



## Foreword

Innovation and the movement from scientific discovery into development and eventually economic well-being is becoming a political imperative of growing importance, especially in the new 'knowledge-based' economies of this new century. This is not to say that this has not always been a key element in the overall scientific-political process for the past 200-300 years but the speed of knowledge transfer is increasing in an evermore globalising world.

Despite the long experience of this process, it is far from simple and often difficult to understand and to motivate. Perhaps the best way forward is by 'learning through sharing'. This is what ESF has attempted to do through its workshop series and related activities.

I hope that this ESF action has aided the learning process. It is something which will be with us for a long time and to which ESF will need to return in the future.

**Enric Banda**  
ESF Secretary General

## Introduction

In the context of the policies and politics of science and industry in recent years, "innovation" has become a jargon word with a special meaning narrower than both its dictionary definition and its everyday usage. It has come to refer to the novel application of knowledge and understanding for useful ends, as distinct from the discovery of the knowledge and understanding itself. Since it is widely held that Europe is less effective at innovation (in this sense) than discovery, and that this threatens performance in the new knowledge based economies, the scientific

community needs to consider its position on such issues – and indeed we are constantly exhorted to do so by Governments, Industry, and other commentators. Over the past two to three years, the ESF has endeavoured to promote this debate at the European level, especially to assist interactions between Member Organisations in their efforts to develop best practice. In particular, we have attempted to provide a means of comparing approaches to this rather complex activity. The ESF with its two sets of stakeholders, its Member Organisations (the research funding agencies and their analogues and academies of sciences from 23 countries) and its links to the European research community at large, is well based to bring people together to share experiences and consider how best to develop the partnership between research and risk finance. It was very much encouraged to do so by EUROHORCs, the European Heads of Research Councils.

Such discussions must have a theoretical dimension too, in attempting to understand and develop models for the synergies that ought to emerge between basic research and entrepreneurial industry. The so-called "linear model" is now widely discredited and research is generally perceived as a continuous spectrum, with "market pull" and "research push" both operating with complex feedbacks between them. Many of the most important research-based innovative developments started rather serendipitously in basic research, while others began with the identification of scientific barriers to practical progress. Since the key to better performance might well be in improved communication across the spectrum of different types of scientific, technical and commercial activity, the scientific community must improve its skills at recognising opportunities for innovation within basic research, and train people in the skills to exploit these opportunities.

More and more scientists are seeing that this brings its own rewards and satisfactions and the ESF workshops have been a contribution to facilitating this process.

ESF organised three workshops which have brought together people from funding agencies, research institutions and academies, the venture capital industry and those involved in developing incubators, people who have established their own companies, and the European Commission. These three workshops aimed at “learning by sharing experiences” and looked at the way research and innovation have developed in the different circumstances and conditions in several European countries and in North America and Israel. These workshops were:

- **Towards a partnership between research and risk finance**, Bonn, 15-16 December 1997, in cooperation with the Hermann-von-Helmholtz Gemeinschaft Deutscher Forschungszentren (HGF) and the European Venture Capital Association (EVCA)

- **Identifying and conceiving the infant venture**, Jülich, 2-3 December 1998, in cooperation with the Forschungszentrum Jülich and the Technologie-Zentrum Jülich

- **Nurturing the infant venture**, 5-6 May 1999, MRC Mill Hill and Heathrow, London, in cooperation with the UK Medical Research Council.

The first of the workshops recognised that the responsibility for encouraging and developing the process of moving research discoveries into innovation is increasingly falling to the research funding agencies and research institutions, especially the research institutes and universities where research is carried out. This may be described as the ‘pre-seed’ funding phase. It also recognised the need to encourage a far greater entrepreneurial attitude within the European research community, in comparison with that which exists in North America. Different countries in Europe had moved at different speeds in bringing about the conditions for entrepreneurialism in research and there were ‘European’ as well as ‘American’ approaches to the issue. In addition, it was reported by the European Venture Capital Association (EVCA) that, despite the availability of funding, the

European venture capital ‘industry’ is less involved in support of ‘high-tech’ ventures than its American counterpart, with only around 13% of funds going into ‘high-tech’ areas (1997 figures).

The second workshop looked at ways in which opportunities for innovation can be identified and the means whereby such opportunities may be commercialised. It recognised that the establishment of a company and the use of venture capital was not the only nor necessarily the best solution. Licensing of development or the further development of the research discovery in-house towards proof of principle for practical application also need to be considered as ways of exploiting discoveries. All avenues of exploitation and financing need to be investigated and the most appropriate one chosen, taking into account the ‘invention’ and its potential market and the ‘structural’ basis on which the invention can be exploited. The workshop also heard of schemes to develop entrepreneurship in young researchers and looked at whether entrepreneurs are “born rather than made” and whether the overall culture in Europe can be altered to encourage entrepreneurship. Various schemes for entrepreneurship training exist from the informal to the more formal, such as the UK scheme ‘Biotechnology –YES’.

The final workshop studied the way in which the gap between research and development could be bridged through cooperative action between research funders, researchers and companies. It also examined the different ways in which incubators may be developed, the role, rights and financing arrangements used by the funding agencies, the recruitment of staff for new enterprises and the experiences from Israel and the USA (especially the Small Business Initiative in Research – SBIR). The last named differed from the others in relation to the ownership of IPR, which is not retained by the US agency, while, in Europe, IPR ownership is an important issue to be considered in commercialising ‘inventions’.

All three workshops heard of a variety of national initiatives across Europe aimed at entrepreneurship and the encouragement of the exploitation of science-based

discoveries. These include ‘University Challenge’ in the UK, ‘BioRegio’ in Germany and changes in French law to encourage such developments. Together with EC actions in this area, all are to be welcomed as providing a new climate in which the research – innovation link can thrive.

## Conclusions and recommendations

The transfer of ideas from fundamental research to the market place (the ‘innovation’ process) is a complex activity and its success is based on many different factors. ‘Learning by sharing experiences’ is probably one of the most efficient ways of transferring know-how and should be encouraged at all levels and especially at the national, regional and European levels.

The strengthening of an entrepreneurial attitude within the European research community is very important even though the lack of ‘entrepreneurism’ has been a long-standing complaint within Europe for many decades.

Not only is the research community ‘risk-averse’ but such attitudes may also be found within the European risk finance industry which shows itself to be particularly ‘technology averse’ in comparison with its North American counterparts. This is despite the availability of funds in the market in Europe for ‘seed’ investment.

Lead times from ideas to the market place may vary considerably. In the software development field the process may be short while in other areas the process may be much slower. Frequently, the ‘innovation’ process may be dependent on developments in other disciplines or other factors and this may also slow the process down, as is the case with pharmaceuticals and similar products where field trials (especially clinical and toxicity trials) and approvals may impose lengthy lead times.

Identifying both discoveries suitable for exploitation and ways of exploitation is both a complicated and sensitive activity. It depends on key individuals who can not only recognise exploitability but who know the potential market. They will also be familiar with the best means of exploita-

tion, dependent on the discovery and the market. All methods from licensing to establishing a company with equity financing need to be examined. It should not be assumed that the most appropriate way of commercialising a discovery is always to create a company. All avenues should be investigated.

Bridging from discovery to innovation is a highly professional activity. Investing in the recruitment and development of such expertise is an important factor in the success of the overall process.

Experience from the USA shows that much of the ‘start-up’ activity is concentrated in relatively few major regions. This points to the importance of ‘local culture’ in which an understanding of the issues and the sharing of experiences is a major part of the entrepreneurial spirit.

Experiences described at the various workshops lead to the conclusion that entrepreneurs and advisers are ‘born not made’ although, as is usual with most ‘nature versus nurture’ issues, they are not mutually exclusive. Nevertheless, there is still a need for education of young scientists in terms of the requirements of commerce, so that those with entrepreneurial potential can recognise and exploit their science. The example of successful role models is probably one of the best incentives. However, the availability of training in business techniques needs to be extended and courses should be encouraged and fostered at all levels within Europe, tailored to local circumstances.

Normally, the example of a successful entrepreneurial culture is that of the United States of America. However, there are what might be called ‘European solutions’ which may help overcome the reluctance of Europe on researchers to move into exploitation. Assisting the ‘inventor’ to move more gradually into the market place, with appropriate returns to the host institution, is one way of bridging the worlds of more fundamental research and commerce. All methods of encouraging entrepreneurship need to be encouraged by Europe’s research agencies. Rewards to inventors and the host institutions are needed not only as incentives but also in generating ‘self-belief’ (“success breeds success”).

IPR and patents are important and complex issues. Many European funding agencies tend to retain IPR in order to receive a 'return on investment' and to 'control' the incentive scheme to their staff. It should be noted that the EC, within its Framework Programme, has a different approach in not retaining IPR and some research councils may also release IPR to grant-holding universities. In the case of the Small Business Initiative in Research (SBIR) scheme in the USA, the argument is that, if IPR is not retained, it is easier for the 'inventor' (the individual and/or their institution) to exploit discoveries, which in turn generates commercial success and tax revenues which may then re-cycle investment back into the research system. The success of this approach is predicated on the continuing commitment to investment in fundamental research – which is the case in the USA.

In terms of patenting, the situation in the EU is complex with 15+1 systems. A single unified approach is necessary. There is also a need to align the differing European and American regimes to provide a unified system which can both reward discoveries and encourage publication and dissemination. The current system in Europe leads to high cost and delay in patenting and must be reduced. Patenting is an expensive process and defending patents even more so. The first stage should not be an inhibitory factor in exploitation of discoveries. The recent European Council in Lisbon in March 2000 has recognised this problem and has set out a target for the introduction of a single European patent system.

'Incubators' may take many forms according to local circumstances. They may be purely commercial operations, they may be 'in-house' actions by the university or research institutions or a combination of the two. Perhaps the most difficult stage in the exploitation is that of funding the 'bridge' between research and development. It is here that partnership schemes and initiatives by national research funding agencies may be most significant and there are several good models to follow in Europe. In other words, there is a need for the investment of 'pre-seed' funding by appropriate research agencies, frequently, but not always, in partnership with the relevant industry. Incubators may also provide

administrative infrastructure and management advice as well as seed fund investment. Increasingly, such early stage investors, whether in incubators or more generally in the risk finance industry, demand the involvement of professional management expertise and this may be a difficult condition for the 'inventor' to accept. Again, successful role models show the wisdom of this approach. Advice is available and there are consultancies specialising in the recruitment of 'start-up' managers.

Finally, while ESF and its Member Organisations are enthusiastic in helping foster a greater entrepreneurial spirit in Europe, it must be recognised that the main return on fundamental research investment is long-term diffusion into the economy through knowledge and human resources transfer. There will always be opportunities for direct commercialisation of discoveries arising in fundamental research but the continuing health of Europe's economy (especially a knowledge-based economy) rests on a continuing investment in fundamental research at a comparable level to that in the USA.

ESF will maintain part of its web site (<http://www.esf.org>) dedicated to research and innovation. The contact details of participants in all the workshops are available from this site as well as selected presentations made during the course of the meetings. In addition, ESF wishes to encourage all those with an interest in promoting the innovation process and who wish to share experiences to do so through the Site and to develop it as an electronic 'coffee shop' for exchanging and advertising ideas and events.

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