Chapter 18

Experimentalist Systems in Manufacturing Multinationals: Recursivity and Continuous Learning Through Destabilization

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Permanent innovation pressures riddle many contemporary manufacturing sectors with uncertainty. In search of new product ideas and processual improvements to gain advantage over competitors, firms continuously modify and improve both their internal and external relations and processes. Such constant searching and optimization destabilizes routines and relations, creating both possibility and hazard for firms and their stakeholders. Uncertainty, the distrust that current resources and practices will yield future advantage, is both the cause and consequence of these continuous optimization processes. As a result, coping with uncertainty is a core governance challenge in contemporary manufacturing firms and across their supply chains.

Production globalization exacerbates these dynamics in two ways. First, it diffuses routine and relational disruption practices to offshore locations. Manufacturing MNCs compete with one another all over the world on the basis of cost, quality, and innovation. Increasingly, in sectors like automobiles and machinery, product sophistication differs little across the markets in which MNCs actively produce (Horner & Hulme, 2017; Horner & Nadvi, 2017; Sutton, 2012). Consequently, firms confront uncertainty in offshore markets at least as intense as they experience in their home markets. These pressures induce firms to extend their search and optimization practices (and the continuous routine and relational disruptions that they involve) to their offshore locations.

Second, globalized production further generates uncertainty simply through the complexity involved in managing the global interrelations and interdependencies of far-flung and increasingly sophisticated production clusters manufacturing common technologies. Complexity associated with localization pressures—the need to adapt models to local tastes and conform with indigenous standards and regulations—adds to the uncertainty by destabilizing designs and production practice. Further,

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players at the center of an MNC exploit innovations and improvements that are generated both at home and offshore and seek to leverage them for advantage in other locations, including the firm's nominal home location. This in turn further disrupts routines and relations in all the receiving locations, creating uncertainty.

The upshot is that many global manufacturing firms live with the uncertainty of product change and routine and relational disruption throughout all aspects of their global operations, virtually all the time. Indeed, it is not merely something that they respond to; it is an environmental situation that they chronically self-induce in order to leverage innovation from where it occurs to where it can be advantageously deployed.¹

In this article, I argue that these highly uncertain environmental conditions and internal firm self-disrupting practices are generating a notable shift away from conventionally hierarchical governance architectures in complex manufacturing sectors like the automobile and machinery industries. Continuous innovation and change in products and processes push traditionally separate functionalities, such as conception/execution, design/production, finance/manufacturing, assembler/supplier, and headquarters/local subsidiary into explicit mutual dependence. The content and scope of functionalities and roles, increasingly, are defined and redefined interactively, through the mutual participation of stakeholder parties, rather than through top-down processes of command and control. Roles and identities are too unstable and transient to support rigid hierarchical authority; the imperative for learning and for the diffusion of knowledge throughout the MNC overwhelms the clumsy and slow-moving unilateral pretenses of top-down bureaucratic order.

But if traditional hierarchical bureaucratic governance no longer works, how do firms govern their global operations? What are the principles of effective governance under conditions of uncertainty that can accommodate and foster continuous routine disruption, innovation, and learning? This article uses case study material on German automobile and machinery multinationals to show that at least those MNCs are managing the uncertainties that their practices encounter and generate by developing post-bureaucratic “experimentalist” architectures.²

¹All this in addition to the continuous negotiations and struggles between MNC home office interest and the ambitions of local players, dynamics that have been the focus of much literature on MNC Center-Local relations. See, generally, Kristensen and Zeitlin (2004), and for an interesting case, Glückler (2014).

²I am not claiming that there is something specifically German about these practices. They are simply German cases. For what it is worth, Netland (e.g., Netland, 2013) and others see the diffusion of self-optimizing CPSs as a general trend. For the material in this paper, I am drawing on a series of research projects I conducted with German collaborators. We conducted over 150 interviews in Germany, Central Europe, and China between 2008 and 2015 in the automobile, auto components, electromechanical, and machinery industries. My aim here is simply to exploit the rich and extensive fieldwork that we did in German companies and describe the experimentalist dynamics that we found there. I am saving the important discussion of national specificities for another day. For a more detailed description of the German case material from which I draw, see Herrigel, Voskamp, and Wittke (2017). For an in-depth study whose authors deal extensively with the implementation of the VW as well as Toyota Production Systems in the BRICs, see Jürgens and Krzywdzinski (2016).

These alternative governance architectures are formal systems of multilevel, interdependent, stakeholder role-, standard- and goal-setting practices that presuppose the provisionality of initial targets (roles, standards, designs, production and cost goals, etc.). Iterative evaluation of frameworks in light of the experience of putting them into practice, at all levels of the MNC, fosters continuous—and formally prescribed—optimization, improvement and learning throughout the organization. Centrally (and collectively or jointly) set goals and standards are modified through the process of attempting to realize them; formally prescribed requirements on the local adapters to defend their changes to central actors both disciplines the local and opens the center to the possibility for the transformation of its own goals and roles.³ The experimentalist systems are processual and interdependent; they are formal and inclusive; and they use collective self-surveillance to foster organizational and technological learning and innovation.⁴

In a very general way, such architectures instantiate a variant of what the management theorists Maurizio Zollo, Sidney Winter (Winter, 2003; Zollo & Winter, 2002), David Teece (Teece, 2007; Teece, Pisano, & Shuen, 1997), and A. G. L. Romme (1997, 1999; Romme, Zollo, & Berends, 2010) call “dynamic capabilities.” According to Zollo and Winter (2002, p. 340): “A dynamic capability is a learned and stable pattern of collective activity through which the organization systematically generates and modifies its operating routines in pursuit of improved effectiveness.” It is “exemplified by an organization that adapts its operating processes through a relatively stable activity dedicated to process improvements.” Such capabilities arise, they argue, “from learning; they constitute the firm’s systematic methods for modifying operating routine.”

Dynamic capability theorists use the notion in an extremely general way to apply to architectures that can govern the revision of operating routines under a wide array of environmental conditions. Hence bureaucratic hierarchy and post-bureaucratic experimentalism can both be, so to speak, dynamically capable. Zollo and Winter (2002) suggest that robust dynamic capabilities of the post-bureaucratic sort—in other words, in which deliberative and codified learning processes are integral to

³In this sense, the perspective here runs orthogonally to the debate about HQ-subsidary relations and embeddedness, for instance, the influence of local institutional relations on subsidiary practices (e.g., Becker-Ritterspach & Dörrenbächer, 2009; Dörrenbächer & Geppert, 2011). Under the important background condition of uncertainty, experimentalist practices routinely accept local deviation from central standards, but formally require an explicit justification from local actors. The center is open to local modification because its members want to identify and circulate beneficial or effective aspects of local innovations across all its global subsidiaries performing similar manufacturing projects. For a discussion of the relationship between the perspective here and the global-local literature on MNCs, see Herrigel et al. (2017, Chap. 4).

⁴Indeed, because the experimentalist practices presuppose the existence of deep environmental uncertainty, the analysis here also runs orthogonally to the HQ-subsidary literature whose authors focus on subsidiary initiative and intra-corporate power relations (e.g., Bouquet & Birkinshaw, 2008; Dörrenbächer & Gammelgaard, 2016; Glückler, 2014). These authors presuppose role positions where the actors know their interests before they act; the analysis here highlights the way in which uncertainty causes precise role identities and interests to emerge out of joint deliberation.

practice—come into being (a) in turbulent and uncertain environments; (b) when there is a learning culture or predisposition in the organization; (c) when less frequently occurring, more heterogeneous, and causally ambiguous tasks are in play.⁵ Under these conditions, they argue, purely behavioral or practice-based forms of randomly induced learning are conditioned and modified by more directive, deliberative, and formal learning mechanisms.

I argue here that post-bureaucratic or “experimentalist” architectures, which are generated under the conditions of uncertainty outlined above, are distinctive within this genus of dynamic capabilities, for three reasons.⁶ First, they presuppose extensive stakeholder involvement in the establishment and revision of standards and organizational goals. Uncertainty undermines hierarchy, destabilizes roles and functions, and makes stakeholder cooperation across boundaries inescapable. Call this the *principle of transparency and inclusion* (Sabel, 2006; Simon, 2015). Second, they emphasize the provisionality and continuous revision of deliberatively established standards and goals in light of practical experience. Crucially here, where bureaucracy governs by rule and relies on unaccountable, informal, and random discretion to reconcile rule with practice, experimentalism formally demands accountability from discretion (peer review, reason giving) in order to modify and improve, rather than simply reconcile, rule and practice. Call this the *principle of revisable planning or governance by plan rather than by rule* (Simon, 2015).

Third, experimentalist architectures are formally proactive and preemptive rather than reactive about error, mistake, and deviation in processes. Simon (2015, p. 62) says that post-bureaucratic organizations tend “to rely on audits more than complaints, and.... [take] a diagnostic approach to complaints, understanding them not just as evidence of idiosyncratic deviance, but as symptoms of systemic malfunction.” Call this the *principle of improvement-oriented self-surveillance*.

Experimentalist governance, then, can be understood as a form of dynamic capabilities in that it involves learning not just at the level of operational routines for the production of given automobiles or machines; it also involves the optimization and recomposition of the learning process itself. But experimentalist architectures are distinctive in their explicit effort to use transparency, inclusion, revisable planning, and improvement-oriented self-surveillance to cast not only routines but also very explicitly the boundaries and inter-relations of roles and functions within the organization into play. By erecting a governance architecture capable of continuously recomposing roles and functions, in addition to routine practices, experimentalist governance induces distinctively self-recomposing circular or recursive learning processes throughout MNC global operations.

The German firms studied here apply this experimentalist version of dynamic capability throughout their organizations, from headquarters to off-shore subsidiary and from top management suite to production-level, shop-floor teams. A central

⁵See also Romme et al. (2010).

⁶See Simon (2015) for elucidation of post-bureaucratic principles in administrative law; see Romme et al. (2010) for description of circular learning in dynamic capabilities under conditions of uncertainty.

diffusion mechanism for these practices is the Corporate or Comprehensive (*Ganzheitliche*) Production System (CPS) (Netland, 2013; Netland & Aspelund, 2013; Netland & Ferdows, 2014; Netland & Sanchez, 2014). Inspired by the original Toyota Manufacturing System, such team/stakeholder-driven formal systems have transformed German manufacturing culture today. Their experimentalist character enhances companies' dynamic capability to negotiate uncertainty in their market and technological environments through induced processes of circular learning and the continuous recomposition of roles and function across organizations in response to challenges.

When they are working properly, experimentalist systems foster and diffuse both organizational and technological innovation within companies and across supply chains (Helper, MacDuffie, & Sabel, 2000; Herrigel, 2010; Sabel, 2006; Spear, 2009). As such, they enhance German manufacturing competitiveness and induce continuous producer and regional upgrading in emerging economies (Herrigel, Wittke, & Voskamp, 2013).

Finally, movement towards experimentalism within manufacturing MNCs is neither seamless nor uncomplicated (Netland & Ferdows, 2014). Indeed, there are three characteristic obstacles to the diffusion in practice of experimentalism's recompositional and circular learning dynamics: hierarchical insulation, stakeholder exclusion, and inadequate empowerment resources for participants. Interestingly, these obstacles exist not only *ex ante*, as firms attempt to construct the experimentalist architectures of corporate production systems and implement them throughout their global operations, but they also are continually regenerated by the recompositional dynamics of the CPS's themselves. Revision of commonly agreed-upon frameworks frequently redefines power relations and stakeholders, creating new possibilities for insulation and exclusion.

In order to prevent such obstacles from paralyzing the global process of recursive learning, many experimentalism-oriented German MNCs, using the principle of improvement oriented self-surveillance, introduce an array of destabilization mechanisms to systematically undermine insulation and exclusion strategies within the global firm and reconstitute the deliberative experimentalist learning process. Interestingly, CPSs often contain penalty default mechanisms as part of the experimentalist framework which systematically monitor widespread deliberation processes for possible paralysis and, when finding it, redefine the deliberative terrain to re-start deliberation (and learning) on a new basis.

This article portrays manufacturing MNCs using experimentalist systems as extraordinarily dynamic organizations (embedded in equally dynamic supply chains) characterized by recursive learning and chronic organizational disruption and recomposition over time. A snapshot of these organizations at any instant in time contains complex admixtures of joint problem solving, team-based goal setting, hierarchical insulation strategies, and patterns of stakeholder in/exclusion. Viewed over time, however, as a constantly self-disrupting process, experimentalist multinationals emerge as dynamically recursive learning systems focused on permanent organizational and technological optimization and innovation.

The article proceeds in three sections. The first section outlines the global competitive and strategic conditions that have given rise to experimentalist governance architectures within manufacturing multinationals and their supply chains. The second section describes experimentalist architectures and how they work. It also addresses a number of failed alternative strategies that German firms pursued prior to embracing experimentalist practices. The third section then discusses characteristic obstacles to experimentalism's diffusion, many endogenous to the practice of experimentalism itself, along with a range of strategies and mechanisms that firms deploy to overcome them.

Experimentalism Grows out of Uncertainty Associated with Changing Global Demand and Attendant Production Relocation

From a developed country's manufacturing MNC point view, global opportunities for growth and expansion have shifted notably in the new century (Baldwin, 2016; Horner & Hulme, 2017; Kobrin, 2017; Sutton, 2012). During most of the twentieth century, the largest manufactured goods markets were also the fastest growing ones. For US, German, and Japanese manufacturers, this meant that they targeted the bulk of their exports and FDI efforts at developed (western) European, North American, and North Asian economies. This situation began to change in the new century, however, as emerging market economies, notably the BRICS, became the driving forces of global growth (cf. Horner & Nadvi, 2017; World Bank, 2015).

Significantly, emerging market demand growth has been so rapid, technologically challenging, and quantitatively massive that it cannot be serviced through exports alone. Instead, firms have been forced to expand FDI and service demand in those emerging markets by "producing where they sell." Since 2009, for example, German automobile makers have produced more cars outside of Germany than inside Germany (Heymann, 2014; VDA, 2012, p. 30). China has, by far, become the largest offshore production location for Germans (VDA, 2017). Similar shifts away from export and toward offshore production characterize automobile industry development in Japan, Korea, the USA, and France (VDA, 2017). In most cases, companies develop global models that are then adapted to local market conditions.

Crucially, this shift toward producing where they sell involves significant upgrading of offshore production operations (Herrigel et al., 2013, 2017; Horner & Hulme, 2017; Sutton, 2012). Competition for market share in growing markets such as China is intense and customer sophistication is developing rapidly (Brandt & Thun, 2010). In order to be competitive, FDI manufacturers must pay attention to manufacturing economies and product quality. Moreover, the MNC affiliates must be able to offer products that appeal specifically to the needs and preferences

of local customers and that are designed according to host country regulatory norms and standards. This presses manufacturers to upgrade local operations in three areas: production worker skill levels, supply base sophistication, and local R&D, design, and engineering capability (Brandt & Thun, 2010; Herrigel et al., 2013; Sutton, 2012).

These strategic shifts within MNCs have created extensive “internal” networks of interconnected production clusters in different global regions, all focused on trying to manufacture the same or very similar end products. This generates quite distinctive governance challenges within global manufacturing MNCs. Firms need to optimize exports from home locations with global offshore production capacity while simultaneously reconciling constant imperatives for process and product optimization, innovation, cost reduction, and learning, not only within individual plants, but also centrally and locally across vast global organizations. This is not easy: Innovation can increase costs; optimization and cost reduction can undermine learning; too much local autonomy can generate centrifugal pressures weakening the various forms of leverage (learning, knowledge, purchasing) that come with global concern membership; too much central direction can undermine local innovation and organizational capabilities crucial for competitive advantage in foreign markets.⁷

Not only that, global competition is so dynamic that there is never a natural sweet spot in which all of these competing goals and pressures can be stably reconciled or in which a happy equilibrium can be found. New products, technical innovation, competition among suppliers, new local regulations, currency value shifts, organizational learning induced possibility—and much more—all constantly destabilize the ordered practices that firms develop and generate new adjustment and governance challenges. Innovation, cost reduction, and learning are imperatives for all actors throughout MNC operations, yet environmental uncertainty is so great that at any given moment players have no clear sense of what strategy would be most optimal for them to achieve those goals. Forced, nonetheless, to act, I here argue that they turn to the revisable and recursive measures associated with experimentalism.

Global Strategies Governed by Self-Recomposing Experimentalist Learning Architectures Within MNCs and Across Supply Chains

Uncertainty along multiple dimensions is thus a crucial element in the emergence of the new global governance practices within manufacturing MNCs. It is not, however, analytically helpful (nor empirically accurate) to view successful manufacturing

⁷For exploration of these dynamics, see Bouquet and Birkinshaw (2008), Becker-Ritterspach and Dörrenbächer (2009), and Dörrenbächer and Geppert (2011).

MNC governance efforts as “reactions” seeking to “cope” with continuously uncertain and recombinatory practices in their organizations and the environment. Rather, this section shows that many manufacturing MNCs are creating (transnational) governance architectures that *systematically induce* organizational destabilization and recompositional experimentation to foster innovation and learning.⁸ This proactive destabilization is accomplished through the workings of formalized “experimentalist” systems, such as corporate production systems (CPSs), Six Sigma programs, and other formal systems of open standards (e.g., ISO certifications). Such systems foster collective self-analysis through formally transparent and inclusive procedures that involve joint goal setting, systematic performance review, prompt problem solving, and organized destabilization of insulation and exclusion strategies.

What Is an Experimentalist Governance Architecture?

I describe the emerging recursive or circular learning-based processes in MNCs as “experimentalist” because they resemble what Charles Sabel, Jonathan Zeitlin, William Simon, and others call “experimentalist governance architectures” in public policy and administrative law contexts (Sabel, 2006; Sabel & Simon, 2011; Sabel & Zeitlin, 2008). Those scholars, in turn, draw theoretically on the American Pragmatic tradition’s use of the word experimentation. Experimentation, pragmatically understood, describes the relational, interactive, and social character of identity, goal setting, and action, in which goals and the means adopted to achieve them are continuously modified and optimized through the social action process (cf. Dewey, 1922; Joas, 1996).

In its most abstract analytical form, the experimentalist governance architecture is a formalized four-step recursive process. All actors are aware of the formal rules and obligations that constitute the system. First, there is joint or collective goal setting. Relevant stakeholders (what Dewey called “publics”) commonly affected by a given problem openly deliberate about solutions and future goals for their common interactions. Second, local stakeholders then implement/pursue these solutions and goals in their milieu. Application or realization of the common standard in the local environment invariably requires local player discretion: Unanticipated problems emerge, intermediate benchmark goals are not fulfilled, local conditions differ from the stylizations used during the general deliberations, and so forth. The center permits local discretion—deviation from agreed upon practice or standards—in order to facilitate problem solving and adaptation that enables the local organization to achieve the goal target. But these deviations must be transparent (other players must be able to observe or review them). In a third step, the deviation/local change must be defended to the central stakeholder teams who delegated the design/standard/goal. Finally, fourth, successful local experiments are then used to review the effectiveness and desirability

⁸Again, this condition distinguishes the view here from authors of other HQ-subsidary literatures who take a more structuralist position, attaching specific interests *ex ante* to particular role positions, compare Bouquet and Birkinshaw (2008).

Fig. 18.1 Pragmatist-experimentalist learning architecture. Source: Design by author

of central/common goals and standards. If the local innovation is compelling enough, this can result in modification of the central standard (Fig. 18.1).⁹

The experimentalist governance school applies this framework to workings of public policy and regulation (cf. also Sabel, Herrigel, & Kristensen, 2018), but it is a very fruitful way to understand how many contemporary MNCs are using CPSs and other formal standard-setting and review mechanisms to govern their global operations. CPSs are formal systems that organize group- or stakeholder-based goal setting within firms to achieve product and process innovation, optimization (cost reduction), and learning on a continuous basis.¹⁰ The systems are rooted in team goal-setting/standardization procedures (regular goal setting meetings) and constitute a hierarchical architecture of team-based goal conversations, ultimately linking (through many mediations) the shop floor to the top management.

The conversations are also systematically cross-functional and global. Product teams, customer teams, design and manufacturing teams, and continuous improvement teams all are constituted in multiple locations and form super-ordinate or umbrella teams that engage with one another across markets and geographical space

⁹ Compare this inclusive and mutual role-defining four-step circular model to the more hierarchical four-step circular model presented by Zollo and Winter (2002, p. 343): External stimuli and processual feedback produce 1.) generative variation (scanning, recombination) → 2.) internal selection (evaluation, legitimation) → 3.) replication (knowledge sharing/transfer adaptive variation, problem solving) → 4.) retention (enactment, routinization).

¹⁰ See Friedli and Schuh (2012), Sabel (2006), Spear (2009), Westkämper and Zahn (2009) for general discussions; for international case studies of implementation and diffusion, see Clarke (2005), Netland (2013), Netland and Federow (2014), Netland and Aspelund (2013), and Netland and Sanchez (2014).

to identify common goals and standards and compare (and defend) their local experiments.

CPSs have diffused widely among manufacturing MNCs. Many companies brand their CPS (e.g., The Siemens Production System or The Volkswagen Production System). The companies also characteristically provide their own corporate names to the mechanisms of goal setting, self-evaluation (performance review), benchmarking, joint problem solving, and goal revision. Despite this nominal variety, however, all follow the general experimentalist logic outlined above. Many smaller companies also embrace similar formal, experimentalist, team-governed, lean production-based principles, even though most do not attempt to “brand” their system.

The following example, taken from a German Truck and Omnibus transmission producer (*Auto-Getriebe*), illustrates the globally recursive and learning elements of these systems.¹¹ Joint German design and manufacturing teams developed a new variant of a medium-sized transmission for the global market. They worked out the technical specifications, cost targets, and manufacturing time in an iterative experimentation and exchange process between design and manufacturing engineers, the prototyping workshop, and the home location shop floor. Very early conversations between this product team and a higher-level global strategy team suggested that the transmission would also be produced in China, Russia, India, and other emerging markets. Design and manufacturing teams from these markets were incorporated into the development process and technical specifications, cost targets, and manufacturing cycle parameters (metrics and standards) for those markets were provisionally established.

My colleagues and I followed the transfer of the technology to the Chinese market. German team members, design and manufacturing engineers, as well as skilled workers from the prototype workshop and home location shop floor, traveled to China to assist local engineers and workers with the initial production set up. Local Chinese engineers educated their skeptical German counterparts about the possibilities and limits of the Chinese location. Adjustments along several dimensions were made locally, involving a variety of input material, contour design, machine usage, and cycle time metrics and standards. Engineers from the transmission producer’s Chinese design center were called in to assist the collaborating teams with these adjustments. As design and production metrics and standards were altered, the German design office was consulted to approve suggested changes to the original targets. The local production and design teams defended the changes to the central teams. In the process, the central team noticed that the adjustments in the flow of

¹¹ I draw all examples from a research project I conducted in eastern Europe and China among German automobile and machinery producers and suppliers funded by the Hans Böckler Stiftung. Company names must remain confidential. We conducted over 150 open-ended interviews at multiple firms and subsidiary operations in both industries between 2008 and 2015 and have anonymized specific cases by agreement with the case partners. When I refer to specific firm names in this text, I am drawing on material that is either in the public domain or is publicly available. Compare Herrigel et al. (2017) for full discussion of the study’s empirical basis.

manufacturing could be used for the same product in eastern European and Indian production locations. Changes were made to the central design. Production performance both in Germany and in offshore locations was, in this systematic fashion, regularly reviewed, metrics and standards were optimized, and roles and relations recomposed.

All of this iterated transfer and exchange occurred according to team-based CPS procedures. Transnational know-how transfer and experience-driven learning, facilitated by formally prescribed team interactions, were systematic features of this system. It was also deeply recursive, as the central teams learned from the experiments of the local teams even as the latter were learning from the former. Finally, revision of the metrics and standards involved role and rule changes within the organization. The division of labor in design and production was continuously optimized and varied. Stakeholder interests were not aligned by the system, they were continuously changed by the process of metric and standard creation, performance review, and optimization.¹²

Obviously, the key to this system's success is that it is global and extends seamlessly throughout all the operations of a firm. For innovation, optimization, and learning to flow recursively within the MNC, everyone must speak the language of the company's CPS. Practices of joint goal-setting and systematic performance review need to become second nature—a new form of self-disrupting routine (Sabel, 2006). This raises the interesting problem of how such systems are globalized.

Firms deploy a number of different diffusion mechanisms. *Auto-Getriebe*, for example, created teaching units that it called Centers of Competence (CoC). These were especially highly performing functional units (e.g., Transmission Housing Assembly) within specific company production locations that had most successfully implemented the CPS. These units were then given the responsibility to help other units doing the same thing elsewhere adopt the CPS routines and develop the capacity to hit performance targets.

My colleagues and I observed CoC at work in a number of units, including the truck-transmission housing assembly group. In all cases, the most advanced workshops were located in the company's home German location. Teams from, for example, the assembly workshop (including managers, engineers, and line workers) travelled to assembly operations in France, India, and China to assist local teams set up operations. These interactions were, in turn, observed by superordinate "international" teams composed of management, engineering, and shop floor representatives from all truck driveline assembly and logistics operations world-wide. The goals were, on the one hand, to get agreement on product and quality metrics and standards among all truck driveline assembly operations (and among global suppliers), and, on the other hand, to get agreement on the core performance review and problem-solving procedures consistent with the company's CPS. The CoC convened face-to-face international team meetings once a year. In addition, two-hour phone meetings

¹² These dynamics can also generate counter-productive forms of exclusion and hierarchical insulation. I discuss these possibilities and the mechanisms firms are developing to deal with them in the following section.

occurred once every quarter (always at 15:00 German time), in which the callers discussed “red status” (i.e., problem/local deviation) issues and made group decisions.

Crucially, the home country CoC’s ambition was not to impose common assembly procedures, materials, or logistical flows on like units across the entire company. Rather, it aimed to construct procedures to achieve agreement on metrics and standards and establish transparent self-optimizing processes of regular performance review. The German location provided the offshore operations with technical advice, demonstrated German procedures, and actively assisted with the industrialization of the offshore locations. But local managers were given much leeway to achieve agreed metrics and standards in locally appropriate ways. Deviations from central practices had to be defended, in particular in discussions within the international team. But if the metrics and standards could be maintained or improved upon, deviations were accepted. Indeed, other operations embraced especially innovative alternative practices, through the information channel of the international team.

Continuous improvement teams (CITs) are an alternative experimentalist governance diffusion mechanism. These teams are especially common in machinery firms. Here, the idea is to create a team of CPS experts (lean production specialists, Six Sigma blackbelts, quality engineers, skilled production workers) travelling throughout the firm’s functional areas and all global production locations interacting with functional teams as CPS consultants and service providers. CIT members continually provide advice about CPS procedure, how to implement practices of joint goal setting and systematic performance review (the next section will show that this can be a purposefully disruptive activity). But, significantly, they also enact the CPS with their interlocutors, making suggestions for workflow improvement and socializing teams in joint problem solving. CIT teams routinely help multifunctional production or product teams construct better ergonomic workplace arrangements for machining and assembly (using CIT budgeted resources). CITs are also globally constituted (indeed, in the two largest machinery producers we observed, CITs are the largest global teams) and engage with offshore locations in the same CPS proselytizing and service-providing manner in which it engaged home country teams.

Again, as with the CoCs, the aim of CIT activity is not to impose uniform technical and work practices across all parts of the company. Rather, it is to cultivate a common team-based joint goal setting and systematic performance review practice focused on optimization and learning. Notably, even as they help establish intra- and inter-team communication procedures, the circulation of experienced CIT members diffuses innovation and useful practical innovations throughout the MNCs global operations. As the CIT head at a German Power Drive producer (*SW-Antrieb*) told us:

We are very careful to ensure that information ... gets transferred.... [W]e train employees, world-wide, in these themes.... [I]deas get discussed and solutions outlined at local units all over the world—we are permanently present, locally. At the same time, our members are constantly traveling between units. We achieve information transfer in this way.

CITs generate organizational learning, establish procedures to sustain it, and help to diffuse it within the global organization.

CoC's and CITs are two of many variants currently diffusing CPSs across MNC firms' global operations. Like the CPSs they are used to construct, these organized practices are disruptive mechanisms. Their aim is to instigate local experimentation for practical improvement of jointly agreed upon central norms, metrics, and procedures. They are not establishing incentive alignments; they are convening discussions to define (and redefine) common goals. The *SW-Antrieb* CIT head describes the character of the process in this way:

We present our plans for investment and change to the local colleagues in a workshop in their plant. We then get together with the employees and ... look at the existing process and determine what is good and what is bad Once we have done all of these things, we work together with the local actors to develop a new production island.... Our job is to see that whatever result is worked out is developed and worked through jointly with the colleagues locally.

The manager then referred to a Korean case where the local players resisted implementing the home company's blueprints in every detail. "We installed a manual conveyor here only three or four years ago," the Koreans told them, "and we don't want to just throw it away." After some detailed back and forth about quality and cost differentials between Korea and Germany, the decision was to keep the manual conveyor. "This was fine with us because the production costs were significantly lower in Korea than in Germany."

The next section will show how this interactive joint problem-solving process plays a crucial role in destabilizing the obstacles to learning that emerge through efforts on the part of managers and worker groups and representatives to insulate or exclude interests from the experimentalist process. In the present context, however, I emphasize again that it is inaccurate to understand the workings of these mechanisms as encounters between distinct home and host country institutional logics.¹³ CoC and CIT team actors do not regard the practices of local interlocutors as a foreign logic; they view local player perspectives as potential resources to be leveraged in a continuous optimization and learning process. Similarly, local players regard CoC and CIT players not as hierarchical principals giving them orders out of a foreign, institutionally embedded universe, but as potential resources and partners to help them achieve goals that both have agreed on. Moreover, when insights gained from local deviation prove effective, they are diffused elsewhere in the MNC. In this way, institutional logics do not clash; they give rise to deliberation. Systematic disruption and joint problem solving gives rise to continuous, mutual institutional recomposition.¹⁴

¹³ Once again running orthogonally to the concerns of the embeddedness school of Dörrenbächer and Geppert (2011).

¹⁴ Crucially, when asked in response to the story of module adaptation in Korea above *Is it always simply a matter of deviations from a standard module or can the process also result in a reconstruction (Umbau) of the module (central standard) itself?*, the Power Drive CIT Chief replied: "That happens quite often. It is very explicitly never excluded as a possibility. It is an essential part of the transfer process."

MNCs committed to a CPS logic are very emphatic about the system's distinctively collaborative and experimentalist aspects. Often this is true because many had tried (and failed) to arrange the technology transfer process in a more conventional hierarchical interest alignment way prior to working toward the experimentalist (formally collaborative) architecture. Prior to the CoC's creation, for example, *Auto-Getriebe* tried to manage technology transfer very hierarchically. Products were developed centrally at the home production location. Designs, discrete manufacturing-process instructions, and specific machinery to be deployed were then handed off to the subsidiary location. The subsidiary locals were then expected to implement exactly what had been handed to them, and their incentives were set according to centrally determined output and cost measures.

Invariably, locals ran into trouble getting the central designs and machinery to work in the ways the Germans did: Locals could not get machines to produce error free, costs were out of line, processes ran into unanticipated bottlenecks due to operator unfamiliarity with procedure (or differences in training and competence). New product ramp-up, as a result, chronically took longer than desired. Under that old system, the solution to such problems was to send a team of production and design experts from the home location to the subsidiary, where they would typically spend weeks telling locals exactly how to set up the German system, make the prescribed machinery work properly, and avoid bottlenecks. According to our senior production manager informant, the old system was an endless, and very expensive, cycle. The expert teams were no sooner home than they were called back to address new problems that had emerged. The old system's transfer process was too rigid and the subsidiaries' resources to address ramp-up problems too under-utilized.

CoCs were developed to introduce communication, flexibility, and local discretion into the technology transfer process. As described above, a key evaluative criterion was not the CoC's technological knowledge per se; rather, it was its organizational abilities to excel collaboratively within the MNC organization. Managers at *Auto-Getriebe* were driven to this experimentalist architecture largely because the old hierarchical incentive alignment arrangement was ineffective. Through a benchmarking process, the firm discovered that the Robert Bosch Corporation had implemented these CPS-driven experimentalist architectures for global product management, and the company decided to do so as well.

Endogenously Generated Barriers to Experimentalism's Diffusion Within Manufacturing MNCs and How Improvement-Oriented Self-Surveillance Mechanisms Also Become Destabilization Mechanisms

Market uncertainty, linked and unremitting pressures to innovate and reduce costs, and constantly evolving best-practice models drive the adoption and diffusion of experimentalist CPSs. The systems are attractive under these conditions both

because they make organizational practices transparent to the actors engaging in them, and because they help actors see that the endurance of specific practical arrangements is contingent upon good performance.

Naturally, there are many barriers to the diffusion of experimentalist CPS practices. Indeed, even in cases where actors extend the experimentalist logic quite far into their organizations, they often encounter limits to further extension. As a result, organizational optimization, recomposition, and recursive/circular learning dynamics become compromised and blocked. In this section, I will some of the most predominant organizational challenges to the diffusion of experimentalism within German manufacturing MNCs.¹⁵ I will also point to an array of strategies that MNCs pursue to overcome these blockages. The main diffusion barriers observed in our cases are: hierarchical insulation, stakeholder exclusion, and inadequate empowerment resources for participants.

Hierarchical insulation involves efforts on the part of higher level management to remove themselves from the continuing stakeholder joint goal setting and self-review procedures. In such cases, managers foster experimentalist problem solving within the domain that they command, but neither confer across domains with other managers or superiors about their domain's relative performance, nor do they negotiate with peer stakeholders about goal setting. In these cases, principal-agent incentive structures govern top management, whereas experimentalist practices govern the practical domains of design and production. Upward diffusion of experimentalism is blocked by the power desires and egoism of managerial ambition within governance and organizational hierarchies.

Such governance segmentation within companies can lead to suboptimal organizational outcomes. Higher managers pursuing incentives based on results grow impatient with the CPS's process-focused, bottom-up problem-solving procedures. They suspend or circumvent the process to generate results for which they will be immediately rewarded. This can create chaos and incoherence in the design and manufacturing value chain: rigorous problem solving is disrupted, learning blocked, and, ultimately, innovation inhibited. In the worst cases, it frustrates and delegitimizes expansive experimentalism at lower levels. Good-willed innovation is blocked by arbitrary power driven by rarified and incompatible managerial incentive structures (cf. Hafner, 2009).

Hierarchical insulation is a central criticism of CPSs in the critical industrial sociology literature. Sauer (2013), Gerst (2011a, 2011b), Pfeiffer (2007, 2008a, 2008b), and Dörre (2015), to take only the most prominent interventions, all point to hierarchical elements that are imposed on production line workers without negotiation: Financial data targets set without production level participation and human

¹⁵ I draw most of the empirical examples presented from fieldwork on German and US MNCs. For an alternative (complementary) perspective on diffusion obstacles, see Netland and Ferdows (2014).

resource hiring practices are two aspects of hierarchical management insulation that all these authors highlight in particular.¹⁶

In our interviews, these pathologies were present, but they were by no means uncontested, even by players beyond the shop floor. Indeed, CPSs themselves often “officially” characterize such insulation strategies as typical organizational pathologies that must be combatted. As I discuss below, many firms, following the basic experimentalist principle of improvement oriented self-surveillance, have developed mechanisms to destabilize insulation efforts.

Stakeholder exclusion also engenders governance segmentation within organizations. It involves the implementation of formal self-optimization procedures without involving all relevant stakeholders. Thus, manufacturing and design engineers are included in product development discussions, but purchasing executives are excluded or only brought in after crucial decisions have been made. Alternatively, manufacturing and design engineers as well as purchasing people are included, but key suppliers are left out or brought in late. These used to be classic errors of exclusion in the early days (1990s) of the diffusion of lean practices within industry (Helper, 1991a, 1991b; MacDuffie & Helper, 1999; Schumann, Baethge-Kinsky, Kuhlmann, Kurz, & Neumann, 1994; Springer, 1999). A great deal of progress has been made in this area since then, especially in the supply chain and the product development process (Helper et al., 2000; Herrigel, 2010; Sako, 2006; Whitford, 2005). But the large body of critical industrial sociological literature is evidence of its continued persistence in German plants.

Perhaps the most prevalent exclusionary barriers are those preventing production-line worker participation. Important case studies of CPS introduction in the German automobile industry, such as Pfeiffer's (2007, 2008a, 2008b; Adami, Lang, Pfeiffer, & Rehberg, 2008) analysis of a complex automobile assembly line, point to the continued exclusion of production-level teams' from upgrading and process redesign discussions, at least in some plants. This can occur when management designates its own agent as speaker of an allegedly self-governing production team, or when higher level teams simply rely on plant managers, section supervisors or set-up engineers for information on work team performance. It can also happen when continuous improvement teams unilaterally impose work-flow improvements without interaction with the line workers whose process they are improving. In all these cases, it is usual for workers and supervisors to communicate informally. But without the formal obligation to make their habitual actions transparent, workers can hide information (e.g., about finicky machines), protect favorite routines from alteration and, worst of all, become complacent about opportunities to make their own collective efforts better and more competitive. They withhold or bury basic information about the character of production. The firm (and management) in this way foregoes valuable knowledge of its operations and squanders resources for recomposition, innovation, and competitiveness (Adami et al., 2008; Pfeiffer, 2007, 2008a, 2008b).

¹⁶ Indeed, the Diesel scandal at VW, where subordinates were led to improvise an illegal work-around in order to satisfy unilateral performance pressures from higher level managers, appears to be a model illustration of hierarchical insulation.

The above forms of exclusion are hierarchically imposed, and thus have an affinity with hierarchical insulation. But it is also possible for certain stakeholder groups to self-exclude themselves from experimentalist self-optimization processes. This can occur in a variety of ways. In our German cases, we encountered examples of works council self-exclusion from newly introduced CPSs in their firm. The works councils in these cases viewed the new system as a threat and refused to participate. Abstinence from participation in the CPS, however, proved confusing for the employees in work teams at all levels, because they experienced a management discourse of empowerment and self-organization and a works council/union discourse of property divide, asymmetric interest, and mistrust. Sometimes, self-exclusion backfires for the works council, as the CPS self-optimization process's success undermines the sense of organizational indispensability associated with the works council's role. Other times, the effect is the reverse: Traditional role and identity cultivation prevents the CPS from gaining genuine traction in the firm.

A final internal barrier to experimentalist diffusion is inadequate empowerment resources for participants. Most prominently, this means the lack of adequate skills at the production and lower management levels, such as one finds in emerging market contexts. Many firms that run CPS procedures in broadly inclusive ways in their home market locations find it difficult to implement thoroughly inclusive self-optimization practices in emerging market operations. Language and cultural difference combined with limited skill and educational competences within the available labor pool make it difficult to configure production in a way that engages employees in useful self-optimization.

In part, low wages and structural weakness on the employee side allows management to not try so hard to implement an experimentalist system. Instead, they crassly exploit cost advantages without continuous optimization, or they impose improvements developed elsewhere on a compliant workforce. Self-optimization processes elsewhere in the company—even those higher up in the emerging market operation—in this way carry the inefficiency of very low cost and very manipulable labor.

Inadequate empowerment resources are not, however, only an artifact of power imbalances. Firms often believe that the constraints that available skill and competence pools place on efforts to localize home country production and work practices result in the loss or destruction of useful knowledge, rather than the generation of new or alternative knowledge about familiar technologies and production processes. For example, in their German operations, woodworking machinery and automobile front-end makers from our sample both use highly skilled workers capable of performing a variety of operations. Their experience generates unique product technology knowledge that can be leveraged for innovation in cooperation with engineers and product designers. Such workers in these firm's home locations in *Westfalen* and on the *Schwäbische Alb* are wholesomely incorporated into self-governing, cross-functional teams and in the serial self-review processes in their respective firms' CPS variants.

In China, however, such workers do not exist in the broader Shanghai labor pool where the firms have their production operations. Hence, when the firms produce the same products in Shanghai that they produce in Germany, even when they make

significant localization changes in the product design, the local management teams have to devise ways to make the product with far fewer skilled workers. Typically, this means that several more narrowly skilled workers will perform in a sequential and disintegrated way what one highly skilled worker would perform in a synthetic way in Germany. The firms incorporate the disintegrated workers less into the self-optimization procedures of their respective CPSs because they believe that the knowledge such workers could contribute through inclusion is less valuable. In part, this is a violation of the inclusion aspect of the transparency and inclusion principle; but there is also an element of the Chinese employees not being able to engage with the transparency element.

Destabilization Mechanisms

Interestingly, all these obstacles exist not only *ex ante*, as firms attempt to construct corporate production systems and implement them throughout their global operations. They also continually regenerate through the CPS's experimentalist dynamics themselves. The revision of commonly agreed-upon frameworks in light of changes to processes and products introduced at a local level frequently redefines power relations and stakeholders, creating new possibilities for insulation and exclusion at various levels and in different locations within the firm.

For example, many firms find that operations that are highly automated in German operations do not require the same degree of automation in lower-wage locations, such as Poland or China (or Korea, as in the quoted example provided earlier). As a result, local players there deconstruct the home procedures and render production flow into a series of manual operations. In some cases, these innovations actually prove more flexible and productive than the automated operations that they replace and, as a result, cooperating teams in the home operations try to replace automation with the newer manual procedures. In so doing, new worker groups emerge and teams are re-constituted. If the firm is not careful to ensure that the newly emergent groups become integrated into existing team deliberative relations in the plant, the new groups can be excluded (not recognized) as (knowledge-bearing) stakeholders in the production process. In such cases, managers can grab power and monopolize control over crucial levels of knowledge and resource flow within the firm.

In order to prevent such obstacles from paralyzing the global recursive learning process, many MNCs, in line with the principle of improvement-oriented self-surveillance, deploy an array of destabilization mechanisms that systematically undermine insulation and exclusion strategies within the global firm and reconstitute the deliberative experimentalist learning process. In particular, the organizational forms described above as knowledge carriers throughout the MNC's global operations—CoCs, CITs—act as destabilization mechanisms undermining efforts to insulate knowledge and exclude stakeholders. This makes sense, their aim is to manage center and local deliberation in ways that circulate technical and

organizational knowledge through the company's transparent formal CPS procedures. They both implement the CPS itself and carry knowledge around the global firm that CPS procedures generate. Local players seeking to exclude stakeholders (e.g., production workers or suppliers) or central actors looking to insulate their own practices from the changes generated by subsidiary actors are targeted by these "third-party" organizations and challenged to defend their efforts. Often, this challenge is enough to initiate inclusion processes: Why are production line workers not involved in team discussions with line leadership staff and application engineers? How will production implementation and run-up problems be dealt with without their input?

It is not only talk, either. Because the CoCs and CITs, in particular, are not supposed to impose solutions on players, but simply to instigate local discussions regarding the implementation of central technologies and metrics (for CoCs) or of possibilities for process improvement in the context of CPS procedures and global best practice (CITs), they have the organizational authority to provoke local actors into defending exclusion or insulation practices. And, as they are globally active, they come to individual central or local conversations with independent knowledge of practices throughout the MNC's operations. They can use this knowledge to insist that specific players contend with best practice within the firm. This use of organizational mission and accumulated practical knowledge to destabilize relations is a crucial dimension of CoC and CIT activity. They do not impose solutions, but rather use their organizational mission to destabilize practices and provoke deliberation about solutions.

But what if, for all that, stalemate or paralysis emerges? Or, what if deliberation proves so contentious and arduous that despite exchange, progress is too long delayed? In such cases, most CPSs provide for a penalty default (Ayres, 2001; Ayres & Gertner, 1989). That is, if local players are locked in dispute or cannot resolve a local problem, a higher order stakeholder team will intervene to redefine the problem that is stymying the local actors in an effort to create better conditions for agreement. Such interventions, moreover, are frequently independent from higher-level team judgment. Rather, the CPS itself establishes penalty default triggers—most often in the form of time frames for decision making, or outer boundary cost or return on investment targets ("gates") for processes. If local deliberation exceeds the allotted time or under- or overshoots cost targets, relevant higher-level teams are automatically called in (often following a logic imposed by Six Sigma instruments) to evaluate the situation.

The CIT head at *SW-Antrieb* (quoted earlier) outlined the procedures *they* follow for improvement project implementation. He highlights both the CIT role as a destabilization mechanism—in particular in identifying stakeholder exclusion and developing strategies for inclusion—and the key role played by penalty default—primarily in the form of strict time frameworks for project implementation.

We are continuously and permanently improving our processes through the involvement of all those who are affected and participating in them. That is our core approach to secure process sustainability. If you like, you can see it as a mixture of business reengineering and classic Toyota continuous improvement ... broadly lean principles. It is a path of many

small and tiny steps.... The limiting factor is always the time frame.... Within 12 weeks, we try to organize the process in a new way. The 12 weeks are a basic grid for us. If we see that the spectrum of themes, the degree of effort, or the scope are too large and can't be resolved within 12 weeks, we then start to segment the themes, and create sequences for effort in very transparent ways.

Twelve weeks, in other words, is a penalty default trigger. Projects that cannot be accomplished in that timeframe are redefined to facilitate more possible forms of collective problem solving. The *SW-Antrieb* CIT chief also emphasized that the role of CIT actors is to make all projects inclusive:

We [the CIT team-gh] in fact rove through the shop floor, observing production and frequently making suggestions for improvement. That is a permanent activity. It frequently happens, however, that the middle management comes to us and says: "I have a concrete problem in this area. Can you try to get people working toward a solution?" A project will be created that is ... interdisciplinary in makeup: That is, all stakeholders (*Beteiligten*) sit at the table and we try to construct a comprehensive/inclusive (*ganzheitliches*) image of optimization. All those affected by the problem participate in the work toward creating a solution. That is a core principle.

The same manager emphasized that CIT teams were needed as destabilizers because the "normal process" of self-optimizing, continuous improvement by specialized multifunctional teams very often tended toward myopia and self-blockage. They inadvertently excluded important players in the value chain:

No matter where you look, at Toyota or other benchmark companies, not a single company has been able to operate only self-optimizing teams. External destabilizers such as CITs are needed. We are no different. We thought initially that the theme of optimization ... would establish itself and run by itself. That didn't happen.... People do not look at their jobs in the whole context of production. This is what interdisciplinary project work tries to overcome. When a worker is active in a specific area of production, that person is generally very highly specialized.... But in the project teams, suddenly, he has to be concerned with material delivery and preparation as well as where the bevel gears that are made in her station will go to next The natural initial response here is to throw up your hands and say—this isn't my job, I don't know anything about this. And the person will avoid looking at the whole production process—not out of ill will, but simply because she sticks to what she knows. Our job is to remind people to see how their activity fits into the whole. We make models of the whole process chain and constantly remind the project participants what the big picture is.

Finally, the CIT head emphasized that it would be counter-productive for his firm's CIT team to impose a solution on the parties engaged in the project. Their job was to convene a conversation among all the relevant stakeholders. The point is to have the stakeholders understand their respective roles and to make all of their actions explicit to one another and to the firm's CIT team. When asked if his firm's CIT imposed solutions on the deliberating project teams, he said:

If we simply imposed solutions on the projects, they would never actually get implemented. Why? Because every person who worked on the process once it was up and running would try to prove to me that the solution doesn't work. Instead, our idea is ... [that] people have to be at the center in the design of the solution because they are the ones who will be responsible for ensuring that the process yields the quality, safety, and reliability that we need.

And the system only works, he emphasized, if it goes all the way down to the production line workers:

The project teams have to include machine operators, set-up people, maintenance, logistics, work preparation, work planning, the foreman (depending on how complex the solution looks like it will be), someone from the tool shop, and tool maintenance who will be able to ensure that the proper tools will be delivered to the new process. That whole team works together to come up with a solution for the new production process. In principle, the CIT team indicates only what methods and strategies are required.... It is up to the team members to choose. Of course, the solution has to be better than what it is replacing. That is the standard. The parameters are generated by our company's formal production system, but the solution is generated by the stakeholder problem-solving process...

Conclusion

All of these activities aimed at stakeholder inclusion and transparency creation are permanent and ongoing within successful experimentalist German MNCs. Projects and products set up in one year are reviewed the next in order to ensure that the original designs are having the desired effect—or to see if optimization projects elsewhere in the value chain have created possibilities in the area that were not possible to see when the initial project was undertaken. Such continuous self-surveillance is disruptive. “Daily routines” are made explicit to those enacting them and reflection leads to change or recomposition. As a result, manufacturing MNCs operating on a CPS logic are constantly in flux. Successfully overcoming problems of exclusion or insulation with one project often create new ones. The teams themselves, and the destabilizing CoC and CIT teams, must be vigilant and continue to root out exclusionary/insulating dynamics. Doing this on a permanent basis fosters learning and innovation within the entire global organization.

The upshot of all of this, of course, is quite paradoxical. In the current environment, manufacturing multinationals' commitment to learning, permanent self-optimization, and recomposition constantly creates the possibility for blockage through insulation or exclusion. Indeed, there are no pure examples of a thoroughly inclusive and systematically deliberative recursive learning-oriented manufacturing multinational. Rather, recursive learning organizations have heterogeneous, hybrid, and constantly self-recomposing governance arrangements with varying and highly contingent admixtures of joint problem solving, team-based deliberation, hierarchical insulation, and stakeholder in/exclusion. In this sense, the core emergent institutions in the new multinational are those that disrupt (especially the principles of revisable planning and improvement-oriented self-surveillance), rather than those that govern. Disruption is a permanent process, while specific formal governance arrangements, like the organizational roles they manage, are always ephemeral.

References

- Adami, W., Lang, C., Pfeiffer, S., & Rehberg, F. (Eds.). (2008). *Montage braucht Erfahrung: Erfahrungsbasierte Wissensarbeit in der Montage* [Assembly needs experience: Experience based knowledge work in assembly]. Mehring: Rainer Hampp.
- Ayres, I. (2001). Default rules for incomplete contracts. Retrieved from <https://ianayres.yale.edu/sites/default/files/files/Palgrave.pdf>
- Ayres, I., & Gertner, R. (1989). Filling gaps in incomplete contracts: An economic theory of default rules. *The Yale Law Journal*, 99, 87–130. <https://doi.org/10.2307/796722>
- Baldwin, R. (2016). *The Great Convergence: Information technology and the new globalization*. Cambridge, MA: Harvard University Press.
- Becker-Ritterspach, F., & Dörrenbächer, C. (2009). Intrafirm competition in multinational corporations: Towards a political framework. *Competition and Change*, 13, 199–213. <https://doi.org/10.1179/102452909X451332>
- Bouquet, C., & Birkinshaw, J. (2008). Managing power in the multinational corporation: How low-power actors gain influence. *Journal of Management*, 34, 477–508. <https://doi.org/10.1177/0149206308316062>
- Brandt, L., & Thun, E. (2010). The fight for the middle: Upgrading, competition, and industrial development in China. *World Development*, 38, 1555–1574. <https://doi.org/10.1016/j.worlddev.2010.05.003>
- Clarke, C. (2005). *Automotive production systems and standardization: From Ford to the case of Mercedes-Benz*. Heidelberg: Physica. <https://doi.org/10.1007/b138988>
- Dewey, J. (1922). *Human nature and conduct: An introduction to social psychology*. New York: Henry Holt. <https://doi.org/10.1037/14663-000>
- Dörre, K. (2015). Beyond shareholder value? The impact of capital market-oriented business management on labor relations in Germany. In C. E. Weller (Ed.), *Inequality, uncertainty, and opportunity: The varied and growing role of finance in labor relations* (pp. 85–118). Champaign: Labor and Employment Relations Association.
- Dörrenbächer, C., & Gammelgaard, J. (2016). Subsidiary initiative taking in multinational corporations: The relationship between power and issue selling. *Organization Studies*, 37, 1249–1270. <https://doi.org/10.1177/0170840616634130>
- Dörrenbächer, C., & Geppert, M. (2011). *Politics and power in the multinational corporation*. Cambridge, UK: Cambridge University Press. <https://doi.org/10.1017/CBO9780511973352>
- Friedli, T., & Schuh, G. (2012). *Wettbewerbsfähigkeit der Produktion an Hochlohnstandorten* [Competitive production in high wage locations]. Heidelberg: Springer. <https://doi.org/10.1007/978-3-642-30276-3>
- Gerst, D. (2011a). *Intensivierung von Arbeitszeit durch GPS* [Intensification of working time through GPSs] [Presentation].
- Gerst, D. (2011b). Sind ganzheitliche Produktionssysteme und Gute Arbeit vereinbar? [Are holistic production systems and good work compatible?]. *Arbeit: Zeitschrift für Arbeitsforschung, Arbeitsgestaltung und Arbeitspolitik*, 20, 246–250. <https://doi.org/10.1515/arbeits-2011-0309>
- Glückler, J. (2014). How controversial innovation succeeds in the periphery: A network perspective of BASF Argentina. *Journal of Economic Geography*, 14, 903–927. <https://doi.org/10.1093/jeg/lbu016>
- Hafner, S. J. (2009). *Sisyphus und Machiavelli bei der Arbeit: Ganzheitliche Produktionssysteme zwischen Mythen und Realitäten* [Sisyphus and Machiavelli at work: Holistic production systems between myths and realities]. Mehring: Rainer Hampp. <https://doi.org/10.1688/9783866183261>
- Helper, S. (1991a). How much has really changed between U.S. automakers and their suppliers? *MIT Sloan Management Review*, 32(4), 15–28.
- Helper, S. (1991b). Strategy and irreversibility in supplier relations: The case of the U.S. automobile industry. *Business History Review*, 65, 781–824. <https://doi.org/10.2307/3117265>

- Helper, S., MacDuffie, J. P., & Sabel, C. (2000). Pragmatic collaborations: Advancing knowledge while controlling opportunism. *Industrial and Corporate Change*, 9, 443–488. <https://doi.org/10.1093/icc/9.3.443>
- Herrigel, G. (2010). *Manufacturing possibilities: Creative action and industrial recomposition in the United States, Germany and Japan*. Oxford, UK: Oxford University Press. <https://doi.org/10.1093/acprof:oso/9780199557738.001.0001>
- Herrigel, G., Voskamp, U., & Wittke, V. (2017). *Globale Qualitätsproduktion: Transnationale Produktionssysteme in der Automobilzulieferindustrie und im Maschinenbau* [Global quality production: Transnational production systems in automobile supply chains and in the machinery industry]. Frankfurt am Main & New York: Campus.
- Herrigel, G., Wittke, V., & Voskamp, U. (2013). The process of Chinese manufacturing upgrading: Transitioning from unilateral to recursive mutual learning relations. *Global Strategy Journal*, 3, 109–125. <https://doi.org/10.1111/j.2042-5805.2012.01046.x>
- Heymann, E. (2014). Zukunft des Automobilstandorts Deutschland [The future of Germany as an automobile production location]. *Deutsche Bank Research*. Retrieved from https://www.dbresearch.de/PROD/RPS_DE-PROD/PROD0000000000444451/Zukunft_des_Automobilstandorts_Deutschland.pdf
- Horner, R., & Hulme, D. (2017). From international to global development: New geographies of 21st century development. *Development and Change*, 50, 347–378. <https://doi.org/10.1111/dech.12379>
- Horner, R., & Nadvi, K. (2017). Global value chains and the rise of the Global South: Unpacking twenty-first century polycentric trade. *Global Networks*, 18, 207–237. <https://doi.org/10.1111/glob.12180>
- Joas, H. (1996). *Die Kreativität des Handelns* [The creativity of action]. Frankfurt: Suhrkamp.
- Jürgens, U., & Krzywdzinski, M. (2016). *New worlds of work: Varieties of work in car factories in the BRIC countries*. Oxford, UK: Oxford University Press. <https://doi.org/10.1093/acprof:oso/9780198722670.001.0001>
- Kobrin, S. J. (2017). Bricks and mortar in a borderless world: Globalization, the backlash, and the multinational enterprise. *Global Strategy Journal*, 7, 159–171. <https://doi.org/10.1002/gsj.1158>
- Kristensen, P. H., & Zeitlin, J. (2004). *Local players in global games: The strategic constitution of a multinational corporation*. Oxford, UK: Oxford University Press. <https://doi.org/10.1093/acprof:oso/9780199275625.001.0001>
- MacDuffie, J. P., & Helper, S. (1999). Creating lean suppliers: Diffusing lean production throughout the supply chain. In J. K. Liker, W. M. Fruin, & P. S. Adler (Eds.), *Remade in America: Transplanting and transforming Japanese management systems* (pp. 154–202). New York, NY: Oxford University Press.
- Netland, T. (2013). Exploring the phenomenon of company-specific production systems: One-best-way or own-best-way? *International Journal of Production Research*, 51, 1084–1097. <https://doi.org/10.1080/00207543.2012.676686>
- Netland, T., & Aspelund, A. (2013). Company-specific production systems and competitive advantage: A resource-based view on the Volvo production system. *International Journal of Operations & Production Management*, 33, 1511–1531. <https://doi.org/10.1108/IJOPM-07-2010-0171>
- Netland, T., & Ferdows, K. (2014). What to expect from a corporate lean program. *MIT Sloan Management Review*, 55(4), 83–89.
- Netland, T., & Sanchez, E. (2014). Effects of a production improvement programme on global quality performance. *The TQM Journal*, 26, 188–201. <https://doi.org/10.1108/TQM-03-2012-0023>
- Pfeiffer, S. (2007). *Montage und Erfahrung: Warum ganzheitliche Produktionssysteme menschliches Arbeitsvermögen brauchen* [Assembly and experience: Why comprehensive production systems need worker resources]. Munich: Rainer Hampp.
- Pfeiffer, S. (2008a). Flexible Standardisierung und ganzheitliche Produktionssysteme—erfahrungsförderlich?! [Flexible standardization and comprehensive production systems—the importance of experience]. In W. Adami, C. Lang, S. Pfeiffer, & F. Rehberg (Eds.), *Montage*

- braucht Erfahrung: Erfahrungsbasierte Wissensarbeit in der Montage* (pp. 143–169). Mehring: Rainer Hampp.
- Pfeiffer, S. (2008b). Montage, Wissen und Erfahrung: Warum “einfache” Arbeit auch Wissensarbeit ist, warum Erfahrung in flexibler Montage so wichtig ist—and was das alles bildungspolitisch bedeutet [Assembly, knowledge and experience: Why “simple” work is also “knowledge” work, why experience is so important in flexible assembly—and what that implies for training]. In W. Adami, C. Lang, S. Pfeiffer, & F. Rehberg (Eds.), *Montage braucht Erfahrung: Erfahrungsbasierte Wissensarbeit in der Montage* (pp. 14–48). Mehring: Rainer Hampp.
- Romme, A. G. L. (1997). Organizational learning, circularity and double-linking. *Management Learning*, 28(2), 149–160. <https://doi.org/10.1177/1350507697282004>
- Romme, A. G. L. (1999). Domination, self-determination and circular organizing. *Organization Studies*, 20, 801–832. <https://doi.org/10.1177/0170840699205005>
- Romme, A. G. L., Zollo, M., & Berends, P. (2010). Dynamic capabilities, deliberate learning and environmental dynamism: A simulation model. *Industrial and Corporate Change*, 19, 1271–1299. <https://doi.org/10.1093/icc/dtq031>
- Sabel, C. F. (2006). A real-time revolution in routines. In C. Heckscher & P. S. Adler (Eds.), *The firm as a collaborative community* (pp. 106–156). New York, NY: Oxford University Press.
- Sabel, C. F., Herrigel, G., & Kristensen, P. H. (2018). Regulation under uncertainty: The co-evolution of industry and regulation. *Regulation and Governance*, 12, 371–394. <https://doi.org/10.1111/rego.12146>
- Sabel, C. F., & Simon, W. H. (2011). Minimalism and experimentalism in the administrative state. *Georgetown Law Journal*, 100, 53–93. <https://doi.org/10.2139/ssrn.1600898>
- Sabel, C. F., & Zeitlin, J. (2008). Learning from difference: The new architecture of experimentalist governance in the European Union. *European Law Journal*, 14, 271–327. <https://doi.org/10.1111/j.1468-0386.2008.00415.x>
- Sako, M. (2006). *Shifting boundaries of the firm: Japanese company—Japanese labour*. Oxford, UK: Oxford University Press. <https://doi.org/10.1093/acprof:oso/9780199268160.001.0001>
- Sauer, D. (2013). *Die Organisatorische Revolution: Umbrüche in der Arbeitswelt—Ursachen, Auswirkungen und arbeitspolitische Antworten* [The organizational revolution: Disruption in the world of work—causes, consequences and human resource solutions]. Hamburg: VSA.
- Schumann, M., Baethge-Kinsky, V., Kuhlmann, M., Kurz, C., & Neumann, U. (1994). *Trendreport Rationalisierung—Automobilindustrie, Werkzeugmaschinenbau, Chemische Industrie* [Report on rationalization trends in the automobile, machine tool and chemical industries]. Berlin: Edition Sigma.
- Simon, W. H. (2015). The organizational premises of administrative law. *Law and Contemporary Problems*, 78(1–2), 61–100. Retrieved from https://scholarship.law.columbia.edu/faculty_scholarship/1827
- Spear, S. J. (2009). *Chasing the rabbit: How market leaders outdistance the competition and how great companies can catch up and win*. New York: McGraw-Hill.
- Springer, R. (1999). *Rückkehr zum Taylorismus? Arbeitspolitik in der Automobilindustrie am Scheideweg* [Return to Taylorism? A turning point for human resource policy in the automobile industry]. Frankfurt am Main & New York: Campus.
- Sutton, J. (2012). *Competing in capabilities: The globalization process*. Oxford, UK: Oxford University Press.
- Teece, D. J. (2007). Explicating dynamic capabilities: The nature and microfoundations of (sustainable) enterprise performance. *Strategic Management Journal*, 28, 1319–1350. <https://doi.org/10.1002/smj.640>
- Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, 18, 509–533. [https://doi.org/10.1002/\(SICI\)1097-0266\(199708\)18:7<509::AID-SMJ882>3.0.CO;2-Z](https://doi.org/10.1002/(SICI)1097-0266(199708)18:7<509::AID-SMJ882>3.0.CO;2-Z)
- Verband der Automobilindustrie (VDA). (2012). *Jahresbericht 2012* [Annual report 2012]. Retrieved from https://www.vda.de/dam/vda/publications/Jahresbericht%202012/1341308052_de_437643196.pdf

- Verband der Automobilindustrie (VDA). (2017). *Jahresbericht 2017* [Annual report 2017].
- Westkämper, E., & Zahn, E. (2009). *Wandlungsfähige Produktionsunternehmen: Das Stuttgarter Unternehmensmodell* [Adaptable manufacturing companies: The Stuttgart Model]. Berlin: Springer. <https://doi.org/10.1007/978-3-540-68890-7>
- Whitford, J. (2005). *The new old economy: Networks, institutions and the organizational transformation of American manufacturing*. Oxford, UK: Oxford University Press. <https://doi.org/10.1093/acprof:oso/9780199286010.001.0001>
- Winter, S. G. (2003). Understanding dynamic capabilities. *Strategic Management Journal*, 24, 991–995. <https://doi.org/10.1002/smj.318>
- World Bank. (2015). *Global economic prospects: Having fiscal space and using it*. Washington, D.C.: World Bank Group. Retrieved from https://www.worldbank.org/content/dam/Worldbank/GEP/GEP2015a/pdfs/GEP15a_web_full.pdf
- Zollo, M., & Winter, S. G. (2002). Deliberate learning and the evolution of dynamic capabilities. *Organization Science*, 13, 339–351. <https://doi.org/10.1287/orsc.13.3.339.2780>

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