

Design Rules, Volume 2: How Technology Shapes Organizations

Chapter 3 Transaction Free Zones

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Working Paper 21-031



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Chapter 3 Transaction Free Zones

By Carliss Y. Baldwin

Note to Readers: This is a draft of Chapter 3 of *Design Rules, Volume 2: How Technology Shapes Organizations*. It builds on prior chapters, but I believe it is possible to read this chapter on a stand-alone basis. The chapter may be cited as:

Baldwin, C. Y. (2020) “Transaction Free Zones” Harvard Business School Working Paper (Aug 2020).

I would be most grateful for your comments on any aspect of this chapter! Thank you in advance, Carliss.

Abstract

In Chapter 2 we saw that the most economical locations for transactions in a task network are the so-called thin crossing points—places where transfers are easy to define, count and pay for. However, in many places in the task network, transfers of material, energy, and information are *so* dense and complex that the costs of treating each one as a transaction would be prohibitive. Such areas can become *transaction free zones*.

The purpose of this chapter is to build a theory of transaction free zones within a task network. I first consider how transaction free zones are related to the economic view that a firm is a “nexus of contracts.” I then explain how transaction free zones are created and governed. I describe three types of transaction free zones: (1) corporations in which all decision rights flow from a single, central authority; (2) commons organizations which govern through consensual rule-making and monitoring; and (3) collaborative communities with open boundaries which govern through consensus and shared norms.

Introduction¹

In Chapter 2 we saw that the most economical locations for transactions in a task network are the so-called thin crossing points—places where transfers are easy to define, count and pay for, and reciprocal information hiding is high. Transactions can go at thick crossing points as well, but total costs will be higher. Still in many places in the task network, transfers of material, energy and information are *so* dense and complex that the cost treating each one as a transaction would be prohibitive.

For example, consider the transfers that occur when a master mold-maker checks

¹ This chapter is based on my paper “Where Do Transactions Come From?” (Baldwin, 2008).

on the work of a subordinate. As recounted by Nicholas Argyres:

The chief mold-maker, in a routine check of work in progress ... [saw] that ‘friction weld’ would set in, causing excessive wear and galling to the mold. ... A third mold-maker assisted in performing the precision grinding necessary to remove the galling. The mold was saved.²

The chief mold-maker’s initial check created a transfer of information about the state of the mold. Checking was part of a pre-specified routine, however, the next steps were not pre-determined, rather they depended on the state of the mold. If the mold had been all right, the chief would have proceeded to other tasks. But discovery of the flaw triggered a new set of tasks and transfers (of material, energy, and information) aimed at saving the mold. In other words, *the task network was not completely fixed, and in response to certain triggering events, it would change on the fly, in complex, non-deterministic ways.*

Transient, uncertain cascades of tasks and transfers like this are extremely common in complex technical systems. They occur not only in mold-making establishments, but in disk drive, laptop, automobile and software organizations as well. Simple, repetitive transfers are the exception not the rule. Fortunately, humans have devised ways to make transfers without making each and every one a transaction. The basic strategy is to create a *transaction free zone*.

The purpose of this chapter is to build a theory of transaction free zones within a task network. I first consider how transaction free zones are related to the economic view that a firm is a “nexus of contracts.” I go on to look at how transaction free zones are created and governed. I describe three types of transaction free zones: (1) corporations in which all decision rights flow from a single, central authority; (2) commons organizations which govern through consensual rule-making and monitoring; and (3) collaborative communities with open boundaries which govern through consensus and shared norms.

In the next chapter, I look at how organizational ties between individuals can be formed to facilitate specific transfers within and across transaction free zones.

3.1 The Firm as a Nexus of Contracts

Most organizations are simply legal fictions which serve as a nexus for a set of contracting relationships. Jensen and Meckling, 1976.

If one assumes that formal transactions and contracts are the fundamental units of analysis in the economic system, then a productive organization—a firm—will appear as a simple hub-and-spoke structure in the network of transactions. Such firms are often described as a “nexus of contracts.” Some economists, such as Michael Jensen and William Meckling (quoted above) and Armen Alchian and Harold Demsetz take the view

² Argyres (1996) p.136.

that a firm is no more than that.³

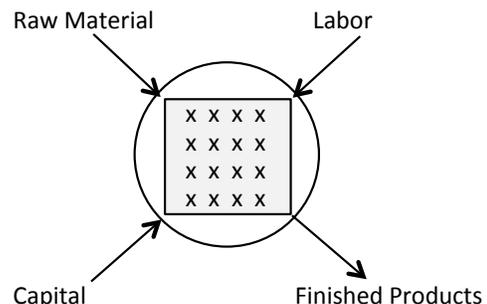
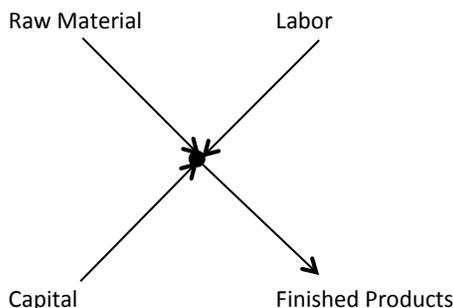
But while any business enterprise is the hub of a set of transactions, most technical recipes require many more transfers of material, energy and information than can cost-effectively be spelled out in formal contracts. Thus managers of firms charged with implementing specific technical recipes cannot limit their activities to setting up the contracts and transactions surrounding the nexus. *They must also organize an internal task and transfer network that transforms raw materials and labor into products and delivers those products into the hands of customers.* For the sake of efficiency, the transfers in the densest parts of the task network, like those surrounding the defective mold, take place within transaction free zones.

A closeup view of most businesses reveals dense networks of tasks and transfers occurring within one or more transaction free zones. The task networks in turn are ringed about by transactions that bring materials, labor and capital into transaction free zones and move products out. Viewed externally, classic firms are a nexus of contracts, as shown in the lefthand panel of Figure 3-1. Viewed internally, they are networks of activity and information transfers set up in accordance with the requirements of the underlying technical recipes ,as shown in the righthand panel of the figure.

Figure 3-1 Two Views of the Firm

The Firm as a Nexus of Contracts

The Firm as a Transaction Free Zone within a Nexus of Contracts



In contrast to Alchian and Demsetz and Jensen and Meckling, Herbert Simon took the view that the interior of firms contained complex activities and organizational architecture. In his famous example of the “visitor from Mars” viewing Earth, he argued that the bulk of all productive activity arose inside firm boundaries. Denoting firms as green areas, and transactions as red lines, the alien observer “would speak of ‘large green areas interconnected by red lines.’ It would not likely speak of ‘a network of red lines

³ Alchian and Demsetz (1972); Jensen and Meckling (1976); Demsetz (1988).

connecting green spots.’ ”⁴

Implicitly, the organizations in Simon’s picture were transaction free zones connected by transactions. Simon went on to pose the questions:

Why [is] the larger part of a modern economy’s business done by organizations, what role [do] markets play in connecting these organizations with each other, and ... with consumers. [Finally] what mechanism maintains the highly fluid equilibrium between them?⁵

Chapter 2 described how transactions can be used to transfer goods and services between organizations and from organizations to consumers. This chapter focuses on how tasks and transfers are implemented inside transaction free zones.

3.2 Transaction Free Zones Defined

Transaction free zones are physical or virtual spaces where, by convention, a designated set of transfers occurs freely—undefined, uncounted, and uncompensated. Transaction free zones are common in human affairs. Every time we strike up a conversation, attend a party or a lecture, shop in a grocery store, or enroll in school, we are creating or entering a transaction free zone.

Transaction free zones have existed for a very long time, while transactions are a relatively recent human invention. Cooperative social groups such as families and tribes are characteristic of humans and our nearest relatives, the great apes. Material, energy and information are freely transferred between members within these groups.⁶ In contrast, the earliest recorded transactions date to the city states of Mesopotamia around 6000 B.C.⁷

It is useful to distinguish between “productive” and “social” transaction free zones. Social transaction free zones are places of social interaction. They may be impromptu (two friends meet on the street and walk together for a while) or institutionalized (a group of friends meets at a café). Productive transaction free zones use technology and organization to transform inputs (including knowledge) into useful outputs. The café is a social transaction free zone for the friends who meet there, but it is a productive transaction free zone for the cooks and waiters who make and serve the drinks and the food.

My focus throughout this book is on productive transaction free zones. Valuable, usable products and services do not arise out of chaos, but deliberately through the

⁴ Simon (1991) p. 27.

⁵ Ibid. p. 29.

⁶ Suddendorf and Corballis (2007); Tomasello (2010).

⁷ On the evolution of transactions, see for example, Mauss (2002); K. Polanyi (1957); Graeber (2011); Scott (2017).

implementation of appropriate technologies. Actors in productive zones intentionally carry out various technical recipes that convert resource inputs into useful outputs.

The recipes in question are often beyond the capacity of any single human actor, and thus require multi-person organizations.⁸ They are sometimes very precise, while at other times they are open-ended and demand creativity and problem-solving ingenuity. Production processes—the making of goods and services according to known recipes—tend to demand higher levels of precision. Design processes—the development of new recipes—require higher levels of creativity and ingenuity. Ultimate success generally requires a blend of both.

Economists often refer to productive transaction free zones as “firms.” However, they also usually assume that firms are organizations created by owners for the purpose of seeking profit. In this book, I wish to consider not only firms as traditionally defined, but also organizations, such as commons organizations, standard-setting organizations, and collaborative communities, that are not profit-seeking and may not have owners. Thus throughout the book, I will use the word “firm” to mean any organization that uses technology (a technical recipe) to create or contribute to the creation of things that people use and value. I will use the term “business firm” to refer to profit-seeking organizations with owners. (The latter include sole proprietorships, partnerships, and corporations.)

A single firm may span one or several transaction free zones. Also, as we saw in Chapter 2, two or more firms may use formal and/or relational contracts to set up a shared transaction free zone. Finally some firms are in the business of facilitating transactions. Firms that “produce” transactions must generally set up a transaction free zone (the marketplace) where buyers and sellers can meet and freely exchange information about what is for sale and another transaction free zone (the back office) to record transactions and guarantee completion of each exchange.

Transaction free zones are easy to create, but can be hard to police. Some individual property rights, by definition, are suspended in these zones because transfers take place freely without compensation. As a result, rational agents may be justifiably reluctant to bring valuable property into such zones. For example, a public library is a transaction free zone for books, and most people would think twice before storing their books on its shelves. Similarly, a person with valuable private information would not want to discuss it at a cocktail party where it might be overheard. And the inventor of an unpatented device would probably not post its design on a public notice board. Understanding the opportunism of others, we do not usually risk our own valuable private property or information in transaction free zones.

However, *transactions can be used to define, count and provide compensation for transfers into and out of a transaction free zone.* When the library purchases books, they enter the library’s transaction free zone. To check one out, a borrower must sign a card and agree to compensate the library if he or she fails to return the book on time. The

⁸ Puranam, Alexy Reitzig (2014); Puranam (2018).

checkout procedure is a transaction under my definition: the borrowed book is defined, counted, and (contingently) paid for. Hence the library is a transaction free zone, but books enter and leave the library via transactions.

The interior of a supermarket is also transaction free zone. Inside it, shoppers can put things in their carts and take them out at will. But before exiting the store, the contents of the cart must pass through a checkout line where the goods are defined (by their barcodes), counted and paid for.

Similarly, a person with valuable private information will discuss it under a contract (a transaction) that provides her with compensation and safeguards. And the inventor of a device will contribute its design to an enterprise in return for shares in the company (another transaction). In this fashion, transactions—defined, counted, and compensated transfers—can be used to move things of value into and out of transaction free zones.

Transaction free zones are necessary for most forms of efficient production. But a transaction free zone designed to hold things of value can't have any holes or leaks. Thus modern market economies have developed sophisticated social institutions that provide for the *encapsulation* of transaction free zones within the boundaries of legally constituted corporations. Corporations subject to unified governance are the first type of transaction free zone discussed in this chapter. They provide an interesting contrast to commons organizations and open collaborative projects, which are discussed later in the chapter.

3.3 Corporations: Transaction Free Zones Encapsulated by Transactions

Defining, counting, and paying for pothooks is easy. Modern goods and services such as laptops, autos, trips, and medicines are more complex, but, with some effort aimed at transaction design, these transfers can also be made into transactions. Bringing labor or capital into a transaction free zone can be harder, however. In pre-modern times, workers might be hired, but might also enter a transaction free zone via marriage, birth, or bondage. A smith's assistant might be his wife or his son. Farmworkers were often serfs tied to the land. Capital would enter via marriage, inheritance, loans (trade credit). In contrast, in modern economies, people are hired and capital is raised via transactions.⁹

By definition, it is impossible to precisely define, measure, and pay for all transfers within a transaction free zone. Hence the transactions that bring labor and capital into the zone cannot perfectly reflect what happens inside. The contracts will perforce be incomplete.¹⁰ However, the legal form of a modern corporation makes it possible to (1) completely surround a transaction free zone with transactions; (2) protect the zone from disruption;¹¹ and (3) determine whether the zone should survive in the

⁹ Bloch (1961); Braudel (1982).

¹⁰ Hart (1995).

¹¹ Many technological processes are fragile, thus part of the job of an organization is to create a

larger economic system. These goals are achieved via the social technology of *incorporation*. (Social technologies are ways of changing social systems that fulfill a human purpose. They do not change the material world but they often do change the way humans behave and thus affect the way material technologies are implemented.¹²)

Incorporation involves creating a legal entity—a corporation—with property rights, whose boundaries are defined by its transactions with customers, suppliers, employees, and investors (see Figure 3-1). By design, many transfers within the boundaries of the corporation are non-deterministic and complex, thus difficult to measure and pay for (recall the mold-maker example above). Such transfers can be efficient only if they take place within a transaction free zone. The corporations' status as a legal person with property rights allows valuable things—capital equipment, intellectual property, inventory and receivables—to be held within the zone, without disruption, for as long as the technology demands.

Goods, labor and capital enter and leave the zone via transactions. Transactions permit the corporation to compensate its suppliers, employees and capital providers, and to receive compensation from its customers.

The difference between inflows and outflows from transactions in turn determines the corporation's *financial sufficiency*. If the balance is positive (assets greater than liabilities), then, as long as it obeys the law, in a market economy, the corporation will have the right to continue as an autonomous, self-governing enterprise. If the balance is negative, the corporation is, by definition, bankrupt, and must be reorganized or liquidated.¹³

Over the last 150 years, corporations have become the most common legal form of business enterprise.¹⁴ Indeed, corporations can be seen as social artifacts *designed for the purpose* of encapsulating complex transfers. Families, villages, and tribes are also transaction free zones in which complex transfers take place, but they were not created for this purpose.

Transactional encapsulation via incorporation is a relatively new way of designing an organization. Particularly important to the definition of a corporation are the legal concepts of segregating the corporation's assets ("asset partitioning") and protecting shareholders from the corporation's creditors ("limited liability").¹⁵ These concepts, which evolved in English and American common law over approximately four hundred years, had the effect of completing the ring of transactions around business firms.

protected space. Thompson (1967).

¹² Nelson and Sampat (2001).

¹³ On this view, the corporation exists as *an equilibrium in a set of linked games* involving customers, suppliers, employees and investors. Hence corporations are institutions as defined by Aoki (2001).

¹⁴ In Chapter 9, I discuss the rise of corporations in the US at the turn of the 20th century.

¹⁵ Hansmann, Kraakman and Squire (2006).

Thus in pre-modern times, if a merchant owned two businesses and one failed, the second would normally be liquidated to pay the debts of the first. There was no way to partition assets based on their role in a technical system. Similarly, members of a partnership were obligated to repay the partnership's debts, using their own personal resources as needed. There was no way to limit the liability of investors in an enterprise.

Today, asset partitioning and limited liability have been adopted as basic principles of corporation law in essentially all market economies. A firm that is legally chartered as a corporation can be completely segregated (hence protected) from its owners' other affairs. If a corporation fails, the other assets of its owners are not affected (limited liability). And if an *owner* fails, the corporations he or she owns cannot be liquidated if they are financially sufficient in their own right (asset partitioning). In particular, a corporation can continue in existence even if its owners die. Thus corporations can own long-lived assets and invest in projects whose returns lie far in the future.

Thus *corporations can be set up to correspond natural boundaries of the underlying task network and the technology, instead of being agglomerations of unrelated holdings linked by common ownership*. The right of corporations to own property, their ability to engage in transactions at their boundaries, plus the rule “only financially sufficient corporations may survive” make these entities full-fledged participants in free markets.

Corporations that capture more value than they consume will survive, while those that fail this test will be liquidated. In this fashion, a reasonably efficient network of corporations implementing a wide range of technical recipes and linked by transactions can evolve without centralized control.¹⁶

3.4 Internal Transactions and Transfer Pricing within Corporations

Transfers within corporations do not have the legal status of transactions between unrelated parties. One division of a corporation cannot call on the courts to adjudicate transfers from another division. Thus corporations are literally transaction free zones from the perspective of the law.

However, organization designers have enormous latitude in designing transfers within corporations. If they choose, they can endow an internal transfer with any or all of the properties of transactions. Thus, inside a corporation, one finds a full gamut of transfer designs. The most complex and difficult-to-value transfers—for example, problem-solving conversations and consultations—are generally undefined, uncounted and uncompensated, and take place on an as-needed basis. Other transfers inside a firm are defined and counted, but not compensated. And a few will be defined, counted, and

¹⁶ The test of financial sufficiency does not imply that every corporation will be efficient. It only implies that there are selective forces in the economy that reward efficiency if it leads to a financial surplus. See Heilbroner (1967; 1994).

compensated according to the corporation's policies.

This last group of transfers satisfies my definition of a transaction. In this sense, Coase and Williamson were right: transactions can take place within firms. But at the task network level of analysis, internal transactions are still a very small subset of *all* the transfers that take place within a firm. Furthermore, I contend, the role of firms and corporations in the economy is precisely to provide transaction free zones, where complex, but necessary transfers can take place without weighing down the system with the costs of defining, counting and paying for each one.

Many modern corporations are divided into individual business units with separate profit and loss (P&L) statements.¹⁷ In these settings, when one business unit provides goods or services to another, corporate policy may treat the transfer as an internal transaction. This practice, known as *transfer pricing*, is an interesting special case in which a set of internal transfers has all the characteristics of a transaction under my definition. Moreover, divisional boundaries are often modularized to facilitate these internal transactions.¹⁸ Hence, transfer pricing points are—by design—thin crossing points in the corporation's internal task network.

3.4 Authority in Corporations

How does complex work get done inside a corporate transaction free zone? For traditional economists the answer to this question was “via the exercise of authority.” While markets were characterized by voluntary exchanges among more-or-less equal parties, firms were characterized by bosses who told subordinates what to do. For example, according to Ronald Coase: “If a workman moves from department Y to department X, he does not go because of a change of relative prices, but because he is ordered to do so.”¹⁹ In the same paper, bases the firm's authority on the legal theory of master and servant:

It is this right of control or interference, of being entitled to tell the servant when to work ... and when not to work, and what work to do and how to do it ... that is the dominant characteristic in this relation and marks off the servant [i.e., employee] from an independent contractor.²⁰

On this view, inside a firm, there are no exchanges between equals, but only orders given and received.

Herbert Simon also placed authority at the center of his theory of organizations.²¹ The essence of the employment relationship (as opposed to a service contract) is the

¹⁷ Hirschleifer (1956); Chandler (1962); Williamson (1985) pp 279-297.

¹⁸ See, for example, Jacobides and Billinger (2006).

¹⁹ Coase (1937) p. 387.

²⁰ *ibid.* p. 404.

²¹ Simon (1951; 1991).

boss's right to identify the *specific* work that will be done within some pre-arranged zone of agreement. Simon then shows that this type of contract will be preferred by both parties if (1) the worker is close to indifferent between actions within the zone of agreement; and (2) the boss is *ex ante* uncertain as to what will have to be done. In later work, however, Simon and James March offered a more nuanced view of authority, suggesting that it might be exercised *indirectly* through control of the “premises of decision-making,” that is, by providing shared vocabularies, setting up communication channels, and creating templates for the interpretation of complex information.²²

Drawing on Max Weber's theory of bureaucracy, Alfred Chandler expanded the view of authority from a single boss-worker relationship to a managerial hierarchy.²³ The large business enterprises that emerged at the end of the 19th Century followed a basic hierarchical structure comprising several layers of managers.²⁴

Modern business enterprise ... employs a hierarchy of middle and top salaried managers to monitor and coordinate the work of the units under its control.²⁵

Chandler argued that the “visible hand” of managerial authority was necessary to guide flows of material, energy and information through the complicated pathways of production and distribution required by the new technologies of high-volume production.

For Oliver Williamson, transaction costs could be avoided through the exercise of direct authority. In an armslength transaction, a supplier or a buyer might demand new terms by threatening to withhold its goods or its orders. Such holdups can be avoided within firms through the authority of a single actor to settle differences for the benefit of the whole.

The authority relation (*fiat*) has adaptive advantages over autonomy for transactions of a bilaterally (or multilaterally) dependent kind.”²⁶

Coase, Simon, Chandler and Williamson treated the attributes of corporations—unified governance, authority, and hierarchy— as if they were one and the same. However, when it suits their purpose, corporations subject to unified governance may *elect not to use* direct authority and/or managerial hierarchies. In the next section, I explain how and why corporations may choose to manage their internal affairs in other ways.

²² March and Simon (1958) Chapter 6. See also the discussion of “unobtrusive control” in Perrow (1986) pp. 128-131.

²³ Weber (1947); Chandler and Galambos (1970).

²⁴ Chandler (1977) Figure 1, p.2.

²⁵ *ibid.* p. 3.

²⁶ Williamson (1991) p. 279.

3.5 The Dilemma of Authority and Hierarchy in Corporations

Even as Chandler's "modern" corporations were building administrative hierarchies based on direct authority, their managers were encountering limits to the usefulness of this method of organizing. Many of these companies were expanding into scientific research and development by establishing industrial research laboratories.²⁷ From the beginning, the founders of research labs insisted that research workers must have more autonomy than production workers or even managers. According to Kenneth Mees, the founder of Kodak's Research Laboratory:

Research work ... cannot be scheduled, since the scientist sets his own pace according to his enthusiasm and interest at the moment. ... [T]he individual can be assigned a problem or problems on which he is expected to report regularly and is allowed to spend the remainder of his time on work of his own choosing as long as it is in the field of the laboratory's interest.²⁸

In other words, the flow of research could not be highly programmed and research workers should be directed with a light, not a heavy hand. A theme in many writings by members of mid-20th century research laboratories was the benefit of allowing researchers a considerable amount of "freedom to come and go, to gossip, smoke and go to conventions ..."²⁹ Such freedom was in stark contrast to the supervised activities of factory workers and the regimented schedules of managers.

Different technologies reward the use of authority and hierarchy to different degrees. For example, in Chapters 8 and 9 below, I will argue that synchronized step processes, which lie at the core of mass production technologies, require central coordination and direct control of work flow to achieve efficiency. In contrast, R&D, product design, and software development are asynchronous processes that require high levels engagement and creative problem solving. Such work does not require minute-by-minute coordination, and overly tight control of workers' actions may be counterproductive.

In an important paper, Robert Freeland and Ezra Zuckerman Sivan have argued that business firms organized as corporations are *inherently hierarchical* because the single legal personality that defines a corporation in the eyes of the law sits at the apex of a pyramid of delegated decision rights. A single decision-maker, embodied in the Board of Directors, is ultimately responsible for all decisions and actions taken by its delegates. Moreover, in the U.S. and the U.K., the corporation and its managers have the "right of close control" over employees actions, and employees have a symmetric duty of obedience to carry out direct orders.³⁰

²⁷ Mowery (1983).

²⁸ Mees and Leermakers (1950), quoted by Shapin (2009), Chapter 5.

²⁹ Bichowsky (1942), quoted by Shapin (2009), Chapter 5.

³⁰ Freeland and Zuckerman (2018) p. 147-149.

However, hierarchy and overt control can create disaffection, lower morale, and stifle creativity. Thus corporations seeking to motivate employees to “consummate” performance generally refrain from exercising the right of close control and rely instead on “unobtrusive controls,” that is, manipulation of the environment and the premises of decision-making.³¹

Freeland and Zuckerman go on to argue that “inherently hierarchical” corporations are needed because the existence of a single point of authority and responsibility—the legal person—makes the corporation reliable in the eyes of customers and other trading partners. *Commitments made by bona fide delegates of a corporation must be honored by the the firm as a whole.*

For such commitments to be coherent and not self-contradictory, the right to make them must be controlled. People who do not recognize a single governing authority, by definition, cannot commit one another to perform any task. Hence commitments made by organizations subject to unified governance are more valuable than commitments made by organizations subject to distributed governance.³²

However, not all productive transaction free zones are characterized by unified governance. In the next two sections, we will look at how distributed governance with and without authority works in commons organizations and open collaborative projects.

3.6 Distributed Governance and Authority in Commons Organizations

Unlike corporations, commons organizations are not encapsulated by transactions. Instead they are defined by their stewardship of a so-called common pool resource, such as a forest, an irrigation system or a fishery. Such organizations have been extensively studied by Elinor Ostrom and her colleagues and this section draws heavily upon their work.³³

In a natural resource commons, a designated set of “appropriators” can access the resource, by taking units out of the common pool. The same group also provides for the maintenance of the resource often by contributing labor. The group is self-organizing and self-governing. It is legitimized by tradition and also generally has some form of legal recognition by the state. Members may use contracts and charters to define the zone.

A commons organization differs from a corporation in that the basic work—cutting wood, pumping water, farming, fishing—is performed by individual members *for their own benefit*. Profit accrues to the individual productive units, which may be households or corporations. The common pool resource may be consumed by any member of the group, and effort and other resources are provided by members without formal compensation. The risk inherent in this structure is that the common pool resource

³¹ Ibid. pp. 153-155; Perrow (1986) pp. 128-131.

³² Freeland and Zuckerman (2018) pp. 157-163.

³³ E. Ostrom (1990; 2005; 2010); E. Ostrom, Gardner and Walker (1994); Hess and E. Ostrom (2007).

will be overused and undermaintained. The group thus faces both a potential “tragedy of the commons” (over-consumption of the resource) and a problem of collective action (under-provisioning of effort, free-riding).³⁴

A commons organization is an association of individuals or firms formed to solve these twin problems. According to Ostrom, members of the association set up (or inherit) an organizational framework that gives participants incentives to comply with rules governing both consumption and maintenance of the resource, and the assurance that others are doing so as well. In effect, the organizational framework transforms a short-term prisoners’ dilemma game, in which everyone has incentives to consume the common pool resource and free-ride, into a repeated game, in which the equilibrium is for everyone to abide by the rules, refrain from over-consumption, and maintain the resource. The transformation is effected through a combination of social norms, information exchange, monitoring, and sanctions.

Commons organizations generally use hierarchical authority to plan work and assign tasks, to administer the organization, and to judge infractions and impose sanctions. However, it is a weaker form of authority than the “close control” that business firms may exercise over employees. First, members of the commons organization are more like owners than employees. There are limits on what can be asked of them in terms of service or contribution. As a result, many commons organizations also have full-time employees, for example, “detectives” to monitor usage or “ditch-riders” to open and close irrigation channels.³⁵

Second, obedience itself has limits. Ostrom described a case from Japan, wherein many members of the commons organization believed the village headman had erred by setting the “mountain opening day” too late. The heads of the leading households organized a group to enter the mountain region en masse before that date. The protestors were fined for this action, but, in acknowledgement of their right to protest, the fines consisted of donations to the village school.³⁶

Third, the authorities in a commons organization are generally elected by members for fairly short periods of time.³⁷ Thus there is a higher level of parity between members and their leaders than between subordinates and superiors in business firms and corporations. The elected leaders of a commons organization can exercise some direct authority over members in the short run, but if they are incompetent or overbearing, they will not be re-elected on the next round.

For all these reasons, commons organizations are subject to distributed, not unified, governance.³⁸ As a result, commons organizations cannot easily make credible

³⁴ Hardin (1968); Olson (1971).

³⁵ E. Ostrom (1990) pp. 68; 72-74.

³⁶ *ibid.* pp. 68-69.

³⁷ *Ibid.* pp. 58-83.

³⁸ In the commons literature, distributed governance is known as “polycentricity” or “polycentric

commitments on behalf of all their members. Such commitments require significant examination, information sharing, and bargaining among the members before they will “buy in.” In the language of Freeland and Zuckerman, the center has limited “voice rights.” Thus commons organizations are generally at a disadvantage vis a vis corporations when outside agents are seeking commitments or guarantees. In the absence of unified governance, the costs of making the organization “reliable” and “accountable” are very high—often too high to be practicable.

What holds a commons organization together is the ability to set rules with respect to the common pool resource and expect compliance with the rules. The perception that compliance is spotty or that some people are getting away with rule-breaking changes the game back to a prisoner’s dilemma, since what the rule-breakers take out in the short run reduces what will be available to rule-followers in the long run. Thus commons organizations often invest heavily in monitoring.³⁹

A very important aspect of authority in a commons organization is the role of judge. Rule-breaking happens and must be dealt with. However, consistency in catching rule-breakers and meting out public sanctions appears to be more important than the magnitude of the punishment. In a traditional commons, sanctions, such as fines, are often small as if to recognize that the needs of a household may be great, and thus rule-breaking understandable, though not condoned.⁴⁰

What can a commons organization subject to distributed governance do that an organization subject to unified governance cannot? Commons organizations leave local action to local parties and respect local rule-making whenever possible. Individual members are jealous of their own prerogatives and will not agree to obey arbitrary rules imposed from above. For these reasons, Ostrom and others claim that commons organizations are more responsive to heterogeneous local conditions than corporate organizations or government bureaucracies, which tend to set uniform policies across the board. They also assert that commons organizations find it easier to experiment with rules and learn from those experiments.

Commons organizations, which vest real decision-making authority in a group of autonomous agents, may also be better at eliciting time, effort, and “sticky” information from the group’s members. Interacting as equals, members have real power and the ability to influence outcomes that are important to them, hence they will invest *more of their own resources* in the collective process.⁴¹ Thus in settings where contributions cannot be forced but must be volunteered, a representative commons organization may

governance” defined as “a complex form of governance with multiple centers of semiautonomous decision making.” I consider the definitions to be equivalent, but will use the term “distributed” throughout this book. V. Ostrom, Tiebout and Warren (1961); E. Ostrom (2010a, b); Aligica and Tarko (2012).

³⁹ E. Ostrom (1990) pp. 58-102.

⁴⁰ Ibid.

⁴¹ Gil and Baldwin (2014).

outperform a single corporation subject to unified governance.⁴²

The drawback, of course, is that commons organizations require time and (much) discussion to arrive at a collective decision. As a result, they are often be slow to adapt to drastic exogenous change, including technological change.⁴³ In principle the Board of Directors of a corporation can turn the whole organization upside down overnight. There are many stories of the rapid restructuring of corporations: faced with the same type of threat, a commons organization is more likely to simply disband.

Natural resource commons are a traditional form of organization with ancient roots in village cultures throughout the world. Nevertheless, they have something to teach us in the information-based economy of today. Many information-based technologies reward the efforts autonomous firms and individuals engaged in rapid, independent experimentation. At the same time, the products of these independent producers must operate as modules within larger technical systems.

In Chapter 5, we shall see that the results of this technological profile may be a *business ecosystem* of autonomous organizations and individuals whose products achieve compatibility by conforming to technical standards. The standards are sometimes promulgated by powerful firms like Intel, Microsoft, Apple or Google. But effective standards can also be the result of a process of consultation, bargaining, and consensus within standards-setting organizations.⁴⁴

According to Timothy Simcoe, standards-setting organizations are commons organizations reinvented.⁴⁵ They are transaction free zones whose existence depends on voluntary compliance, information sharing, and donated effort. Their members represent diverse sponsoring organizations with different, often conflicting interests, thus they are not subject to unified governance. Like all commons organizations, they produce rules. Members obey the rules because the benefits of ongoing participation in the standards-setting organization outweigh the benefits of “going it alone” or sharing profits with the owner of a proprietary standard.

3.7 Distributed Governance without Authority in Open Collaborative Projects

Corporations and commons organizations are both characterized by their boundaries. The boundaries of corporations are determined by transactions that determine their property rights and employment relations. Commons organizations are bounded by the physical limits of the common pool resource and their rules of membership. Indeed, Elinor Ostrom made “well-defined boundaries” the very first of her design principles for

⁴² E. Ostrom (2010a).

⁴³ Ostrom (2005) p. 272.

⁴⁴ Simcoe (2006; 2012); West (2007).

⁴⁵ Simcoe (2014).

a robust commons.⁴⁶

However, following the rise of the Internet, new organizations emerged that were transaction free zones without formal boundaries. In online and open source communities, interested parties create transaction free zones in the form of websites and information repositories. Access to these zones is generally not restricted, but open to all comers. Information flows freely within a zone and can enter or leave it without impediment, hence the zones have very fluid and permeable boundaries. Members of a zone collaborate to create some good that all members value, such as a codebase (e.g. Linux), a data repository (e.g., the Open Commons Consortium), or an encyclopedia (e.g. Wikipedia).

Generally the good that is created is “non-rival,” meaning that any person can use it without diminishing its value to others. As a result, there is no threat of over-consumption and no looming tragedy of the commons. There may be free riding, but the contributors to the project are not harmed by the presence of free riders.⁴⁷ Open transaction free zones often combine social interaction and fun with production. Contributors enjoy participating in joint projects that result in something all find useful.⁴⁸ Participants freely contribute their own resources, including information, ideas, and effort, and thus there is generally no need to use transactions for the purpose of acquiring resources.

In these circumstances, the mundane transaction costs of defining, measuring and valuing what is in the zone or flows out become an unnecessary burden on all concerned. Furthermore, vigilant policing of the zone’s boundary (to discourage free-riders, for example) can deter new members from coming in. Yet when the good is non-rival, new members’ contributions are a means of enhancing its value for everyone. As a result, even small levels of policing can undercut the productivity of these zones.⁴⁹

The existence of open transaction free zones subject to distributed governance demonstrates that the designers of task networks are able to locate transactions and membership tests selectively, placing them only where they are needed. Large clusters of interdependent tasks and transfers can be sustained as dynamic equilibria with no transactions within or around them and with participants entering and leaving at will.

These clusters of tasks and transfers and the people performing them are “firms” in the sense that they produce valuable goods that compete with other goods in the economy.⁵⁰ But although they are visible (as clumps) in the task network, such “firms” do not have transactional boundaries.⁵¹ They are not a “nexus of contracts” and they do not

⁴⁶ Ostrom (1990; 2005).

⁴⁷ Baldwin and Clark (2006).

⁴⁸ Lakhani and Wolf (2005); Gambardella, Raasch and von Hippel (2016).

⁴⁹ Raymond (2001) p. 138.

⁵⁰ Greenstein and Nagle (2014).

⁵¹ Since 2000, a number of these zones have been incorporated as non-profit foundations (O’Mahony,

make use of hierarchical authority to get work done. They are not subject to unified governance: the leaders of the organization cannot commit its members to a particular course of action.

Despite the absence of these organizational characteristics, open collaborative projects are demonstrably productive organizations. As such, they challenge us to understand better which technologies “respond well” to well-defined boundaries, unified governance and hierarchical authority, and which do better with open boundaries, distributed governance and decentralized authority. These issues will be treated in depth in Part 4 of this volume.

3.8 Conclusion: How Technology Shapes Organizations

In any task network there are places where the technology dictates that transfers must be dense and complex. Mundane and opportunistic transaction costs will be high in such locations, and thus transactions between independent parties will not be cost-effective. Such areas can be made into “transaction free zones” to avoid overburdening the productive system with transaction costs.

Most productive work takes place within transaction free zones. In such zones, the vast majority of transfers are not well-defined, counted or compensated. Transaction free zones can be *encapsulated* via transactions to create the legal form of a modern corporation. However, there are at least two other forms of productive organization—commons organizations and open collaborative projects—that make use of transaction free zones but do not fit the profile of traditional business firms or corporations.

Corporations are a type of business firm where the organization itself is a legal person with the right to own property and enter into transactions. Corporations also have indefinite life, and as separate legal persons, can protect their assets from seizure by creditors of their owners (asset partitioning) and shield their owners’ assets from seizure by creditors of the corporation (limited liability). These attributes mean that the managers of corporations can make the transactional boundaries of enterprise match the task network and duration of the underlying technologies. These advantages have made corporations the preferred legal method of setting up profit-seeking firms in most modern economies.

Legal incorporation provides for centralized decision rights that flow from the shareholders to the Board of Directors and from there to managers and employees. Under Anglo-American law, employees have the obligation to follow the orders of their managers and a duty to protect the interests of their the corporation.

The success of corporations as an organizational form has convinced many

2003; O’Mahony and Ferraro, 2007). Members take this step (sometimes reluctantly) in order to assert property rights over valuable products, such as codebases (asset partitioning), and to protect themselves from lawsuits (limited liability). In these instances, two institutional forms are combined to create a third, hybrid form.

scholars and practitioners that the attributes of corporations are attributes of all organizations capable of producing valuable goods and services in the economy at large. However, if we widen our perspective, then it is clear that other forms of organization can also carry out complex technical recipes and may be equal or superior to classic corporations in some cases.

For example, a commons organization protects and renews a depletable common pool resource by limiting access and by creating rules that members can agree on and will voluntarily obey. An open collaborative project does not have fixed boundaries to limit access, but creates incentives for interested parties to contribute, while protecting the jointly created artifact from malicious or inadvertent damage. These organizational forms may be superior to corporations for some technologies and in some social settings.

In most large technical systems today, all three types of organization—corporations, commons organizations, and open collaborative projects are present. There is also a fourth form of organization: ecosystems of autonomous firms and individuals that work together to create joint. The route to understanding how technologies shape organizations is to explain what combinations of technology and organizational form are sustainable and how the resulting organizations both complement and compete with one another.

In the next chapter we shall look at what happens *inside* and *across* transaction free zones. Specifically, through what organizational mechanisms are complex technical processes carried out within transaction free zones? How often are transactions located at thin crossing points in the task network? When and why do we see transactions at thick crossing points? When do independent firms create shared transaction free zones? Finally, how is digital technology influencing the structure of organizations?

These questions are all fundamentally related to the *mirroring hypothesis*, which is the focus of the next chapter.

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