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**Author:** Holzmann, Thomas O.
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2 Background

In this chapter, matchmaking is introduced from different perspectives and gives an interdisciplinary overview of the research streams. The thesis consists of three scientific parts including six independent studies. Each chapter provides a separate literature review based on the necessary perspective for the study. In order to avoid redundancy, I waive a long literature review at this point and present our research agenda based on the editorial of our special issue in *Technology Analysis & Strategic Management* Journal.

Traditionally, matching theory belongs to neoclassical economics researching market transactions, market equilibrium and game theoretical situations (Roth & Sotomayor, 1990). Game theory is based on mathematical proof and probabilistic reasoning assuming rather fictive situations. In order to link theoretical modelling e.g. from game theory or market design (Roth, 2002) to real world problems, those problems have to be understood in detail first. In my study I follow the reasoning of market engineering and market design (Weinhardt, Holtmann, & Neumann, 2003). In order to develop suitable market mechanisms the requirements, the market structure, and the agents on the market have to be clearly analysed.

Therefore, my thesis is based on a process theory approach (Van de Ven, 2007) with socially constructed findings about the matching process on open innovation markets. I contribute to theory building with my work by getting engaged in real matching cases. Research on matching theory and market design may be inspired by my findings as shown in part V in this thesis, the same way as I was inspired by matching theory and market design for my research topic.
Matchmaking as interdisciplinary field

Inter-organizational cooperation is seen to further innovation in clusters (Porter, 2000), in networks (Powell et al., 1996), or for open innovation (Chesbrough, 2003). If this is the case, finding suitable partners for collaboration, matchmaking, is of strategic relevance.

Matchmaking is known for its complexity. Its challenges have been studied for the creation of strategic alliances (e.g. Doz, 1996; Mitsuhashi & Greve, 2009), of strategic joint ventures (e.g. Hacklin, Marxt, & Fahrni, 2006), and with a more operational focus, of supply chains (e.g. McCutcheon & Stuart, 2000) using supplier selection tools (e.g. Chan, 2003). Matchmaking has equally been studied for innovation: to find partners with ideas (e.g. Afuah & Tucci, 2012; Jeppesen & Molin, 2003), technologies (e.g. Mishra, Deshmukh, & Vrat, 2002; Phaal, Farrukh, & Probert, 2006; Shehabuddeen, Probert, & Phaal, 2006) or to find “lead-users” for new product development (Hippel, 1986). Across these diverse situations, a common pattern of intermediation has been observed as a dedicated service to address the challenges of the matching process (Howells, 2006), either as brokers (Hargadon & Sutton, 1997; Katzy & Crowston, 2008) or as online services (Galbraith & McAdam, 2013).

In the literature, the phenomenon of matchmaking has mainly been discussed from three theoretical perspectives (Table 2) as economic

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9 This chapter is based on the editorial of the special issue Holzmann, T., Sailer, K., Galbraith, B., & Katzy, B. R. 2014a. Matchmaking for open innovation—theoretical perspectives based on interaction, rather than transaction. Technology Analysis & Strategic Management, 26(6): 595-599.

This special issue is the result of an initial call for papers for a workshop about “matchmaking for collaborative innovation” at the ICE & IEEE ITMC Conference in The Hague, The Netherlands in June 2013 from which the open call for papers was developed. Selected presenters from the workshop were specially invited to submit their revised and extended versions for consideration. This special issue builds on two previous Technology Analysis & Strategic Management issues specializing on “Managing open innovation in current and emerging intermediaries in the technology transfer process” Galbraith, B., & McAdam, R. 2011. The promise and problem with open innovation. Technology Analysis & Strategic Management, 23(1): 1-6. and “The convergence of ICT, policy, intermediaries and society for technology transfer: evidence from European innovation projects” Galbraith, B., & McAdam, R. 2013. The convergence of ICT, policy, intermediaries and society for technology transfer: evidence from European innovation projects. Technology Analysis & Strategic Management, 25(3): 249-252.
market creation, as sociological network forming, and as a computational multi-criteria optimization process. From an economic perspective, matchmaking is approached with a focus on market transactions (e.g. Williamson, 1998) and the necessary market structures and settings to create optimal allocation of supply to demand (Spulber, 1996). Pricing in auctions or game theoretical negotiations are well known matching mechanisms. If uncertainty increases, real option pricing creates better matching results (Miller & Arikan, 2004). And if supply and demand dynamics distort market stability, the Diamond, Mortensen, Pissarides (DMP) Model explains better matchmaking results e.g. on job markets (Mortensen, 2011; Pissarides, 1985). The advantage of such economic pricing is the reduction of the matchmaking problem to a one-dimensional problem of finding the right price.

The recent advances of computer science enable more sophisticated matchmaking procedures through multi criteria optimization. The growing field of modular ICT applications in the Internet requires fast switching of servers to clients (Mowshowitz, 2002) for the execution of computational tasks, for which dedicated matchmaking algorithms are developed (e.g. Veit, 2003). Such automated routines are coordination mechanisms that allow for scoring or ranking of preferences with multiple criteria and are tools to automatically match and assign criteria or agents. Such optimization of matching processes is of interest to the economics of marriage as matchmaking on dating markets (Gale & Shapley, 1962), the matching of organ donors to patients (Roth, Sönmez, & Ünver, 2005), or emerging electricity markets in “smart” grids because these are inherently multi-dimensional matchmaking problems (Schnizler, Neumann, Veit, & Weinhardt, 2008), which are in practice increasingly facilitated through Web-platforms.

The study of the emergence of inter-organizational innovation partnerships adds interactions as a further dimension to matchmaking as the creation of social relationships between human and organizational actors and thus, the evolution of the partner networks (Ring & Van de Ven, 1994). Sociology focuses on relational and social interactions between actors and organisation theory (Conway, Jones, & Steward, 2001, p. 11), especially network theory helps to understand the social
ties between actors (Granovetter, 1983; Granovetter, 1973), the reason for and the emergence of collaboration and inter-organisational relationships, or the role of trust (Cropper, Ebers, Huxham, & Smith Ring, 2008).

<table>
<thead>
<tr>
<th>Perspective</th>
<th>Economics</th>
<th>Sociology</th>
<th>Computer Science</th>
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</thead>
<tbody>
<tr>
<td>Theory/field of application</td>
<td>Market microstructure, transaction costs, matching theory, two-sided markets</td>
<td>Organization sciences, network theory &amp; evolution</td>
<td>Multi-agent systems, matching algorithms, infrastructure</td>
</tr>
<tr>
<td>Units of Analysis</td>
<td>Transactions</td>
<td>Ties</td>
<td>Algorithms/source code (Computational)</td>
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<td></td>
<td>(Homo economicus) Agent</td>
<td>Actor</td>
<td>Agent</td>
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<tr>
<td>Input</td>
<td>Offers &amp; demands</td>
<td>Expectations &amp; intentions</td>
<td>Attributes &amp; dimensions</td>
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<tr>
<td>Matching output</td>
<td>Economic deals, equilibrium, resource allocation</td>
<td>Relationships</td>
<td>Assignments</td>
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<td>Mechanisms for coordination</td>
<td>Negotiations, auctions, pricing, real options</td>
<td>Social interactions, communication, trust</td>
<td>Algorithms, routines, scoring, ranking</td>
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Table 2: Theoretical perspectives on matchmaking.

The dissertation is based on pre-published articles discussing matchmaking for innovation at the cross road of summarized theoretical fields. The contributions are of conceptual nature and equally show underlying mechanisms for intermediation in open innovation contexts and how emerging innovation networks and market transactions for open innovation can be managed. Theoretical and practical implications are derived from my research agenda I have followed from October 2010 to September 2014.