The objectives of this workshop are to clarify the roles of industry and academia in software engineering research in Europe, to identify European-wide actions that the European Commission may approach, and to design a roadmap for the development of the software industry in Europe.

**Industry and Academia**

With regard to the first objective, it has been said that industry and academia should interact more often, with more intensity, and using better understood common grounds. We cannot disagree with this. However, we would like to emphasise what, in our experience, is one of the most important factors that usually contribute to the poor communication between these two worlds. Industry, by its very own nature, invests in research that hopefully will result in successful products; academia does not necessarily take this approach. This difference has a double effect. On the one hand, academia is often criticised by getting involved in research of arguable usefulness. On the other hand, industry is sometimes criticised by neglecting important areas of research that are not expected to result in short-term, benefit-reaping products.

It is evident that research agendas set by industry and academia in isolation would be different and highly misaligned. The only way to amend this is to give academia and industry different roles in the common endeavour of producing a single, coherent research agenda. Neither of these parties should be left alone to produce a complete plan, but their specialised efforts should be co-ordinated and integrated in an appropriate way. Since industry drives the economy, we suggest that it is industry who establishes what immediate and foreseeable needs there exist, and what timeframes are to be considered. Academia, in turn, should be responsible to integrate industry’s requirements into an overall plan, filling gaps, fixing imbalances and providing infrastructural research not directly usable by industry.

Letting industry alone (or academia alone, for that matter) decide Europe’s research agenda would be a serious and far-ranging error.

**European-Wide Actions**

With regard to the second objective, i.e. identifying European-wide actions that the European Commission may approach, we believe that there are two specific areas which should be considered. The first one refers to education, while the second one relates to helping small enterprises to prosper. Currently, education in software engineering is mainly provided by universities through undergraduate and postgraduate courses, as
well as via professional training in industry. The experience of a future software engineer that travels through such an educational path varies largely over time: undergraduate courses are usually highly theoretical, and their practical aspects are often toy-sized. Contact with real problems is negligible. Postgraduates sometimes have a day job, which can offer them an excellent opportunity to confront what they learn in the classroom with the “real world”. Finally, professionals working in industry keep learning, but do it from an extremely applied and pragmatic perspective, focussing so much on day-to-day problems that theory and foundational issues are very often forgotten. This, in turn, leads to the well known “old school” effect. So, in a few years in the life of a software engineer, the emphasis goes from excessive theory to excessive practice, passing through a possibly optimal point towards the middle. Given the fast pace at which software technology evolves, this situation means that most professionals will merely scratch the surface of any new technological development that may appear once they leave university, and a generation must pass before the new technologies are properly understood and applied in a productive context.

We believe that the European Commission should take the appropriate measures to achieve a better balanced educational path for software engineers, exposing students to real problems from as early as possible, and keeping theory and foundational issues present throughout the productive life of professionals.

With regard to the second aspect, i.e. helping small companies prosper, we must recall that the vast majority of software engineers in Europe work for small companies, and that most software companies in Europe are small or very small. At the same time, many of these companies are very short-lived, dying in the first two years of life. Sometimes, failure comes from unfeasible products or incorrect management, but some other times, failure comes from poor support to basic business issues such as cash flow or sales. These companies fail even when their product ideas are brilliant and their potential contribution to European innovation is large.

In order to promote innovation and support the continuity of the careers of incipient software professionals, we believe that the European Commission should take the necessary steps to constitute the supporting mechanisms that would allow start-up companies to benefit from institutional help. This does not necessarily involve giving them money, but rather information, contacts and a challenging and stimulating environment in which to thrive. Many universities have experimented with the idea of start-up hatcheries or incubators, sometimes with excellent results. It is important to bear in mind that, from the perspective of a start-up hatchery, a high success ratio (many surviving companies) is not necessarily good, since it may indicate that the risk being taken is too low; start-up hatcheries should take high risks in order to actively explore the innovation space widely and deeply.

Software Industry Roadmap

Our general perception is that the European software sector lacks infrastructural support for their engineering practices, having focussed too strongly on short-term developments and neglecting long-term strategy. A 21st-century roadmap must necessarily contemplate this, and include the appropriate infrastructure development aspects, without which European industry can only make very small improvements.
We have mentioned before that a balance between theory and practice in education is necessary; this is only one way to develop part of the necessary infrastructures. In addition, active research in often-neglected areas such as development methodologies and niche modelling techniques, while bearing significant risk, may result in dramatically improved software development capabilities for industry.

The roadmap should clarify that emerging ideas such as software factories, aspect-orientation and method engineering are not well understood enough as to be adopted by industry. Unfortunately, it is too common to see companies jumping on the bandwagon of every new technology that comes up, often with questionable long-term results. Emerging ideas like these must be first investigated and only be adopted by industry later, once they are properly understood and can be adequately exploited. This is not only a matter of time, but also of active dissemination of research outcomes, especially to technical and top managers.

Summary

We believe that the European software industry is in an excellent position to take substantial steps towards higher competitiveness and leadership in a not too distant future. In order to achieve this, the roles of academia and industry must be specialised and integrated as far as a common research agenda is concerned. Also, a better balanced educational path and the appropriate start-up support mechanisms must be put into place. Finally, infrastructural support for the software industry must be actively left to mature before it is adopted for production purposes.