

THEMES OF COORDINATION IN IS REFERENCE THEORIES

Research

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Abstract

Due to ever-growing investments in information systems (IS) in organizations, IS literature promotes an enterprise-wide perspective to keep local, short-term investments in line with global, long-term intentions. One of the central discourses in realizing an enterprise-wide perspective is the necessity of coordinating IS change and development efforts across organizational units. Notwithstanding its criticality, there is a lack of coherent body of theory about coordination. This study hence seeks to spotlight coordination as a lens by investigating prominently used reference theories in IS that implicitly consider coordination. Through conducting thematic analysis and synthesizing the reflection of coordination in IS reference theories, this study identifies four theory-grounded themes of coordination namely, informing, controlling, legitimating, and socializing. The identified themes guide prospective research in investigating IS phenomena through the lens of coordination.

Keywords: Coordination, Reference Theory, Thematic Analysis, Theme

1 Introduction

Over the past decades, we have witnessed an enormous growth of investments in information systems (IS) in organizations. Even though these constant investments have had a considerable impact on organizations' performance (Melville et al., 2004; Brynjolfsson and Hitt, 2000), they caused ever-growing challenges in *coordinating IS change and development* projects, which are distributed across business units (Peterson, 2004). All of today's large organizations have to deal with a significant number of IS projects—affecting several hundred to some thousand applications—of which budgets and ownerships are often allocated to business units. Investments in IS thus tend to be developed to meet the short-term, local units' business needs without the consideration of a long-term, *enterprise-wide* prospect (Boh and Yellin, 2006).

There are a number of disciplines in practice as well as in IS literature that address the issue of coordinating IS changes and developments so as to commit an enterprise-wide perspective, and to ensure the consistency of IS investments with long-term intentions. More prominently, the fields of IS governance (Sambamurthy and Zmud, 1999; Peterson, 2004), enterprise architecture (Zachman, 1987; Schmidt and Buxmann, 2011; Boh and Yellin, 2006), and IS project portfolio management (De Reyck et al., 2005; Bardhan and Sougstad, 2004), among others, contribute to this discourse. Through taking a concerted view on IS investments, these disciplines share the same concern, that is, to coordinate change and development endeavours throughout an organization. While not focusing on a specific discipline of discourse, this study employs an orthogonal perspective on coordination itself as it is central to realizing an enterprise-wide view and is one of the pivotal discussions in the pertinent disciplines. To this end, we focus on *coordination as a lens*, and aim to identify and eventually synthesize theoretical bases to be used in the investigation of enterprise-wide endeavours.

Coordination is defined as “integrating or linking together different parts of an organization to accomplish a collective set of tasks” (Van de Ven et al., 1976) and as “the act of managing interdependencies between activities performed to achieve a goal” (Malone and Crowston, 1990). With regard to theoretical bases, there is no single coherent body of theory about coordination (Malone and Crowston, 1990). Although Malone and Crowston (1990) provide relevant conceptualizations for a theory on coordination, their contribution did not enjoy a wide uptake in the literature, and was reflected and employed in only a few studies such as (Crowston, 1997; DeSanctis and Jackson, 1994). Building on Malone and Crowston (1990)’s contribution, we argue that there are theories from many different disciplines that implicitly consider coordination, and can consequently be used in our effort to formulate coordination as a theoretical lens. To cater a theory-grounded synthesis on coordination and due to interdisciplinary nature of coordination (Malone and Crowston, 1994), this study investigates *IS reference theories* that implicitly cover coordination. IS reference theories refer to imported, borrowed theories (e.g., institutional theory, game theory) from external disciplines (e.g., management science, computer science, sociology) to describe, explain, predict, or design IS phenomena (Straub, 2012).

This study employs a thematic analysis approach in investigating coordination in IS reference theories. Based on existing conceptualizations on coordination, we develop an analysis framework at the outset. We use this framework to examine how, and from which perspectives, IS reference theories consider coordination. This research process results in identifying *four themes of coordination* namely, *informing*, *controlling*, *legitimizing*, and *socializing* and their complementarity. These themes can be used in different IS disciplines to guide prospective research on enterprise-wide endeavours through a coordination lens. Since our investigation is built on IS reference theories, the derived themes can also contribute to coordination-related discourses in the reference disciplines.

The remainder of this paper is structured as follows: First, we introduce the methodology of this study, explaining how IS reference theories are collected and investigated by a systematic and deductive research process. We then identify coordination approaches in IS reference theories, and thematically synthesize them to the four themes of coordination. Implications and limitations are finally discussed.

2 Methodology

In the investigation of coordination as a lens for studying IS phenomena, we examined dominantly used IS reference theories. To investigate how IS reference theories approach coordination, to classify and eventually synthesize them into themes of coordination, we opted for a thematic analysis approach (Boyatzis, 1998) along with adapting Nickerson et al.’s (2013) taxonomy development method to the purpose of our research (Figure 1). A theme refers to a manifestation of latent patterns within the given set of qualitative data (Boyatzis, 1998). First, based on extant discussions on coordination, we developed an analysis framework to not only outline the underpinning concept of coordination, but also to systematically analyse implicit reflections of coordination in IS reference theories. We then collected IS reference theories according to their relevance to the formerly developed framework. We finally conducted a thematic analysis to identify themes of coordination from IS reference theories.

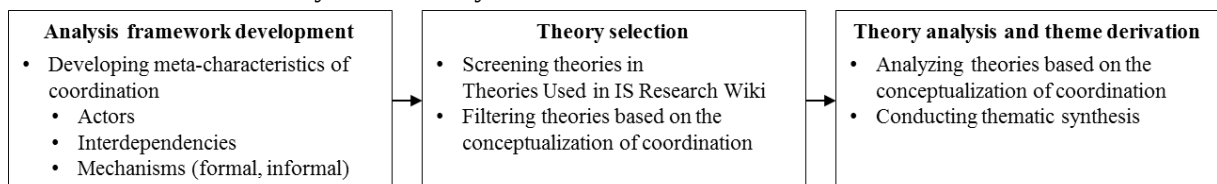


Figure 1. Research process

Analysis framework development: Following Nickerson et al. (2013), at the outset we derived meta-characteristics underlying the concept of coordination (Table 1). According to the most dominant definitions, coordination refers to “integrating or linking together different parts of an organization to accomplish a collective set of tasks” (Van de Ven et al., 1976), and to “the act of managing interdepend-

encies between activities performed to achieve a goal” (Malone and Crowston, 1990). Building on these definitions, we derived three meta-characteristics of coordination concept namely, *actors*, *interdependencies*, as well as *mechanisms*. In effect, actors in an organization perform tasks, and interdependencies determine how to perform these tasks (Malone and Crowston, 1990). These interdependencies are due to common goals among different actors, collective set of activities to achieve goals, as well as shared resources that are used or affected by activities (Crowston, 1994). As such, coordination issues arise when interdependencies constrain actors for performing activities, achieving goals, or using resources (Crowston, 1994). To manage interdependencies, and eventually to deal with coordination problems, existing literature promotes formal hierarchical structures and informal lateral relations, which are called coordination mechanisms by Martinez and Jarillo (1989).

Regarding *actors*, we took into account different levels of analysis due to distinctive focus of the examined theories. Actors were considered in “individual” (e.g., employee, decision-maker), “group” (expressed in terms like collectives, social systems, or networks), and “organization” (comprising multiple groups) levels (Malone and Crowston, 1990). “Market” and “society” were additionally added as the scope of some theories reaches beyond individuals and organizations, and therefore raises the level of abstraction (Giddens, 1984). We characterized “market” beyond the organizational level, dealing with dependencies or relations among organizations, or formalized structures. Far beyond the perspective of market is what we characterized as “society”, a term for multiple structures or social systems.

Regarding *interdependencies*, Malone and Crowston (1990) as well as Crowston (1994) characterized “activities”, “resources”, and “goals” as determinants of interdependencies among actors. “Goal” is defined as ends, expectations, or directions, to which activities are performed (Crowston, 1994). “Activity” is a representation of pursuing something, described by workflows, processes, routines, or control practices (Malone and Crowston, 1990). “Resource” is represented by a vast range of physical (e.g., work assets) and abstract (e.g., information, capability) objects (Crowston, 1994).

Mechanisms built on Martinez and Jarillo’s (1989) conceptual framework on coordination mechanisms, comprising both *formal* and *informal* dimensions. Their framework was chosen in favour of other conceptualizations on coordination mechanisms (DeSanctis and Jackson, 1994; Grant, 1996; Okhuysen and Bechky, 2009; Brown, 1999; Mintzberg, 1979; Galbraith, 1973) due to the level of abstraction and comprehensiveness, being applicable to all characterized actors and interdependencies. Following Martinez and Jarillo (1989), we characterized *formal mechanisms* as “departmentalization”, a mechanism that deals with the structural design of the organization (e.g., units), “decision-making”, which describes hierarchically-fostered forms of authority command, “formalization and standardization”, which describes the extent to which rules or job descriptions are written down (e.g., manuals, documents), as well as “planning” (e.g., strategies, functional plans) and “control” (e.g., of behaviour, output) mechanisms. Following Martinez and Jarillo (1989), we also characterized *informal mechanisms* comprising “lateral relations”, describing direct contacts among individuals complementarily to hierarchy, “communication”, describing informal contact among individuals, as well as “socialization”, illustrating cultural- and emotional-oriented mechanisms among actors (e.g., shared goals).

Actors					Inter-dependencies			Mechanisms							
								Formal				Informal			
Individual	Group	Organization	Market	Society	Activity	Resource	Goal	Department-alization	(De-)Centralized Decision-Making	Formalization/ Standardization	Planning	Output/ Behaviour Control	Lateral relations	Informal Communication	Socialization

Table 1. Analysis framework (adapted from Malone and Crowston, 1990; Martinez and Jarillo, 1989; Van de Ven et al., 1976; Crowston, 1994)

Theory selection: Theories were retrieved from the *Theories Used in IS Research Wiki* (Larsen et al., 2015). The provided list of theories is contributed by researchers from the international IS community, and has been acknowledged as scholarly information and explanatory source (Straub, 2012; Lim et al., 2009). Due to the large number of theories available, the next step set out an iterative theory screening and filtering process. Based on our outlined conceptualization of coordination, we systematically selected theories in two sequentially filtering rounds: First, coordination had to be illustrated as an interdependency, involving actors that are dependent on goals, activities, or resources. Second, there had to be mechanisms for coping with these interdependencies. Starting with 91 theories, we finally selected 16 reference theories complying with our outlined conceptualization. In order to ensure covering all aspects of theories on coordination, and to exclude interpretations or interferences that could have biased the original lenses, we traced all theories back to their seminal developments. To reach out seminal developments solely, we looked up all listed references per theory in *Theories Used in IS Research Wiki* through Google Scholar, and selected the two highest-cited seminal references for each reference theory. Due to the elapse of time since the seminal contributions, and for a better understanding of the more prevalent theory aspects as well as discourses, we additionally selected two articles from IS literature (provided in Theories Used in IS Research Wiki) that applied the respective theories (Larsen et al., 2015). The latter includes both the most recent published paper as well as the highest-cited papers in the AIS senior scholars' basket of journals.

Theory analysis and theme derivation: In order to examine how IS reference theories consider coordination, we applied our outlined conceptualization, and coded all theories by their respective illustration of actors, interdependencies, and mechanisms. Including each theory's assumptions, we described the original context of analysis, and particularly those elements that reason coordination in the given assumptions of each theory. As such, guided by our analysis framework, which contains all previously defined meta-characteristics and their constitutive elements, we finally derived the main themes of coordination in IS reference theories.

3 Coordination in IS Reference Theories

Coding of theories based on our analysis framework aimed to identify how coordination is implicitly reflected in each respective IS reference theory. To this end, we derived underlying assumption of each theory, which helped us understand the background of pertinent actors, interdependencies, and mechanisms, and that further reasoned coordination for the given assumption. Table 2 summarizes the main assumptions of the selected theories along with their approach to coordination with regard to our analysis framework.

Agency Theory	• Assumption: Work performed by division of labour and contracted principal-agent relations; economic uncertainty; asymmetric information; conflicting risk-behaviour/goal settings between principals and agents • Actors: Individual, group, organization • Interdependencies: Informational and behavioural interdependencies (involving goals and activities) • Mechanisms: Practices of risk and behaviour control' (hierarchical) forms of decision-making; formalization (e.g., allocation of property rights)
<i>Seminal articles:</i>	<i>(Jensen and Meckling, 1976; Alchian and Demsetz, 1972)</i>
<i>IS references:</i>	<i>(Chen and Edgington, 2005; Melville et al., 2004)</i>
Boundary Objects Theory	• Assumption: Communities of practice (e.g., teams with shared characteristics, common language) with interacting and communicating relations; need for mutual understanding and common "language basis" across communities • Actors: Individual, group, organization (collectives related to "community of practice") • Interdependencies: Dependency on shared area of concern (e.g., goal, activity) as a basis for mutual understanding

	• Mechanisms: Diverse formal (e.g., formalization) and informal (e.g., communication) instruments for creating common understanding and shared knowledge communities
<i>Seminal articles:</i>	<i>(Star and Griesemer, 1989; Bowker and Star, 2000)</i>
<i>IS references:</i>	<i>(Rosenkranz et al., 2014; Levina and Vaast, 2005)</i>
Game Theory	• Assumption: Formalized incentive structure (i.e., “game”); two or more parties involved; rational decision-making by anticipation of and reaction to actions of other involved parties (e.g. for benefit maximization) • Actors: Individual, group, organization; “formalized structures” (e.g., also market and society) • Interdependencies: Dependency on the respective activities and goals of others • Mechanisms: Decisions-making and behaviour control; modelling and planning among alternatives affecting the respectively involved other parties (un-/informed)
<i>Seminal articles:</i>	<i>(Von Neumann and Morgenstern, 1944; Nash, 1950)</i>
<i>IS references:</i>	<i>(Gal-Or and Ghose, 2005; Clemons and Row, 1993)</i>
Institutional Theory	• Assumption: Organizations as social constructions; isomorphism fostered by cultural-cognitive, normative, and regulative mechanisms; constraining and regulating organizational behaviour • Actors: Organization, market, society • Interdependencies: Dependency of social constructions on their and others’ activities, and resources • Mechanisms: Regulative, normative, and cultural-cognitive mechanisms for regulating and controlling behaviour; socialization
<i>Seminal articles:</i>	<i>(Scott, 2013; DiMaggio and Powell, 1983)</i>
<i>IS references:</i>	<i>(Bharati and Chaudhury, 2012; Orlikowski and Robey, 1991)</i>
Organizational Culture Theory	• Assumption: Organizations as cultural processing system (functional view); cultural patterns in organizations, and their adoption by individuals as legitimate way for perceiving, thinking, and (un-/conscious) feeling within the cultural system • Actors: Individual, group, organization • Interdependencies: Integration of individuals; behaviour of individuals consciously and unconsciously dependent on cultural (processed) patterns • Mechanisms: Cultural patterns processed through espoused values (e.g., strategies, goals), visible artefacts (e.g., formalized/structural mechanisms), and underlying assumptions (e.g., informal mechanisms), yielding internal integration/external adaptation
<i>Seminal articles:</i>	<i>(Schein, 2010; Burrell and Morgan, 1979)</i>
<i>IS references:</i>	<i>(Iivari and Huisman, 2007; Leidner and Kayworth, 2006)</i>
Organizational Information Processing Theory	• Assumption: Amount of information processed determined by uncertainty; labour division and specialization, requiring integration of interdependent roles and tasks, as well as the increase of information processing capabilities • Actors: Organization • Interdependencies: Organization design; interdependent roles and tasks • Mechanisms: Integrating mechanisms, such as rules or programs, hierarchy, targets, and goals; design strategies, such as the creation of slack resources, self-contained tasks, vertical information systems, and lateral relations
<i>Seminal articles:</i>	<i>(Galbraith, 1973; 1974)</i>
<i>IS references:</i>	<i>(Trkman et al., 2010; Gattiker and Goodhue, 2005)</i>
Organizational Knowledge Creation	• Assumption: Static forms of knowledge (i.e., tacit, explicit) in the organization (per se not sufficient for creating organizational knowledge); dynamic knowledge conversion

Theory	creating organizational knowledge • Actors: Individual, group, organization • Interdependencies: Organizational knowledge dependent on information conversion patterns • Mechanisms: Four dynamic patterns of knowledge creation by information conversion/exchange mechanisms: Internalization, externalization, combination, and socialization
<i>Seminal articles:</i>	<i>(Nonaka, 1994; Anderson, 1983)</i>
<i>IS references:</i>	<i>(Ruiz-Mercader et al., 2006; Lee and Choi, 2003)</i>
Organizational Learning Theory	• Assumption: Stored/embedded information (e.g., memory, routines); applicable for reflecting undertaken actions between expected and factual outcomes; necessary due to changing goals and/or environments • Actors: Individual, group, organization • Interdependencies: Dependency on information resources and decision-making activities • Mechanisms: Informal/lateral relations for information adaptation and interpretation; application of information in decision-making for organizational learning
<i>Seminal articles:</i>	<i>(Levitt and March, 1988; Huber, 1991)</i>
<i>IS references:</i>	<i>(Hahn et al., 2009; Salaway, 1987)</i>
Resource Dependency Theory	• Assumption: Uncertainty in resource acquisition; control over resources fostering interdependencies among organizations to maintain and drive competitiveness • Actors: Organization, market • Interdependencies: Dependency on resources and control-related activities • Mechanisms: Bargaining power of control over resources; lateral and social firm relations among (interdependent) organizations
<i>Seminal articles:</i>	<i>(Pfeffer and Salancik, 2003; Pfeffer, 1981)</i>
<i>IS references:</i>	<i>(Yeh, 2005; Lee and Kim, 1999)</i>
Social Capital Theory	• Assumption: Organizations as value-maintaining systems of social relationships (e.g., relations among actors); formation of social capital through individual human capital • Actors: Individual, group, organization (collective formations) • Interdependencies: Dependency on the value of relationships to others (resources, goals, activities) • Mechanisms: Mechanisms in relationships (e.g., lateral relations, socialization); mechanisms in management of collectively owned capital (e.g., socialization, communication)
<i>Seminal articles:</i>	<i>(Granovetter, 1973; Coleman, 1988)</i>
<i>IS references:</i>	<i>(Yuan et al., 2006; Wasko and Faraj, 2005)</i>
Social Cognitive Theory	• Assumption: Inter-personal relations and (social) behaviour of individuals; actor analysing through embedded information (e.g., in behaviour), observation, and interpretation • Actors: Individual, group (collective formations) • Interdependencies: Dependency on activities and goals of others' behaviour • Mechanisms: Socialization and lateral relations among individuals (fostering cognition, adoption and interpretation of others' behaviour)
<i>Seminal articles:</i>	<i>(Bandura, 1977; 1986)</i>
<i>IS references:</i>	<i>(Liaw et al., 2006; Compeau et al., 1999)</i>
Social Network Theory	• Assumption: Social relations among individuals (see also Social Capital Theory); inter-personal connections for information/knowledge diffusion • Actors: Individual, group, organization (collective formations)

	• Interdependencies: Dependency on the relationship to others (e.g., on their activities, resources, goals) • Mechanisms: Mechanisms in relationships and exchange practices (e.g., lateral relations, communication, socialization)
<i>Seminal articles:</i>	<i>(Granovetter, 1973; Watts and Strogatz, 1998)</i>
<i>IS references:</i>	<i>(Wade et al., 2006a; 2006b)</i>
Stakeholder Theory	• Assumption: Stakeholders with legitimate interests on the organization; stakeholder identification, analysis, and management necessary for organizational value creation • Actors: Individual, group, organization, market, society (stakeholder formations) • Interdependencies: Organization dependent on (the legitimate interests of) its stakeholders (involving their activities, resources, goals) • Mechanisms: Stakeholders management and analysis excelled by formalization and planning mechanisms
<i>Seminal articles:</i>	<i>(Freeman, 1984; Donaldson and Preston, 1995)</i>
<i>IS references:</i>	<i>(Chan and Pan, 2008; Smith and Hasnas, 1999)</i>
Structuration Theory	• Assumption: Society's structures impacted/formed by the interactions of individuals, in turn, society's structures impact these interactions of individuals (i.e., "interplay") • Actors: Individual, group, organization, market, society (structure formations) • Interdependencies: Dependency on structures as well as interplay among individuals and structures (involving activities, resources, goals) • Mechanisms: Formal shape of structures imposed by individuals (e.g., through behaviour, habits, routines); structures impacting the interactions of individuals
<i>Seminal articles:</i>	<i>(Giddens, 1984; Giddens, 2013)</i>
<i>IS references:</i>	<i>(Pozzebon and Pinsonneault, 2005; Orlikowski, 1996)</i>
Theory of Administrative Behaviour	• Assumption: Limited information available to decision-maker in organizations; decision options and impacts often partially or completely unknown; bounded rationality of decision-maker that are governed by the structural design of the organization • Actors: Individual, organization • Interdependencies: Decisions are dependent on organizational design (e.g., activities, resources, goals) • Mechanisms: Rationale design activities of the decision-maker's organizational environment, such as by structural mechanisms; formalization, and the allocation of decision-making authority (i.e., decentralized mechanisms)
<i>Seminal articles:</i>	<i>(March and Simon, 1958; Simon, 1955)</i>
<i>IS references:</i>	<i>(Lamb and Kling, 2003; Bakos and Treacy, 1986)</i>
Theory of Collective Action	• Assumption: Expectations towards certain achievements by individual actors; collective (e.g., in teams, groups, unions) pursuing of interests for effectively achieving individually-shared goals and/or achievement expectations • Actors: Individual, group, organization (collective formations) • Interdependencies: Dependency on (expected/shared) collective goals, resources, and activities • Mechanisms: Interest alignments by individually-shared goals (e.g., lateral relations, socialization); management of group size to effectively and efficiently pursue collective actions (formal decision-making and control mechanisms)
<i>Seminal articles:</i>	<i>(Olson, 1965; Hardin, 1982)</i>
<i>IS references:</i>	<i>(Zhao et al., 2011; Wasko et al., 2004)</i>

Table 2. Coordination in IS reference theories

4 Themes of Coordination

Our investigation of IS reference theories has identified various coordination mechanisms through which interdependencies among different actors are managed or set up. In general, theories are about actors, as well as interdependencies among actors due to shared activities, goals, and/or resources. Corresponding to our outlined conceptualization, coordination mechanisms not only help further explore interdependencies, but also shed light on how to cope with them. As such, coordination mechanisms underlie interdependencies, do impact them, and are imposed as well as upheld by them. We now elaborate on these findings that guide us synthesizing themes of coordination.

(1) We found one prevailing element of coordination that exists in exchange and alignment practices among individuals, groups, and organizations: Information. In all contexts and under various theoretical assumptions, an integral part of any interdependency among actors as well as any coordination mechanism was information, which was embedded throughout the organization, and occurred in both explicit and implicit forms (Anderson, 1983; Nonaka, 1994). Although actors were apparently impacted by information, information itself necessarily required actors to enable and facilitate it (dynamic interactions), for instance towards specific activities, goals, or under certain situations (e.g., Levitt and March, 1988). Information is both formalized and subtle; it could be both actively transmitted in explicit nature (e.g., for achieving a basis for shared understanding, see Star and Griesemer, 1989), and implicitly gathered, for instance embedded in objects (e.g., routines) or actors (Bandura, 1977). Often, information created an essential understanding of where particular problem settings or conflicting misalignments among actors and/or their interdependencies are.

(2) Especially among the set of theories originated from sociology (e.g., social capital theory, social network theory), we found a wide range of lenses that are, although grounded in different contexts and share different assumptions, oriented towards the relations of individuals. We found a vast part of actor-related (mostly individual-relying) interdependencies that were particularly fostered by the behaviour and the perceptions of actors. Actors appeared to enable coordination by their social relations towards other actors (Granovetter, 1973): They observe human behaviour, adopt, and interpret information or anticipate (re-)actions in social relations (Levitt and March, 1988). Socialization created a more concrete understanding where hierarchical coordination reaches its limit, and where lateral coordination complemented interdependencies among involved actors. It furthermore drew attention on coordination from an individual perspective in a particular situation, context, or interdependency (e.g., towards collective goals) (Olson, 1965).

(3) In contrast to these individual-oriented, lateral perspectives of coordination, we found a large number of theoretical assumptions that expose interdependencies impacted by often centralized forms of coordination. These characteristics of coordination were particularly categorized by our analysis framework as control. Controlling helped us cater a solid understanding of coordination that aims to solve potential conflicts among interdependent actors. Often, behavioural aspects of an actor represented a conflict assumption to the organizational level, and, based on these assumptions, coordination evolved for moderating expected negative effects (Alchian and Demsetz, 1972). Furthermore, it can evolve between the organizational and individual level for harmonizing not collectively shared goals (e.g., Schein, 2010).

(4) Based on our set of theories, we further captured a particular mode of coordination, which resembled an embedding system for actors, interdependencies, and mechanisms. This embedding system, for instance, encompassed a social (Scott, 2013) or cultural construction (Schein, 2010). This finding, which enjoys a considerable support from IS reference theories, referred to coordination with the purpose of harmonizing interdependencies among actors by a wide range of, for instance, cultural, normative, dynamic, or environmental mechanisms (Schein, 2010; Giddens, 1984; DiMaggio and Powell, 1983). What these forms of coordination had in common was the purpose of gaining and providing legitimacy within their respective system environment. This legitimacy helped us understand both single, situational dynamics as well as cumulative (e.g., cultural) systems in their entirety (Giddens,

1984), therefore reasoning coordination generally beyond selected actors, interdependencies, or situations.

Building upon the abovementioned insights, we outline four themes of coordination: (1) Informing, (2) socializing, (3) controlling, and (4) legitimating (Table 3). For each of these themes, we describe common purposes and provided illustrative examples of these purposes.

Theme	Purposes of coordination: <i>Illustrative example</i>
Informing	- Information exchange: <i>Information acquisition and application in decision-making processes (e.g., Levitt and March, 1988)</i> - Dynamic information facilitation: <i>Interaction for knowledge creation and facilitation throughout the organization (e.g., Nonaka, 1994)</i> - Bridging dissimilar/asymmetric levels of information: <i>Achieving a basis for common understanding (e.g., Star and Griesemer, 1989)</i>
Socializing	- Achieving collective benefits: <i>Social networks upheld for collectively-shared goals (e.g., Olson, 1965)</i> - Achieving social relations: <i>Social integration by the formation of networks (e.g., Granovetter, 1973)</i>
Controlling	- Mitigating expected negative effects resulting from not collectively shared goals: <i>Contract between principal and agent against negatively expected effects through the agent's behaviour (e.g., Jensen and Meckling, 1976)</i> - Harmonizing not collectively shared goals: <i>Values and norms established towards desired conceptions, by which behaviours can be compared (e.g., DiMaggio and Powell, 1983)</i>
Legitimizing	- Harmonization by cultural and normative patterns: <i>Taken-for-granted character of culture among all those who follow, adapt, or change it (e.g., Schein, 2010)</i> - Harmonization by dynamic patterns: <i>Interplay among actors changing structures, and the structures changing the interactions of actors (e.g., Giddens, 1984)</i> - Harmonization by environmental factors: <i>Organizations becoming legitimized systems by producing social behaviour, and being reproduced by this behaviour (e.g., DiMaggio and Powell, 1983)</i>

Table 3. Purposes and illustrative examples of coordination themes

4.1 Informing theme of coordination

The informing theme of coordination exists among multiple exchange practices and interrelations dealing with explicit or implicit forms of information (and knowledge). One purpose of coordination in this theme is *information exchange*. Organizational learning theory for example shows coordination as an instrument for knowledge acquisition, interpretation, and application (e.g., in decision-making processes) (Levitt and March, 1988). The bulk of information gathered from any object may be adapted and used for pursuing different goals and activities (Granovetter, 1973; Nahapiet and Ghosal, 1998; Freeman, 1984), for interpreting as well as changing goals and activities (Huber, 1991), or for being implicitly shared by individual behaviour (Nonaka, 1994; Schein, 2010; Scott, 2013).

We also find coordination more dynamically represented among exchange practices, for example in organizational knowledge creation. We define this coordination purpose as *dynamic information facilitation*. We know from theory that knowledge itself is distinct (i.e., is tacit in nature), and requires continuous interaction activities as well as information processing capabilities for facilitating knowledge in larger environments (e.g., in organizations) (Galbraith, 1973; Nonaka, 1994). Within an organization, the more information is shared, the more interaction there is, and the more information is facilitated throughout the organization (Nonaka, 1991).

Furthermore, we find a purpose of coordination that deals explicitly with *bridging dissimilar or asymmetric levels of information*: For example, boundary objects act as mechanisms for externalizing

and combining distinct and/or asymmetric levels of knowledge, information, and understandings within or also among groups of individuals (Star and Griesemer, 1989; Bowker and Star, 2000).

4.2 Socializing theme of coordination

A prevalent theme of coordination among the investigated theories is socialization, which is to the major extent determined by interdependencies that take place within social relations and interrelations among individuals. One purpose of coordination can be described as *achieving collective benefits*. In social capital theory for example, coordination can be perceived as a means for aligning social relations for collective benefits (Nahapiet and Ghosal, 1998; Coleman, 1988). Hereby, coordination can be interpreted as relational instrument enabled among individuals or groups, and it can further be determined by shared goals, resources, and activities in selected situations (Nahapiet and Ghosal, 1998). The theory of collective action also promotes social interrelations among individuals for achieving shared goals among the involved actors (Olson, 1965; Hardin, 1982).

Coordination also deals with the purpose of *achieving social relations*. For example, socialization occurs in processes of personal contact and social integration among individuals and groups (e.g., Granovetter, 1973). Given the focus on personal contacts and social integration, we find social relations laterally aligning and tying individuals in networks, for instance for the purpose of information and knowledge exchange (Granovetter, 1973; Nahapiet and Ghosal, 1998). Following social cognitive theory, socialization achieves social relations particularly in lateral structures, where individuals observe the behaviour/interaction of other individuals, and adopt it to their actions and behaviour, ultimately reproducing social structures in their environment (Bandura, 1977).

4.3 Controlling theme of coordination

Another widely used theme of coordination is concerned with control. Here, we find coordination as an instrument for the purpose of *mitigating expected negative effects resulting from not collectively shared goals*. Goals exist on the organization-wide level; however, organization-wide goals may not necessarily be shared by all actors. For example, agency theory perceives coordination as instrument for solving conflicts that may arise due to the potentially conflicting behaviour of an individual under asymmetric distributed information and/or capabilities (Jensen and Meckling, 1976). As illustrated by agency theory, the unequally expected gains and losses from interdependencies between individual and organizational goals are necessarily required to be controlled by coordination (Alchian and Demsetz, 1972). A similar argumentation is provided by resource dependency theory, revealing control as mechanism for mitigating expected negative effects resulting from not possessed resources (Pfeffer and Salancik, 2003). Although resource dependency theory is primarily concerned with the inter-organizational level, the control of resources for coordination does well apply to the intra-organizational level, too. Similarly, game theory is concerned with the mathematical modelling of decision-making among two involved parties that face potentially resulting costs and losses through the decision of the respective other party involved (Von Neumann and Morgenstern, 1944): The theory assumes that all involved players think rationally and analyse the structure in order to coordinate their actions (decisions) to their own goals and benefits.

Furthermore, coordination maintains a purpose of *harmonizing not collectively shared goals*. This purpose supports coordination as a control instrument on both the organizational and inter-organizational levels. Following the inter-organizational perspective discussed by Scott (2013), the social construction of institutions is built on a set of regulative, normative, and cultural-cognitive mechanisms (DiMaggio and Powell, 1983; Scott, 2013): The regulative pillar concerns a set of coercive mechanisms through which organizations constrain and regularize behaviour. The cultural-cognitive pillar creates the frames through which shared conceptions are made. Finally, the normative pillar introduces an obligatory dimension into social life by the means of values and norms; while values are the desired conceptions to which existing behaviours can be compared, norms are legitimate

means to pursue valued ends (DiMaggio and Powell, 1983). We take this argument as bridge from the inter-organizational to the organizational perspective. Following organizational culture theory, not collectively shared goals become harmonized in the process of internal integration by cultural patterns, which are processed on both the conscious and unconscious level (Schein, 2010). While on the conscious level, organizations become visible in their artefacts (e.g., structures, processes) and espoused values (e.g., goals, strategies), the unconscious level remains with underlying assumptions (e.g., perceptions, thoughts, feelings), through which culture (e.g., goals as part of espoused values) becomes ultimately adopted and followed by individuals (Schein, 2010).

4.4 Legitimizing theme of coordination

The legitimacy theme explains coordination as a taken-for-granted character. One purpose of coordination in legitimacy is the *harmonization* of (sub-) systems (e.g., business units) with their overall environments (e.g., organizations) *by cultural and normative patterns*. Following organizational culture theory, we can identify taken-for-granted characteristics among cultural mechanisms, which are used for driving internal integration and organizational behaviour beyond selected actors, interdependencies, or situations. Often, organizational culture is favoured as a static legitimating process. Culture exists by certain norms, values, and rules, which are adapted by organizational actors; the subsequent perception and behaviour of actors are a result of the perceived culture (Schein, 2010).

We further find a coordination purpose for the *harmonization by dynamic patterns*. Once again, organizational culture serves as an illustrative example. Culture exists as a dynamic legitimating process: Norms, values, and other cultural mechanisms can be actively influenced (e.g., by activities), and therefore vary in organizations and situational contingencies. For instance, an organization can have sub-cultures (Schein, 2010). In this case, coordination becomes a legitimating means, as it represents a cultural taken-for-granted character among all those who follow, adapt, or those who change it. Another example is the dynamic interplay among individuals and the structure they are acting in (Giddens, 1984). Structures are created through the actions of individuals (or assumptions on them, see Jensen and Meckling, 1976), organized as rules, or social systems. Structures reproduce the actions they are impacted by, and that simultaneously impact the actions of individuals (“interplay”), which we identify as dynamic form of harmonization (Giddens, 1984). Consequently, individuals start to rationalize their activities, resource usage, and goals based on these structures (Giddens, 1984).

Another purpose of coordination is the *harmonization by environmental factors*. According to institutional theory, organizations become legitimated social constructions, where they provide stability and meaning to social life (Scott, 2013; DiMaggio and Powell, 1983). They are continuously reproduced by the social behaviour of their actors, and therefore become a take-for-granted environment for those actors reproducing it, as well as controlling for those not reproducing it (Scott, 2013; DiMaggio and Powell, 1983).

4.5 Complementarity of Coordination Themes

Building on the derived themes of coordination and in order to provide an integrated view on coordination, we discuss relationships and complementarity of the four themes. In effect, the presented themes of coordination are not mutually exclusive. On the contrary, they shape a basis for the other themes or complement one another.

As the most basic coordination theme, the informing theme serves as the fundamental basis for all other themes in managing interdependencies among different actors. Being present in both explicit and implicit forms (Nonaka, 1994), informing means are required for realizing any form of socialization (lateral relations), control (hierarchical structures), and legitimation (e.g., see Granovetter, 1973; Jensen and Meckling, 1976; Schein, 2010). While the informing theme can be perceived as the constitutive coordination means of the other themes, the legitimating theme serves as an overarching theme in which all themes of coordination interact. As such, the legitimating theme reaches beyond the

themes of informing, controlling, or socializing, and that both structures and is structured by other themes (what structuration theory similarly describes as "interplay", see Giddens, 1984): For example, legitimacy structures controlling/socializing environments and, in turn, becomes structured by changes and developments of controlling/socializing environments (DiMaggio and Powell, 1983).

Moreover, both the controlling and socializing themes complement each other in terms of hierarchical and lateral relations as well as interdependencies among actors. The controlling theme outlines a hierarchical structure of mechanisms, often top-down, and particularly applies centralized mechanisms for coping with interdependencies (Tsai, 2002). In contrast to hierarchical structures, the socializing theme encompasses more personal, lateral modes of coordination (Nahapiet and Ghosal, 1998). Taking into account that most organizational activities do not follow hierarchical structures (Galbraith, 1973; Tsai, 2002), social/lateral structures become an effective complement to any coordination theme in the form of control.

5 Conclusion

This research was motivated by the role of coordination as a lens to examine different organizational (Crowston, 1997) and, in particular, IS (Brown, 1997; DeSanctis and Jackson, 1994) phenomena. Although conceptual (Van de Ven et al., 1976) and theoretical (Crowston, 1997; Malone and Crowston, 1990; 1994) approaches have been made, this research was further motivated by the fact that there is no factual theory on coordination. Facing demands of contributing to coordination (theory) in an interdisciplinary way (Malone and Crowston, 1990), this research reports a thematic analysis on coordination by using IS reference theories that are rooted in various disciplines. While there are studies addressing coordination in specific IS phenomena, this study laid emphasis on coordination itself as a lens.

Building on a systematic research process, we investigated IS reference theories that implicitly approach coordination. Drawing on 16 theories, we conducted a thematic analysis, and synthesized the implicit reflection of coordination in IS reference theories to four themes of coordination namely, informing, socializing, controlling, and legitimating. We also provided the underpinning concepts and purposes of each of the derived themes. All of these themes necessarily include a coordination-enabling perspective regarding actors, interdependencies, and underlying mechanisms. We finally elaborated on the complementarity of the derived themes in order to cater an integrated, coherent view on coordination. In all, there was considerable support from the investigated theories that strengthened the synthesized themes.

While building on Malone and Crowston (1990), our study complements their research by going beyond merely conceptualizing coordination and its constitutive elements. Our study, in turn, proposes theory-grounded themes to guide prospective research in investigating IS phenomena through the lens of coordination. Further, there is a constant debate in IS research where, and for which problem settings to use theoretical lenses (e.g., Walsham, 2006). As coordination represents an interdisciplinary lens, the identified themes and their related theories (theoretical discourses) can guide the application of theoretical lenses in different disciplines of IS research.

Besides the above-mentioned contributions to existing body of theory on coordination, our research offers new approaches in employing coordination as a theoretical lens in the studies of enterprise-wide IS undertakings. Coordinating various IS change and development projects to ensure an enterprise-wide perspective has long been the dominant topic of interest in disciplines, such as IS governance and enterprise architecture. Nevertheless, in enterprise architecture discipline, for instance, the existing studies merely rely on strict governance procedures (Boh and Yellin, 2006; Richardson et al., 1990; Peristeras and Tarabanis, 2000) that not only are challenging in deployment, but also do not sufficiently leverage the intended enterprise-wide approach (Ross and Quaadgras, 2012; Winter, 2014). The latter is yet mainly related to the controlling theme of coordination. As discussed in section 4.5, all of the derived themes of coordination are of importance to be taken into account due to their complemen-

tarity. As such, the formulated concepts and purposes of informing, socializing, controlling, and legitimating themes can not only open new avenues of research through employing different themes of coordination, but also help scholars provide a multifaceted and exhaustive view on their phenomena of interest.

The main limitation of this study concerns the number of investigated reference theories. First, we acknowledge that there could be other theories that implicitly deal with coordination, and that can be incorporated to this study. As we are interested in the application of theories in IS, we nevertheless have investigated theories that are applied, in one way or another, in IS research. Second, having 16 theories in our analysis prevented us conducting an in-depth investigation of each theory. Despite this factual limitation, by selecting seminal studies, which developed the respective theories, as well as the most recent application of theories in IS literature, we ensured of capturing the main theoretical assumptions of the investigated theories.

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