

### 3 Research program

#### 3.1 General Description and Connections between the Individual Projects

The main agenda of EBIM is to foster insights into economic and social processes under consideration of their dynamic nature and the large relevance of (strategic) interaction effects. Important goals in this respect are the development and application of mathematical methods and concepts that allow to analyze rigorously such processes under the assumption that individuals act goal-oriented to best satisfy their needs and the fruitful application of such concepts in areas of large economic relevance. Whereas this is a continuation of the general agenda of the first EBIM funding period, the concrete research plan of the current proposal, although building on insights from the previous projects, is quite distinct. It focuses on two main theoretical issues and two main areas of economic application. From a theoretical perspective implementation in the presence of non-cooperative interaction is in the center of the proposed work, where particular attention is paid to the fact whether 'reasonable' mechanisms like suitably designed markets may be used for the implementation. Furthermore, the analysis of decision making under uncertainty in a dynamic and strategic context is a major challenge in the second EBIM period. Insights in these two areas can be exploited in many economic contexts. Within EBIM a strong emphasis will be on the understanding of processes and policies facilitating the formation of human capital. Furthermore, the consideration of the endogenous determination of neighborhood structures governing 'local' interaction is an important theme in this proposal. As will be made clear below, the basic approach pursued in EBIM is to rely in the economic analysis of these topics on a rigorous theoretical basis. The areas of concentration of work in the second EBIM period on the one hand represent recent developments in international scholarly work, where the interest in the understanding of social networks, human capital formation or implementation issues has flourished (see e.g. Goyal (2007), Aghion (2008), Hurwicz and Reiter (2006)). On the other hand, they build on the expertise of the involved researchers and the work carried out in the first EBIM period. The fact that several of the research areas indicated in the first EBIM proposal in the meantime have developed rapidly with a large number of recently published research papers (e.g. on networks economics) is an indication that the basic agenda of EBIM is addressing timely and relevant research questions in economics.

In order to highlight the connections between the individual projects planned for the second term of the EBIM IRTG we first provide a brief overview of the main research topics of the four individual projects. A more detailed description of the projects is provided in the next subsection. The first project 'Cooperative Games and Implementation of Cooperative Structures' focuses on conceptual foundations for the implementation aspect of the EBIM agenda. In particular, it is concerned with the question how cooperative solutions can be achieved in non-cooperative environments. In addition to relying on a traditional mechanism design approach the project will inquire under which circumstances cooperative solutions can be achieved as a market equilibrium of an appropriately designed market. Also the second project 'Ambiguity and Risk in Finance and Economics' is foundational in a sense that it develops new methods for dealing with decision makers' exposure to ambiguity and risk. On the one hand, it is planned to extend the foundations of non-expected utility theory and risk measures to dynamic contexts with ambiguity, on the other hand the properties of mean-variance-skewness utility functions and their relation to existing concepts of risk aversion are analyzed. In both cases applications of the conceptual work for decision problems in finance and economics will also be treated in the project. The third project 'Strategic Location Decisions: Spatial Distribution, Network Formation and Knowledge Flows' is based on the premise that in many circumstances firms are strongly affected by local interaction with their neighbors, where neighborhood might be determined in various senses. In particular, geographic proximity and neighborhood in a sense of belonging to the same network(s) is considered. For both cases characteristics of firm's optimal location decisions are studied in strategic and non-strategic settings, and the effect of the interplay of geographic and network-based neighborhood structures on location patterns is studied. These issues are treated in frameworks where knowledge flows between neighboring firms (e.g. due to local technological spillovers and R&D networks) crucially affect their success. Based on this the project aims to clarify the relationship between stable (equilibrium) outcomes and socially desirable location patterns and to examine the scope for intervention. The fourth project 'Government Intervention and Economic Dynamics' is concerned with the design and implementation of policies enhancing economic growth. Particular emphasis is put on ways the formation of human capital can be affected by different ways of financing educational expenses. A macroeconomic view is augmented by microeconomic analysis examining different financing schemes taking into account the involved risk and the asymmetry of information

concerning individual abilities. In addition the projects aims at characterizing incentive policies that induce socially optimal trajectories of the population size.

Although the different projects address questions in different areas of economics and analyze them at different levels of aggregation, they are based on common methodological denominators and they intend to shed light on a few common topical economic issues from different perspectives. From a methodological point of view all projects heavily rely on mathematical model building as a basis. They share a strong focus on the characterization of rational behavior in a dynamic context and, since individuals do not act in isolation, the interaction of economic agents plays a vital role in all projects. The EBIM projects also include a normative perspective that stresses the need for a sound understanding of what can be implemented by different types of policy and market interventions. The different projects aim to apply and extend decision-, game- and implementation-theoretic insights in order to meet challenges posed by several recent developments in economic analysis. One such development is the fast growing interest of economists and social scientists for the emergence of different types of networks and the characteristics of interactions governed by neighborhood structures. Local interaction structures and networks have already been the topic of one of the projects in the first funding period of EBIM, the current proposal builds on that and makes the study of emergence and stability of local interaction structures based on different types of neighborhood definitions a central theme that is addressed in several projects. A second main economic theme of the proposal is the analysis of the formation of human capital and its effects on economic success on a micro- and macroeconomic level. Human capital formation is arguably one of the central challenges faced by policy makers and managers in industrialized economies. The different EBIM projects aim to contribute to the ongoing debate on optimal human capital formation policies by addressing a number of complementary crucial issues, in particular the financing of human capital formation, the proliferation of knowledge exchange and the optimal use of the growth potential of human capital, using rigorous mathematical modeling and appropriately developed theoretical concepts. The different planned contributions on this topic also highlight how the theoretically oriented aspects of the agendas of the different projects can be fruitfully combined to deal with relevant economic problems. The consideration of the different aspects of human capital formation highlighted in the projects asks for concepts that allow to deal with uncertainty, network formation and implementation issues, all of which are on the EBIM agenda.

To make the relationship between the different projects more concrete, we provide a short discussion of different links between the individual projects :

*Project 3.2.1. - Project 3.2.2:* On the methodological level there is a close link via abstract non-additive set functions serving as a basis for modeling cooperative TU-games as well as for formalizing and analyzing risk measures.

*Project 3.2.1. - Project 3.2.3:* The general insights concerning implementation of cooperative solutions, in particular the subproject dealing with implementation of network structures, will provide a basis for the normative part of project 3.2.3. where the question is addressed how policy makers could intervene in order to foster the formation of socially desirable types of R&D networks.

*Project 3.2.1. - Project 3.2.4:* One issue raised in Project 3.2.1 is the simplification of implementing mechanisms, which seems to be necessary for successful policy implementation. Another crucial aspect is the enforcement of policies and effectivity of rules and procedures. This agenda has been forcefully propagated under the name "genuine implementation" by Hurwicz (1994) in the general context of economic and institutional design.

*Project 3.2.2. - Project 3.2.3:* Strategic (location) decisions are usually based on game models relying on von Neumann-Morgenstern utilities of agents. Alternative decision models necessarily have a crucial impact on strategic interactions and equilibria.

*Project 3.2.2. - Project 3.2.4:* An important research question in project 3.2.4. concerns the optimal way investment in human capital formation should be made. Crucial aspects of this investment problems are its dynamic nature and the uncertainty the investor faces with respect to the abilities of individuals for which funds might be spent. Project 3.2.2. deals with decision problems characterized by such properties and therefore will provide a valuable input for this project. On the other hand, the type of decision problems considered in project 3.2.2. might be influenced by the characteristics of problems arising in the framework of project 3.2.4.

*Project 3.2.3. - Project 3.2.4:* Both projects deal with aspects of human capital formation but pursue complementary approaches. Whereas the focus of project 3.2.4. is on the design of education financing schemes on an individual and macroscopic level, project 3.2.3. is concerned with the impact of firm's

location decisions on the intensity of exchange of knowledge between individuals. In that sense, project 3.2.3. contributes to a better understanding of the micro-processes leading to human capital formation. Furthermore, both projects are concerned with spatial aspects of economic activity.

## References

- AGHION, P. (2008), 'Higher Education and Innovation', *Perspektiven der Wirtschaftspolitik*, 9, 3, 28 - 45.
- GOYAL, S. (2007), *Connections: An Introduction to the Economics of Networks*, Princeton, Princeton University Press.
- HURWICZ, L. (1994), 'Economic design, adjustment processes, mechanisms, and institutions', *Review of Economic Design*, 1, 1-14.
- HURWICZ, L. AND S. REITER (2006), *Designing Economic Mechanisms*, New York, Cambridge University Press.