

INTRODUCTION TO COORDINATION CONCEPT

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Abstract

We usually have only an intuitive sense of what the word coordination means. Importance of studying of the coordination concept and consequently coordination mechanism is important from contemporary advancements in managing businesses – movement from management by business functions to knowledge management by business processes. In this paper I have suggested serious discussion about coordination concept because it is an interdisciplinary issue, and ordinarily, a communication problem.

Key words: coordination, dependency, coordination mechanism, shared resource problem, supplier-customer problem.

Classification JEL: D8 – Information, Knowledge, and Uncertainty

1. Introduction

All business (and organization) models¹ are based on two core concepts: *specialization* and *coordination*. The first concept is known from A. Smith: *The Wealth of Nations* (1776). According [4] specialization occurs „when people concentrate their efforts on a particular set of tasks – it permits each person (and country) to use the best advantage its specific skills and resources”. One of the fact of economic life is that, rather than have everyone do everything in a mediocre way, it is better to establish a division of labor – dividing production into a number of specialized steps or tasks.

The second term seems to be too diverse for understanding and knowledge sharing. Studies or theories describe coordination only in general terms, without characterizing in detail differences between the problems dependencies create or how the proposed coordination mechanisms solve those problems. This situation makes it difficult or impossible to determine what alternative coordination mechanisms might be useful in a given case or to directly translate these alternative designs into specifications of individual activities. Usually we difference coordination mechanisms such standardization, planning and mutual adjustment and we use them in response to three different patterns of dependencies – pooled, sequential or reciprocal. Generally, we distinguish between four different sources of dependencies – task, role/position, social and knowledge.

Importance of studying of the coordination concept and consequently coordination mechanism is important from contemporary advancements in managing businesses – movement from *management by business functions* to *knowledge management by business processes* (process management approach and philosophy). It is influenced by process and information technology innovations that have transformed the way businesses work. These innovations practices have a clearly goal, business performance improvement. Looking for improvements, businesses have applied concepts and methodologies such ‘total quality management’, ‘business process redesign’, ‘supply chain management’, and ‘the learning organization’.

¹ A business model can be defined as what a firm/business does and how it makes money from doing it.

2. Coordination Framework

2.1. What Coordination is?

We usually have only an intuitive sense of what the word coordination (or co-ordination) means. Typical dictionary explanations for coordination are: „the act of coordinating, making different people or things work together for a goal or effect”, or „the regulation of diverse elements into an integrated and harmonious operation”. Coordination also means „integrating or linking together different parts of an organization to accomplish a collective set of tasks” or „integrating or linking together different resources to accomplish a collective set of tasks”.

The coordination concept is an interdisciplinary subject and there are the two primary disciplines that influence it. They are organizational studies, including all parties of management (especially human resource management, operations management, marketing management) and computer science, including related disciplines like information technology and artificial intelligence.

An intelligible and clear definition of coordination is introduced in Coordination theory from Malone and Crowston [2]: „*Coordination is the act of managing interdependencies between activities.*”

The influence of different disciplines and diversity of the definitions illustrate the difficulty of defining coordination and communication understanding between businesses, departments, individuals. Therefore, at the beginning, we use a following simplified definition:

Coordination is managing dependencies among activities.

This definition is consistent with the simple intuition that, if there is no interdependence, there is nothing to coordinate. Coordination has also similar meanings with words like ‘cooperation’, ‘collaboration’, ‘competition’. Each of these words have their own connotations, an important part of each of them involves managing dependencies between activities.

Now, it should be clear that dependency and coordination have been important topics in economics and organization studies. The two are related because coordination is seen as a response to problems caused by dependencies; but both words – dependency and coordination – usually mean the same thing.

2.2. Important Examples of Coordination Processes

A primary thing for facilitating and understanding the concept among different disciplines (and people) is identifying and studying the fundamental processes involved in coordinated systems. At first, we need to imagine (and/or visualize) and consequently analyze processes in these systems. Second, if coordination is defined as managing dependencies, then progress should be possible by characterizing different kinds of dependencies and identifying the coordination processes that can be used to manage them. The following table suggests some examples of a raw analysis [3].

The important cognition is that *shared resource* are scarce (or limited, with finite constraints) and they can be managed by a variety of coordination processes such as FIFO (first-come, first-out/serve), priority order (or rule), budgets, managerial decision, and market-like bidding. For better understanding, we can use simple example (managing shared resources). If two workers need to use/share the same (one) equipment, they could use a FIFO mechanism. The second alternative, they can use a form of budgeting with each worker having pre-assigned time segments. The third is a line manager explicitly decides what to do when (two) workers want to use the equipment at the same time. Finally, in special cases they might even want to ‘bid’ for use of the equipment and the person ‘willing to pay the most’ would get it. It is also important to note that many specific processes that arise in particular kinds of systems can be seen as instances of more generic processes.

Table 1: Examples of a raw analysis

Dependency	Examples of coordination processes for managing dependency
Shared resources - Task assignment	FIFO, priority order, budgets, managerial decision, market-like bidding - Same as for shared resources
Supplier/customer relationships - prerequisite constraints - transfer - usability	- notification, sequencing, tracking - Inventory optimization methods (e.g., JIT, EOQ) - standardization, ask users, participatory/concurrent design
Simultaneity constraints	Scheduling, synchronization
Task/subtask	Goal selection, task decomposition

I believe that one of the most interesting possibilities for creation and transfer knowledge about the coordination is to identify and systematically analyze a variety of dependencies and their associated coordination processes. Now, we will discuss in detail the first two categories of dependencies from the table.

2.2.1. Managing Shared Resources

Whenever multiple activities share some limited resources (money, space, time, etc.), a resource allocation process is needed to manage the interdependencies among activities. Resource allocation is probably the most widely studied of all coordination processes. To illustrate the possibilities for analyzing of coordination processes, we need to show how the processes can be analyzed in different disciplines, namely economics and organization theory.

A lot of *economics* theories are devoted to studying resource allocation processes, especially those involving market-like pricing and bidding mechanisms. As scientists have observed, markets have a number of interesting properties as resource allocation mechanisms. They can be very decentralized – many decision makers interacting with each other locally can produce a globally coherent allocation of resources without any centralized controller (recall A. Smith: *The Wealth of Nations*). In other case, markets have a build-in set of incentives – when all participants in a perfect market try to maximize their own individual benefits, the overall allocation of resources is globally „optimal”.

Organization theory has also paid great attention to resource allocation issues. Namely, control of resources is intimately connected with personal and organizational power; we know „those who control resources have power”. Organization theory emphasizes hierarchical resource allocation methods where managers at each level decide how the resources they control will be allocated among people (employees). In practice, however, resource allocation is a much more complex issue than a simple hierarchical model and it is extremely important for studying tripartite conditions of any successful activity: ‘to know – to want – to be allowed to do’.

2.2.2. Managing Supplier-Customer Relationships

Another extremely common kind of relationship between activities is a ‘producer-customer’ relationship (see also the table above); it means a situation where one activity produces something that is used by another activity. This relationship clearly occurs in all manufacturing operations/processes, where the output of one step on a workstation is the input to the next. It also occurs with information whenever one person uses information from another. Supplier-customer relationships we can describe through several types of dependencies:

- a) **Prerequisite constraints** – the supplier activity must be completed before the consumer activity can begin. When this dependency exists, there must be (at least) some notification process to indicate to the customer activity that it can begin. Managing prerequisite dependencies often require explicit sequencing and tracking processes to be sure that supplier activities have been completed before their results are needed; computerized management science methods (PERT charts or CPM) are often used by businesses.
- b) **Transfer** – when one activity produces something that is used by another activity, the thing produced must be transferred from the supplier to the customer. Managing this dependency usually involves physical transportation; physical transportation is a coordination activity in this sense. Note, when the 'thing' is information the transfer we call communication. In addition, managing the transfer dependency also often involves storing the things being transferred from one activity to another. Operations management and logistics use specific methods for determining a 'right' level of inventory and replenishment time.
- c) **Usability** – another dependency that must be managed in a supplier-customer relationship is that whatever is produced should be usable by the activity that receives it. One way to manage this dependency is by standardization, creating uniformly interchangeable outputs in a form that users expect. Another and related alternative of the dependency is participatory/concurrent design.

3. Managing Task-Resource Dependencies

In Malone and Crowston's Coordination theory [2] the important type of dependency is between a task and a resource. Recall that tasks are either goals or activities and according to the simple model of actions, activities have preconditions and effects. But we have to consider a goal as having effects but no preconditions. Both, the preconditions and effects are the resources required, consumed or created by an activity. Figure 1 shows the generic dependencies.

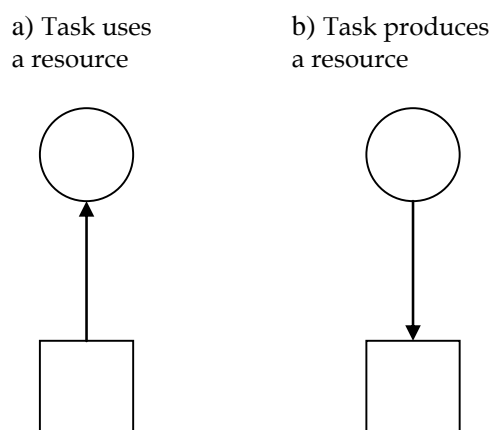


Fig. 1 – Task uses or produces a resource

3.1. Task Uses a Resource

Consider a task that requires or consumes some resource. If there is just one appropriate resource known, then that resource must be the one used. This case includes an actor deciding that it should perform a task itself or knowing only one other actor that could perform it. However, there can be a lot of possibly appropriate resources, and the situation creates the problem of resource assignment, it means, knowing a task with a precondition and looking for an appropriate resource that satisfies the precondition. In order to assign resources to a task, the following steps need to be performed:

- a) identifying what resources are required by the task,
- b) identifying what resources are available,
- c) choosing a set of proper resources,
- d) assigning the resource.

This is essentially an outline of a decision process – intelligence, design and choice of an alternative – where the first step is divided into intelligence about the needs of the task and about the available resources. Now, we will discuss the steps in the order listed above.

Ad a) Identifying necessary resources – The resources needed by a task must be identified. In some cases the assigner may need to know what kind of resources are available to be able to characterize the task requirements along the same dimension. Generally, actors' roles may range between two extremes: specialists and generalists. In a specialist model, only one actor can perform any given task, so the needs of the task must be identified in terms of these actors' specializations. In the generalist case, any actor can perform the task. In reality, things are rarely so precise, so that organizations will be located along the spectrum between these two extremes.

Ad b) Identifying available resources – A set of appropriate resources must be identified. In the simplest case, there is only one potential resource, for example, only one actor, that can perform the task. This may be due to specialization of roles of departments or individuals, i.e., who is supposed to do a particular task, rather than a distribution of ability, i.e., who is capable of doing the task. In the general case there may be several resources that could be used for the task, making it necessary to choose one. The available resources may be known *a priori* to the assigner; the assigner may know a larger set of resources, some of which may be appropriate; or the assigner may have to spend some effort identifying what resources might be appropriate.

Ad c) Choosing a resource – One particular resource must be chosen. To choose a particular actor or other resource from those available requires some way to evaluate how good a particular resource will be for the task. Obviously, there are many possible bases for making the decision, such as speed, quality, availability, motivation, etc. Which criteria to use depend on the nature of tasks being coordinated? In some cases, it is important to consider when the resources are available, especially if multiple resources are required at the same time. In this case, the choice depends on when the required resources are free. Numerous techniques have been developed to schedule multiple resources in Operations Research/Management Science.

Ad d) Assigning resources – The assignment of the resource must be communicated to the actor performing the task. As well, for non-shareable resources, the resource must be marked as 'in use' or other assigners warned to avoid conflicting assignments. When the resource is the effort of an actor, the actor must be told to perform the task. Where the personal goals of the individual actors differ significantly, e.g., when the actors are whole departments rather than individuals, the assigner may have to convince the performer to do the task by designing appropriate incentives schemes or monitoring performance.

3.2. Task Produces a Resource

Another kind of coordination mechanism is to choose tasks that have a particular effect, thus maintaining a goal-resource relationship between the desired resource and the tasks. To choose the tasks is a planning task, for which many methods have been developed. In general, an actor must know the effect to be achieved and know (or be able to generate) possible tasks, sub-goals or simple activities, and their preconditions and effects, and be able to choose among multiple possible decompositions. As well, the actor may have to choose tasks that create needed resources.

There are obviously many ways to decompose goals into activities. Alternately, an actor might precede one step at a time, choosing an activity that appears to move closer to the desired goal, performing it and then reassessing the situation.

If multiple subtasks are performed to accomplish some effect, it may be necessary to integrate their results. This integration step is usually viewed as a kind of coordination task.

4. Conclusion

There are many approaches and explanations of coordination concept – it is an interdisciplinary issue, and ordinarily, a communication problem. There are a lot of coordination mechanisms and problems. I believe we will collaboratively and seriously study coordination problems, mechanisms, and decision-making models for improving business and management education and practices.

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