

A Literature Review of Coordination Mechanisms: Contrasting Organization Science and Information Systems Perspectives

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Abstract. Information systems (IS) research has long been promoting the necessity of aligning local IS investments in organizations with their enterprise-wide objectives. One of the prominent means to realize such an alignment are mechanisms that coordinate various stakeholders in different organizational entities. Despite its prominent origins and manifold translations from organization science (OS), there is no single theory on coordination. The research at hand conducts a literature review of the underlying coordination mechanisms to offer a comprehensive understanding of coordination for prospective IS research. To this end and structured in eight categories of mechanisms, we contrast the reflection of coordination in OS and IS research. In outlining implications for future research, we also discuss how IS studies follow and complement OS research.

Keywords: Coordination, Coordination Mechanism, Literature Review, Organization Science, Information Systems Research

1 Introduction

An increasing number of information systems (IS) change and development endeavors focus on creating local solutions for specific business needs [66]. Prominent reasons refer to organizational landscape complexities, time dependencies, and economic efficiency arguments that have led organizations to allocate IS change and development responsibilities as well as project ownerships to local business units [56]. While this allocation has brought about high performance gains on a local/short-term basis, in the long-run organizations have begun to face challenges in consistently aligning, integrating, and managing their corporate IS landscapes [52].

Over the past decades, IS research and practice have broadly addressed the necessity to *coordinate* IS change and development endeavors on an enterprise-wide basis in order to meet enterprise-wide and long-term intentions. In this vein, a particular group of enterprise-wide IS management approaches has been promoted, such as enterprise ar-

chitecture management [67], project portfolio management [14], or enterprise application integration management [42]. Nonetheless, in response to increasing complexities and uncertainties, a key characteristic of many enterprise-wide IS management approaches is their operationalization under top-down, strictly governance-based coordination mechanisms (e.g., hierarchical authority command, control) [23, 24]. Notwithstanding their specific utility, these top-down coordination mechanisms reflect only a limited facet of coordination, and may thus not be effective in every organizational context [6, 24]. Hence, a comprehensive understanding, reflecting the magnitude and diverse facets of coordination and its constituent mechanisms, becomes necessary.

Coordination is a well-established research topic that has arguably been developed in organization science (OS) and later on adopted by IS research [7, 16]. It is defined as the achievement of “concerted action” whenever actors (e.g., employees) become dependent on one another, for example due to sharing the same tasks, resources, or goals [75]. In this vein, coordination is further defined as the “linkage and integration of different parts of an organization” toward a certain goal [77, p. 322]. Coordination becomes realized through a diverse set of mechanisms [45], which are defined as “tools for achieving integration among different units within an organization” [49, p. 490]. Mechanisms address specific and general problems of emerged dependencies [12] and “permit coordinated action across a large number of interdependent roles” [25, p. 28].

Despite coordination’s manifold adaptations, translations, and interpretations from the OS literature, there is not a single theory on coordination [29]. Recognizing this general laggard, in the paper at hand we aim at contributing toward a comprehensive understanding of coordination for prospective IS research. As coordination has originated and been largely adopted from the OS literature, we provide an overview and contrast the existing research on coordination mechanisms in both the extant OS and IS literature. Furthermore, we emphasize a structured representation of mechanisms as a basis for guiding prospective IS research through the lens of coordination.

The paper at hand is structured as follows: In the next section, we present our literature selection and analysis method. Then, the results are presented in the subsequent section. Finally, we critically discuss the resulted insights along with a conclusion on further steps, implications, and limitations.

2 Research Method

In order to provide an overview on the phenomenon of interest, we opted for a review of prior research to identify the main discourses on coordination mechanisms in OS on the one hand, and to compare them with the discourses in the IS literature on the other hand. Both disciplines, OS and IS, have been discussing coordination for decades. A significant number of publications arrived in the top journals of both disciplines. Because of the large number of available publications and as we expect the highest quality work in the top journals, we limited our review to these journals. Hence, we selected the relevant peer-reviewed publications from both the *AIS senior scholars’ basket of*

*journals*¹ and a selected basket of highest ranked journals provided in *Harzing's journal quality list*² [30]. As a search strategy [78], we used the inclusion criterion of “coordination” solely, searching on the EBSCOhost databases for (i) title (TI “coordination”) and (ii) abstract (AB “coordination” NOT TI “coordination”) fields. This was followed by a significant exclusion of articles (focusing hereby in particular abstracts, keywords as well as the main text body of the respective publications). Articles were excluded that either did not exclusively focus the linkage and integration of corporate units or stakeholders toward a certain ends [see also 44, 76] or did not have an explicit focus on coordination mechanisms [see also 48]. We used only the search term “coordination” because our study aims at providing an overall analysis of explicit coordination literature, thereby also identifying different topics and discourses related to coordination mechanisms. In order to ensure the inclusion of influential and frequently cited publications outside the senior scholar basket, we used forward and backward searches [78].

Following the suggestions of Webster and Watson [78], we developed a framework for guiding the literature analysis and for classifying the collected publications based on their topical focus of discussion. We built our analysis framework on the taxonomy of coordination mechanisms suggested by Martinez and Jarillo [49], who differentiate formal (departmentalization, de-/centralized decision-making, formalization/standardization, planning, control) and informal (lateral relations, communication, socialization) classes of mechanisms (Table 1).

Table 1. Overview of Coordination Mechanism Coverage in IS and OS literature

Discipline	Hits	Hits after exclusion	Mechanism Coverage							
			Formal					Informal		
			<i>Departmentalization</i>	<i>Decision-Making</i>	<i>Formalization/Standardization</i>	<i>Planning</i>	<i>Control</i>	<i>Lateral Relations</i>	<i>Communication</i>	<i>Socialization</i>
IS	146	30	10	5	4	5	5	8	4	6
OS	835	31	7	7	8	3	8	4	7	5
Total	981	61	17	12	12	8	13	12	11	11

1 European Journal of Information Systems, Information Systems Journal, Information Systems Research, Journal of the Association for Information Systems, Journal of Information Technology, Journal of Management Information Systems, Journal of Strategic Information Systems, MIS Quarterly

2 Academy of Management Journal, Academy of Management Review, Administrative Science Quarterly, Journal of Business, Strategic Management Journal, Management Science, Organization Science, Organization Studies, Organizational Behavior and Human Decision Processes

As opposed to other forms of classification [16, 25, 29], this taxonomy offers an explicatory basis for a comprehensive review of coordination mechanisms. Since organizations maintain complex structures, different levels of functionalities, as well as vertical and horizontal integration, the developed analysis framework based on Martinez and Jarillo's [49] taxonomy gives an exhaustive abstraction of coordination mechanisms. Furthermore, it explicitly differentiates between formal and informal (more personal) coordination modes, which has been emphasized by early coordination mechanism literature [77]. Building upon this framework, we developed a coding scheme to systematically synthesize the collected publications.

As Table 1 indicates, prior to exclusion, coordination mechanisms have received different levels of attention from OS and IS scholars. This is partially due to the fact that the IS literature started comparably late addressing coordination mechanisms. Other reasons may be found in different foci of OS and IS discussing the respective coordination mechanisms. Due to our significant exclusion, we were able to not only filter those articles with the most exclusive focus on coordination, but also to select those with the most explicit coverage of coordination mechanisms. This led to a reduced and more compact set of articles for further analysis, given the initially large number of publications in the extant OS and IS literature.

The next section provides an overview on each coordination mechanism as well as on the main topics discussed in OS and IS for each of these mechanisms. We abstract the discussed topics in each discipline first, before reporting their main findings in order to contrast differences and similarities in OS and IS, respectively. Since the collected literature includes publications that address more than one coordination mechanism, some publications were assigned to more than one category.

3 Results

3.1 Formal Mechanisms

Departmentalization. Often reflected in the organizational structure [49], departmentalization is discussed as a coordination mechanism to enhance business unit integration and horizontal work process alignment [26]. The corresponding linkage between departmentalization and coordination effects receives strong support throughout OS literature [26, 41]. Departmentalization has been mainly discussed in the context of organizational process design [47] as well as organizational unit segmentation [41, 79]. Early contributions reveal organizational process design as a coordination mechanism that impacts departmental interactions [7, 54]. With the same token, organizational unit segmentation has been introduced as a coordination mechanism that manages dependencies among work processes [46, 47, 63], and is impacted by the degree of integration and alignment as well as by the form of communication [29, 79].

IS literature mainly promotes departmentalization in the form of governance bodies, structural overlays (e.g., roles, groups) and physical collocation [7]. It refers to the extent to which business and IT entities engage in workflows, tasks, and processes related to

IS and information technology (IT) functions [2, 28]. Furthermore, IS literature emphasizes the role of IT as a means to support departmentalization-related coordination [5, 22, 24, 70]. This role has been demonstrated in decreasing transaction costs of coordination [59, 60, 82] as well as in increasing task-related interactions [77] and communication [50].

Decision-Making. According to Martinez and Jarillo [49], decision-making can be reflected in either centralized (higher levels of command) or decentralized (lower levels of command) coordination mechanisms. The centralized decision-making is explained mainly by the structural design of the organization, particularly by hierarchies in OS literature [21, 55]. In the context of decentralized decision-making, social interaction and organizational communication [10] become increasingly important as mechanisms of coordination [10, 23]. The more decentralized organizations are, the more complex decision-making becomes [29]. This complexity is also expressed by the comparably high efforts of communication made in decentralized structures [33, 40].

The IS discipline investigates decision-making in decentralized forms, aimed at integrating business unit collaboration, as well as in centralized forms, aimed at mitigating risks of uncertainty [7, 81]. Thereby, decentralized decision-making promotes the role of individual responsiveness, for instance on IT systems development [16]. Drawing from the results of centralized decision-making, IS literature acknowledges the role of IT as supporting mechanism on enterprise-wide coordination [15, 53, 64]. Finally, Brown [7] studied prior OS and IS literature, finding a significant number of organizations engaged in horizontal mechanisms, i.e. a combination of centralized and non-centralized forms of authority command. These mechanisms facilitate collaboration and integration in the organization, and further promote the coordination of business and IS activities across corporate boundaries [7].

Formalization and standardization. Formalization and standardization is the extent to which policies and rules are documented and established through standard routines [49]. Formalization and standardization have been addressed by OS literature in the context of large organizations with complex work environments [36]. Within these complex environments, formalization and standardization act as a coordination mechanism through applying methods and procedures to reduce complexity in processes within, and collaborations between organizational units [36, 49]. Hereby, formalization and standardization lower costs/risks and increase the organization's overall efficiency [82]. OS studies see coordination to be achieved by standards in workflow processes [47, 55] as well as by the establishment of rules and formalized procedures [29, 38]. Both methods are reviewed as rather top-down delegation [27]. The same counts for behavioral control on interactions, which aims at fostering coordination across organizational units by rules and regulations [29, 58]. For this reason, strong hierarchical organizations are often described as being highly dependable on formalization, which establish structural methods top down, for example by the formation of routines [29, 38]. In line with formalization, this coordinating effect is similarly explained by standardization [27].

The IS discipline explicitly differentiates formalization/standardization from informal, more personal modes of coordinating corporate entities and stakeholders [7]. Compared to OS, the IS literature covers formalization and standardization in the context of IT support on complex organizational environments and workflow processes [48, 68]. Both formalization and standardization are addressed as approaches for organization-wide guidance/coordination, thereby incorporating standardized methods and technologies [48, 68] and formalizing the intra-organizational process alignment function of IT [72].

Planning. Systems and processes like strategic planning, budgeting, schedules, and goal settings are considered as planning mechanisms [49]. The OS literature investigates the coordination mechanism of planning in the case of new technology investment, team performance, and dynamics, as well as concurrent engineering processes. Kapoor and Lee [37] examine firms' coordination choices (alternative plans) and demonstrate alliance types of coordination (the broader the better) as the most effective plan for new technology investment. Lanaj et al. [43] criticize decentralized planning, owing to the fact that even though decentralized planning has positive effects on multi-team performance, it has even stronger negative impact on between-team dynamics. Finally, Terwiesch et al. [74] provide alternative coordination strategies to manage coordination in concurrent (parallel) engineering processes.

In terms of planning, the IS discipline is less prescriptive than OS. Except Tan and Harker [73], who explicitly recommend distributed scheduling methods, other studies aim at outlining a typology of planning mechanisms instead of prescribing a specific approach [16, 28]. Yet, other studies take a different perspective and outline steps of strategic planning for information resource management by taking into account coordination requirements [68] or argue the strategic opportunity granted by communication technology to foster coordination in a globally distributed teams [80].

Control. Control mechanisms consider both output control as well as bureaucratic and impersonal control [49]. The OS discipline provides different perspectives on control mechanisms of coordination. Considering control mechanisms as a feedback loop between different coordination practices [9], the existing literature suggests a taxonomy of control options (structures) for different sets of coordination practices [21, 71]. The extant literature also investigates control mechanisms on both the individual and group (team) levels. On the individual level, the role of liaisons [61] as well as the transfer of managers between different subsidiaries [18] has been discussed. On the group (team) level, scholars have investigated control mechanism as a means for knowledge sharing and integration [29, 62]. Lastly, organizational learning, as a control mechanism [10], has also been the focus of extant research.

In the IS literature, coordination and control are often discussed concurrently. A great deal of research has been dedicated to illustrate the role of IT as enabler of coordination and control [22, 59]. Also, a large number of publications discusses the trade-off between coordination and control [11, 22], where coordination is reflected in integrated/federated IS and control in centralized IS. Furthermore, in line with some topics of research in OS literature, IS scholars also provide a taxonomy of control mechanisms

for business-to-IT and IT-to-IT units horizontal collaborations [7], discussing the organizational learning aspect of control mechanisms [69].

3.2 Informal Mechanisms

Lateral relations. Martinez and Jarillo [49] explain lateral relations as direct contact between individuals, groups or organizational departments that cut across the formal structure. OS literature sheds light on lateral relations by the investigation of task integration (activity-resource fit) and interactional behavior [7, 28]. Here, lateral relations are described as cross-departmental forms of interaction: complex tasks are coordinated by cross-functional interactions, thereby integrating tasks and resources [7, 9]. Another widely addressed topic refers to employee behavior and roles in lateral relations [55], indicating that they impact social interaction [76].

Regarding the IS discipline, lateral relations are mostly described in the context of task design, role-based interactions, and group dynamics with the purpose of conquering organizational/task complexity [2]. Thus, organizational structures and processes are of facilitating rather than impacting relations [28]: for instance, cross-departmental relations may be fostered by IS governance mechanisms [7, 16] and eventually lead to integrations of lateral interactions [44]. These lateral relations, which are considered as horizontal mechanisms [28, 70, 77], evolve as supplement mechanisms to the firm's established structural forces (i.e. hierarchy) and enable interaction across departments [4].

Communication. According to Martinez and Jarillo [49] and similar to lateral relations, communication acts as a supplement to formal mechanisms. Both OS and IS literature consider this coordination mechanism as contact practice among organizational actors that fosters information and knowledge exchange [57] as well as organizational learning [20]; however, the form and nature of underlying mechanisms differs. The OS literature investigates communication mechanisms as creator of a common basis to transfer information [55, 62] and knowledge [57]. Communication, in knowledge management, can also be an active coordinating mechanism in the practice of social interaction [76]. This coordination mechanism evolves in the form of boundary spanners [27], connecting social interactions and facilitating the exchange of information [38].

The IS literature mainly addresses the role of IT systems as a means to reinforce communication mechanisms [16], for instance, reducing informational complexity [65], and bridging differences in knowledge characteristics and physical distances [13, 16]. The role of IT has been highly emphasized in enhancing information processing capabilities, task, information, and environmental uncertainty [70]. Since information processing capabilities are highly dissimilar in nature [8], information technologies are considered as a necessity to realize communication mechanisms [13]. Furthermore, IT contributes to coordination performance through enabling and supporting cooperative work [70].

Socialization. Socialization is described as building an organizational culture of shared strategic objectives and values [49]. Socialization remains a subject to the OS discipline

as a control artifact on employee behavior in the organizational environment [18, 31]. OS literature indicates socialization as coordination base in the context of interaction and relationship management [32]. The underlying mechanisms of socialization facilitate not only the coordination within organizations, but also increase firm capabilities, individual knowledge, and organizational learning [8, 29, 76].

The IS discipline introduces socialization as IT supported integration mechanism of the work environment [31]. Socialization is present in information processing and communication, both inside [35] and outside [17] of the organization. It furthermore coordinates organizational units toward shared objectives [3, 34]. Important to mention is the enablement and support of cooperative work through the means of IT [70]. In addition, socialization integrates work-flow processes through the support of IT and thereby reduces their complexity [19].

4 Discussion

Building on a comprehensive review of coordination in the extant OS and IS research, we synthesized the reflection of coordination mechanisms to three general streams (see Table 2).

The first stream describes *IS as an artifact subject to coordination*. Due to the substantial penetration of IS in organizations' daily routines [6] as well as in strategic planning processes [51], the integration of IS in organizations, from the coordination perspective, has long been the subject of investigations. The integration of large, dispersed organizations through the means of IT and IS artifacts is instrumental to realize coordination success, not only on a local/business unit basis, but also on the enterprise-wide level [16]. This finding is underpinned by a considerable number of studies in OS outlets [47, 74] that contribute to this discussion. In this stream, IS follows OS as its reference discipline in the main discourses, for instance in socialization, communication, and formalization/standardization [8, 31, 60].

Table 2. Main Discourses on Coordination Mechanisms in OS and IS literature

	Mechanisms	OS Discipline	IS Discipline
Formal	Departmentalization	<ul style="list-style-type: none"> • Hierarchical organizational structure/design • Organizational process design 	<ul style="list-style-type: none"> • Structural overlays and physical colocation as related to the IT/IS context • IT as a means to support hierarchies and departmentalization • IT support on task-related interactions and decreasing transaction costs
	Decision-Making	<ul style="list-style-type: none"> • Centralized decision-making: hierarchical design of organization 	<ul style="list-style-type: none"> • IT support for integrating cross-unit decision-making processes • IT support to facilitate enterprise-wide decision-

		<ul style="list-style-type: none"> • Decentralized decision-making: social interaction; organizational communication • Horizontal mechanisms: structural overlays and physical colocation 	<ul style="list-style-type: none"> • making in decentralized structures • Horizontal mechanisms: structural overlays and physical colocation
	Formalization/Standardization	<ul style="list-style-type: none"> • Formalized standards, rules, routines, workflows, and policies • Formalization and standardization in complex organizational environment 	<ul style="list-style-type: none"> • Formalization and standardization in complex organizational environment • IT support for workflows • Modular formalization • Standardization in technologies
	Planning	<ul style="list-style-type: none"> • Alternative coordination structures/strategies • Decentralized vs. centralized coordination planning 	<ul style="list-style-type: none"> • Typology of coordination planning mechanisms • IT-supported planning methods
	Control	<ul style="list-style-type: none"> • Taxonomy of control structures • Individual and group (team) level control • Organizational learning 	<ul style="list-style-type: none"> • Taxonomy of control mechanisms • IT as enabler of control • Organizational learning
Informal	Lateral Relations	<ul style="list-style-type: none"> • Organizational behavior • Cross-functional interaction • Activity-/Task-resource fit • Informal character • Physical colocation 	<ul style="list-style-type: none"> • Horizontal interdependencies • Informal character • Governance/Integration spanner
	Communication	<ul style="list-style-type: none"> • Learning/knowledge exchange • Social interaction • Boundary spanners 	<ul style="list-style-type: none"> • IT to reinforce communication mechanisms • IT to reduce complexity, facilitate knowledge sharing, and support cooperative work
	Socialization	<ul style="list-style-type: none"> • Culture, values, shared objectives • Interactional behavior • Firm capabilities and learning 	<ul style="list-style-type: none"> • IT supported (internal and external) environmental integration • IT supported shared objectives

The second stream exposes *IS as a means of coordination*. This is where IS act primarily as technological coordination support for organizational work environments—more prominently for communication [16]—such as by IT systems that bridge physical distances or different knowledge characteristics [13, 16]. In addition, IS also support the horizontal integration of the work environment, for instance by aligning corporate

teams to a boundaryless network [34], by linking team members toward shared objectives [34], or by enabling cooperative work through the means of IT systems [70]. Nevertheless, IS literature goes beyond the mere discussion on IS as yet another coordination means. Due to ever increasing size of organizations and their presence in global markets, IS are used to leverage global synergies [22], to coordinate business functions [39], and to manage cross-subsidiary similarities [11]. This is where IS literature contributes to OS through commencing emergent management approaches, such as IS-enabled enterprise transformation, digital transformation, among the others. For instance, these new approaches are initially discussed in new typologies of control mechanisms [7], modular business configuration to overcome complexity [65], and IS-enabled horizontal integration [16].

The third stream reveals the *complementarity of coordination mechanisms in IS*. Typically, a high degree of specificity of coordination mechanisms helps to translate coordination goals into individual tasks and actions. However, this specificity might only be useful in a given situation [12] and it may neglect to consider the organization as a whole. For this reason, IS literature has often applied a combination of different perspectives of mechanisms, concluding that the reach and impact of specific/one-sided coordination mechanisms—for instance, strict top-down driven planning or control mechanisms—often remain limited [4, 7]. For example, formal coordination mechanisms are often complemented by informal mechanisms, in which desired coordination goals become concretized in specific tasks, actions, or sub-goals [4, 7, 16]. These findings highlight, on the one side, the complementarity of coordination mechanisms for prospective research. On the other side, these findings also imply to reconsider singular perspectives in research, which often shed light only on specific mechanisms, but neglect their meaning to the organization as a whole. For instance, enterprise-wide IS management disciplines, such as enterprise architecture management [1] or project portfolio management [14], might benefit from such a broader, complementary perspective.

5 Conclusion

This study offers a structured representation of coordination and its respective mechanisms in both OS and IS research. Through contrasting the reflection of coordination in the OS and IS discipline, this study argues how IS research follows and how it can go beyond its reference discipline of OS. Our investigation is limited to a selective, although important, set of peer-reviewed journals. We admit that the current evaluation neglects other potentially relevant contributions. Due to the chosen level of abstraction, more granular insights into the collected set of coordination mechanisms become a necessary step for future research. Nevertheless, this study provides a valuable basis given the large number of topically broad publications discussing coordination in various contexts.

With regards to the resulted insights from our review of coordination literature, we encourage future research to particularly focus on the second and third identified

stream, namely, *IS as a means of coordination* and the (often necessary) *complementarity of coordination mechanisms*. *Firstly*, we emphasize to focus on decentralized and federated as well as informal modes of coordination. As mentioned earlier, companies are growing to target diverse geographical markets through diverse sets of products and services; simultaneously, they are impacted by a broad range of dynamic influences. Owing to the increasing investments in corporate IS, growing interdependencies as well as complexities, firmly centralized modes of coordination become unfeasible and need to be complemented. Decentralized (also horizontal) and federated forms are expected to complement and leverage coordination among sub-units and subsidiaries, thereby reinforcing cross-unit collaboration, synergies, and ultimately performance improvements. This might lead to eventually reconsider the traditional understanding of exercising coordination in a strict hierarchical, top-down driven way. This also implies the necessity of investigating how organizations dynamically move between different modes of coordination as well as how top-down and bottom-up modes of coordination co-exist or complement each other. Further, due to increasing dominance of technologies that foster informal coordination, such as enterprise social media, the impact of traditionally formal mechanisms might be reconsidered through the complementary impact of informal, more personal mechanisms. *Secondly*, we call for future research to deepening investigations into pertinent IS sub-disciplines that all share the same ends, i.e. to align local corporate IS endeavors so as to meet enterprise-wide objectives and long-term intentions. This encompasses, among others, the disciplines of enterprise engineering, IT governance, project portfolio management, and enterprise architecture management.

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