An Extended Coordination Theory for Governance of Tasks, Projects, Firms and Business Ecosystems[1]

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INTRODUCTION

In his classical microeconomics text, Adam Smith argued that breaking unified tasks into smaller specialized subtasks could create significant efficiencies at the system level. When a task is subdivided into smaller subtask, each worker learns to work faster through learning curve efficiencies, requires less training, and can thus be paid less while producing vastly more output. Offsetting these individual gains in productivity, however, Lawrence and Lorsch (1967) asserted that subdividing work tasks into smaller more specialized subtasks leads to a differentiation in workers' goals, skills and time perspectives that places new coordination burdens on management. But what is the nature and extent of these additional coordination burdens that arise from subdivided and differentiated workflows? The answer is that not all workflows — whether at the task, project, program, business unit, organization or business ecosystem level — are created equal. Different kinds of workflow for tasks that span across the boundaries of individuals, teams or firms responsible for their execution require different coordination mechanisms.

COORDINATION MECHANISMS FOR DIFFERENT KINDS OF WORKFLOW

Answering this question, James Thompson (1967) defined three kinds of workflows for complex, fragmented tasks performed by specialized workers, each requiring a different coordination mechanism.

POOLED INTERDEPENDENCE FOR INDEPENDENT WORKFLOW

The simplest type of interdependence that Thompson defined exists between any set of tasks that must all be completed to achieve a desired outcome. So any task with a deliverable that is required to successfully achieve a desired outcome has at least pooled interdependence with other tasks in the project that also need to be completed for the desired outcome to be achieved.

Pooled interdependence is the least costly form of interdependence to coordinate. However, tasks with pooled interdependence may also have other kinds of interdependence with other tasks that are more costly to coordinate, and which we describe next. Pooled interdependence can be coordinated in one of the following two ways:

1. Managers can coordinate pooled workflow by specifying tasks' required outputs and the skills required by the workers who will carry out those tasks. Workers with the appropriate skills can then complete their tasks largely independently of other workers because there are no technical or sequencing interdependencies between tasks. This first approach for coordinating pooled interdependence is used for complex tasks being carried out by "craft" or "professional" workers who have undergone extensive training to carry out complex work processes with minimal or no supervision —e.g., licensed electricians in construction, auto-mechanics in a service station, lawyers in court or neurosurgeons in medicine (Stinchcombe 1959).
2. Alternatively, pooled interdependence between less complex tasks being executed by unskilled workers can be coordinated by specifying –and in some cases, rigidly enforcing– the detailed work process by which each task should be carried out. A highly specified workflow for unskilled workers can be enforced through physical mechanisms like Henry Ford's moving assembly line, or by equally rigid software applications for sales or clerical workers with screens that only allow particular kinds of data to be entered in a fixed order and that only allow certain kinds of transactions. In the 21st century many of these kinds of tasks are being partially or fully automated.

Sequential Interdependence

Sequential interdependence is the second type of interdependence Thompson specified. It arises in workflow in which a given task cannot be initiated (or completed) until one or more prerequisite tasks have been completed. This kind of interdependence arises from constraints related to physical laws —e.g., gravity support or topology—or by one or more required scarce resources that are required by both tasks tasks so that production steps cannot be executed concurrently (A before B, or B before A) rather than concurrently. It is found in many kinds of manufacturing where subcomponents need to be manufactured and assembled to be incorporated into larger subsystems, and ultimately into the finished product. Laws of physics such as gravity require almost all kinds of construction to be executed in a fixed sequence: foundations provide gravity support for structures, which in turn provide gravity support for exterior walls and roofing. Similarly, a building must be enclosed before materials or components that could potentially be damaged by wind, rain or snow, such as carpets or drywall, can be installed, and so on.

Sequential workflow is coordinated hierarchically by:

(1) Scheduling tasks to occur in a specified sequence and requiring them to be completed by specified times, and

(2) Rescheduling tasks as needed to accommodate design changes, variance in the completion time of prerequisite tasks, or shortfalls in the availability of required or shared resources.

Scheduling is typically performed at least one hierarchical or contractual level above the level of all involved participants, so that scheduling and rescheduling decisions will be authoritative. Inserting buffers between tasks that have high variance in their durations is a commonly used strategy to avoid the need for frequent rescheduling. However, Goldratt (1997) argues that work will often expand to fill the available time, so that leaving buffers between tasks simply encourages workers engaged in the task ahead of a buffer to relax until the hard deadline—the end of the buffer—approaches, in what he called the “graduate student effect.” Critical Chain scheduling attempts to eliminate the time buffers from individual tasks and allocate them collectively to the manager of each chain of tasks in the schedule, who can later use the buffers to deal with schedule overruns in any part of that chain of tasks.

Reciprocal Interdependence

The third type of workflow that Thompson identified involves "Reciprocal" interdependence. Thompson stated that reciprocal interdependence requires "mutual adjustment" as a coordination mechanism, but without saying why. Thus his definition of interdependence and its required form of coordination was somewhat tautological.

The extended framework presented in this paper suggests that there are actually two distinct kinds of interdependence that require mutual adjustment and that thus correspond to what Thompson calls reciprocal interdependence. I propose to call them "compatible" vs. "contentious" interdependence. These two kinds of interdependence require different mechanisms for coordination; and the latter is much more challenging and costly to coordinate than the former.

Compatible Interdependence

Compatible interdependence occurs if the workflow requires a spatial or functional fit between the task outputs of two or more interdependent workers or workgroups, but achieving a fit does not result in conflicting sub-goals for the team members responsible for the tasks with compatible interdependence—i.e., neither responsible participant strongly prefers a particular solution for their decisions or choices that need to be mutually compatible. They just need to be sure their decisions are compatible. This kind of interdependence can be coordinated by requiring that the involved parties communicate and confirm the decisions they each make in initially choosing and subsequently revising their subtask solutions in order to maintain alignment between their respective components or subsystems. If none of the involved parties has strong preferences about the possible alternative choices for these interface decisions, communication and confirmation between the parties when making or changing any decisions that involve component interfaces is all that is required to achieve coordination. Such decisions might involve choosing matching colors, selecting chemically compatible materials at component interfaces, setting the diameter and thread pitch of screws or bolts and their coresponding nuts or tapped holes, etc.

Contentious Interdependence

Recall that Lawrence and Lorsch (1967) warned us that when we subdivide tasks into subtasks tht will be executed by specialized workers or workgroups, difference begin to arise in the respective workers' goals, skills and time orientation. Thus interface decisions are not always easily or even amicably resolved. Like compatible interdependence, contentious interdependence also requires a spatial or functional fit between the outputs of the interdependent workers' tasks. But in this case, achieving alignment creates a conflict between one or more of the subgoals held by the interdependence workers or work groups. A particular choice of the interface parameter that is more desirable to one workgroup is less desirable to the other, or vice versa. An example of this type of workflow with conflicting subgoals might be the design of an auditorium for which the architect strongly prefers open lines of sight and hence no interior columns, or at least the largest possible spans between any columns; in contrast, the structural engineer prefers shorter spans—i.e., by inserting interior columns— to reduce bending moments and so as to reduce the size of beams, the thickness of slabs, etc., and theeeby minimize the amount of steel or concrete in the structure. Another example is the choice of material for an automobile door, for which the safety engineer would prefer a heavy, reinforced steel door to protect the occupants from a side-impact; the mechanical engineer designing the engine prefers making the door from lighter weight aluminum to optimize acceleration and fuel consumption; and the sustainability engineer prefers a fiber-composite door that is intermediate in weight, will not corrode and rebounds from moderate impacts.

For this kind of workflow, the workers cannot simply communicate their decisions to one another. They need to negotiate the decision to achieve what Thompson calls "mutual adjustment". If the workers have been acculturated to understand the trade-offs between safety, acceleration, fuel economy and sustainability for the automobile in the example above, they are likely to be able to reach a mutually acceptable compromise. If, in contrast, they strive to make their decisions in terms of their own parochial local subgoals, they will often reach an impasse, so that decentralized "mutual adjustment" fails. In this case, they need to escalate the issue to a more senior manager who has a more global perspective on the trade-off in order to reach a decision.

Developing evaluation criteria and rewards for workers—or incentive contracts for supply chain participants—that share risks and rewards at the system level can help to overcome parochialism and achieve goal alignment between sub-teams or firms hoe goals would otherwise be contentious. It thus facilitates "decentralized mutual adjustment" without the need to escalate impasses. For example, Integrated Project Delivery (IPD) in construction uses both contractual and social mechanisms to secure system-level goal alignment among and trust between supply chain partners that would otherwise have contentious interdependence under the typical design-bid-build, hierarchical, fixed price project delivery approach (Hall & Lehtinen 2015).

Note that the various kinds of interdependence often exist simultaneously. Additional coordination of sequential workflows in projects or business ecosystems will be required depending on whether the actors and resources along the sequence involve contentious or compatible workflows. If a workflow with sequential interdependence also involves compatible interdependence to achieve spatial and/or functional alignment between the outputs of the separate workgroups, managers must facilitate information sharing between the actors involved—not just sharing of schedule updates with the scheduler. Moreover, if patents, trade secrets or other forms of proprietary ownership prohibit actors from sharing information with each other to coordinate sequentially across the workflow, the workflow interdependence can become contentious. In a contentious-sequential case, managers must require negotiation between the actors, and prepare for escalation and conflict resolution to resolve deadlocks between the actors.

There is a real art to managing this kid of interdependence successfully. Managers should not tell workers who escalate an impasse "what to do". This will guarantee that the next issue that comes up will also be escalated. Rather, they should "teach the workers how to decide" these issues in terms of high-level project, business unit or business ecosystem goals and tradeoffs. This will give workers and groups with contentious interdependence the "big picture" perspective that can use to resolve future issues of this kind autonomously. This can be thought of as "teaching team members the project culture."

Table 1 summarizes the three types of workflow interdependence and their associated coordination mechanisms (Thompson, 1967) and governance mechanisms (Levitt 2015) for coordinating and governing them. Although this coordination framework has been developed for tasks carried out by individuals and subgroups within a single organization, or teams employed by separate firms within projects, it can be extended to a more generic networks of activities performed by organizations within business ecosystems.

Thompson Interdependence Types	Interdependence arises from:	Thompson Coordination Mechanisms	Extended Interdependence Types	Proposed Extended Governance Mechanisms
Pooled	Task output is required for project completion	Rules & Standards: - outputs -worker skills -work processes	**Pooled**	Managers: define output specifications and required worker skills; or create detailed process specifications
Sequential	Physical or informational precedence between tasks	Schedules	**Sequential**	Hierarchically schedule tasks, and continuously reschedule tasks to address changes
Reciprocal	"Need for mutual adjustment"	Mutual adjustment	**Compatible**	Interdependent parties exchange information frequently during task execution and update each other immediately of changes
			Contentious	Managers clarify and share high-level project goals and tradeoffs, interdependent parties negotiate solutions; parties escalate in event of impasse, managers clarify tradeoffs in case of impasse and let parties renegotiate

TABLE 1. Interdependence Type and Aligned Coordination Mechanism:
Thompson 1967 vs. Levitt 2015

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