping or validation to scale up innovation and businesses.[19] Among the different areas of work of ENoLL, health and wellbeing might represent an important field for adopting the living lab approach in sport ecosystems.

On the other hand, the development of sport ecosystems might also provide sport science departments with different types of benefits, such as:

- developing the high performance for the elite athletes, including Universities athletes;
- fostering technological developments and social innovation;
- developing business development coaching practices;
- accessing more funds for research purposes (both private and public funds);

https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014XG1205(01)&from=GA

[14] Hasche, N., Höglund, L., & Linton, G. (2019). Quadruple helix as a network of relationships: creating value within a Swedish regional innovation system. Journal of Small Business & Entrepreneurship, 1-22. Available at: https://www.tandfonline.com/doi/pdf/10.1080/08276331.2019.1643134?needAccess=true&

[15] EPSI (2016). Strategic Research and Innovation Agenda 2016-2021. Available at: https://epsi.eu/wp-content/uploads/2017/08/EPSI-Strategic-Agenda-web.pdf

[16] Ibid.

[17] Examples of more academic international and European associations can be the Association Internationale des Ecoles Supérieures d'Education Physique (AISEP), the International Council of Sport Science and Physical Education (ICSSPE), the European College of Sport Science (ECSS) and the European Association for Sociology of Sport.

[18] Examples of this type of organisations can include the International Council of Sport Science and Physical Education (ICSSPE), the European Association for Sport Management and the European Federation of Sports Medicine Associations.

[19] https://enoll.org/about-us/

- producing pre-studies that might widen the research scopes of the department and lead to new funding opportunities;
- increasing the quality of education through real word cases;
- increasing their research networks through collaboration with other research departments or R&D units of companies.

In this context, sport departments might also play a key role in developing models and methods of intervention that might foster local or regional innovation and development. Universities do not operate in a policy vacuum and are key influencers in elite and community sport.[20] Sport departments within universities have increasingly focused their efforts on establishing collaboration opportunities with innovation and technological centres to create hubs and clusters, aimed at sharing expertise and promoting innovative practices in the field of sport. Universities and sport departments also increasingly have an important role in the collection and monitoring of data relating to sport participation, sport policies and programmes developed at national or local level. In this regard, universities also play a key role in boosting and developing high performance practices in sport, for instance through their collaboration with local or regional High Performance Centres.[21][22] In this paper, we will however mostly look at the role of universities in the research and innovation field and how this might contribute to shape local and regional policies.

In more general terms, as emerged during the literature review exercise, research and innovation in sport through universities and sport departments are mainly aimed at:

- Boosting elite athletes' performance through technological development and innovation;
- Increasing citizens' participation in sport and raising awareness of the importance of sport in a given community;
- Promoting a healthy lifestyle and well-being through sport and physical activity;
- Meeting the needs of the evolving sports market;
- Boosting innovation in different fields and in line with sustainability goals;
- Effectively using data, technology and innovation to drive changes in the sport sector;
- Strengthening the business creation capacity of the sport sector.

In particular, due to their role as knowledge creation centres, sport science departments can encourage investments by local authorities and sport industry companies to foster the technological development and broader innovation in the sport realm. Moreover, sport science departments also take part in regional or local programmes aimed at raising-awareness of the benefits of sport and physical activity for citizens. In addition to this, universities provide (science-based) knowledge and information to stakeholders and citizens on the health benefits of sport, which can help to promote sport participation, high competition and benefits in terms of healthy lifestyles and wellbeing in a local community. Finally, where civil society organisations are involved in sport projects, the participation of universities can enhance the legitimacy and reliability of the organisation and of the sport programme developed, thus also contributing to raise the voice of sectors which might often be under-represented at the policy-making level, due to the specificity and autonomy of the sport sector and its main actors.

[20] Julie Brunton & Chris Mackintosh, 'University sport and public policy: implications for future research', International Journal of Sport Policy and Politics, 9:3, 373-376, 2017, available at: https://www.tandfonline.com/doi/full/10.1080/19406940.2017.1361460.

[21] Universities, B., & Sport, C. (2012). Placing higher education in the performance pathway. Available at: http://www.fisu.net/medias/fichiers/Placing_HE_in_the_Performance_Pathway_A_Performance_Analysis_of_the_World_University_Games.pdf

[22] https://sportperformancecentres.org/centre-world-mapa

The role of sport science departments becomes even more evident in relation to the development of smart specialisation strategies focusing on sport policy, as they can provide local and regional authorities with the opportunity to achieve local innovation goals. Through their roles in undertaking research and as knowledge producers, universities can contribute to identify and assess needs for innovation, as well as viable solutions to address sport-related issues in combination with other actors of the sport ecosystem. In fact, sport is increasingly included in smart specialisation strategies all over Europe, either as an economic priority or as an innovation area.[23]

Universities could contribute to the development of smart specialisation strategies in the following specific ways:

a) Producing rigorous assessments of the region's knowledge assets, capabilities and competencies, including those embedded in the university's own departments as well as local businesses;
b) Bringing global awareness and developing partnerships across regional borders within the framework of Euroregions;
c) Providing specialist research expertise and links to national and international networks of knowledge;
d) Enhancing the skills and competences of staff working in the field of sport policy through teaching programmes or ad-hoc training programmes;
e) Contribute to capacity building on the demand side through new business formation, student enterprise, and graduate placements as well as encouraging staff to actively engage with local businesses;
f) Contribute to local knowledge creation and its translation into innovative products and public and private services.[24]

Through our desk-based analysis of good practices and sport projects involving universities as key innovators we have identified three main domains of intervention, through which sport departments might contribute to shape local policies in the sport realm and in collaboration with other actors. By presenting the following domains of intervention, we aim to explain how sport departments might play a pivotal role in sport projects having a wider impact on different socio-economic aspects of a given local or regional community. The evidence collected shows that universities may foster local development through sport by using different approaches, including the following categories of intervention:

- **Research & technological innovation**: increasing the knowledge and development of innovation practices and technologies in the sport realm by creating clusters, hubs and innovation centres in collaboration with private companies and ICT industry;
- **Infrastructural development**: fostering infrastructural and broader economic development through projects, programmes and research outputs aimed at promoting the long-term sustainability of sport facilities;
- **Social inclusion, High performance & Well-being**: fostering social inclusion and promoting a healthy lifestyle by organising annual competitions of indoor and outdoor games; organising sport exchange programmes or internships for elite athletes in high performance centres or organising programmes and undertaking research to foster the inclusion of marginalised groups (i.e. people with disabilities, migrants, etc.).

Through the identification of these intervention domains we have been able to categorise the projects and programmes developed by or with universities in the context of triple and quadruple helix models.

[23] https://ec.europa.eu/sport/sites/sport/files/paper-sport-mapping-strategies_en.pdf
[24] Kempton, L., Goddard, J., Edwards, J., Hegyi, F. B., & Elena-Pérez, S. (2013). Universities and smart specialisation. S3 policy brief series, 3.

In particular, projects and programmes in the Research & technological innovation and Social inclusion & well-being domains provide useful examples of how universities can play an active role in triple and quadruple helix models to boost innovation and social developments in the sport realm. The following sections will further explore the role of universities and their interactions with other actors. On the other hand, the projects focusing on the Infrastructural developments mainly refer to opportunities for universities to improve their sport facilities and infrastructures.

In the following section, we will further examine how universities and sport departments have contributed to regional and local development through these three typologies of intervention, by describing relevant projects and programmes for each of the categories identified. In fact, the term is also increasingly applied in the context of regional smart specialisation strategies and development programmes.

4. Main typologies of intervention

In this section we will explore how universities and sport departments can develop a more active role in shaping local and regional policies for sport, by describing three categories of intervention for universities in the sport field. It explores to what extent universities interact with other actors of the triple and quadruple helix models to shape sport policies that might more broadly contribute to the socio-economic development of local communities. In addition to this, for each category of intervention identified, 2-3 case studies are highlighted in order to provide good practice examples of how programmes, projects and research outputs shape local and regional sport policies and represent good practice examples for other local communities.

Research & Innovation

The case studies relating to this first domain of intervention represent good practice examples of sport ecosystems established by or with universities and sport departments for the development of research and technological innovation in the sport realm. The projects outlined in this domain have a strong research component, and the universities involved played a major role in defining the project priorities and innovation needs (Case Study 2 and 3), as well as in initiating the research hub (Case Study 1). In addition to this, Case Study 2 demonstrates how the interactions between universities, sport organisations and companies might contribute to the development of new sport practices in a given community. Finally, Case Study 3 represents a good example of collaboration between academia and industry, and particularly SMEs, in which research centres share their expertise to develop sustainable sport goods and hence contributing to the overall sustainability of the sport sector in the relevant local areas.

Universities and sport departments have been involved in the development of sport-related research by creating clusters, hubs and research centres in collaboration with private companies, industry, sport organisations and national governments. A notable example is the creation of the Swedish Winter Sports Research Centre at Mid Sweden University. The Centre is operated by four institutions, sport organisations, the city council and the county council, its objective being to implement a multidisciplinary centre for research and development related to sports at the Mid Sweden University.[25] It provides a very interesting example of regional smart specialisation, building on a strong research base to build a sport competence cluster in the regional economy working with local and regional authorities, sport organisations and local businesses to strengthen the links between

[25] European Union, 'European Union Regional Policy Investing in our regions: 150 examples of projects co-funded by European Regional Policy', 2010, available at: http://ec.europa.eu/regional_policy/sources/docgener/presenta/projectbook/project_book_02_research_en.pdf.

universities and industry. The Centre also has the potential to conduct international research in the field of winter sport and health.[26]

Case study 1: Winter Sport Centre (Sweden)[27]	
Name of intervention	The Swedish Winter Sports Research Centre (SWRC)
Organisation	Mid Sweden University
Funding sources	European Regional Development Fund (€1,053,663), other contributors (€1,099,509)
Description	The SWSRC was established in 2007 as part of the Mid Sweden University. The SWSRC is a multidisciplinary sport science research centre that brings together researchers, coaches and athletes. Five university departments participate in the centre, each contributing with different scientific expertise – the medical sciences, natural sciences, engineering and mathematics, engineering and sustainable development, and social sciences departments. The SWSRC also undertakes extensive international research and development (R&D) cooperation. The Centre has two primary research foci: sports and performance and sports and health. In sports and performance, the physiological research at SWRC primarily focuses on aerobic energy processes and the factors that limit aerobic capabilities. The SWRC has also created a 'phys-lab' (in the field of sports and health) that allows R&D work related to public health.[28]
Evidence of specific outcomes	The incorporation of the Centre within the University structure strengthened the profile and position of the initiative and enhanced collaboration with other regional sport and health actors. The Centre has also established itself with a strong R&D focus and has strengthened sport education in its fields of expertise. Indicators used for measuring research outputs and impacts, such as publication, physical infrastructure and research collaborations (national and international) are all on or above the initial targets set. In particular, the Centre has been successful in working with national sports teams. There is also a significant presence of international visiting researchers in the R&D centre. The SWSRC also works closely with Peak Innovation - a 10-year project commercializing research, and promoting entrepreneurship in sport, tourism and the outdoors. This is developing into a powerful cluster at the heart of a smart specialisation strategy.[29] In addition to this, the collaboration with two specialist sport associations, with the Swedish Olympic Committee and business representatives also provided the opportunity to combine theory and practice in the sport field. Through these collaboration opportunities, the research departments contributed to the development of a Test centre in performance and public health, a Training centre for elite athletes and a laboratory focusing on prototypes and product development.

[26] SHARE Database of Sport Projects, available at: https://cloud-utilities.storage.googleapis.com/fusion-tables/index.html?1f-FvO_vnyD6X78gtdSRn4v-U3WwjnePJ9FXdY4gLQ3Q.
[27] Project website available at: https://www.miun.se/en/swsrc.
[28] European Commission, 'Study on the Contribution of Sport to Regional Development through the Structural Funds: Final Report', July 2016, available at: https://op.europa.eu/en/publication-detail/-/publication/3e9c6d76-9aa1-11e6-9bca-01aa75ed71a1.
[29] Ibid.

Universities and sport departments have contributed to the development of innovative practices and technologies in the sport realm in collaboration with private companies, the ICT industry, sport associations and governments. Notable examples of effective collaboration between universities and the private sector include the creation of the InnoSportLab for Sailing in the Netherlands and the innovative ski helmet produced through the cross-border collaboration of Austrian and Italian partners. These are described further below.

A Dutch co-ordinated INTERREG project, InnoSport Lab Sailing, aimed to enhance sport performance in sailing through the production of innovative sailing products by universities, sport associations/organisations and enterprises. This project therefore brought many leading stakeholders together focusing mainly on innovation and entrepreneurship (including the Technical University of Delft, other universities in the Netherlands, the Dutch National Olympic Committee, InnoSportNL, the Hague local authority, the Water Sport Association, etc). The key objectives of the project were to enhance the skills of sailors and trainers, create more business and encourage more people to participate in sport.

Case study 2: InnoSportLab Sailing (The Netherlands)	
Name of intervention	InnoSportLab Sailing
Organisation	Technical University Delft
Funding sources	European Regional Development Fund (€1,322,415), public co-financing (€2,702,690), private co-financing (€690,975).
Description	InnoSportLab in the Hague (opened at the end of 2010) was established to develop and test new sport-related products, systems, facilities and services. The Dutch National Olympic Committee aims to have a substantial presence in the top 10 of the Olympic medal table for sailing. Thus the project supports top-sailors with innovative products and services, as a way of improving their performance, but also at the same time assists enterprises with promising innovations to create new possibilities for business activity in sailing and thus create a supportive environment for outstanding sailing success. The lab has also assisted many start-ups and existing SMEs in the past few years. The core aim of the project is therefore to create 'a golden triangle' with the purpose of achieving more Olympic medals, more business and more people who participate in sport.[30]
Evidence of specific outcomes	The InnoSportLab has produced several innovative sailing products. These were developed by students in cooperation with universities and companies. Thus, students, companies and universities learnt from each other and increased their skills levels through research and innovation. While companies benefited from the research outputs provided by the universities to commercialise the sporting goods, the universities and its students had the opportunity to gain and practices technical and theoretical skills. In this regard, the support provided by the project to start-ups and SMEs represent a good example of the interactions between academia and industry in the context of triple helix models of innovation.

[30] Ibid.

	The InnoSportLab will help to attract water sport athletes and tourists to the Hague area and contribute to the development of the local economy. The Lab has also put the Netherlands on the map as an attractive and innovative sporting nation. The project will create field labs where companies, knowledge institutes and sport work closely together in practice to develop and test the new sport-related products, systems, facilities and services. Employment and skills levels will therefore be increased through such research and innovation. The InnoSportLab model is sustainable, is drawing in external investment and is also transferable. For example, at an international level a project building on InnoSportLab Sailing has been developed under the 'INTERREG 2 Seas' programme. This project is for the coastal regions of the Netherlands, England, Belgium and France and offers new possibilities for cross-border cooperation in the field of innovation for sailing. [31]

Safe a Head is a very good example of the high potential deriving from cross-border collaboration between different partners including private companies, universities and research centres (key elements of the triple and quadruple helix models) in contributing to innovation in sport and reducing the carbon footprint. The project is an example of classic technological innovation, showing that the sport equipment market is very capable of generating innovative products leading directly to increased market sales. It also shows how sport and physical activity can be well integrated into research and innovation initiatives. [32]

Case study 3: Safe a Head (Austria and Italy)[33]	
Name of intervention	Safe a Head
Organisation(s)	• Dolomiticert scarl (private company- Lead Partner) • University of Padova (Mechanical Engineering Department) • University of Salzburg (Sports Department).
Funding sources	European Regional Development Fund (€393,849), other contributors (€131,283)
Description	The objective of the project (which ran from May 2011- May 2014) was to develop an innovative ski helmet with alternative materials in order to reduce the carbon footprint and increase market sales. It was developed based on analyses and tests performed on commercial helmets. The intervention aimed to foster investment in R&I, strengthening cooperation between SMEs and research institutes. It also aimed to improve the SMEs' capacity to innovate within strategic sectors for regional economies, by increasing cross-border collaboration with different research centres.[34]

[31] Ibid.

[32] SHARE Database of Sport Projects, available at: https://cloud-utilities.storage.googleapis.com/fusion-tables/index.html?1f-FvO_vnyD6X78gtdSRn4v-U3WwjnePJ9FXdY4gLQ3Q.

[33] Lead partner project website available at: http://www.dolomiticert.it/en/.

[34] European Commission, 'Study on the Contribution of Sport to Regional Development through the Structural Funds: Final Report', July 2016, available at: https://op.europa.eu/en/publication-detail/-/publication/3e9c6d76-9aa1-11e6-9bca-01aa75ed71a1.

Evidence of specific outcomes	The project contributed to the economic development of the regions involved through the creation of a new and innovative ski helmet on the basis of analyses and tests performed on commercial helmets. The findings and the results of the research are used by various companies and SMEs in the sport sector and other companies aiming to create highly innovative helmets and visors. Therefore, the increase of know-how for the companies of the sport sector is the main contribution of the project to regional economic development. The project also supports, indirectly, the tourism sector. The increased safety on the ski slopes is expected to increase the number of people practicing skiing and snowboarding in the Alpine regions. With regard to sustainable development, the project revealed that the carbon fibre was the most important component in the calculation of the environmental impact of a standard ski helmet and mask (57.7% of the total). Thus the project introduced the use of new materials with a minor impact on the environment (estimated reduction of impact: around 30%). In this regard, the project also provides a positive example of how universities might shape local sport interventions, by setting up networks of actors working in different fields (i.e. sport industry, tourism, etc.) to boost innovation in the sport field and it illustrates how universities might play a crucial role in triple helix models of innovation. There was an increase of market sales through innovative products in sports equipment. The project is also a good example of effective cross-border cooperation and collaboration between different partners. The project shows good evidence of easy transferability: a similar approach could be adopted elsewhere and the know-how achieved through the project is easy to transfer. The project also does not include any dependence on specific circumstances, nor legal or funding barriers.[35]

Infrastructural development

The case studies illustrated in this section show how universities can be beneficiaries of European funds and foster infrastructural development at regional and local level. The development of sport facilities and training centres might in fact contribute to the achievement of regional innovation goals and build-up expertise and skills to strengthen the regional sport sector. Moreover, the sport-based infrastructural development also has strong social and economic implications, as it might contribute to the development of elite athletes, to increase the participation in sport and create new jobs.

Universities have also contributed to national infrastructural and broader economic development through projects, programmes and research outputs aimed at promoting the long-term sustainability of sport facilities. These include the construction of the Sport Science Training Centre at the University of Debrecen in Hungary and the rehabilitation of the Campus- Faculty of Physical Education and Sport at Babes-Bolyai University in Romania.

[35] Ibid; SHARE Database of Sport Projects, available at: https://cloud-utilities.storage.googleapis.com/fusion-tables/index.html?1f-FvO_vnyD6X78gtdSRn4v-U3WwjnePJ9FXdY4gLQ3Q.

These projects illustrate that through the involvement of universities in the infrastructural development of their campuses, they have contributed to local economic and social development. These projects have provided spaces for sport research, education and activities, created jobs in the local community, and created 'social togetherness' and a sense of community through the local and national matches held at these premises.

Case study 4: Construction of Sport Science Training Centre (Hungary)	
Name of intervention	Construction of Sport Science Training Centre
Organisation	University of Debrecen
Funding source	European Social Fund (€5.7 million), other contributors (€1.1 million)
Description	The University of Debrecen wanted to build the Sport Science Training Centre so that it could be used as a place where educational activities, sport related research and sport activities could take place. The new building will therefore be used to house several sporting games, gymnastics and fitness activities. Both competitive and leisure activities will be held in the centre including regional and national matches and other sporting events. The building will be three stories high including a 1,166m^2 ground for sport games, 679m^2 ground for a gymnastics training hall, a smaller gym, teacher's offices, changing rooms, small sport equipment storage rooms, bathrooms and a medical room.[36]
Evidence of specific outcomes	The Centre will serve as a place to conduct sport science education, research and competitive and leisure sporting activities. It will contribute to social developments as games and competitions will be held there. The construction of the building will also create new jobs. The Centre will become a home for activities, communal togetherness and provide an attractive environment for social learning through sports. The Sport Science Training Centre (4,400 m2) will also allow thousands of students, who did not have the opportunity before, to do sport indoors.[37]

Case study 5: Rehabilitation of the Campus- Faculty of Physical Education and Sport (Romania)	
Name of intervention	Rehabilitation of the Campus- Faculty of Physical Education and Sport
Organisation	Babes-Bolyai University
Funding source	European Regional Development Fund (€4,344,151)
Description	The Babes-Bolyai University aimed to: • extend their educational facilities by building additional floors at the Faculty of Physical Education and Sport; • rehabilitate the water supply, sewerage and illumination (including floodlit) of their sport infrastructure ; • rehabilitate and modernize five multifunctional sports fields; • restore access to roads, alleys and gutters so they are suitable for jogging.

[36] Ibid.
[37] Ibid.

	The project thus provided new/rehabilitated the existing sport infrastructure at Babes-Bolyai University (i.e. brought sport fields in line with competition standards, extended teaching space for students at the Sport faculty and jogging space).[38]
Evidence of specific outcomes	The project contributes to economic and social development in a number of ways: • The park provides teaching and training infrastructure for 2,500 students of the Faculty of Sport and for another 17,500 students who have sport as part of their curricula; • It is likely to stimulate sport-related employment; • The park hosts training and competitions for local sport clubs; • The rugby field hosts the national championship matches; • The project involved the rehabilitation of one of the two largest parks of the Cluj Napoca which is an important recreational area for the local community. The project's principal results were: • 13 new classrooms and 390 course places were created; • Five multifunctional sports fields were built; • Paths and access routes were restored; • Lighting and underground electrical infrastructure were restored; • Power networks were replaced and resized; • An environmentally friendly floodlit football pitch was created.[39]

Social inclusion & wellbeing

As also outlined in the Council conclusions on the role of sport as a source of and a driver for active social inclusion, "sports movement can make an important contribution to issues of public interest such as social inclusion".[40] In this regard, the relationship between sport and social inclusion has been widely explored by sport scientists from universities and sport institutes all over Europe. This section thus aims to explore the role of higher education institutes in shaping local sport policies fostering social inclusion and promoting a healthy lifestyle.

The case studies presented in this section represent good examples of sport ecosystems developed to promote social inclusion and healthy lifestyles. In particular, they demonstrate how universities can play a key role in developing methodological tools and in creating learning opportunities in the sport domain aimed at boosting the employability levels of young people (Case Study 6). The project outlined in the case study 7 represents instead a good practice example of interaction between all the actors of the quadruple helix model in which universities provide research outputs and technical expertise for the development of programmes aimed at increasing physical activity and mobility in EU workplaces.

[38] European Commission, 'Study on the Contribution of Sport to Regional Development through the Structural Funds: Final Report', July 2016, available at: https://op.europa.eu/en/publication-detail/-/publication/3e9c6d76-9aa1-11e6-9bca-01aa75ed71a1.
[39] Ibid.
[40] European Union, 'Council conclusions of 18 November 2010 on the role of sport as a source of and a driver for active social inclusion', available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52010XG1203(04).

In the context of sport and social policy, universities have increasingly had a key role in facilitating partnerships and cooperation opportunities with sport organisations and other sport-related stakeholders to access European funding opportunities. In this regard, some projects aim to foster social inclusion by increasing the employability opportunities of young unemployed people, providing them with training opportunities but also developing volunteering schemes in the sport sector and for sport organisations. In fact, the methodological and thematic expertise offered by universities and sport departments might provide volunteers and unemployed people with skills required to enter the labour market in the sport domain.

Some other projects focus instead on the development of skills for sport departments' students in the field of tourism. For instance, a few projects aim to provide training opportunities for students in sport courses, in order to further develop the students' competences and skills on tourism related aspects, and on how they might contribute to the development of sport tourism at regional or local level. Through ad-hoc training and the professionalisation of students, volunteers, the unemployed and sport organisation employees, university sport departments can enhance the employability of youth, but also provide sport organisations with tools or ICT-based platforms for promoting sport activities or sport-related working and volunteering opportunities.

As also illustrated in the case study below, in order to achieve these results, sport organisations often cooperate with university departments and institutes in order to gain the methodological and training expertise required to access European funds.

Case study 6: Youth Sport Vol (Estonia and Finland)	
Name of intervention	Youth Sport Vol[41]
Organisation(s)	Sport Year Foundation (Estonia) & Haaga-Helia University (Finland)
Funding source	European Regional Development Fund (€209,995)
Description	The project was developed by the Sport Year Foundation, an Estonian association connecting volunteers at all ages, sport event organisers and sport clubs, locally and internationally. The main partner for this project is the Haaga-Helia University of Applied Science (Helsinki, Finland). This 2-year project started in 2016 and was mainly aimed at increasing the social inclusion of unemployed young people and improving their access to the labour market through the development and piloting of a cross-border sport volunteers' model in Estonia and Finland. Through voluntary work, the unemployed youth had the opportunity to develop their skills through work experience in different organisations with people from different nationalities and age groups.
Evidence of specific outcomes	In order to set up the project a grant of approximately €200,000 was provided through the European Regional Development Fund. With this fund, the project contributed to: • Developing and piloting an innovative ICT-based platform aimed at bringing together organisers of sport initiatives and volunteers in Finland and Estonia; • Organising workshops, seminars and conferences aimed at promoting sport volunteering opportunities as a labour market advantage among university and vocational institute students in Estonia and Finland;

[41] Project website available at: https://www.scult.org/en/about/interreg-central-baltic-youth-sport-vol-project.

	• Setting up a cross-border promotion campaign to distribute the project to other countries and enhance the transferability opportunities of the developed model. The research component of the project, led by the Haaga-Helia University has been crucial for the development of IT tools, for the organisation of training opportunities for volunteers and for the dissemination of results, while the sport organisation was mostly involved in the day-to-day management of the project. This demonstrates the added value provided by education institutions and the unique role they might play for the development of innovation practices in collaboration with civil society organisations.

In addition to the example presented above, universities can also play a significant role in raising awareness and sharing expertise and knowledge on the benefits of sport to health and wellbeing. In this regard, several projects supported by European funds and focusing on the collaboration between civil society organisations and academia generally, aim to foster participation of particular sub-segments of society in sport and physical activity. While the main objective of these types of projects is to tackle physical inactivity, universities often play a key role in conducting targeted research on inactive lifestyles among selected target groups or in specific Member States. In addition to this, universities may also have a pivotal role in proposing and developing models of intervention and programmes suitable for different environments and target groups, i.e. workplaces, schools or recreational centres.

For this reason, these projects may have both a local and international focus. Where a project has an international dimension, collaboration between different universities located in different Member States may also contribute to enhancing knowledge among different target groups and in different geographical or social environments on the benefits of sport and physical activities. In addition to this, projects with a larger geographical scope may also benefit from the inclusion of other actors who are part of the triple and quadruple helix model, such as international associations and NGOs, municipalities or local stakeholders (i.e. chambers of commerce, sport clubs, etc.). For instance, the projects presented below provides a good example of how a large consortium of different stakeholders might collaborate to promote a healthy lifestyle and wellbeing in different communities or Member States through ad-hoc partnerships in the context of the EU-funded projects or by applying the living labs approach.

Case study 7: HEMA Project (France, Belgium, Latvia, Portugal, Estonia, Greece, Finland)	
Name of intervention	HEMA Project [42]
Organisation(s)	European Federation for Company Sport (France) European Cyclists Federation (Belgium) Sport Vlandeeren (Belgium) City Council of Daugavpils (Latvia) Club of cycle-friendly towns and territories (France) University of Coimbra (Portugal) Eesti Spordisemts Kalev – KALEV (Estonia) Chamber of Commerce and Industry of Korinthia (Greece) European platform for Sport Innovation (Belgium) Tampereen Pyrinto ry – TAMPEREEN (Finland)
Funding source	Erasmus+ (Key action sport) (€ 387,363)

[42] Project website available at: https://hemaproject.com/.

Description	"Healthy Employee, Mobile and Active" (HEMA) is a 3-year programme intended to tackle the high level of physical inactivity in Europe. The project began in 2019 and its main aim is to increase participation in physical activity by combining sport, physical activity and mobility. In this context, the concept behind the project is to combine practical tools and good practices with research outputs. The ultimate goal is then to associate moments of practicing and grassroots sport to specific discussions and studies around ways of implementation of physical activity and mobility in EU workplaces.
Evidence of specific outcomes	The project involves an innovative methodology aimed at associating physical activity to mobility schemes within companies. In this regard, several activities will be implemented in order to leverage levels of physical activity and mobility at work: • A state of play and diagnosis of the levels of physical activity and mobility at work in Europe; • A survey targeted at employers and employees to identify major levers and brakes; • A pilot test implemented for three months in Belgium, France and Latvia; • A digital connected challenge for employees to measure their number of steps by walking, cycling or running; • Dissemination activities to discuss the key research findings and good practice examples developed. The idea is to combine research outputs, knowledge sharing and good practices which may play an important role in establishing specific models of intervention for local policy makers willing to tackle sedentarism in their local communities. It also represents a peculiar case of innovation in sport through the collaboration of all the actors of the quadruple helix model, in which universities can contribute by providing methodological and research outputs.

Case study 8: The Vitality Living Lab	
Name of intervention	The Vitality Living Lab[43]
Organisation(s)	Sport and Technology Foundation
Funding source	ERDF and Province of Noord-Brabant (50%) & Sport and Technology Foundation partners (50%) (€4.8 million)
Description	The main goal of the Vitality Living Lab project is to create a global ecosystem for innovation & business creation within the domain of sports & vitality. As result of the increasing number of people with an inactive lifestyle, 14 partners of the Sport and Technology Foundation are working together within the Vitality Living Lab project to strengthen the South Netherlands regional innovation ecosystem around sport and vitality and to promote a healthy active lifestyle in society.

[43] Project website available at: https://sportsandtechnology.com/vitality-living-lab/

Evidence of specific outcomes	The innovation approach developed by this cluster contributed to: • Develop a data system (vitality information system) to bring together open source public data on vitality; • Encourage public-private cooperation around challenges in different neighbourhoods in Eindhoven, Uden, Vught, Helmond; • Develop more than 35 Innovative solutions that were tested for validation in living labs; • Create new businesses (5 start-ups) that respond to the new market opportunities; • Stimulate new activity and employment. In terms of more quantitative and measurable results, the project achieved the following: • Strengthened number of Field labs / experimental gardens: direct 3, indirect 3; • Number of SMEs assisted: 35; • Contribution with cases / pilots of gross regional product (on average on an annual basis): 2,5 million euro; • 10 FTEs annual employment.

5. Conclusions

The case study evidence demonstrates the following roles for university sport departments in shaping local and regional policies and as key actors of both triple and quadruple helix models:

- Universities can link up with private companies to set up partnerships aimed at fostering research and innovation in the sport domain, leading to the sharing of expertise and technical skills. This might then contribute to the development of new sport equipment and technological innovation that might enhance the performance of athletes and the attractiveness of the whole sport sector;
- Universities may collaborate with local authorities (i.e. municipalities, chambers of commerce) and civil society organisations (i.e. sport NGOs and grassroots movements) to foster social inclusion of disadvantaged groups. In fact, universities and research departments might offer training opportunities to boost the upskilling of youth or unemployed people;
- Universities might also play an important role when collaborating with sport associations and local authorities as they can provide methodological insights and intervention models aimed at facilitating the participation in sport and physical activity of specific target groups (i.e. elderly, people with disabilities, etc.);
- Universities are also often considered reliable stakeholders at the policy-making level, as they are usually involved in consultation processes and regarded as key knowledge partners. When collaborating with sport organisations, this pivotal role played by universities might also contribute to enhance the visibility and raise the voice of sectors that might otherwise be under-represented at the policy making level due to the specificity of the sport sectors and the autonomy of sport stakeholders;
- Universities might also be beneficiaries of EU funds to renovate their sport facilities or to create sport centres for their students with wider social and economic benefits for local communities;
- Universities' role in sport-based projects might also be seen in relation to the long-term and sustainable infrastructural development, by decreasing the use of carbon footprint for their facilities or by developing sustainable sport-related equipment;

- Universities might also have an important role in facilitating international partnerships, by using existing links with other international sport and research departments, which might then facilitate a wider dissemination of results and enhance the transferability opportunities of a specific project.

Moreover, as also mentioned in section 2, an increasing number of regions include sport as a focus in their smart specialisation strategies. The paper has explored the different potential roles of universities in defining and developing regional smart specialisation strategies, thus contributing to actively shape the local policies in different fields. Our analysis shows that the contribution of universities in the context of smart specialisation strategies, and more in general, in triple and quadruple helix models of innovation, can be developed further in the future. There is undoubted potential for university sport departments to work more with the public sector, business and other social partners, as this could provide exciting opportunities for universities to broaden their role locally and contribute to enhance the impact of their teaching and research. On another level, regional policy makers might encourage a stronger engagement of universities by analysing and mapping the local universities' sport-related specialisms against the economic priorities of the region in order to build up an S3 partnership.

Finally, due to the increasing relevance of the efforts in the context of sustainability and clean environment on the EU agenda (i.e. Green Deal) it is also important to mention the need to further explore the potential role of universities and sport departments in quintuple helix models to achieve innovation in different fields and in line with sustainability goals. In this context, the fifth helix encompasses the natural environment dimension which might then be articulated in sport ecosystems in order to reduce emissions and carbon footprints in sport or also to raise awareness on environmental sustainability.

Annex I – Other projects involving universities as key actors in local sport policy development

In the table below we have listed some relevant projects contributing to shaping local sport policies and developed by or in cooperation with higher education institutes and universities.

No.	University	Website	Project
1.	Vrije Universiteit Brussels (Belgium)	www.vub.ie	Energy efficient renovation of the swimming pool infrastructure in the Vrije Universiteit Brussels student campus: http://www.vub.be/2020/swimming-pool
2.	Haaga-Helia University of Applied Sciences (Finland)	www.sportpolis.fi	*Exercise Science and Business Sportpolis* aims to create a hub of expertise in enterprise, education and research in the Haafa-Helis University's Vierumäki Campus.
3.	University of South Denmark (Denmark)	https://www.sdu.dk/en	*Experience Economy in and around Vadehavet* aimed to develop the tourism and experience economy of the South-West of Jutland with a view to boosting the local economy and its businesses. Among its different partners, the University of South Denmark ensured the use of the latest knowledge in the field which in turn led to a strengthening of competences and innovation and ultimately led to increased economic growth and job creation.
4.	University of Debrecen (Hungary)	https://www.edu.unideb.hu/	The project *"3 missions" Sport and Science for Society in Eastern-Hungary*, led by the University of Debrecen, has contributed to the training of present and future professionals in sport with a complex approach executed through the development of university courses and course materials in the field of sport-recreation management and physical education, with workshops, and the training of coaches at the grassroots level.

5.	Budapest University of Physical Education (Hungary)	https://english.tf.hu/	*Curricular/methodological development and professional training for teachers for daily physical exercise* is a project implemented by the Budapest University of Physical Education. The project aims to develop professional sport knowledge for physical education teachers and coaches working in primary and secondary schools.
6.	University of Hamburg (Germany)	https://www.uni-hamburg.de/en.html	The project *Fit for Business* was developed by Sport Drenthe in collaboration with other partners, such as the University of Hamburg. It aims to improve the health of employees at 24 Dutch and 24 German firms in the Eems-Dollard region (EDR).
7.	Paracelsus Medizinische Privatuniversität (Austria)	https://www.pmu.ac.at/	The project *Trail for Health Nord* aims to develop products and services around water and health tourism concepts to strengthen regional development and tourism targeting the elderly in light of demographic change.
8.	Sheffield Hallam University (United Kingdom), University of Ulster (United Kingdom), Eindhoven University of Technology (the Netherlands), Delft University of Technology (the Netherlands) and Howest (University College of West Flanders, Belgium)	N/A	*ProFit* aims to stimulate innovation and new business creation in the sports industry by developing an international network of FieldLabs.
9.	Hanze University of Applied Science (Netherlands)	https://www.hanze.nl/eng	The Centre of Expertise *Healthy Ageing* is focused on innovation related to health and care themes with 48 Living Labs including over 160 organisations. The project aims to achieve innovation in the fields of health & technology and healthy environments.
10.	Universität Passau (Germany)	https://www.uni-passau.de/	Overall aim of the project *Moving all day – Moving school* is to collect evidence on success and failure factors of the sport offered in schools in Austria and Bavaria.

11.	Aarhus Universitet (Denmark)	https://www.au.dk/	The *Event-based Innovation* project is based on the idea that large sports events are fertile grounds for the launch and development of innovation projects. Making use of a triple helix model, involving local authorities, sports organisations and enterprises to build a transnational competence cluster, the project aimed to build on concrete examples in the field of sensors, networks, data processing, data presentation, interaction and games, operations and project management, results analysis and commercialisation models.
12.	Kymenlaakso University of Applied Sciences (Finland)	https://www.xamk.fi/en/frontpage/	The *LITAS* project's main objectives are to provide learning environments with appropriate facilities, tools and equipment; to encourage people's health and well-being.
13.	Democratic University of Thrace (Greece)	http://duth.gr/	The *Sport tourism* programme focuses on updating the knowledge of University graduates from Departments of Physical Education and Sport who are interested in upgrading their knowledge in sport tourism.
14.	University of Pécs (Hungary)	https://international.pte.hu/	The *Training Programme Development In the Transdanubian Region* project's main objective was to develop training programmes in the curriculum for sport and health awareness connected to natural and social science subjects.
15.	University of Szeged (Hungary)	https://u-szeged.hu/english	The goals of the project (*Development of differential and complex high education services in connection with sport, meeting the requirements of the 21st Century in the Southern-Great Plain region*) were to develop the sport science curriculum and training, network development at national and international levels, expanding a PhD programme, establishing sport science laboratories, preparing sport physician training programmes and organising a mentor programme for athletes in the institute.
16.	University of Thessaly (Greece)	http://old.uth.gr/en/	The *Life After Sports* project aims to develop an innovative 3-Stage Dual Careers Programme that facilitates an optimal combination of high-quality training and education to young athletes using face-to-face workshops.

17.	University-Colleges of Limburg-Leuven (Belgium)	https://www.ucll.be/international	*PLAY'IN TOGETHER* project's objective is to make societies more inclusive of all people with disabilities, thanks to the promotion of Olympic, Paralympic and European values in socio-sport activities.
18.	Technical University of Munich (Germany)	https://www.tum.de/en/	The *Promoting active travel to school in Europe* project aims to create evidence-based data regarding active transport to school.
19.	Lithuanian Sports University (Lithuania)	https://www.lsu.lt/en/	The *Easybasket in Europe* project aims to develop a new model of teaching basketball (completely experimental for the time being) to children and testing it on target groups of kids coming from school, NGOs and clubs, thus providing training for Federation trainers that will then spread it all over Europe.