Reflexive Innovation

On Innovation in Radicalized Modernity[1]

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1 Reflexive Innovation and Sociation Today: Definitions

Today, innovation as 'creative destruction' (Schumpeter 2003: 83) is becoming a social imperative that increasingly characterizes innovation societies far beyond their economies (Hutter et al., this volume). This development is accelerated through *reflexive innovations* that actors constitute in interactions drawing on modern institutions, systems of regulation, and the actors' capabilities. These specific conditions, both symbolic and material, influence which innovations are produced, advanced, and transformed and how this occurs, and these conditions themselves are again and again produced and reproduced in processes of innovation. In this essay, informed by structuration theory (Giddens 1984), I outline a practice-theoretical perspective of reflexive innovation as a defining feature of radically modern societies (cf. Giddens 1990a). I have systematically developed the concepts that underpin this perspective elsewhere (Windeler 2001, 2014). The present essay adopts an alternative perspective on innovation compared with established innovation research; it draws on Joseph Schumpeter but then addresses innovations in their relationship to society as being conveyed through social practices.

Since the 1960s, innovations have played an increasing role in shaping modern societies and have often been a topic of public and academic discourse, not least

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because prestigious universities and newly established research institutions have devoted attention to the issue (Fagerberg 2005; Godin 2012; Knoblauch, this volume). The prominent role of innovation is the source of the dynamics of renewal in modern societies: each individual innovation seems to be 'merely' a transition for other ones that are evolving. Everything is to be redone; everything seems improvable by innovation. Innovation becomes an imperative for action—even beyond the classic fields of business and science. Preserving the current state is relegated to the background, and what has been destroyed is suppressed (Erumban and Timmer 2012). As this takes its course, societies transform themselves into innovation societies, and innovation becomes a panacea for every socio-economic problem (Godin 2015: 7). This in turn focuses increased attention on innovations in politics, business, and society in general. The innovation imperative proves quite robust, while innovations themselves are not at issue even if they contribute, for instance, to financial, energy, and environmental crises. But innovations do not simply evolve on their own. To understand which ones are currently being generated, and how this happens and why, one needs an understanding of innovation that presupposes an understanding of innovation societies since innovations are recursively constituted on the basis of given social conditions.

Establishing such an understanding is, however, easier said than done, given that sociation in present-day society tends to be difficult to grasp and the concept of innovation has been at risk of completely losing its distinctiveness for some time now (ibid.). If we refuse to simply surrender to this diagnosis, a look at the perspectives that dominate the literature is of little avail. My approach to tackling this problem is inspired by Joseph Schumpeter's (2000: 51f.) famous definition of innovation as new combination of already existing resources, materials or means of production. I ask, how can innovations be explained in societal contexts?

Let us start with Schumpeter's social-philosophical sketch of a research program in which he defines the core of innovation in this way:

> The change [that identifies an innovation] *transmuting one imprinted form into another one* must represent a crack, a jerk, a leap […]. When starting from the old form, the new one must *not* be reachable by adaptation in small steps (Schumpeter 2005: 113, first emphasis A.W.).

With Joseph Schumpeter, the theoretical problem of innovation research can be formulated as follows: How can the transfer of one imprinted form into another be explained? He himself did not succeed in finding an answer to this question in his lifetime. As Markus C. Becker, Thorbjørn Knudsen, and James G. March (2006: 357) have argued, Schumpeter

> was never able to link his typology of new combinations to an understanding of the processes generating novelty. Thus, although Schumpeter saw combinations as involved in novelty, he found it difficult to provide any description of an inheritance mechanism that is any more precise than the word 'combination'.

Not that Schumpeter (2005) did not try. He made a total of three attempts, though he himself discarded them as inadequate. He tried to explain innovation through the entrepreneur's personality, through the depersonalized entrepreneurial function, and with reference to evolutionary theory. His verdict was that rationally and scientifically, "the *triad* 'indeterminacy, novelty, leap' remains unconquerable all the same" (ibid.: 117). At the end of his manuscript, however, he calls for further elaborating the aforementioned *triad*: "I think it is more correct to speak of a new task" (ibid.: 118).

I take up this task from a practice-theoretical perspective. In so doing, I follow Schumpeter more than just a little but then take a different route. I share his view that innovation addresses the transfer of 'imprinted forms into others', and that the problem of explaining innovations is not only one of imperfectly mastering the facts but rather refers to the theoretical inclusion of the *triad* that he mentions:

> To many, it will seem obvious to say that the 'in-explicability' of development [that means: of innovation] sketched above might perhaps just be an effect of the imperfect mastering of the facts, and will disappear with its perfection. Such an interpretation has obvious support, due to the fact that the better we master a state and the apprehensible factors of change, the sooner we develop an idea of things to come. Unfortunately, you do not reach the essence of the matter in this way (ibid.: 117).

What Schumpeter means by the 'essence of the matter' is that innovation—the leap from one imprinted form into another one that he diagnosed—cannot be deduced and remains *unforeseeable* (see also Ortmann 2016). This is highly plausible because it seems true for an astounding number of things in modern life: many things are created by someone stumbling upon something or 'accidents' happening (Kennedy 2016). But even if innovations are developed along innovation paths, their fundamental unpredictability may be reduced but cannot be completely eliminated (for a discussion of innovation paths, see, e.g., Garud and Karnøe 2001; U. Meyer 2016; Sydow et al. 2012; Windeler 2003). At the same time, it is important to note that even fortunate coincidences must be noticed and unexpected discoveries made. From a practice-theoretical perspective, serendipity cannot simply be reduced to discovery. What is needed for something to be discovered (and to be susceptible to discovery in the first place) is people's perspicacity, cleverness, at-

tention, and activities as well as—often overlooked—social contexts that enable or even trigger discovery (Merton and Barber 2004). And grounded in this insight is the fact that innovations are not simply discovered but need to be constituted in social practices.

This shifts the focus to ways of understanding and analyzing innovations. And here there are alternatives to the ways by which both Schumpeter and the dominant practice of innovation research have approached the subject matter. The alternative presented here is the practice-theoretical approach that I propose and will discuss in more detail below.

Three paradigms characterize innovation research today: the paradigms of 'creation,' 'evolution,' and 'structure or institution.' Whereas some emphasize the role of artistic or technical ingenuity in creating the new—or, as Joseph Schumpeter initially did, the significance of entrepreneurs with certain character traits—others highlight the importance of mutations, emergence, coincidences, poor imitations, and the like—as Schumpeter did attempt to devise more generally (Becker and Knudsen 2002; Rammert 2014: 628f.; Windeler 2003). The literature on national innovation systems, by contrast, primarily has stressed structures and institutions, neglecting the actors' agency, whereas that on entrepreneurship—committed to the creation paradigm—has failed to consider structures and institutions and has concentrated on agency, of individuals and collectives (e.g., teams and organizations like start-ups; Autio et al. 2014; Zahra, Wright, and Abdelgawad 2014). What unites such analytical approaches are the basic paradigmatic assumptions regarding structure and actors deeply engrained within them. In this regard, I agree with the general objection formulated by Anthony Giddens:

> Explicitly or otherwise, such authors have tended to see in structural constraint a source of causation more or less equivalent to the operation of impersonal causal forces in nature. The range of 'free action' which agents have is restricted, as it were, by external forces that set strict limits to what they can achieve. The more that structural constraint is associated with a natural science model, paradoxically, the freer the agent appears […]. The structural properties of social systems, in other words, are like the walls of a room from which an individual cannot escape but inside which he or she is able to move around at whim. Structuration theory replaces this view with one which holds that structure is implicated in that very 'freedom of action' which is treated as residual and unexplicated category in the various forms of 'structural sociology' (Giddens 1984: 174).

In the practice-theoretical perspective proposed here—in contrast to what structural, evolutionary, and institutional theories suggest—social requirements in the form of structures, structural features, and mechanisms are neither fixed and ex-

ternally given nor forces that compel actors to act. Instead, they are *implicated* in acting and *restrict and enable* it at the same time when actors endogenize them in acting while drawing on the customary procedures and techniques used in applying requirements. Their latitude or 'freedom to innovate' is thus not simply externally given but recursively constituted on a recurrent basis by the actors in interactions. From this perspective, however, actors do *not* have the degree of freedom to act that structural, evolutionary, and institutional theories accord to them. Actors *cannot* (within the framework of given constraints) act more or less at will, for instance, *arbitrarily declaring something an innovation*; instead, their action is oriented by rules and resources that are activated in interaction and that indicate to them what one is expected to do in this context. Overall, this means that neither what actors do nor institutions, structures, and structural features can be seen as residual and not requiring further explanation.[2]

This raises the question of whether there are possibilities to overcome the deficits of established innovation research? I think there are. What I propose is at least a *shift in perspective* on innovation. This proposed shift places the focus on *social practices*—meaning regularized types of action or ongoing series of 'practical activities' (Giddens 1993: 81)—without losing sight of the institutions, structures, and actors involved, but also without according any one entity the central role per se, as is usually the case. As I show below, the practice-theoretical perspective considers innovation as something that is actively brought into the world, even if the results are not intended and at least to some extent elude planning and control. This is so because innovation is a social and therefore socially embedded process that is recursively produced and reproduced by actors under given circumstances, although not of their choosing, on which they nevertheless have some degree of influence. The practice-theoretical approach pursued here leads to a specific concept of innovation that differs fundamentally from the established understandings in at least seven aspects that I will discuss below and provides an analytical perspective that correlates with this concept, which I will outline thereafter.

First, the practice-theoretical perspective offers an alternative understanding of innovation compared to established innovation research by *decentering the subject* without completely departing from it. Actors (such as individuals or organizations) come to be viewed as agents who situationally produce and reproduce innovations

2 Even if given conditions have a certain 'objectivity' for individual actors, these conditions do not determine their actions, though they limit the range of options (Giddens 1984: 177), and rules and resources indicate to them how these are to be used appropriately. And if actors cannot resist social conditions and forces, this is always also because of their motives and the goals that they are pursuing (ibid: 178).

as innovations in interactions incorporating social practices (based on the rules and resources embedded in them). It is not only the subject that is decentered in this understanding of innovation. Innovation is specifically not addressed as the result of individual action alone, as the creativity paradigm would have it, nor is it viewed as something in which actors are negligible, as the evolutionary, structural, and institutional paradigms suggest. And what is at least as significant, the practice-theoretical approach offers an alternative understanding of innovation to that proposed by Joseph Schumpeter and a large part of innovation research. Innovation is understood as the transfer of one imprinted form into another one, constituted *as* innovation *in social interactions by knowledgeable agents referring to social practices*.

Second, this practice-theoretical perspective distinguishes between means of action and innovation. It assigns great significance to the means of action for innovation. This is so especially because a certain potential to cause, enhance, or prevent innovation as well as a certain performativity (Muniesa 2014) is inherent to such means.[3] At the same time, this perspective *decenters* the *social significance* of such means. It is perhaps surprising that this is entirely in line with Schumpeter (1934). For him, although an entrepreneur innovates by means of new or newly combined resources, materials, or means of production, the artifacts—or rather the means of action[4]—do not themselves transfer one imprinted form into another one. They can be results or moments of innovation processes, no more and no less. This understanding of means of action enables a closer focus on their significance, depending on their uses and on the characteristics of the types of innovation.

Third, this brings us to a new view of the *production and reproduction of innovations*. From a practice-theoretical perspective, actors constitute innovations as innovations in processes of interaction. Innovations thus *exist*, are present in time-space, *only in the form in which they are instantiated* and *coordinated* as *memory traces in social interactions*. Actors can focus on and advance an innovation. But determining from which point in time onward a change is to be considered an innovation or whether something that already exists must still be considered an

3 The means of action can trigger innovation even if they are not used, as illustrated by the example of the atomic bomb, which, although currently not in use, continues to initiate 'innovations in warfare' (Eden 2004).

4 I am using the concept of means of action and not the conventional, yet insufficiently defined, concept of 'artifact' commonly referred to in the innovation literature (e.g., Braun-Thürmann 2005: 6). In so doing, I am trying to avoid associations with Aristoteles' definition of the artifact, which considers artifacts as a means made for a certain purpose and explicitly presumes a maker or an author or a group of authors (Hilpinen 2011).

innovation—or still this *particular* innovation—is the product of recurrent interaction. An innovation is thus *neither* based only on the *perception of individuals nor* can it *be determined independently of how it is used and evaluated*. Thus this understanding differs from that of Schumpeter, who seems to assume precisely that when he states that "When starting from the old form, the new one must *not* be reachable by adaptation in small steps" (Schumpeter 2005: 113) or, in earlier work, claims that one can speak of an innovation in the modern economy when entrepreneurs "have employed existing means of production differently, more appropriately, more advantageously. [When] [t]hey have 'carried out new combinations'" (Schumpeter 1934: 132). From a practice-theoretical perspective, actors continuously produce and reproduce novelties as innovations (or refrain from doing so) by, for instance, producing and reproducing in their social practices a new product, method, or behavior as an innovation. This also implies that innovations do not always yield positive results, as Schumpeter assumes; they are therefore also not always desirable per se; they by no means always lead to more appropriate or more advantageous combinations of resources, materials, or means of production, although this may sometimes be the case. Furthermore, assessments of innovations often vary among actors depending on the individual situation. For the assessments themselves, it should be noted that the forms and criteria of valuation and evaluation (Lamont 2012) are also socially constituted. This being the case, they can turn out differently depending on context, varying, for instance, with the practices and criteria of relevant professional groups in the respective areas of activity.[5] It comes as no surprise that advocates and footdraggers, winners and losers certainly do not assess innovations nor the associated comparative advantages in the same way, be they economic or related to social prestige, the satisfaction of needs or something else (see also Rogers 2003: 15). And they not only diverge in their assessments but also in their ability to assert their positions. Actors thus recursively declare changes in form in the respective contexts to be innovations and apply their own individual assessments accordingly.[6] However, if the declaration of

5 The degree of novelty of the innovation and the means can vary, as well as the degree to which they are seen as things with which one can do things in a new way. Some novelties—such as organizations—make an imprint on entire eras of society, while others vanish again quite rapidly (such as, for instance, the Discman, which was once an innovative practice of music reception; see also Oudheusden et al. 2015; Tavassoli and Karlsson, 2015).

6 The possibility to declare something an innovation is constitutive of the innovation. That does not preclude that the declaration itself resembles more than 'innovation dust' (U. Meyer 2016) and simply varies what is known or even pretends that what is familiar is brand new, just as long as the accompanying claim that something is an

a change as an innovation is to attain social relevance, it must prove itself as such in social practices.

Fourth, this also entails a different understanding of the *diffusion of innovations*: innovations are not completed by the first act of the 'transfer of one imprinted form into another one', as traditionally assumed in the footsteps of Schumpeter (Fagerberg 2005). The idea of the diffusion of a *given* innovation that is possibly deviated from, which goes back to Everett Rogers (2003: 17), is replaced by a conception of diffusion as an *ongoing social production and reproduction of innovation*, during which both that which remains the same and that which changes are recursively produced, sustained, or possibly altered. Innovations, and the means of action and meanings with which they are associated, thus always have their own history and cannot be understood independently of it.

Fifth, another component of the practice-theoretical perspective on innovation involves the *embedding and embeddedness* of *innovations* in *ensembles of social practices*. As actors recursively construct innovations by drawing on social practices, they are always entangled in several social practices at once—and potentially in a variety of ways. Ensembles of social practices—which, besides practices of organized exploration and experimentation, can include many others, such as routines—are gaining significance for innovations and their extension in time and distanciation in space, depending on what is generated as an innovation, what means are required to do so, and which activities have been undertaken (Dodgson 2011). The network connections involved here among actors who are linked with each other by means of social practices, a connectedness that is mostly positively connoted in 'relational sociology' (Emirbayer 1997), can be highly ambivalent, es-

innovation is recognized as such in social practices. The declaration of something as an innovation is always accompanied by socially determined assignments of value and practices of evaluation (Antal, Hutter, and Stark 2015; Lamont 2012; Rammert 2014). Yet not all innovations are subject to discursive disputes; for instance, the use of the atomic bomb was not debated in this way, and other things—such as the changes in the form of traveling associated with rolling suitcases—are barely discussed or not discussed at all (I owe this juxtaposition to Raimund Hasse). In any case, innovations are always also based on more or less explicit attributions of meaning and evaluations that in turn are based on predetermined practices of declaration. In the process, what is new for some actors can be familiar to others. This is because, as James March and Herbert Simon already stated some time ago for organizations, "most innovations in an organization are a result of borrowing rather than invention" (March and Simon 1993: 209). Their statement also describes the mechanism by which perception and utilization of skills, developments, and means gain significance for innovations (Cohen and Levinthal 1990).

pecially for innovations.[7] Besides the often-proclaimed advantages, problems can also arise, for instance, information that is crucial to a business might be leaked to a competitor (Pahnke et al. 2015). Embedding innovations in ensembles of social practices means, furthermore, that innovations can influence, pave the way for, or trigger bundles and series of (other) innovations. Whether and to what extent existing innovations increase opportunities for others to come (Clausen et al. 2011) is just as relevant a question as how innovations mutually interact, that is, how they become part of, advance, displace, or generate other innovations—without it always being immediately clear or even unambiguously determinable who creates what or where the borderlines are between these processes. Innovations thus always construct both *continuities* and *changes in the hitherto customary.*

Sixth, innovations not only have a certain duration and spatial distribution; they also have *their time and their place while they contribute to creating them*. For example, innovations utilizing smartphones or mobile application software (apps) presuppose the existence of capital that is continuously on a quest for new, exploitable ideas, as well as the existence of the Web as a virtual 'place' for almost any form of transaction.

Seventh, innovations are *powerfully* produced and reproduced. Complex innovations in particular are prototypical examples of this. If one follows David Yoffie and Michael Cusumano (2015), for example, the success of the world's leading technology companies—Microsoft, Apple, and Intel—is based not least on the fact that they are capable of creating cross-industry platforms and ecosystems that en-

7 Exponents of structural network analysis have attributed networks of social relationships great significance for innovations and their diffusion. Mark Granovetter, for instance, emphasized 'weak ties' (Granovetter 1973, 1974) and Ronald Burt 'structural holes' (Burt 1992, 2005). Michel Ferrary and Mark Granovetter (2009) linked the robustness of the Silicon Valley innovation cluster first and foremost to venture capitalists and their connections with other actors. Yet actors of a 'clique' (with strong relationships among themselves) can under no circumstances ensure that all information flows in the same fashion. Information flow depends on what is at issue and which activities are linked (or not linked) with which practices in which ways. Moreover, not all actors are equally in the position of being able to actually articulate or use information in networks of relationships, precisely because networks of relationships feature these structural characteristics (Windeler 2001: 118ff.). Organizations, for instance, may be incapable of absorbing external ideas in spite of maintaining external relationships. The 'not invented here' syndrome is an example of this (Cohen and Levinthal 1990: 133). One can add to this networks of relationships among components (as in the case of technologies, for instance) that combine with the skills and abilities of actors and with space (Carlsson et al. 2002), as well as reflections on the performativity of networks (Healy 2015) or problems of developing appropriate indicators (Nelson et al. 2014).

able other producers to create products and services on the basis of an established technology that (other) actors can then appropriate as innovations. Michel Ferrary and Mark Granovetter (2009) report something similar when they show how venture capitalists together with other enterprises again and again pave the way for innovations in Silicon Valley in a controlled fashion. Occasionally, even national regulatory frameworks are revised or sites created, such as consortia, conference series, and the like, to enable innovations (Belt and Rip 1987; Schubert, Sydow, and Windeler 2013; Sydow et al. 2012). That said, innovations can yield results that even run counter to the interests of those who operate them. Furthermore, it is by no means always agreed who is able to appropriate the results (Dedrick, Kraemer, and Linden 2009). As a general rule, *innovations are* thus *contested* and accompanied by disputes. But this also applies more generally: "New ways threaten the old and those who are wedded to the old may prove highly intolerant" (Gardner 1981: 32)—and often for quite convincing reasons (Adner and Snow 2010; Ortmann et al. 1990). Nonetheless, innovations can also spread virtually unnoticed, as we see in the rolling suitcase example. Moreover, intended innovations can fail for a variety of reasons. Besides conflicts over (potential) consequences and ideologies, innovations can—as regards their performance and acceptance—fall far short of expectations or require capabilities that do not sufficiently exist. It is also true that "[i]f there is too much hype at the discovery stage and the product doesn't live up to the hype, that's one way of its becoming disappointing and abandoned, eventually" (Colapinto 2014: 18). Furthermore, the development of means that are constitutive for innovations can be unsuccessful or forbidden, their use even banned—as the example of the atom bomb teaches us. But innovations can also fail for entirely different reasons, as the 'not invented here' syndrome shows.

Drawing on the considerations above, I will define the practice-theoretical concept of innovation as follows: *innovation* is a change that social actors reflexively and recurrently produce and reproduce as a transfer of one imprinted form into another by drawing on social practices in their interactions. In innovation processes, social actors thus not only modify established forms. They reflexively and recurrently transmute imprinted forms into another in a particular manner. They create 'new' forms and destroy imprinted ones in socially proved ways. For social actors in innovation processes not only create, advance, and in some cases alter the mentioned transfer; in each case they also prove (and have to prove) the respective transfer as an innovation in social practices. In this way the constitution of innovations is intertwined with changes in social practices or even the production of new forms of activities in a particular context—that social actors view as outside the range of existing ones—that, in turn, influence the further constitution of innovations in time and space. In principle, anything to which an imprinted form

can be attributed can be innovated—to whatever extent intended.[8] This applies, for instance, to objects, methods, procedures, regulations, forms of coordination (such as those characteristic of markets, organizations, or networks), and resource mobilization as well as to forms of signification, legitimation, and domination, types of capabilities, action fields, all the way to modes of sociation. Yet out of the sheer endless array of things that could be innovated only a selection actually become subject to innovation.[9]

To understand the social constitution of innovations and particularly that of innovations with a certain degree of complexity—one needs an analytical perspective that is able to include in the analysis institutional and structural requirements, regulations of social systems, and the capabilities of the actors involved to explain more exactly how innovations embedded in social contexts are produced

8 I am skeptical about the widely held assumption that, behind an innovation, there is always the intention of an actor or a group of actors to create an innovation (Godin 2015: 235). Not only do the participating actors differ, they also pursue different intentions. Furthermore, these innovations are occasionally put to uses that are quite different from what they were originally intended for, often producing effects that no one had considered (Gould and Vrba 1982; Villani et al. 2007). And for the actors it is often primarily about something other than innovations, such as economic, political, or other interests. Innovations can thus also be the unintended, unanticipated, or simultaneous result of actions otherwise motivated.

9 An example might illustrate what I mean when speaking of the highly selective realization of innovations. Our semiconductor study investigated innovation in the technology to manufacture computer chips (Sydow et al. 2012). In 2000, six alternative technological options were under discussion in this field of innovation. At the same time, people in the field agreed that for economic reasons there could be only one solution for the mass production of computer chips around the world. What is most interesting is how these options were narrowed down to that one solution. To make a complex story short, besides technical criteria regarding the feasibility and maturity of the technological alternatives, the globally leading researchers, employees of the corporations involved (such as Intel), system suppliers (such as ASML and Canon), and politicians included professional, economic, and political criteria in their assessments. The criteria were fed into a highly organized process of technology innovation on a global scale. A toolbox consisting of both field-specific and cross-cutting instruments and organizational arrangements was used to assess and coordinate collaboration in research and development as well as financing and manufacturing. This toolbox included (1) roadmaps for continuous planning, (2) conferences to exchange ideas, create shared viewpoints and means of legitimation, as well as establish agreement on collaborative research and political projects and survey and coordination tools, and (3) consortia such as SEMATECH (Lange et al. 2013; Schubert et al. 2013).

and reproduced than Schumpeter and many other innovation studies do.[10] Below I will present a practice-theoretical analytical framework that is informed by Anthony Giddens's structuration theory. The constitution of innovations is presented as a process that competent actors constitute by drawing on social practices; the interactions that they engage in reflect social institutions and regulations of social systems such as organizations (on this, see Figure 1 below). In Sections 2 to 4, I conceive of innovation societies as radically modern societies that are characterized at the level of social institutions by the modern principle of reflexivity, by the ensembles of driving forces of modern societies, and by sets of institutionalized positions. As further specifics of the social constitution of innovation in innovation societies, I highlight the general specifications of the conditions and the skills of the actors involved, which are shaped primarily by organizations, networks, and the fields of innovation. The specifics of the concrete issues of innovation I will not discuss further in this essay. Section 2 starts with *modern institutions*. Section 3 then discusses *structures* of social practices and the *skills of the parties involved*. Section 4 addresses the *regulation of social systems*, and Section 5 concludes with an outlook on *implications for innovation research* and the *development of the innovation society today.*

2 Reflexive Innovation and Institutions

In showing that creative destruction is an inherent feature of capitalist sociation, Schumpeter (2003) attributed significance to social context in the constitution of innovation. However, this insight is usually lacking in contemporary innovation

10 Innovations in the cultural sphere, for instance, address changed forms of signification that are used as innovations in social practices. In the political and economic sphere, innovations address changes in the form of domination that are utilized as innovations in social practices. In the political sphere, innovations principally pertain to changes in forms of shaping social time-spaces, the production and reproduction of bodies, associations of people, and life opportunities. In business, the issue is primarily about changes in forms of the power of disposition, in forms of use of the means of production (such as raw materials, the tools of production, and technologies), and in forms of the production and use of goods and services. In the field of law—for instance, in the context of prosecution or jurisprudence—innovations affect the transfer of the ingrained ways of making judgements and providing legitimation into other ways of doing so that are used as innovations in social practices (Giddens 1984: 33, 258). Innovations can, however, also combine references to different spheres of society and, in so doing, feature different points of reference (for the latter aspect, see also Rammert 2014 as well as Section 2.2 below).

studies. To understand innovation societies as contexts of reflexive innovation, I propose to choose a more general point of departure than Schumpeter did. Innovation societies today can be understood as radically modern societies, as societies characterized by the *modern principle of reflexivity* (Section 2.1). As radically modern societies, innovation societies are, contrary to Schumpeter's assumption, societies in which *capitalist economization* pervades not just the economy but all fields of action; together with *industrialization and rationalization*, it forms an integrated ensemble that acts as a driver of modern sociation (Section 2.2). Moreover, even in the process of innovation in the economy, it is not only entrepreneurs who play significant roles, as Schumpeter suggests. Rather, a number of different actors, embedded in ensembles, now assume institutional positions in innovation processes, among them also entrepreneurs in some areas (Section 2.3). My broader argument is that if we want to understand how innovations shape innovation societies today and are in turn shaped by them, we need to develop an understanding of the principles, drivers, and networks of positions presented in the next sections.

2.1 Reflexivity as a Principle of Modern Sociation and Innovation

Today, reflexivity is an institutional feature of modern societies and the innovations that they generate. By making this determination, I draw on a thought by Giddens (1990a), who contrasts the form of *reflexivity* observed in the modern era with traditional forms of sociation. Reflexivity is thus *not* an invention of modernity, but it develops a specific form in it:

> The reflexivity of modern social life consists in the fact that social practices are constantly examined and reformed in the light of incoming information about those very practices, thus constitutively altering their character (ibid.: 38).

What is special about the *modern principle of reflexivity* becomes apparent by contrasting it with traditional reflexivity. When actors act traditionally, they monitor, rationalize, and motivate their own actions and those of others as well as occurrences in terms of whether they provide a legitimate contribution to sustaining traditions or changing them in the spirit of these traditions. Exemplarily, Augustine's aphorism "Do not seek to understand in order to believe, but believe that thou mayest understand" refers to traditional actions. This is because he not only ties human knowledge and insight to faith but also sees the purpose of life in living in accordance with faith. In the modern era, this is completely different. The

modern imperative is to *act in light of ever new information about social practices and how they might be organized differently*. Actors—just as observers—are thus called upon to act without protection by some higher order (such as religions) and on the basis of forms of order created by people (which can be potentially revised). The empirical validity of a reflexive order presumes actors who engage in reflexive action, who at least implicitly recognize these orders de facto, and who assume that they can procure suitable information if they wish to do so and that such information tends to provide an appropriate foundation for their involvement in events, activities, and relationships. We will discuss this in more detail shortly.

To say that actors act reflexively does *not necessarily* imply that they have a more comprehensive understanding of social issues or that all changes—including innovations—are equally likely. Actors always take into account only what they are paying attention to—and this is not independent of the actors' abilities and the conditions governing their actions. Moreover, they give meaning to what selectively occupies their attention in quite different ways as they recursively create, advance, and possibly change situations, circumstances, processes, and so on in the course of their actions. The information used in acting is anything but neutral simply because it is always *selectively* produced and reproduced—sometimes to a very high degree, for instance, in organizations. What is also crucial is that a large portion of the capacity to act is at the level of *practical skills*. Actors may know how one is expected to act under given conditions and show their understanding in their activities but may not necessarily be able to explain in detail why it is necessary to do so in this way under these circumstances. There is always much that actors do not grasp even to slightest extent and definitely not in depth—particularly under the conditions of radical modernity. The information and knowledge that actors use today, not least in innovation processes, necessarily require, for instance, expert knowledge that they for the most part cannot control independently. Modern-day actors are nevertheless expected to act competently; they are assumed to know how to exchange goods and services impersonally, work in teams, use airplanes, or live in high-rise buildings, and so on, and particularly how to collaborate with others to produce and reproduce innovations. That they do not know how all this works in detail does not mean that they do not act on the basis of their understanding and knowledge and express this in their activities. Further on, it does not exclude that they can give reasons why they do what they do, or did what they did, in a certain way and not differently. Their ability to do what they do presupposes confidence in, for instance, ensembles of technological achievements, expert knowledge, and (other) people (Giddens 1990a); it is furthermore based on practical knowledge and some degree of control (Sydow and Windeler 2003). From this it follows that it is interesting to whom or what actors in innovation processes pay attention, what

they focus on, and in which way and why, and whether this produces, advances, or paves the way for (or impedes) alternatives, the new, and innovations (on reflexivity, see also the essay by Hubert Knoblauch in this volume).

Although contexts of action today continue to display different combinations of both modern and traditional conditions, and people certainly do not always act only in ways that qualify as modern, the modern principle of reflexivity is even further radicalized in the era of *reflexive modernity*. The social world is now more generally scrutinized and (re-)configured under the spotlight of a continuous stream of ever new information; the practices of valuation and evaluation themselves are also increasingly designed in a reflexive way. Exploring, testing, and experimenting while taking contexts and means of action into account that are different from those that are known and likewise making use of different capabilities than those that are usually employed becomes a permanent state. Actors are now increasingly required to act in a modern way and, in so doing, take practices of reflexive valuation and evaluation into consideration, assess both the given and that which deviates from it, and check it for usability. In this way, innovations today are produced and reproduced reflexively to a certain degree, rendering them reflexive innovations. Actors constitute this form of innovation recursively on the basis of a continuous stream of new information, which is systematically—and to some degree even strategically—generated about *conditions, consequences and ways in which actors recursively produce and reproduce innovations in time-space*. In this way, they not only continuously and systematically generate information and knowledge about innovations but observe and design innovations anew again and again in light of new information and new knowledge. *Reflexive innovation* thus refers to innovations that are borne by an incessant process of producing new information and knowledge. In principle, this amounts to a *pluralization* of possibilities for innovation, precisely because they are less determined by that which is familiar, customary, instilled, and constantly repeated.

The fundamental pluralization of possibilities for innovation under conditions of reflexive modernity is also based on actors recursively taking into account modern means of production and reproduction of the social, for instance, modern forms of dealing with times and spaces, symbolic tokens, technological achievements, and expert knowledge—or at least they are expected to do so to a certain degree. Modern ways of dealing with *times and spaces* are characterized by actors primarily coordinating activities and events in terms of measured times and spaces (Giddens 1990a: 14ff.; Gilbert-Walsh 2010; Koselleck 2000: 78ff.) in time-space and, on this basis, by reflexively connecting and/or decoupling and recombining the places, regions, and spaces in which they are produced and reproduced. In principle, modern-day actors can thus continuously dis-embed innovation activities and

events from their respective contexts in new or altered ways by employing new or modified means of action and pursuing divergent aims and horizons, and then re-embed them in time-space and in activity and event streams that are reflexively linked (or decoupled) in varying ways. These re-embeddings can transcend the boundaries of individual social domains, national territories, or political-administrative units.[11] The possibilities for reflexive innovation are furthermore supported, enhanced, and complemented by modern forms of handling *symbolic tokens* (such as money), *technological achievements* (such as individual machines, technology platforms, or technologies combined in buildings or infrastructures) and through reflexive forms of the use of *expert knowledge* (such as that of professional groups) (Giddens 1990a: 27; Orlikowski and Scott 2008; Windeler 2014: 239ff.). Further adding to this—and conveyed, for instance, through consulting, Internet searches, and recruiting employees of various professions—are forms of observation, rationalization, and the inclusion of hitherto disregarded contexts, means of action, and skills. Today these are included systematically and not just 'experimentally.' Sometimes they are even designed to initiate or enhance innovations and generate alternative options. In addition, actors are to a certain degree expected to use information and knowledge about moods (Silver 2011), dispositions (Bourdieu 1977: 78 ff.), emotions (Nussbaum 2013), and the 'other of reason' (Böhme and Böhme 1985); this, too, is information, and this knowledge is also relevant to something happening or not happening (Windeler 2014: 234ff.). Moods and emotions can—as the performances of Steve Jobs, the former CEO of Apple, testify to—be used at least to increase the social significance of innovations and/or the opportunities for their exploitation. This means that change must not necessarily await suitable opportunities for it to become an innovation. To a certain degree, opportunities

11 Taylorist/Fordist forms of organizing production are prominent examples (Boyer and Freyssenet 2003). Current extensions of these modes of production are Industry 4.0, which envisions the digital transformation of industry, and logistic chains by means of which flows of goods and activities are coordinated on a global scale (Gereffi and Fernandez-Stark 2011). Globally coordinated research and development activities attest to the fact that nation states and policies defined by governments are not always at the center of attention, without, however, being irrelevant (Sydow et al. 2012). Places, as geographically situated physical settings, are reflexively related to one another, interconnected, and bound together in space via their utilization periods and (in time via the) time-bound chains of events that occur within their boundaries just as times, activities, and events are bound to spaces. Both places and interaction partners seem more easily replaceable in times of reflexive modernity, although they do not lose their significance completely owing to their specific characteristics or specific capacities, as long as the differences continue to be treated as relevant; some even gain in significance.

can also be (collectively) created—however, not always successfully. Moreover, innovations are by no means always a response to conditions of scarcity. Sometimes abundance and excess are the problem and one that calls for innovations of a special kind—for instance, how to deal with a surplus of data or information, individually and as a society (Abbott 2014).

That which has been established, no matter what it may be, even the most current innovation, tends to come under pressure in radicalized modernity, increasingly requiring specific justifications for it to be continued.[12] The complexity of innovation processes is in principle systematically enhanced through the pluralization of potentially and actually relevant conditions, consequences, and ways in which actors recursively produce and reproduce innovations in time and space. This complexity is selectively reduced, however, by employing expertise, trust, and social practices of dealing with these situations. The social practices of dealing with the universalizing radicalized principle of reflexivity drive modernity and keep it on the path of reflexivity while they also institutionalize the form of reflexive innovation, which in turn further develops and, in some instances, changes modern institutions in specific ways.

2.2 Reflexive Innovation and the *Trias* of Capitalist Economization, Industrialization, and Rationalization

Reflexive innovations are currently being created, advanced, and in some cases altered in innovation societies by drawing on *ensembles of modern institutions*—as practices that are deeply sedimented in time-space (Giddens 1979: 80)—rather than by only referring to, for instance, economic institutions—as Schumpeter supposes at least for the modern economy—or 'post-modern' institutions, however they may be defined (Giddens 1990a: 11f.). The ensembles of modern institutions are shaped in turn by the driving forces of modernity, as determined by Karl Marx, Émile Durkheim, and Max Weber, which today, however, are recurrently modified in a reflexive manner. Present-day innovation societies are driven, as the assumption goes, by reflexive forms of capitalist economization, industrialization, and rationalization.

The thesis of radical modernity, which I have adopted, and modified, from Anthony Giddens, is based on the idea that modernity is taking a new shape and that this process is mediated by forms of radicalized reflexivity. This is equally true,

12 Yet even traditions can be continued, but only on the basis of knowledge that is itself not reflected in traditions (Giddens 1990a: 36ff.; Windeler 2014: 283).

as I will claim, for the driving forces that characterize modernity and the innovation processes that come with it. The thesis I wish to propose is as follows. In accordance with Karl Marx, we live in a modernized *capitalist* society today in which—mediated by the reflexively advanced principle of *capital valorization*—the production of goods and accumulation of capital create incessant momentum, and *capitalist economization* forms the sociation and the innovation processes embedded therein, even beyond the sphere of the economy. Sociation and its dynamics—and here I draw on Émile Durkheim—is additionally characterized by processes of reflexive *industrialization*, that is, continuous processes of reflexively advanced forms of a *complex division of labor and industrial exploitation of nature*. Today, it is not least *rationalization*—as I intend to argue with reference to Max Weber—that leaves its imprint in reflexive form not only on innovation processes but also on sociation, its momentum, and on the ongoing disenchantment of the world. This means that actors today produce and reproduce *spheres of life* reflexively on the basis of science, modern technology, and bureaucracy and that this extends not only to the economy but also to politics, technology development, law, art, the military, and even to lifestyles and the individual conduct of life. In so doing, they are assessing future developments and necessary 'precautions' *on the basis of intersubjectively defined criteria* as opposed to criteria given through habits, customs, conventions, and traditions. Thereby, they *systematize*, at least to some degree, *by rigorously calculating* the information considered relevant for the purpose of rationalization and *calculate* social events mostly on the basis of *numbers* and *numerical* considerations. In this way, they methodically *control and shape* events, activities, and relationships in those spheres and in innovation processes on the basis of rather specific information and knowledge that is acquired while focusing on rationalization.

The reflexivity principle of modernity thus also accounts for the driving forces of modernity as defined by the classics of sociology and thus shape the basic conditions of innovation in a modified form. The driving forces, too, are (individually or in ensembles) reflexively created anew, sustained, and, as the case may be, transformed time and again. Practices of valuation and evaluation are moments in these processes as they help orient the reflexively linked (and decoupled) driving forces in present-day fields of action, co-create their reflexive manifestations and interconnections, and in turn are themselves shaped by the ensembles of driving forces. In these processes, it is their ongoing incorporation in social interaction that recurrently confers upon the driving forces (and their ensembles) their socially constituted power and adaptability.

Current debates have highlighted this. For some time now, a number of innovations have been triggered, for instance, through processes of reflexively driven

'marketization' in other areas of society (such as science or health) as well as arrangements at the interface of neoliberal capitalism and social market economy or have been influenced by these processes. Public disputes today about issues concerning the industrial exploitation of coal, oil, and gas or renewable energies, while being fed by information, expertise, and knowledge, are not only drawing a great deal of attention to the forms of industrial exploitation of nature but also often initiate innovations and shape the ways in which they are evaluated. Never-ending discourses on issues of intensifying bureaucratization and the need to reduce or transform it bear witness to the reflexive inclusion of the rationalization of the world in public as well as private communication and, at the same time, are subject to multifaceted innovations. What the debates, disputes, and discourses also make clear is that at issue here are ensembles of driving forces, for instance, when the matter in question is renewable energies and the criticism thereof. Individual driving forces can have a dominant impact on the formation of the institutions and structures and also innovations found in individual spheres, such as economization in the economy. However, when one force dominates, the others do not immediately become insignificant. It is rather that forces interacting in ways that match well improves their efficacy—without, however, determining what will happen or can happen.

2.3 Reflexively Institutionalized Positions, Position Practices, and Forms of Positioning

In today's innovation societies, reflexive innovations are further characterized by institutionalized actors, interactions, and relationships. Besides the entrepreneurs to whom Schumpeter referred, modern institutions play an important role in constituting other relevant actors of innovation, such as venture capitalists, regulatory actors, consumers, or users, any of whom may be involved in innovation processes. Whether these actors are individuals, organizations, nation states, or others, they not only operate under given institutional conditions, but they themselves are also institutionalized as innovation actors. Modern-day innovation processes thus feature reflexively institutionalized positions or roles—roles if the normative rights and obligations associated with positions are relatively clearly formulated. Institutionalized guidelines and ideas that indicate what it means to be an innovation actor in general and, for instance, a venture capitalist in particular are associated with requirements and ideas that specify what it means to act as such and to maintain relationships with others accordingly (this I will address in more detail below). These institutionalized requirements and ideas can also vary depending on the

field of action. Innovation actors are thus not individual actors (e.g., individual entrepreneurs), as Schumpeter would have us believe, but actors that are institutionally embedded in networks of positions by which they are related to other actors and by which their activities are interrelated. In some contexts—such as in Silicon Valley—even the networks of positions are institutionalized.

The institutionalized forms of action that individual innovation actors or groups of actors in innovation processes are expected to display include financing or financial support (Ferrary and Granovetter 2009; Lange et al. 2013), signalizing, embedding, collective learning, and selection (Ferrary and Granovetter 2009), participation, and conflict resolution (Windeler and Wirth 2005), the creation of public awareness (Schubert et al. 2013), influence on legislative processes (Barley 2010), standardization and patent registration, valuation and evaluation (Lamont 2012), as well as the regulation of innovation in social systems such as organizations, networks, and fields of innovation. Additional activities to be mentioned here are generating and monitoring institutionally codified terms and meanings, legitimations, or forms of powerful implementation of innovations (or the prevention thereof).

People who hold positions monitor, control, and shape innovations. In so doing, they incorporate practices of valuation and evaluation that are institutionalized in fields of action, practices that today are often determined by professional groups or professions. Some act in the roles of authorized representatives or self-proclaimed 'guardians' and monitor compliance with institutionally defined guidelines. This usually results in struggles among actors over relevant practices, knowledge (bases), and relevant skills—for instance, between professional groups in the respective domains (Abbott 1988). Sometimes organizations such as associations, clubs, or inter-organizational governance units, which is what Neil Fligstein and Doug McAdam (2012) have written about, actively assume positions responsible for defining, monitoring, and generalizing the conditions that govern action in the field in question. Greenpeace represents such an organization for the environment. Fields of action thus cultivate patterns, established in time-space, of coordinated responsibilities and forms of conflict resolution and consensus building. The designations, assessments, and efficacy of positions may vary with the structural features of different sets of positions. New positions may even evolve by chance owing to fortunate circumstances, as the history of the emergence of venture capitalists in the USA illustrates (Kenney 2011). What positions actors occupy today is thus based on modern institutions, rules and resources, and the usual solutions predominant in the fields of action on the one hand and on the reflexive activities of positioning on the part of those involved, who in turn act on the basis of conditions regulated by social systems on the other.

In their activities, individuals, organizations, and nation states thus express modern ideas of actors and innovation actors—possibly of different kinds depending on the field of action—that identify them as universally 'responsible' and 'authorized' to contribute to shaping the world by means of institutionalized activities (J. W. Meyer 2008); however, today these ideas also require that they act reflexively, both individually and in coordination with others, and take into account the institutionalized patterns and ensembles of reflexively formed driving forces that are ingrained in positions, the actions associated with these positions (henceforth referred to as 'position actions'), and the contexts of interaction. Actors are thus authorized, legitimized, and prompted to create, advance, and possibly change innovations by drawing on the institutionalized forms of signification, legitimation, and domination ingrained in innovation practices as well as on the forms of coordination and regulation of innovations engaged in with others that are inherent to these practices. Which of the positions and actions in these positions—in interrelated ensembles of such positions and position actions—play a central role in individual innovation processes and which are more peripheral is a question to be answered empirically, as is that of who takes and can take which positions. Actors today are thus not only prompted—and this may differ depending on context—but also authorized in a socially recognized and legitimated manner to represent their own interests in innovation processes and beyond as well as to (responsibly) act as representatives for 'others.' This applies even to 'entities lacking agency'—such as ecosystems, animals, and plants as well as imagined actors such as fetuses or endangered languages or cultures—and to 'principles,' such as those of law and science, of the professions, or also of high culture or etiquette (J. W. Meyer 2008; Meyer, Boli, and Thomas 1987: 24f.; Meyer and Jepperson 2000: 62ff.). Whether innovation processes differ when they involve pursuing innovations of interested agents compared to those pursuing innovations of 'entities lacking agency' is an empirical question. What this extensive institutional authorization also does is to institutionally expand and restrict the possibilities for innovation at the same time. This makes a substantial contribution to socially constructing, restricting, and enabling the institutionalized pluralization of innovations and to further advancing the institutionalization of innovation societies.

The radicalized reflexivity principle, along with the driving forces of modernity and the institutionalized (ensembles of) positions, not only lends particular momentum to innovation processes to modernize but also plays a part in determining which innovations are generated (and which are not) and how this occurs. However, since institutions do not determine how actors act and since their social significance unfolds by actors taking them into account in acting, the extent to which modern institutions require innovations depends on how actors reflexively

monitor, rationalize, and refer to them in their activities. A crucial factor in understanding innovation is thus how actors—coordinated with others—reflexively create, sustain, and possibly change innovations by drawing on modern institutions and which possible alignments of conditions and practices of innovation they develop in the process.[13] I will now discuss the conceptual foundation of how to analyze from a practice-theoretical perspective how actors take institutions into account in acting and lend them significance.

3 Reflexive Innovation, Structures, and Modern Actors

Joseph Schumpeter experimented all his life with different approaches to include the relationship between action and structure in innovation processes. Contemporary innovation discourse is also characterized by the paradigms of creation, evolution, and structure or institution, as I indicated at the outset of this essay. With this in mind, I propose an alternative approach to the problem of structure and action in innovation by drawing on Anthony Giddens. This approach substitutes the duality of structure for the dualism of action and structure prevalent in innovation research. In this alternative view, innovations are recursively produced and reproduced by actors in interactions and relationships in time-space. This is because actors—be they individuals, organizations, or nation states—constitute everything social (and thus also societies, innovations, and the actors themselves) by drawing on social practices while *actualizing* in interactions capabilities stored in traces of memory and forms of action used in social practices, which have evolved at the level of ensembles of societies and organizations (⇩ in Fig. 1). And in so doing, they *(re-)produce* (themselves as) actors as well as, for instance, organizations and society as a whole, including their institutionalized forms and conditions (⇧ in Fig. 1). From this it follows that actors always have some latitude; what actors do is fully determined neither by institutions nor by the requirements of social systems or situational circumstances. It is rather the rules and resources that are ingrained in social practices and actualized in interactions as well as the generalized capacity to act associated with them (which indicate to actors which capacity to act is usually implied in a certain set of rules and resources) that invariably enable actors

13 These alignments also extend beyond efficiency, effectiveness, or supposed functional necessities (Boli and Thomas 1997; DiMaggio and Powell 1983). According to John W. Meyer (2009), they result in a 'world polity' that nevertheless takes neither the reflexivity principle of radically modern societies adequately into account nor the specifics of the ensembles of modern institutions in different fields of action.

to act skillfully, precisely because they restrict the possibilities of action. On this basis, actors also create innovations recursively by actively engaging with a given world that they not only interpret but also co-create by using ensembles of social practices that mediate between actors and the world, without, however, controlling events in this way—and certainly not comprehensively.

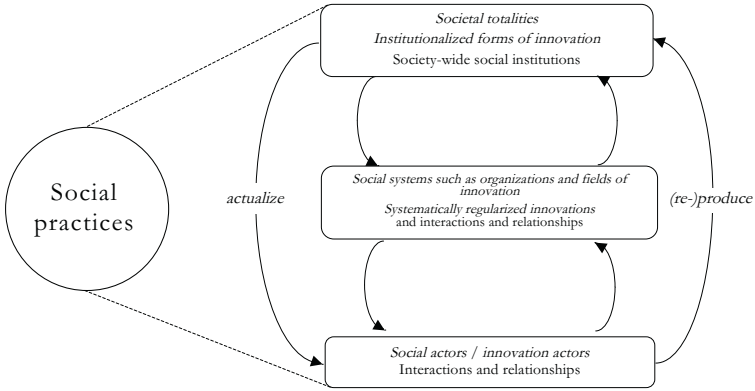

Figure 1 Social constitution of innovation—the practice-theoretical perspective (my own illustration).

Actors are confronted with *textures of conditions* in innovation processes. These textures are constituted, first, by actors recursively taking into account radical modern institutional conditions and forms of innovation (as discussed in Section 2), second, by the regulations of innovation activity that are primarily shaped in organizations, networks, and fields (which will be discussed in Section 4 below), and, third, by actors reflexively considering the situational conditions encountered in interaction situations. These textures of conditions are produced and reproduced, in ever-recurring cycles, as the medium and result of the social constitution of innovations outlined in Figure 1. Actors today are expected to command and express a certain *repertoire of reflexive skills*, mediated via the textures of conditions, particularly in innovation processes. It is assumed that actors involved in innovation reflexively and recursively take into account in appropriate ways content-related and procedural conditions and requirements (Windeler 2014). And when actors actualize and express suitable skills in the course of action, they not only demonstrate their understanding of events, they also prove themselves to be competent, even if their skills—as shown in Figure 1—are the product of social systems (Giddens 1990a: 79). What is decisive is this: even though the actors'

knowledge is above all practical, their understanding and knowledge determined by society and always limited, and their information always selective and often inadequate, they use their understanding, information, and knowledge as their basis for action. Any explanation of innovation (or of the social in general) that were to ignore the actors' understanding of events and how they use this understanding in action is thus destined to fall short from the outset since that which is investigated includes what (other) actors have constituted as significant in action (Giddens 1984: 179, 213).[14]

> This is a mutual interpretative interplay between social science and those whose activities compose its subject matter—a 'double hermeneutic'. The theories and findings of the social sciences cannot be kept wholly separate from the universe of meaning and action which they are about (ibid.: xxxii f.).

But how do actors generate their ability to constitute innovations by drawing on existing textures of conditions? Actors recurrently produce and reproduce their capacity to act in innovation processes in time-space by recursively and reflexively monitoring, rationalizing, and motivating activities and observing and reflecting on events in these processes and beyond. They draw on actualized traces of memory that show repertoires of possible solutions, means of action, and forms of action envisioned in action (in innovation processes). This connects current action with earlier situations of action that one has experienced, learned about, or observed. In this process, actors recursively produce in interactions information, knowledge, and their understanding of innovations and how these three elements are socially embedded in time-space. This information, knowledge, and understanding is produced in the three dimensions of the social defined in structuration theory: *signification*, *legitimation*, and *domination* (ibid.: 29). As a result, actors have an understanding and knowledge—particularly for contexts that they are familiar with—of how to signify an innovation in the respective context and assign it meaning, evaluate it, and how to use material (such as nature, raw materials, and other material objects) and immaterial things (such as knowledge, social networks, and influence on peoples' opportunities in life) as a facility in a socially recognized way usually associated therewith. They can thus actively incorporate given re-

14 Actors can, for instance, use given requirements for different reasons and in different ways. They can, first, use them intentionally, second, because they consider their use natural, without explicitly associating interests with them, or, third, because they do not see any opportunities (so far) to change the situation that requires or suggests using the guidelines. One arrives at very different explanations, however, depending on what is the case.

quirements recursively in their actions. Unlike the common assumptions made by structural, institutional, and evolutionary approaches in innovation research, their actions are thus neither determined nor can they act at will within the framework of given requirements. Instead, rules and resources actualized in interactions as well as the perceived generalized capacity to act provide actors with orientations for acting competently under given conditions, suitably to the given framework, and by making use of their scope for action.

Rules and resources ingrained in innovation practices along with the generalized capacity to act offer actors the *techniques and generalizable procedures* usually employed in these practices as well as an idea of *the skills that one usually acquires by using them*. They indicate how to skillfully interact with others (in innovation processes) under given conditions—for instance, by including expert knowledge that largely exceeds one's own control—and thereby create, advance, and possibly change innovations as well as declare changes to be innovations. The rules and resources allow actors to signify changes as innovations with the help of interpretation schemes, evaluate them by applying norms, and influence them by using facilities, the means of which include symbolic tokens as well as technological achievements and expertise. The rules and resources of innovation combined with the generalized capacity to act to have *constitutive* and *generative* effects in social practices. This is because they enable actors to recursively produce and reproduce innovations, on a recurrent basis, in interaction with others, even if the capacities vary among actors and depend on the circumstances of action. They also allow actors to create new significations, legitimations, and ways of exercising domination as well as to generate new skills (for instance, in terms of creative monitoring, rationalizing, and acting). In addition, they make it possible to recombine existing techniques and procedures with commonly used capabilities—both systematically and playfully. The rules and resources together with the generalized capacity to act by employing them thus puts actors in a position not only to repeat existing things but also *to imagine new things, to 'design the future' by discovering, shaping, and attributing meaning* and *to develop ideas of whether and how one could realize what has been imagined*—for instance, to assess possibilities for generating innovations (see Beckert [2013] on the significance of imagined futures for capitalist economies and Popitz [2000] on the significance of creativity). In so doing, the imagined structures the realm of possibilities for a future present.

What is innovated and in which way is thus oriented, enabled, and restricted by what has been brought to mind reflexively. The way actors envision given requirements in action fundamentally contributes to shaping what is innovated and how that occurs. This is so because societies, organizations, networks and fields, and interactions—and hence all the levels of the social addressed in Figure 1—are

oriented by ensembles of rules and resources that are ingrained in social practices, the generalized capacity to act that they represent, and traces of memory that actors recursively and mutually convey to each other in interaction (Windeler and Sydow 2001). That said, innovations may not be realized in some circumstances quite simply because they fall between the cracks of institutional, systemic, and situational attention, conditions impede them, or actors are simply overwhelmed or fail to develop sufficient interest in the change in question.

The social dimensions of signification, domination, and legitimation—conveyed via the rules and resources used in social practices of innovation—also constitute the *dimensions of innovation* and their *valuation and evaluation* (here I am expanding on Michèle Lamont's [2012] thoughts in this direction). They do so because not only meanings and evaluations but also forms of domination are always ingrained in innovations, innovation regimes, and the attribution of value. Thus, what needs to be determined is which significations, which evaluations, and which uses of which resources as well as which generalized capacity to act characterize individual innovations and how they interact in the individual contexts of given structural and institutional conditions. It is also interesting to identify which actors create, are able to use, and actually do use the realm of possibility for innovation, the evaluation of innovation, and the declaration of something as representing an innovation and in which ways they do so. This is so because the realms of possibility by no means determine action, as I have pointed out above, even though they may often not offer a great number of alternatives. What they most certainly do, however, is promote certain lines of action by selectively restricting the possibilities of action.

4 Regulation of Innovation: Organizations, Networks, and Fields of Innovation

Schumpeter did not discuss the production and reproduction of innovations in organizations in any depth. Innovation research on the whole is characterized by considerable gaps in this respect. On the one hand, there are numerous studies and reflections on innovation that neglect or even completely omit the so-called meso level of the social. On the other hand, there are a great number of studies that explicitly address organizations and networks in the context of innovations while forgetting the social embedding of organizations, networks, and fields. Both of these gaps need to be addressed, as innovation processes in innovation societies cannot be understood without including organizations and social institutions since actors take them into account in their actions.

Organizations and selected networks are important in innovation processes not only as actors, as I have made clear in Sections 2 and 3. Together with what we have referred to as fields of innovation, they constitute *institutionalized* '*sites of innovation*.' As interwoven meso orders, they not only specify the institutional requirements at the level of society but, by what they regulate and what they do not, they also play a significant part in orchestrating the conditions under which actors produce and reproduce innovations. Through their systems of regulation, organizations, networks, and fields of innovation thus shape to a relevant extent what is done at any one time and which results these activities can potentially yield or not.[15] In this way, they specifically enable and restrict the ability to act of the actors involved in innovations—and thus the innovations themselves. When considering these systems of regulation, however, we must not forget that these regulations not only reflect modern institutions, social practices, and the ability of actors at the level of the social, as illustrated in Figure 1, but actors in turn, drawing on regulated social practices, also play a substantial role in forming the regulations themselves (see Figure 1 again).

What is (or is not) subject to reflexive regulation, in which way, and why in contexts of innovation is an empirical question. The empirical task is therefore to determine—as I have done elsewhere—what general conditions characterize the following aspects in the individual context of action:

(1) "the *selection* of actors, issues, action domains, means of action, and modes of time-space coordination—in the social system or in its environments,
(2) the *allocation* of means and time-spaces to actors, activities, events, and the settings of action,
(3) the *evaluation* of the relevant system occurrences,
(4) the *system integration* (or disintegration) of activities of present and absent actors as well as of artifacts, types of action, or technologies,
(5) the configuration of *orderings of positions and* of *positionings* of activities, tasks, issues, types of action sites, system units, procedures and programs, artifacts, and responsibilities, and what general conditions characterize
(6) the *constitution of the system borders* between units (e.g., departments) of the system as well to other systems. What is regulated is, for instance, activities

15 Some social systems (e.g., all organizations as well as selected inter-organizational networks) specifically develop the collective ability to regulate, transfer special tasks in the regulation of system events to individual actors (such as managers), and continually use the knowledge acquired to shape such regulations systematically. But even in organizations, it is *not solely* 'managers' who shape the order of the system but rather *all* actors relevant to the social system, yet not all to the same extent. Moreover, social systems are always confronted with the regulations of other social systems and their wider contexts.

of 'boundary spanners' or salesrooms, the management of resource flows, the access to system means, the use and dissemination of sensitive information, the inclusion of issues that are not part of the system, the permeability and surveillance of system borders, the ways of dealing with conflicts over the demarcation or shifting of borders, and the embedding of activities and events in contexts across systems or sub-systems" (Windeler 2014: 249ff., my translation).

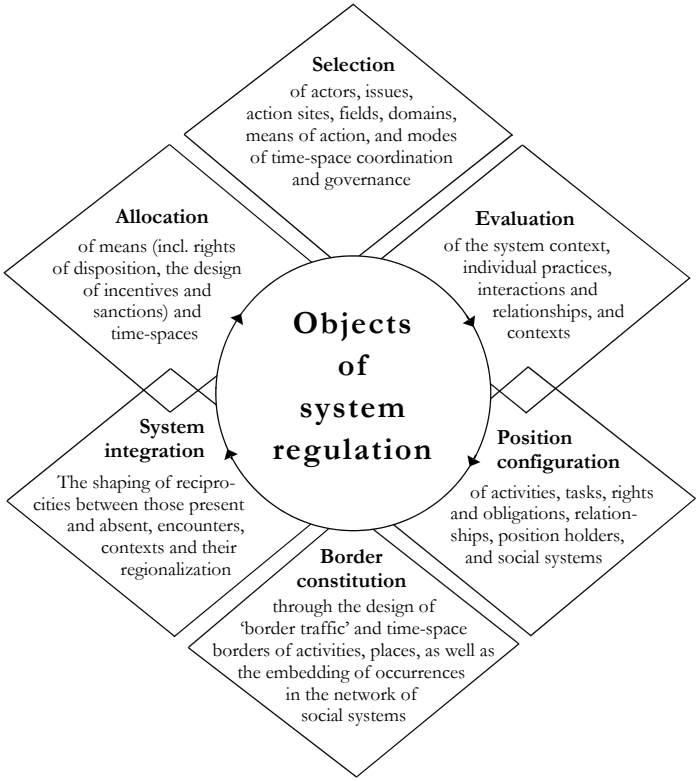

Figure 2 The objects of system regulation (Windeler 2014: 250, adapted).

The interlaced meso orders of organizations, networks, and fields, which are gaining increasing importance for innovation processes today, are not least a medium and result of social practices in which actors pave the way for innovations by cooperating in a regulated manner long before innovations become valuated and evaluated in markets or public discourse. Precisely because regulations of organizations, networks, and fields usually mutually determine each other in innovation

processes, it is helpful to consider the structural characteristics of each of the respective orders separately.

Organizations—whether non-profit organizations, governmental organizations, or economic organizations—are considered by many to be the most significant innovation of mankind, not only because they are essential for the creation, implementation, and proliferation of capitalism, socialism, and democracy but also because they shape a great number of innovations (Böhme 2004: 28ff.; North, Wallis, and Weingast 2009; Weber 1978). Organizations are ascribed this significance in innovation processes particularly because they offer actors a specific, organizational form for the pursuit of innovations. It is a form that does *not* directly define the contents of the innovation itself but specifies a specific way of creating, sustaining, and possibly changing innovations. In specifying how to go about the task of innovation, organizations enable actors to jointly pursue innovations with others in an organized fashion and produce and reproduce innovation for other people (such as shareholders, members of an association, or citizens of a state) and for other purposes (e.g., to protect the basis of life) highly selectively and in a focused way. What is special about the organizational form of innovation results from organizations *coordinating the conditions of their reproduction highly reflexively* in time-space (Giddens 1990b: 302). This means organizations administer activities, events, and processes both within and outside of organizations in a highly reflexive manner. In this way, they not only constitute very specific conditions for innovations but also shape the modern principle of reflexivity to a significant degree and are in turn also shaped by this principle to a substantial extent. In innovation processes, organizations continuously generate, in a highly reflexive manner, selective information and knowledge, in accordance with the organization's specific focus of attention, about internal and external contexts of action, practices, and generalized skills and abilities that the organization deems relevant; they make use of this knowledge for administration, for the highly reflexive shaping of the conditions of action, and for organizational action in general. This implies that organizations are particularly well suited to meet the requirements of reflexive innovation and create innovations of this type—which, however, by no means precludes that the results can continue to be highly ambivalent, precisely because their reflexive focus tends to be systematically myopic toward much that they classify as less important. Modern-day organizations even transform themselves into reflexive organizations as a medium and result of actively embedding themselves in radical modernity and being embedded by the activities of other actors (Windeler 2015). If appropriately organized, they can expand their ability to regulate innovation processes, assume specific organizational roles in innovation processes, establish patterns of action expected in such roles, and actively contribute to shaping the specification of roles

and positions in fields of action. At the same time, organizations' ability to act in innovation processes—despite the degree of agency that they are able to generate—should not be overestimated. There is much that does not even come into their organizational focus. There are also many things that go on in an organization that does not follow the same pattern throughout the organization; there may, for instance, be some variation among departments: one might be promoting an innovation while the other is undermining it. Overall, even highly powerful organizations cannot control innovation processes—let alone completely. But it is nonetheless also true that they can develop a specific ability to make use of innovations and can set conditions for innovations within and beyond the organization. In this respect, it is interesting, specifically for innovation studies, how organizations regulate and coordinate initial conditions for innovations and the processes of creating them. It is all the more astonishing that a great number of innovation studies pay very little attention to organizations.[16]

Let us now turn from individual organizations to inter-organizational networks. In *inter-organizational networks* organizations coordinate activities with other organizations and are essential for innovation throughout society today. They are characterized by the fact that they regulate and coordinate interactions and rela-

16 Three examples might briefly indicate the relevance of organization and organizations. One example is Facebook. It operates its communication platform very deliberately according to a fixed format, requiring that users submit to using all kinds of defined functions such as the so-called 'Like' button or to being targeted by advertising (Dolata 2015). In this way, Facebook has significantly influenced innovations in communication practices in recent years. The organizational arrangements of *research institutes* or *labs* also have a significant impact on innovations. This is because the lab is, unlike Karin Knorr Cetina (1988: 89, my translation) assumes, far more than just "a room that accommodates utensils and equipment for conducting [research] that scientists can combine to 'experiments.'" Labs and research institutes organize research. To this end, they usually select participants in a very deliberate way, determine topics and domains to be investigated, equip research teams with buildings, apparatuses, and other resources such as time and money, and define general conditions for the collaboration with other labs and actors. The same applies to *research-funding organizations* such as the German Research Association (DFG) or ministries involved in research funding: "In particular, what has gone overlooked in this discussion are organizational practices at the level of the funding source. Managers in research funding organizations like the National Science Foundation must translate broad agency goals into a multitude of operational decisions. How to choose the scientific fields to support? How to evaluate and select among proposals? How to manage ongoing research programs? These organizational practices undoubtedly affect the behavior of scientists in some way and may very well impact the rate and direction of scientific and inventive activity. This raises the questions: What practices matter and in what way?" (Colatat 2015: 874).

tionships among *more than two* organizations, which remain autonomous, primarily with a view to the *enduring sets of interrelationships* constituted between them (Windeler 2001: 231ff.). Inter-organizational networks are thus linked in a specific way with the organizations that support them, and practices and regulations at the network and organization level are recursively interwoven (Windeler and Sydow 2001). The recursive linking of organizational practices and regulations among participants in the network poses great challenges to the organizations involved and requires special abilities from them while at the same time opening up possibilities for them to expand their capacity to act (Battilana and Lee 2014; Bromley and Meyer 2017; Jandhyala and Phene 2015; Meyer and Rowan 1977; Parsons 1956, 1957; Pfeffer and Salancik 1978; Thompson 2004; Windeler 2001, 2014). By combining cooperation and competition in a particular way, they generate opportunities to make joint use of or generate resources in the network, to jointly cultivate markets, to collaboratively develop innovations, as well as to jointly influence the relevant contexts of action (e.g., to influence legislation [Barley 2010]) and to pursue collaborative strategies of exploitation or exploration (March 1991) of innovations (Windeler 2012).

If we look at settings such as Silicon Valley, it is obvious that, at the meso level, other contexts besides organizations and networks are systematically gaining significance today. Following Andrew Hoffman (1999), I propose including settings such as Silicon Valley as special *issue-based fields* since their theme is innovation. *Fields of innovation* develop around individual *innovation issues*, each of which is recursively constituted in the respective field—such as the innovation of industry regulations, production technologies, or forms of participation—in time-space (cf. DiMaggio and Powell 1983; Fligstein and McAdam 2012). Fields of innovation—as the Silicon Valley example demonstrates—are often colonized by various populations of actors (be they individuals, organizations, or social movements) that may be rooted in different spheres of society, nations, or cultures. They are also characterized by specific ensembles of regulations, structures, and actors with specific capacities to act. Fields of innovation's structures thus frequently refer not only to the forms of signification, legitimation, and domination that prevail in individual spheres of society; they sometimes combine these or weave them into new ensembles of structures and structural characteristics specific to the fields of innovation in question. Under the field of innovation's governance, social actors even from time to time combine the *most varied forms of regulation and coordination in parallel*, for instance, the type of regulation and coordination characteristic of markets, organizations, and networks. Social actors in these fields thus deliberately pursue innovation processes in ways that are different from what would be possible in markets, organizations, and networks alone. Fields of innova-

tion hence oftentimes enable actors of varying origin (such as spheres of society, professional groups, and cultures) to pursue, generate, and advance innovations in a very specific way under the conditions of the respective field. This allows actors to make creative use of and recombine different systems of regulation and forms of coordination to create, advance, or possibly change innovations. Individual types of actors can hold central positions in fields of innovation—such as, for instance, venture capitalists in Silicon Valley or consortia like SEMATECH in the global semiconductor industry. The social significance of a field manifests itself in the interactions among participants and in the ideas, narratives, and practices specific to the field. This significance is also expressed in ensembles of field-specific, relationally linked (or decoupled) rules and resources, positions and position actions, and the degree of institutional life that they develop. As more recent studies show, the logics of fields play an elementary role, especially for young firms (Pahnke, Katila, and Eisenhardt 2015). But even disruptive developments need fields in which they can evolve in order to generate successful innovations (Ansari, Garud, and Kumaraswamy 2015). Often company specifics interact with specifics of industries or fields in processes of innovation (Barbosa, Faria, and Eirizy 2013; Windeler and Sydow 2001). Political-administrative units (such as nation states) can be of great significance for fields of innovation, but they need not be—as, for instance, our study on the semiconductor industry illustrates (Sydow et al. 2012). This relative autonomy lends fields of innovation their particular significance in a world in which political-administrative units are often losing significance—owing not least to the increasing (reflexive) development of fields of innovation themselves.[17]

5 Innovating as Reflexive Exploration and Experimentation

The practice-theoretical perspective developed here obviously does not provide the mechanism of innovation that Joseph Schumpeter was looking for, nor does it formulate a normative frame of reference that indicates what should be innovated

17 In the literature on sociation under the conditions of modernity, the prevalent ideas of a mechanistic, progressive, internal differentiation and functional specialization of society are not well suited to capture the processes that I have referred to in considering the creation of order in fields of action that cut across different spheres of society (Giddens 1990a: 21f.). This is not to say that we must reject these concepts completely, but we should probably put them into perspective by thinking of them more in terms of *possible* points of reference and *potential* results of social practices (for an alternative point of view, see Passoth and Rammert in this volume).

and in which way. It offers something different instead: a *theoretically informed view of innovation* that makes it possible to deconstruct innovation processes and sensitizes for the conditions, consequences, and practices of innovation in innovation societies today.

Innovating in radical modernity resembles, as I have tried to show, an ongoing reflexive process of exploration and experimentation under conditions of uncertainty and conditions that are given, yet also actively co-created. Ensembles of modern institutions, regulations, and actors' capabilities shape the realm of possibilities for innovation, each in their specific way, and produce a multitude of possibilities for reflexive innovation that become reality only in highly selective contexts that are also invariably determined by domination. This strips innovation of any apparent innocence and randomness and brings lines of conflict. One of them is that the imperative of innovation continuously summons one to innovate and question all that is given, whereas modern institutions and systems of regulation—particularly at the levels of ensembles of societies, organizations, networks, and fields of innovation—produce a certain uniformity, specifically when confronted with the fundamental uncertainties characteristic of radical modernity. And this prompts the question of what significance is actually accorded to the homogenization of practices, standardization, and regulation as well as to forms of signification, legitimation, and domination for innovation processes and the further development of the social context. Such processes of harmonization tend to decrease the spectrum of alternatives and increase the vulnerability to changing circumstances, which the financial, energy, and environmental crises as well as the often futile attempts to regulate them have demonstrated. At the same time, they tend to favor those who are able to set the conditions.

Under the conditions of a radicalized modernity, steering innovation processes often resembles 'driving by sight', or 'riding the juggernaut', as Giddens (1990a: 139) put it. This processional wagon, which weighs many tons and is used in Hindu processions honoring Krishna, has the characteristic that once it gets rolling, it develops enormous power and quite simply crushes people who oppose it or land under its wheels. It can serve as an image for the reflexive modern era and for reflexive innovations in innovation societies, which are marked by development processes that exhibit characteristics of a wagon such as the juggernaut, yet without heading for a predictable end. The obvious idea that any attempt to steer innovation is therefore completely in vain turns out to be short-sighted nonetheless: as humans, we are—precisely with the aid of modern institutions, regulations and forms of coordination as well as actor's modern capabilities—jointly able to steer innovations in desired directions for some time and to a certain degree. But that which is harnessed always threatens to get out of control and to go where its momentum

takes it, irrespective of the will of those holding the reins. Reflexive action gains in significance in the process: precisely because control is always only partial, possibilities to steer things in desired directions gain strategic significance since this skill gives those who master it opportunities to gain a comparative advantage, even if they have to 'drive by sight' and repeatedly need to correct their course—which is easier for those who manage to keep their eyes on what is coming ahead of the current situation. By contrast, those who, for whatever reason, are unable to do so are largely at the mercy of what is to come. With this in mind, reflexive innovations also refer to radical forms of devaluation, disruption, and destruction. If the social challenges are to be met, what we need at the very least is the capacity for reflexivity in order to constitute appropriate, socially relevant reflexive innovations in time-space. The side effect of this is that exercising this capacity further advances the modern principle of reflexivity and the form of reflexive innovation.

The image of the juggernaut of innovation illustrates something else in a pointed manner: the *sovereignty trap* in the current mode of sociation. Organizations in particular are culturally summoned and empowered to act in a sovereign way, to produce and reproduce innovations on their own. When actors—from politics, business, or other spheres—claim to exercise sovereignty in their actions, individually or together with others, they are aggrandizing the actor, claiming credit for processes that they have long ceased to master or perhaps never have. Even so, the continuously asserted claim of sovereignty, also advanced in the media, implies that responsibility for the consequences of innovations, particularly the undesirable ones, can be attributed to them. This in turn prompts opponents to claim that they could do it better than those who maintain they have solved the task. This sets a vicious cycle in motion that alternates between the claimed sovereignty of being in control of innovation processes and the actual lack of such control—a process that can evolve into a spiral at increasing speed.

Much would be gained if alternatives were to become clear again and if a lack of alternatives would cease to dominate the picture. Also much would be won if, instead of painting the picture of an ideal, untainted world of successful innovation, there were a greater inclination to take into account the recursive relationship between innovation and society under the conditions of radical modernization and more attention were paid to the social processes involved in constituting the freedoms required for innovation. This is crucial since it is precisely under the conditions of reflexive modernity that innovations and the practices of their valuation and evaluation must be questioned reflexively. There may be no escape from the innovation society, but it is nevertheless worthwhile to communicate in society about substantial alternatives and alternative paths of innovation. It is also worthwhile to reach a common understanding in society for regulating innovation

and to cultivate the art of reflexive innovation, particularly under the conditions of radical modernity. Regulation of any kind, however, resembles 'driving by sight' given that new regulations inscribe themselves into the textures of regulations, which not only mutually determine one another but also continuously evolve and sometimes transform themselves in the process. The moment they are established, they are again immediately confronted with new challenges. The foremost task of innovation research worthy of the name is thus to draw on theoretically informed analytical approaches to generate information about which ensembles of forces are advancing innovations today, in which settings, and how these ensembles are in turn driven forward by innovations, what consequences are associated with this process, and which alternatives could be realized and in which ways. I consider this task to be a collective one. What we need to do is refine theory perspectives, as the one presented here, that enable us to understand and explain how innovation societies are socially constituted.

References

Abbott, Andrew. 1988. *The Systems of Professions*. Chicago, London: University of Chicago Press.

Abbott, Andrew. 2014. "The Problem of Excess." *Sociological Theory* 32(1): 1-26.

Adner, Ron and Daniel Snow. 2010. "Old Technology Responses to New Technology Threats: Demand Heterogeneity and Technology Retreats." *Industrial and Corporate Change* 19(5): 1655-1675.

Ansari, Shahzad (Shaz), Raghu Garud, and Arun Kumaraswamy. 2015. "The Disruptor's Dilemma: TIVO and the U.S. Television Ecosystem." *Strategic Management Journal* 37(9): 1829-1853.

Antal, Ariane Berthoin, Michael Hutter, and David Stark, eds. 2015. *Moments of Valuation. Exploring Sites of Dissonance*. Oxford: Oxford University Press.

Autio, Erkko, Martin Kenney, Philippe Mustard, Don Siegele, and Mike Wright. 2014. "Entrepreneurial Innovation: The Importance of Context." *Research Policy* 43(7): 1097-1108.

Barbosa, Natália, Ana Paula Faria, and Vasco Eirizy. 2013. "Industry- and Firm-Specific Factors of Innovation Novelty." *Industrial and Corporate Change* 23(3): 865-902.

Barley, Stephen R. 2010. "Building an Institutional Field to Corral a Government: A Case to Set an Agenda for Organization Studies." *Organization Studies* 31(6): 777-805.

Battilana, Julie and Matthew Lee. 2014. "Advancing Research on Hybrid Organizing. Insights from the Study of Social Enterprises." *The Academy of Management Annals* 8(1): 397-441.

Becker, Markus C. and Thorbjørn Knudsen. 2002. "Schumpeter 1911: Farsighted Visions on Economic Development." *American Journal of Economics and Sociology* 61(2): 387-403.

Becker, Markus C., Thorbjørn Knudsen, and James G. March. 2006. "Schumpeter, Winter, and the Sources of Novelty." *Industrial and Corporate Change* 15(2): 353-371.

Beckert, Jens. 2013. "Imagined Futures: Fictional Expectations in the Economy." *Sociological Theory* 42(3): 219-240.

Belt, Henk van den and Arie Rip. 1987. "The Nelson-Winter-Dosi Model and Synthetic Dye Chemistry." Pp. 135-158 in *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology*, edited by W. E. Bijker, T. P. Hughes, and T. J. Pinch. Cambridge: MIT Press.

Böhme, Hartmut. 2004. "Einführung: Netzwerke. Zur Theorie und Geschichte einer Konstruktion." Pp. 17-36 in *Netzwerke. Eine Kulturtechnik der Moderne*, edited by J. Barkhoff, H. Böhme, and J. Riou. Cologne: Böhlau.

Böhme, Hartmut and Gernot Böhme. 1985. *Das Andere der Vernunft. Zur Entwicklung von Rationalitätsstrukturen am Beispiel Kants*. Frankfurt a. M.: Suhrkamp.

Boli, John and George M. Thomas. 1997. "World Culture in the World Polity: A Century of International Non-Governmental Organizations." *American Sociological Review* 62(2): 171-190.

Bourdieu, Pierre. 1977 [1972]. Outline of a Theory of Practice. Cambridge, New York: Cambridge University Press.

Boyer, Robert and Michel Freyssenet. 2003 [2000]. *Produktionsmodelle. Eine Typologie am Beispiel der Automobilindustrie*. Berlin: Edition Sigma.

Braun-Thürmann, Holger. 2005. *Innovation*. Bielefeld: transcript.

Bromley, Patricia and John W. Meyer. 2017. "'They Are All Organizations': The Cultural Roots of Blurring Between the Nonprofit, Business, and Government Sectors." *Administration & Society* 49(7): 939-966.

Burt, Ronald S. 1992. *Structural Holes. The Social Structure of Competition*. Cambridge: Harvard University Press.

Burt, Ronald S. 2005. *Brokerage and Closure: An Introduction to Social Capital*. Oxford: Oxford University Press.

Carlsson, Bo, Staffan Jacobsson, Magnus Holmén, and Annika Rickne. 2002. "Innovation Systems: Analytical and Methodological Issues." *Research Policy* 31(2): 233-245.

Clausen, Tommy, Mikko Pohjola, Koson Sapprasert, and Bart Verspagen. 2011. "Innovation Strategies as a Source of Persistent Innovation." *Industrial and Corporate Change* 21(3): 553-585.

Cohen, Wesley M. and Daniel A. Levinthal. 1990. "Absorptive Capacity: A New Perspective on Learning and Innovation." *Administrative Science Quarterly* 35(1): 128-152.

Colapinto, John. 2014. "Material Question. Graphene May Be the Most Remarkable Substance Ever Discovered. But What's It for?" *The New Yorker*, December 22. Retrieved April 18, 2017 (http://www.newyorker.com/magazine/2014/12/22/material-question).

Colatat, Phech. 2015. "An Organizational Perspective to Funding Science: Collaborator Novelty at DARPA." *Research Policy* 44(4): 874-887.

Dedrick, Jason, Kenneth L. Kraemer, and Greg Linden. 2009. "Who Profits from Innovation in Global Value Chains? A Study of the iPod and Notebook PCs." *Industrial and Corporate Change* 19(1): 81-116.

DiMaggio, Paul and Walter Powell. 1983. "The Iron Cage Revisited. Institutional Isomorphism and Collective Rationality in Organizational Fields." *American Sociological Review* 48(2): 147-160.

Dodgson, Mark. 2011. "Exploring New Combinations in Innovation and Entrepreneurship: Social Networks, Schumpeter, and the Case of Josiah Wedgwood (1730–1795)." *Industrial and Corporate Change* 20(4): 1119-1151.

Dolata, Ulrich. 2015. "Volatile Monopole, Konzentration und Innovationsstrategien." *Berliner Journal für Soziologie* 24(4): 505-529.

Eden, Lynn. 2004. *Whole World on Fire: Organizations, Knowledge, and Nuclear Weapons Devastation*. Ithaca, London: Cornell University Press.

Emirbayer, Mustafa. 1997. "Manifesto for a Relational Sociology." *American Journal of Sociology* 103(2): 281-317.

Erumban, Abdul Azeez and Marcel P. Timmer. 2012. "The Dark Side of Creative Destruction: Innovation and Retirement of Capital." *Industrial and Corporate Change* 21(5): 1149-1174.

Fagerberg, Jan. 2005. "Innovation. A Guide to the Literature." Pp. 1-26 in *The Oxford Handbook of Innovation*, edited by J. Fagerberg, D. G. Mowery, and R. R. Nelson. Oxford: Oxford University Press.

Ferrary, Michel and Mark Granovetter. 2009. "The Role of Venture Capital Firms in Silicon Valley's Complex Innovation Network." *Economy and Society* 38(2): 326-359.

Fligstein, Neil and Doug McAdam. 2012. *A Theory of Fields*. Oxford: Oxford University Press.

Gardner, John W. 1981 [1963]. *Self-Renewal: The Individual and the Innovative Society*. New York, London: W. W. Norton & Company.

Garud, Raghu and Peter Karnøe, eds. 2001. *Path Dependence and Creation*. Mahwah: Lawrence Erlbaum.
Gereffi, Gary and Karina Fernandez-Stark. 2011. *Global Value Chain Analysis. A Primer.* Durham: Center on Globalization, Governance & Competitiveness (CGGC), Duke University.
Giddens, Anthony. 1979. *Central Problems in Social Theory: Action, Structure, and Contradiction in Social Analysis*. Berkeley: University of California Press.
Giddens, Anthony. 1984. *The Constitution of Society. Outline of the Theory of Structuration*. Cambridge: Polity Press.
Giddens, Anthony. 1990a. *The Consequences of Modernity*. Cambridge: Polity Press.
Giddens, Anthony. 1990b. "Structuration Theory and Sociological Analysis." Pp. 297-315 in *Anthony Giddens. Consensus and Controversy*, edited by J. Clark, C. Modgil, and S. Modgil. London, New York, Philadelphia: Falmer.
Giddens, Anthony. 1993 [1976]. *New Rules of Sociological Method*. 2nd ed. Cambridge: Polity Press.
Gilbert-Walsh, James. 2010. "Revisiting the Concept of Time: Archaic Perplexity in Bergson and Heidegger." *Human Studies* 33(2/3): 173-190.
Godin, Benoît. 2012. "'Innovation Studies': The Invention of a Specialty." *Minerva* 50(4): 397-421.
Godin, Benoît. 2015. *Innovation Contested. The Idea of Innovation over the Centuries*. London: Routledge.
Gould, Stephen Jay and Elisabeth S. Vrba. 1982. "Exaptation—A Missing Term in the Science of Form." *Paleobiology* 8(1): 4-15.
Granovetter, Mark. 1973. "The Strength of Weak Ties." *American Journal of Sociology* 78(6): 1360-1380.
Granovetter, Mark. 1974. *Getting a Job. A Study of Contacts and Careers*. Cambridge: Harvard University Press.
Healy, Kieran. 2015. "The Performativity of Networks." *European Journal of Sociology* 56(2): 175-205.
Hilpinen, Risto. 2011. "Artifact." *The Stanford Encyclopedia of Philosophy* (Winter 2011 Edition), edited by E. N. Zalta. Retrieved April 18, 2017 (https://plato.stanford.edu/archives/win2011/entries/artifact/).
Hoffman, Andrew J. 1999. "Institutional Evolution and Change: Environmentalism and the U.S. Chemical Industry." *Academy of Management Journal* 42(4): 351-371.
Hutter, Michael, Hubert Knoblauch, Werner Rammert, and Arnold Windeler. This volume. "Innovation Society Today. The Reflexive Creation of Novelty."
Jandhyala, Srividya and Anupama Phene. 2015. "The Role of Intergovernmental Organizations in Cross-Border Knowledge Transfer and Innovation." *Administrative Science Quarterly* 60(4): 712-743.
Kennedy, Pagan. 2016. "How to Cultivate the Art of Serendipity." *The New York Times,* January 2. Retrieved April 18, 2017 (https://www.nytimes.com/2016/01/03/opinion/how-to-cultivate-the-art-of-serendipity.html).
Kenney, Martin. 2011. "How Venture Capital Became a Component of the US National System of Innovation." *Industrial and Corporate Change* 20(6): 1677-1723.
Knoblauch, Hubert. This volume. "Communicative Action, the New, and the Innovation Society."

Knorr Cetina, Karin. 1988. "Das naturwissenschaftliche Labor als 'Verdichtung' von Gesellschaft." *Zeitschrift für Soziologie* 17(2): 85-101.

Koselleck, Reinhart. 2000. *Zeitschichten. Studien zur Historik*. Frankfurt a. M.: Suhrkamp.

Lamont, Michèle. 2012. "Toward a Comparative Sociology of Valuation and Evaluation." In: *Annual Review of Sociology* 38(1): 201-221.

Lange, Knut, Gordon Müller-Seitz, Jörg Sydow, and Arnold Windeler. 2013. "Financing Innovations in Uncertain Networks. Filling in Roadmap Gaps in the Semiconductor Industry." *Research Policy* 42(3): 647-661.

March, James G. 1991. "Exploration and Exploitation in Organizational Learning." *Organization Science* 2(1): 71-87.

March, James G. and Herbert A. Simon. 1993 [1958]. *Organizations*. New York: Wiley-Blackwell.

Merton, Robert K. and Elinor Barber. 2004. *The Travels and Adventures of Serendipity. A Study in Sociological Semantics and the Sociology of Science*. Princeton: Princeton University Press.

Meyer, John W. 2009. *World Society: The Writings of John W. Meyer*, edited by G. S. Drori and G. Krücken. Oxford: Oxford University Press.

Meyer, John W. 2008. "Reflections on Institutional Theories of Organization." Pp. 790-811 in *Organizational Institutionalism*, edited by R. Greenwood, C. Oliver, K. Sahlin, and R. Suddaby. London: SAGE.

Meyer, John W., John Boli, and George M. Thomas. 1987. "Ontology and Rationalization in the Western Cultural Account." Pp. 12-37 in *Institutional Structure. Constituting State, Society, and the Individual*, edited by G. M. Thomas, J. W. Meyer, F. O. Ramirez, and J. Boli. Newbury Park: SAGE.

Meyer, John W. and Ronald L. Jepperson. 2000. "The 'Actors' of Modern Society: The Cultural Construction of Social Agency." *Sociological Theory* 18(1): 100-120.

Meyer, John W. and Brian Rowan. 1977. "Institutionalized Organizations: Formal Structure as Myth and Ceremony." *American Journal of Sociology* 83(2): 340-363.

Meyer, Uli. 2016. *Innovationspfade. Evolution und Institutionalisierung komplexer Technologie in organisationalen Feldern*. Wiesbaden: Springer VS.

Muniesa, Fabian. 2014. *The Provoked Economy. Economic Reality and the Performative Turn*. London: Routledge.

Nelson, Andrew, Andrew Earle, Jennifer Howard-Grenville, Julie Haack, and Doug Young. 2014. "Do Innovation Measures Actually Measure Innovation? Obliteration, Symbolic Adoption, and Other Finicky Challenges in Tracking Innovation Diffusion." *Research Policy* 43(6): 927-940.

North, Douglass C., John J. Wallis, and Barry R. Weingast. 2009. *Violence and Social Order. A Conceptual Framework for Interpreting Recorded Human History*. New York: Cambridge University Press.

Nussbaum, Martha. C. 2013. *Political Emotions: Why Love Matters for Justice*. Cambridge: Belknap Press of Harvard University Press.

Orlikowski, Wanda J. and Susan V. Scott. 2008. "Sociomateriality: Challenging the Separation of Technology, Work and Organization." *The Academy of Management Annals* 2(1): 433-474.

Ortmann, Günther. 2016. “Innovation: In Ketten tanzen.” Pp. 237-248 in *Innovationsgesellschaft heute. Perspektiven, Felder und Fälle*, edited by W. Rammert, A. Windeler, H. Knoblauch, and M. Hutter. Wiesbaden: Springer VS.

Ortmann, Günther, Arnold Windeler, Albrecht Becker, and Hans-Joachim Schulz. 1990. *Computer und Macht in Organisationen. Mikropolitische Analysen*. Opladen: Westdeutscher Verlag.

Oudheusden, Michiel van, Nathan Charliera, Benedikt Rosskampa, and Pierre Delvenne. 2015. “Broadening, Deepening, and Governing Innovation: Flemish Technology Assessment in Historical and Socio-Political Perspective.” *Research Policy* 44(10): 1877-1886.

Pahnke, Emily C., Riitta Katila, and Kathleen M. Eisenhardt. 2015. “Who Takes You to the Dance? How Partners’ Institutional Logics Influence Innovation in Young Firms.” *Administrative Science Quarterly* 60(4): 596-633.

Pahnke, Emily C., Rory McDonald, Dan Wang, and Benjamin Hallen. 2015. “Exposed: Venture Capital, Competitor Ties, and Entrepreneurial Innovation.” *Academy of Management Journal* 58(5): 1334-1360.

Parsons, Talcott. 1956. “Suggestions for a Sociological Approach to the Theory of Organizations I.” *Administrative Science Quarterly* 1(1): 63-85.

Parsons, Talcott. 1957. “Suggestions for a Sociological Approach to the Theory of Organizations II.” *Administrative Science Quarterly* 1(2): 225-239.

Passoth Jan-Hendrik and Werner Rammert. This volume. “Fragmental Differentiation and the Practice of Innovation. Why Is There an Ever-Increasing Number of Fields of Innovation?”

Pfeffer, Jeffrey and Gerald R. Salancik. 1978. *The External Control of Organizations. A Resource Dependence Perspective*. New York: Harper & Row.

Popitz, Heinrich. 2000 [1997]. *Wege der Kreativität*. Tübingen: Mohr Siebeck.

Rammert, Werner. 2014. “Vielfalt der Innovation und gesellschaftlicher Zusammenhalt. Von der ökonomischen zur gesellschaftstheoretischen Perspektive.” Pp. 619-639 in *Vielfalt und Zusammenhalt. Verhandlungen des 36. Kongresses der Deutschen Gesellschaft für Soziologie in Bochum und Dortmund 2012, Part 2*, edited by M. Löw. Frankfurt a. M.: Campus Verlag.

Rogers, Everett M. 2003 [1962]. *Diffusion of innovations*. 5th ed. New York: Free Press.

Schubert, Cornelius, Jörg Sydow, Arnold Windeler. 2013. “The Means of Managing Momentum: Bridging Technological Paths and Organisational Fields.” *Research Policy* 42(8): 1389-1405.

Schumpeter, Joseph A. 1934 [1912]. *The Theory of Economic Development*. Cambridge: Harvard University Press.

Schumpeter, Joseph A. 2000 [1911]. “Entrepreneurship as Innovation.” Pp. 51-75 in *Entrepreneurship. The Social Science View*, edited by R. Swedberg. Oxford: Oxford University Press.

Schumpeter, Joseph A. 2003 [1942]. *Capitalism, Socialism, and Democracy*. London, New York: Routledge.

Schumpeter, Joseph A. 2005 [1932]. “Development.” *Journal of Economic Literature* 43(1): 108-120.

Silver, Daniel. 2011. “The Moodiness of Action.” *Sociological Theory* 29(3): 199-222.

Sydow, Jörg and Arnold Windeler. 2003. "Knowledge, Trust and Control. Managing Tensions and Contradictions in a Regional Network of Service Firms." *International Studies of Management & Organization* 33(2): 69-99.

Sydow, Jörg, Arnold Windeler, Cornelius Schubert, and Guido Möllering. 2012. "Organizing R&D Consortia for Path Creation and Extension: The Case of Semiconductor Manufacturing Technologies." *Organization Studies* 33(7): 907-936.

Tavassoli, Sam and Charlie Karlsson. 2015. "Persistence of Various Types of Innovation Analyzed and Explained." *Research Policy* 44(10): 1887-1901.

Thompson, James D. 2004 [1967]. *Organizations in Action. Social Science Bases of Administrative Theory*. New Brunswick, London: Transaction Publishers.

Villani, Marco, Stefano Bonacini, Davide Ferrari, Roberto Serra, and David Lane. 2007. "An Agent-Based Model of Exaptive Processes." *European Management Review* 4(3): 141-151.

Weber, Max. 1978 [1922]. *Economy and Society*. Berkeley, Los Angeles: University of California Press.

Windeler, Arnold. 2001. *Unternehmungsnetzwerke. Konstitution und Strukturation*. Wiesbaden: Westdeutscher Verlag.

Windeler, Arnold. 2003. "Kreation technologischer Pfade: Ein strukturationstheoretischer Ansatz." *Managementforschung* 13: 295-328.

Windeler, Arnold. 2012. "Kooperation und Konkurrenz in Netzwerken. Theoretische Überlegungen zum Strukturwandel der Arbeitsorganisation." Pp. 23-50 in *Vertrauen und Kooperation in der Arbeitswelt*, edited by C. Schilcher, M. Will-Zocholl, and M. Ziegler. Wiesbaden: VS Verlag.

Windeler, Arnold. 2014. "Können und Kompetenzen von Individuen, Organisationen und Netzwerken. Eine praxistheoretische Perspektive." Pp. 225-301 in *Kompetenz. Sozialtheoretische Perspektiven*, edited by A. Windeler and J. Sydow. Wiesbaden: Springer VS.

Windeler, Arnold. 2015. "Organisationen in der radikalisierten Moderne: Herausforderungen." Pp. 173-188 in *Zur Zukunft der Organisationssoziologie*, edited by M. Apelt and U. Wilkesmann. Wiesbaden: Springer VS.

Windeler, Arnold and Jörg Sydow. 2001. "Project Networks and Changing Industry Practices. Collaborative Content Production in the German Television Industry." *Organization Studies* 22(6): 1035-1061.

Windeler, Arnold and Carsten Wirth. 2005. "Strukturation von Arbeitsregulation: eine relationale Mehrebenenperspektive." Pp. 163-191 in *Organisation von Arbeit*, edited by M. Faust, M. Funder, and M. Moldaschl. Munich, Mehring: Hampp.

Yoffie, David B. and Michael A. Cusumano. 2015. *Strategy Rules: Five Timeless Lessons from Bill Gates, Andy Grove, and Steve Jobs*. New York: Harper Collins.

Zahra, Shaker A., Mike Wright, and Sondos G. Abdelgawad. 2014. "Contextualization and the Advancement of Entrepreneurship Research." *International Small Business Journal* 32(5): 479-500.