OPPORTUNITIES WITHIN COST – A SWEDISH PERSPECTIVE

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ABSTRACT

COST Actions are of scientific importance in their substantial contributions to scientific and technical literature as well as research training and exchanges. This contribution to science is widely recognised both within and outside Europe. COST Actions have frequently been the precursors for successful projects in the EU Framework Programme, and will continue to provide platforms for Horizon 2020 proposals. Furthermore, COST Actions foster scientific excellence throughout Europe and have a societal impact in their contribution to knowledge, to its wider dissemination to policy makers and the public at large and to the tackling of problems deriving from urging societal needs.

The aim of this paper is to outline activities in the three Actions to date, and how these can benefit the European research community, and in particular students, in establishing new collaborative links and learning new methods relevant to their research. Particular emphasis will be placed on the benefits of training schools and short term scientific missions – both proven benefits to early stage researchers.

Key words: COST, opportunities, wood technology.

INTRODUCTION

European research benefits from many funding opportunities designed to maintain Europe's position at the forefront of development and sustainability. Recent activities such as the Framework programmes have been succeeded by the Horizon 2020 programme, where focus aims more towards commercial development through reaching various technical readiness levels (TRLs). Higher values of TRL represent the greater opportunity for commercial exploitation. However there is still a need for innovative research. In addition to national and international schemes funding such innovative research, one of the key schemes for promoting research and development is COST.

Founded in 1971, COST – European Cooperation in Science and Technology – is the first and widest European framework for the transnational coordination of nationally funded research activities. It is based on an inter-governmental agreement and comprises currently 35 European Member Countries plus one Cooperating State, as shown in Figure 1.

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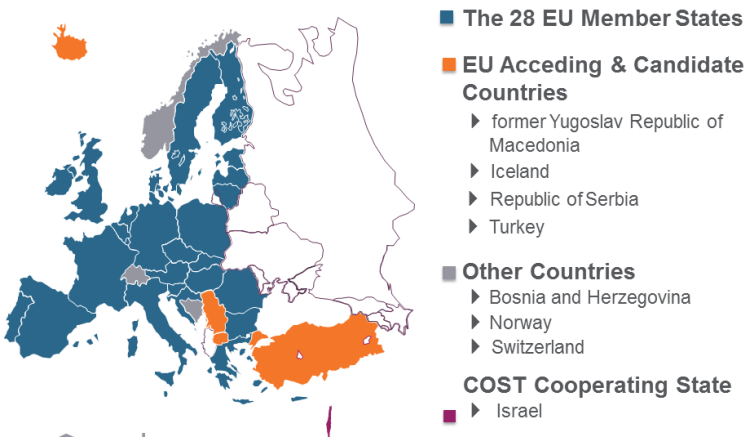

Figure 1: Countries funded under the COST scheme

COST's mission is to strengthen Europe's scientific and technical research capacity by supporting cooperation and interaction between European researchers, covering from basic to applied or technological research and including research addressing issues of pre-normative nature or of particular societal importance.

In order to achieve its goal, COST operates over 9 different thematic domains, as well as a special trans-domain programme, which allows combinations of themes within a particular Action. The domain of interest to the wood science and technology groups across Europe is the Forests, their Products and Services (FPS). Forestry Research supports activities aiming at meeting the economic, environmental and social needs of present and future generations in a sustainable way. In the light of the current international forest dialogue the FPS domain offers a forum for encouraging a scientific debate on ensuring a sustainable provision of forest products and services, such as wood and wood products, water and soil protection, climate regulation, bioenergy, rural development, recreation and public health, habitats for wildlife, landscape diversity, carbon sinks and reservoirs. FPS currently has a total of 28 active Actions at the time of this conference.

WHAT COST ACTIONS ARE BEING UNDERTAKEN BY SP TECHNICAL RESEARCH INSTITUTE OF SWEDEN

As a result of ongoing research activities within SP Wood Technology that did not correspond with any ongoing COST Actions, a series of applications have led to the granting of three COST Actions within FPS.

COST FP1205: Innovative applications of regenerated wood cellulose fibres

Fibre demands for fabrics, textiles and nanomaterials are increasing worldwide – partly linked to the growing world population and partly due to the increase in material expectations of developing nations. However, the majority of fibres produced to meet current demands tend to be derived from plantations. This is putting a considerable strain on cultivated land. Approximately 17.3 million km^2 of land on earth is cultivated (about 11.6%). However approximately 10-20 million hectares of this is lost per year due to urbanisation. When combined with the growing population on earth, the amount of arable land per head of population is dropped from 4,400 m^2 in 1960 to an estimate of

1,700 m^2 projected in 2025. This places a dilemma on the farming communities – growing more food (the logical choice) or more non-food crops (e.g. for fibres). Thus, what appears to be a shortage of cellulosic fibrous materials at present is going to increase over the coming years, unless other sustainable sources from non-arable land can be developed.

Cellulose is by far the most abundant natural form of biomass, usually associated with plants and trees but can also be obtained from bacteria. Whilst common in conjunction with lignin and hemicelluloses in plants and trees, it is the purer cellulosic form, such as derived from cotton, which provides the textile industry and the emerging nanocellulose industries with the vast majority of their resources. Cellulose fibres are known to have good strength properties, relatively high stiffness, whilst being only of moderate density, due to the hollow nature of the fibre composition. Whilst naturally occurring fibres can have species specific or even growth specific properties, regenerated cellulose fibres will have a more uniform mechanical performance.

Cellulose nanofibres (whether derived from conventional agricultural resources or from timber sources) have a wide range of potential applications, and these are increasing. Since the first isolation of nanocellulose fibrils in the late 1970s, research has looked at a range of different uses for this versatile product, ranging from additives for the food industry (such as thickeners), pigments and fillers, for the coatings industries, whilst the aggregation of fibrils provides macroscopic fibres used in the pulp and paper and textile industries.

Since these first uses of nanocellulose, there has been considerable international research activity into their manufacture, with a range of terms now being used to describe the material produced, including nanowhiskers, nanocrystals, monocrystals, nanocrystallites, nanofibrils and microfibrillated cellulose. In the case of nanofibrils, there is usually a combination of crystalline and amorphous material present. A range of processing conditions is known to exist, whereby the use of mechanical homogenisation or chemical processing can yield different forms of nanocellulose. Each particular category has its own properties, so providing researchers with a wealth of material options for innovative products. The properties of nanocellulose and regenerated fibres can be further altered through the use of surface modification.

COST FP1303: Performance of bio-based building materials

It is recognised that the construction market is one of the major employment sectors across the European Union. It was estimated in 2008 that the sector provided direct employment to around 26 million jobs across the Union. This comprised approximately 75% construction enterprises (many of which were micro to medium sized enterprises), who combined generated a turnover of €1.6 trillion (approx 5 % of the EU-27 GDP in 2008). Whilst this sector has faced a significant downturn in activities and income due to the current economic downturn, there is a continued demand for new and/or improved housing. This is being further affected by increased awareness into resource efficiency and performance. This has led to a reconsideration of approaches to issues such as energy, climate change, impacts on natural resources (energy, water and materials) and public convenience and welfare (accessibility, safety, security, indoor air quality, etc.). Not only is this relevant to new building programmes but also to the

existing building stock (where the greatest levels of change may be achieved). This has led to an increased demand for sustainable construction.

The European Commission, through its "Ad-hoc Advisory Group for Bio-based Products" has undertaken a range of studies into the market potential of bio-based products. Its "Measures to promote the market introduction of innovative bio -based products" aims to encourage Green Public Procurement for bio-based products. Recent outputs from the task groups involved in developing measures to promote the market introduction of innovative bio -based products suggested that:

Preference should be given to bio -based products unless the products are not readily available on the market, the products are available only at excessive cost, or the products do not have an acceptable performance.

A key issue for the competitiveness of wood and other bio-based materials is the delivery of reliable components of controlled durability with minimum maintenance needs and life-cycle costs. The importance of service-life issues is reflected in the existing Construction Products Directive (CPD) which should be fulfilled by construction products during a 'reasonable service life'. This will be formally replaced by the Constructions Products Regulation (CPR) in 2013, which mirrors the requirements of CPD whilst also including sustainability.

Bio-based materials, and more specifically wood, are fundamental building materials for most of the nations across the globe. It has potential to be one of the truly lowest impact embodied energy materials for construction yet at the same time work to be able to predict and satisfy the performance of the products in service is lacking.

COST FP1404: Fire safe use of bio-based building products

Wood construction and bio-based building products have high market potential since they can provide carbon sinks, push regional production and decrease the embodied energy of building materials. During the last decade, the increased interest in sustainable products led to the development of a large range of products and solutions on the building market to satisfy customer needs including serviceability, sustainability and durability. Europe has achieved a leading position in construction with combustible building products and has a noticeable market share of multi-story timber buildings. However, markets in US and Canada are stimulated by such a success and have launched large research projects on feasibility studies of tall timber (>30 storey) buildings in urban areas to meet sustainability demand in the near future.

Renewable building products have the potential to replace partly or totally commonly used energy intensive building materials such as cement, etc. However, important requirements have to be fulfilled. As a very important issue the fire safety has to be addressed for any type of building product (EU Construction Product Regulation No 305/2011, CPR). Fire Safety of buildings is linked to the usage and geometry of the building, the type of construction element and its build-up as well as the type of material. Fire Safety is normally divided into (i) Fire Safety Engineering (FSE) covering fire safety of the whole building (or defined parts of it), (ii) Fire Resistance, dealing with the behaviour of load-bearing structural elements, and (iii) Reaction to fire, analysing the contribution of building materials to the fire development. Although these

working areas are very often covered by different professionals, they are markedly interrelated. Bio-based building products are organic materials which undergo decomposition processes when exposed to the heat of a fire. However, the interaction of the building materials, the composition, arrangement as well as protection of the building materials have all a significant effect on the speed of decomposition as well as their contribution to the overall fire development.

Fire safety in general and, more specifically, of bio-based building products is a very complex task requiring a multi-disciplinary approach involving different persons from different field of knowledge and practice such as structural engineers, material chemists, fire engineers, building physicist, etc. Due to the large differences in their approaches as well as regional influences solutions differ between countries and field of applications. Further, product developers and researchers tend to solve the issues related to fire safety within their own field of expertise despite the fact that solutions may be solved better using other strategies and collaborative research.

WHAT CAN COST ACTIONS OFFER?

Each COST Action is set up in a way to help promote research and cooperation. Each participating country nominates national experts who act as information providers to their country, ensuring widespread dissemination of information. As well as organising regular workshop conferences and specialised meeting on subjects related to ongoing activities, there are a range of activities aimed in particular at Early Stage researchers (persons who gained their PhD within 8 years), which include:

Training Schools – in order to provide up to date training by experts in a given subject, training schools are designed to allow groups of researchers (and in particular Early Stage Researchers) direct access to new methods, training in equipment and direct discussion with recognised world leaders in the subjects being taught. Typically 15-20 trainees are reimbursed at a course lasting a minimum of 3 days, up to a maximum of 2 weeks. Usually these training courses have between 3-5 experts present to assist in the training.

Short Term Scientific Missions (STSMs) – often researchers find at some point in their studies the need to access specialist equipment or the need to learn a new method of analysis. Each COST Action allocates reimbursements for several STSMs each year. Applications are relatively straightforward, in that a candidate has to provide a written plan of the work to be undertaken during the STSM and provide a letter of acceptance from the host institute should funding be granted. A candidate can come from any country that has signed up to the COST Action, going to any other country within that same Action. Each STSM can last from 5 days up to 3 months. Other than providing the candidate with access to specialist equipment and new techniques, the main aim of these STSMs is to result where possible in collaborative scientific publications. These missions could in turn lead to longer lasting research collaboration between European groups, or provide new research opportunities after current studies have been concluded.

Workshops, seminars and conferences – each Action aims to run at least two workshops or equivalent each year. Often these are run in conjunction with larger conferences or jointly with other COST Actions. This means there are a wide range of expertises

present at each event, where the emphasis is on direct access and open discussion between young researchers and international experts. Often these COST meetings can provide young researchers with their first experience of attending and presenting at a larger international event, and as such ESRs are actively encouraged to participate. Usually any person that has completed an STSM is invited to present their results at a workshop or Action conference.

Special grants for attending conferences – young researchers are encouraged to apply for travel grants to attend and present work related to their COST Action. Normally these travel grants are to conferences outside Europe.

CONCLUSIONS

COST represents a key component in the research strategy across Europe, providing valuable resources to be allocated in advancing collaboration in research areas. It also helps define many areas of research of development from previous framework programmes, and now towards Horizon 2020. Each Action provides a range of opportunities, whereby scientists (and especially Early Stage Researchers) can attend workshops, attend training schools and undertake specialist research linked to their postgraduate studies. SP Wood Technology has three Actions running and encourage young researchers to take full advantage of the opportunities within.

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