

Coordination and Control in Organizations*

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Abstract

Merging companies attempt to realize synergies by sharing resources to exploit scale economies in functional areas such as R&D, manufacturing, or sales. If it were possible to do everything else the same, such mergers would always be value creating. However, in order to exploit the synergy, the firm will typically need to centralize decision-making in the relevant function. We develop a model of organizational structure in which the decision of what activities to group under a common manager determines the information available and the incentives of decision-makers. We characterize the optimal choice of organizational structures as a function of the value of synergies, the importance of incentives and the importance of local adaptation.

1 Introduction

Organizations exist to coordinate complementary activities in the presence of specialization. Different organizational structures, through their impact on the information

*This paper is an in-depth revision of a previous version that circulated under the title "Organizing for Synergies." In particular, this version pays close attention to issues of incentive provision and truthful communication that were sidelined in our previous analysis.

available and the incentives of decision makers, involve tradeoffs in the type and level of synergies and coordination that can be achieved. We develop a model to capture the tradeoffs that guide organizational structure in the presence of coordination problems and potential synergies. The model allows us to explore the mechanisms by which these tradeoffs operate, develop predictions about when different organizational structures are optimal and provide a framework for thinking about other issues relating to organizational structure.

These tradeoffs can be critical in determining how an organization can realize synergies among different business units. There are countless examples of firms that fail to implement organizational strategies that allow them to realize the potential gains from a merger. Many of the most spectacular failed mergers involve the inability to achieve the synergies that motivated the deal. The recent merger between AOL and Time Warner is a particularly prominent example of what appears to be quite common.¹ The merging parties claimed an important source of increased value from the merger would be synergies from selling advertising packages that included all media encompassed by the merged company's divisions. However, centralized ad-selling was thwarted by divisional advertising executives who felt they could get better deals than the shared revenue from centralized sales. An outside advertising executive was quoted by the Wall Street Journal, stating, "[t]he individual operations at AOL Time Warner have no interest in working with each other and no one in management has the power to make them work with each other." AOL Time Warner could have chosen to provide more authority to the centralized advertising unit, but this too is not without cost and significant peril. Taking authority away from business units over such an important source of revenue could reduce the sensitivity of decisions, reduce the coordination among the different activities of a business unit and blunt incentives.²

The more general question is one that arises in any theoretical discussion of mergers. Typically, it is possible to identify some likely source of potential synergy in mergers of related companies by taking advantage of scale economies and sharing resources in some functional area, be it R&D, manufacturing, distribution, brand coverage, or sales. A simple (or simplistic) justification for the merger is that the two firms can do everything as before except the narrow combination of activities needed to exploit the synergy. The standard (economist's) response to this is that there are costs associated with

¹See Rose, Angwin, and Peers (2002).

²The anecdotal evidence is also supported by the broader empirical literature on merger performance in corporate finance. See Andrade, Mitchell, and Stafford (2001).

expanding the scale of the firm and then there is some hand-waving about managerial diseconomies of scale that derive from increased bureaucracy and limited spans of control, and perhaps less financial market discipline if both merging companies are public. These answers are mostly imprecise and they are not very satisfying. They do not explain why bureaucracy increases if most everything is the way it was before the merger. Perhaps more important, they do not tell us when these costs are relatively important and when they are not. Thus, we cannot make predictions about when mergers will be efficiency-enhancing because we can only speak to the details of one side of the tradeoff.

This lack of specificity about the costs of organizational scale is also a problem in many discussions of the theory of the firm. An important strand of this literature focuses on the tradeoff between the contractual relationships and internal relationships. An enormous literature has explored the imperfections of contractual relationships; it provides us with predictions of when contractual mechanisms are likely to perform well and when they will not. Again, the internal side of the tradeoff is given less attention and the empirical implications derive from only one side of the tradeoff between the costs of contracts and the costs of internal organization.

The problem of organizing to achieve synergies is not unique to mergers; all companies with related lines of business must decide which activities to centralize, how to allocate control rights over complementary decisions, how to share relevant information, and how to create incentives for effective coordination and efficient operations. The example that motivated us to develop our model is a Harvard Business School case on Jacobs Suchard (Holland 1989). In the late 1980s, Jacobs Suchard was Swiss coffee and confectionery company with the leading EEC market share in confectionery products. It had a decentralized organizational structure with general managers for largely independent business units organized around products and countries, so for example, there would be a French confectionery business unit and a German beverage business unit. The general managers received compensation based on business unit and corporate profits. Each business unit had its own sales, marketing, and manufacturing divisions. There was a small corporate staff. The autonomy and incentives of the general managers created an entrepreneurial environment that was able to attract and retain talented executives as general managers.

The tariff reductions, open borders, and standardization of regulation of the upcoming 1992 European integration created the opportunity for Jacobs Suchard to

achieve cost savings by combining manufacturing plants across countries. The company planned to shift from 19 plants to six primary plants that would serve all of Europe. General managers were to lose responsibility for manufacturing, but maintain control of sales and marketing. The company would appoint a "manufacturing center sponsor" to oversee the plant managers and focus on economies of scale through, among other things, global product standardization. Profit measurements for business units would be based on transfer prices from the manufacturing plant. The changing European environment also created the opportunity to improve performance by consolidating products across countries and developing common marketing strategies. Therefore, the company appointed "global brand sponsors" for each of the five major confectionery brands. These were general managers given the additional responsibility, along with general managers, to promote their brands globally, develop new products, and standardize the brands across the world, including standardization of packaging across countries. There was a proposal by some executives, which was not accepted, to give the global brand sponsors control of marketing as well as profit and loss responsibility for their brands. This would leave the general managers and their units as mere sales centers.

Jacobs Suchard's experience with its new organizational structure demonstrates the tradeoffs that arise in attempts to organize to realize synergies. Business unit marketing managers were unable to make decisions because either the global brand sponsor or general manager would disagree. Conflicts were common over issues such as packaging, advertising, choice of factory, who would pay for product development, and international marketing efforts. The senior corporate manager responsible for all of confectionery would resolve disputes between general managers and global brand sponsors. General managers fought standardization in manufacturing that they believed would harm their unit's profits. The general managers no longer controlled their own business units having to rely on manufacturing, packaging, product selection, and marketing decisions made, in part, by others. The outcome was to reduce coordination within business units, increase time and effort to communicate, defend, and debate strategic choice, rely on decisions by poorly informed senior managers, threaten the firm's entrepreneurial culture, and blunt incentives for general managers.

It is difficult to determine if the organizational change was a good decision or not. It is clear, however, that the benefits from the attempt to create cross-border synergies did not come without costs. These costs include poorer coordination and incentives within business units, increased conflict and centralized decision-making,

and the communication and influence costs that go with it.

We develop a model to capture the basic issues in the Suchard example and, more generally, the tradeoffs that guide organizational structure in the presence of local information, coordination problems, and potential synergies. In our model, an organization consists of two divisions, which can be defined by product, customer, or geography, and one functional area in which potential synergies exist, such as R&D, marketing, manufacturing, or sales. Imposing the functional synergy results in gaining these synergies, but at the cost of reduced local adaptation. Both of these values, the benefits of the synergies and the cost of lack of adaptation for each product unit are random variables, and are only observed by the managers of the relevant unit – that is the functional manager observes privately the value of synergies and the divisional managers observe the value of local adaptation. In other words, the organizational structure determines the availability of information, so that managers are only able to obtain knowledge from the operating units they oversee. This assumption captures the idea that managers are specialized in understanding the inner workings of these operating units. This allows them to understand detailed, verifiable information provided by lower level managers, and to induce credible revelation of information.

Finally, all, managers, functional and divisional, must be provided with incentives in order for them to work hard at tasks at which performance is hard to contract upon. This means that their effort must be linked to the results they obtain, creating a stake by the manager in his or her division's profits.

We study three main types of organizational structures. First, decentralized organization, in which product division managers function essentially as stand alone units—making their decisions without coordination. Second, functional authority, in which the functional manager is granted the authority to determine whether the synergy will be or not implemented, potentially after communicating with the divisional managers. Third, centralized conflict resolution, where top management takes an active role in resolving conflicts if divisional managers and functional managers disagree about the convenience of synergies.

When are different organizational structures preferred? What is the interplay between incentives, local adaptation, synergies, and communication? The core of our analysis proceeds in two steps— first we study the interactions among all managers under different incentive and organizational arrangements absent central management, and then we introduce the centralized conflict resolution role of the senior management.

The key trade-off in our model is between strengthening incentives by tightly linking

pay to own unit performance, versus reducing incentives by loosening up that link in order to improve communication and implementation of decisions. To understand this trade-off suppose that manager's pay is very tightly linked to own unit performance. Then the manager works hard, but he is very much at odds with other managers— he does not want to ever implement a synergy if he is a divisional manager (that costs his division money) or never wants local adaptation if he is a functional manager. As a result of this conflict of interest, communication (which is always cheap talk) cannot be successful— as it is never truthful. Moreover, implementation is suboptimal, as a manager is never willing to value equally his own and someone else's losses. If the link between pay and performance is weakened, i.e. the power of incentives is reduced, managers are more aligned with one another, improving communication and implementation.

The above reasoning underlies our first set of results. First, attaining synergies inevitably involves organizational costs in the form of (1) lost local adaptation and (2) weaker incentives. Moreover, if communication is desired, so that decisions about synergies take into account the relation between the value of synergies and the value of local adaptation, then incentives must be further reduced.

This organizational structure, with one centralized function but local, divisional managers, captures Jacobs Suchard structure with centralized manufacturing but business unit control over sales and marketing. Our analysis shows that simply putting a manager in charge of synergies is not enough— if divisional managers are not invested in these synergies, communication will be inefficient and not credible (divisional managers will always exaggerate the cost to them of standardization). If instead, communication and true ex post implementation is desired, then exploiting functional synergies comes at the cost of decreased local adaptation and lower incentives throughout the organization. Hence, if incentives are important, then decentralized organizations are preferred, while as synergies become more important, functional authority is chosen.

The presence of both functional and product division managers creates a potential role of senior management to resolve disputes and coordinate activities. The senior manager may be the CEO, but could also be an executive of lower rank. Thus, we also analyze a structure with centralized conflict resolution (partial matrix), in which disagreements can arise between the product division managers and the single functional manager. If the managers are unable to agree on their choices, any can appeal to the senior manager who will obtain information at a cost to both division and senior managers. The senior manager will then choose strategies that maximize firm value given his information. This structure allows the organization to use ex post information even

when no fruitful communication between product and functional managers is possible.

We show that the role of senior management in solving conflicts affects incentive strength, organizational choices, and communication among divisional and functional managers. First, conflict resolution allows for an increase in incentive strength, as the main cost of strong incentives is worse ex post implementation of synergies, and conflict resolution allows for some ex post conditional implementation. Second conflict resolution reduces horizontal communication. The reason is two fold. First, incentive compatible communication is harder to sustain, as agents can lie to reduce synergy implementation and get the added benefit versus truthtelling of reducing implementation of synergies and reduced conflict. Second, high incentive pooling equilibria with no communication are less costly, because some ex post implementation can be ensured through the senior management intervention.

The paper proceeds as follows. Section 2 reviews the literature. Section 3 presents the model. Section 4 studies incentives and communication in functional organizations. Section 5 studies conflict resolution. Section 6 presents some numerical extensions of the model. Section 7 discusses the main implications of the model and some evidence on them. Section 8 concludes.

2 Related Literature

Scholars have been aware of the importance of designing the organizational structure to solve coordination problems at least since Chandler's (1962) classic analysis of the impact of the change from functional to multidivisional organizational forms on the performance of large corporations. Also seminal is Lawrence and Lorsch's (1967) study of the mechanisms organizations use to integrate its differentiated activities. The theoretical literature trying to understand these coordination problems originated with the theory of teams of Marshack and Radner (1972). This approach studies coordination among agents when information must be necessarily disperse, but purposely assumes away incentive issues to simplify the analysis.³ Agents with common interests would choose to share their information if they could, so an additional necessary restriction is the existence of some communication costs that prevent agents from freely communicating.

³Team theory models assume that all players have the same payoffs for every state and action profile.

Most studies of coordination in organizations sharing this (non-incentive based) methodology focus on situations where there exist no interdependencies among tasks.⁴ We depart from this view, and assume instead that the organizational design must take into account the existence of interdependencies among tasks. Several antecedents for this view are particularly worth noting. Cremer (1980) studies the optimal grouping of subunits into units in a resource allocation problem. The existence of interdependencies among subunits means that any particular grouping creates externalities, as some interdependence must be ignored. The question he considers is how to group units in a way that internalizes as many of these externalities as possible, when agents ability to collect information is limited. The attractive generality of the approach limits, at the same time, its insights to the initial one that the organization should put together related units and segregate unrelated ones.⁵

Vayanos (2002) studies decentralized information processing when tasks are related. In his setting, when agents aggregate information to communicate it to a superior, some information is lost. Moreover, the decision of one agent impacts those of other agents. Under these circumstances, the problem is to determine how best to group units into subunits to minimize the information loss while taking into account the interdependencies. Rivkin and Siggelkow (2002) also develop a model with decentralized information processing and interdependent decisions. They analyze how the degree of centralization relates to other organizational variables. Most closely related to our model, Roland, Qian and Xu (1999) model the tradeoff involved in the organizational design choice as one between decentralizing and allowing multiple divisions to use their local knowledge versus losing standardization and economies of scale. Among other things, they show that the M-form improves coordination at the expense of economics of scale. While our approach coincides with theirs in modelling coordination as requiring the matching of the organizational design choices to each other under local knowledge, our model allows us to study the incentive conflicts that result from the reliance on this local knowledge. This allowance for conflicts (and conflict resolution) between synergies also allows us to study a broader set of organizational structure. Harris and Raviv (2002) study the organizational structure that best appropriates synergies when managers are expensive. Their model, however, abstracts from conflicts between synergies and from the use of local knowledge for local adaptation.

⁴See e.g. Keren and Levhari (1983), Radner, (1993), Van Zandt (1999), Bolton and Dewatripont, (1994), and Garicano (2000).

⁵Aoki (1986) and Genakoplos and Milgrom (1991) deepen and generalize the study of a resource allocation problem of this kind.

A recent literature has studied jointly the incentive problems and the coordination costs that follow from the design decision, focusing in particular on the M-form versus U-form choice. Holmstrom and Tirole (1991), analyze transfer pricing between different divisions under interdependencies. They associate the M-form with a decentralized organization in which division managers are free to both trade internally and with the external market. They show that, while the M-form tends to maximize incentives, it results in divisions being less well coordinated relative to more centralized organizational forms which do not allow external trade. The problem they study is a pure moral hazard problem; the informational consequences of the design play no role in it. Maskin, Qian and Xu (2001), in contrast, highlight the advantages of the M-form in providing incentives based on yardstick competition, but interdependencies between decisions play no role.

There is a large literature which investigates how the boundaries of the firm affect the ability of divisions or firms to coordinate. Gertner (2000) analyzes a model where conflicts over coordination problems are resolved by senior management if the combatting units are both part of the same firm. In contrast, disputes are resolved through contractually allocated control rights if the units are part of separate firms. In both cases, the dispute resolution mechanism is used only if the parties fail to reach a negotiated agreement. Gertner studies how ownership structure affects the incentives for the units to share information. Hart and Holmstorm (2002) argue that whereas independent firms coordinate too little their activities, integrated firms have a tendency to realize too many synergies, neglecting private benefits of managers and workers. While this paper shares our view that organizational structure affects incentives, in it, unlike in ours, organizational form does not affect the use and availability of information.

More broadly, what distinguishes our approach from previous papers is the ability of our model to study organizational design issues when agents are self-interested and coordination among them is important. In our view, developing a framework that can deal both with the reasons the organization is actually set up as well as with the informational asymmetries and incentive conflicts that emerge as a result of the design decision is an essential step towards a deeper understanding of both organizations and incentives. Moreover, it allows us to illuminate an issue that is almost completely absent from all of these accounts, and that, on our view, is pervasive in organizations: the existence of conflict and the role of managers as conflict resolvers.

3 A Model of Synergies, Communication and Incentives

3.1 The model

Production

The organization consists of 2 products divisions and 1 functional area. We use the term "product division" broadly, to represent a product, a geographical area, a customer segment, or some combination of all of these. So, a product division in a bank could be trust services for customers with accounts greater than £1,000,000 in Scotland. The functional area may be manufacturing, or marketing for example. The organization seeks two conflicting objectives: to adapt its products to the local environment, and to obtain functional synergies. Attaining functional synergies requires giving up the benefits of tailoring production to the individual local environment.

Product division adaptation: Adapting all the functions in a product division to the local environment is valuable. For simplicity, but with no loss of generality, we measure this value by the cost of imposing a centralized decision on an individual product unit. This cost is measured by an independent and identically distributed random variable drawn by each of the two product divisions, which we denote $\Delta \in \{\Delta_l, \Delta_h\}$. Δ thus represents the cost of not being *adapted* to the local environment, that is of producing a product that is unsuitable to the local needs. Producing a non-adapted product costs Δ , while producing a product that is adapted yields 0. We let p be the probability that the value of adaptation is high, that is: $\text{Probability}[\Delta = \Delta_h] = p$. For most of what follows we assume that $p = 1/2$ for simplicity, but we allow for a general form of p in Section 5. We define the mean and variance of this random variable in the usual ways, that is $\bar{\Delta} = E\Delta$, and $\sigma_{\Delta}^2 = \text{Var}(\Delta)$.

Functional coordination: There may also be synergies from coordinating the strategies of the product divisions. We think of these synergies arising from economies of scale through standardization or economies of scope etc. For example, there may be cost-savings in manufacturing from producing the same product for all geographical operating units in a single plant. We model this by assuming that a functional manager, if there is one, receives a second independent random variable $k \sim U[0, K]$, that determines the payoff from *coordinating* the activities of both product divisions. We assume further for simplicity (to reduce the need to track different cases through the analysis), that $K > 2\Delta_h$ — the maximum available product synergies are higher than

the maximum value of adaptation.

Managers' Information and Incentives

The organization can assign specialized managers to the product and functional areas. Managers obtain private information about the benefits of adaptation (products) and coordination (functions) in the unit they manage. That is, if no manager is assigned, no information about synergies is obtained. Managers must also undertake some effort, for which they incur a private cost— thus some effort incentives must be provided. The effort aspect is completely separable from the decision making aspect, for simplicity.

To model the need to provide incentives, we assume that on some fraction v of the tasks effort is not contractible (for example because it is not observable or verifiable). We further assume that effort cost on these tasks is quadratic, so that net output on the non-contractible tasks is given by:

$$y = v\left(e - \frac{e^2}{2}\right)$$

That is, v measures the importance of non-contractible effort, and thus summarizes the importance of providing incentives for effort provision. We ignore the contractible tasks, since there is no trade-off in them— the effort is chosen as first best regardless of the organizational decisions we consider here. We assume that three managers are assigned in any of our organizational forms, so that the organizational forms differ only in the decision rights, the incentives assigned and the communication among managers that takes place, and not in the number of employees.

To focus on the trade-offs between synergies and incentives, we assume that agents are risk neutral, so that absent any communication problem, the incentive problem can be simply solved by allocating to agents the entire marginal product of their effort. Calling w the agent's earnings, the utility of the agents then takes the form:

$$U = w - \frac{e^2}{2}$$

Agents may communicate their observations on the state of the world. That is, product managers may communicate the Δ for their product, and the functional manager may communicate the k . However, this communication is unobservable and unverifiable ('soft'), and thus when they transmit such a message they engage in cheap talk.

Contractibility and observability

We assume that while the allocation of decision rights is contractible, the actual decisions are not, neither *ex ante* nor *ex post* – that is the organization cannot determine on a case by case basis who makes what decision or what that decision will be. We share the view that contractual incompleteness matters with the theory of the firm in the Grossman-Hart-Moore tradition, where this incompleteness, together with *ex post* efficient bargaining, means that the allocation of decision rights must be made to motivate efficient *ex ante* investment under costless *ex post* bargaining. But we depart from that view in that we assume that bargaining is efficient neither *ex ante* nor *ex post*, so that incompleteness matters because the party with the decision decides on the adaptation to the state of the world that is actually realized.⁶

Similarly, we assume that the contractibility on output is limited, so that agents cannot agree on a detailed mapping of states of the world to rewards to the agents, but rather are limited to determining the *ex ante* share of outputs that the agents will obtain eventually. This is consistent with the view that, under imperfect enforcement and verifiability, more detailed contracts are unenforceable.

To sum up, the organizational designer faces three problems: providing the right incentives for effort, facilitating credible communication between the agents, and ensuring that whichever agent makes the decision has incentives to implement the decision most favorable to the whole organization. Of course, as we will show, these three objectives are in conflict, and the organizational design must optimize the trade-offs involved. The tools available to solve these problems are the design of the incentives provided, which we summarize by the shares of the output they receive; the allocation of managers to functions; and the allocation of decision rights to these managers.

3.2 Ex ante decision making

The organization may opt for *ex-ante* decision making, by imposing a simple *ex ante* decision rule. This may be of two types: a decentralized one, that determines that the synergies will always be ignored, and all the decision making power is within the product units, or a centralized one that chooses the synergy in all cases and forgoes the benefits of local adaptation. In either case, the organization can provide first best incentives to all three managers (the functional and the product division one), since only one manager deals with each function or product. The absence of incentive conflicts reflects the fact that in this case it is easy to recognize which manager's contribution is responsible for which output.

⁶See Baker, Gibbons and Murphy (2003, 2004), for a lucid discussion of this distinction following on earlier work by Williamson (1985).

If the organization is decentralized or product based, product managers adapt their product to the local environment, and the organization achieves no functional synergies nor it incurs any cost of maladaptation. In this case, each manager's problem is given by:

$$\pi_i^D = \max_e v_i \left(e - \frac{e^2}{2} \right)$$

which results in first best effort $e = 1$, with output $y_m = v_p/2$. The organization is perfectly adapted, and it does not incur any non-adaptation costs. Letting the cost of the managers be 0, (all of our organizations use three managers, so this cost is irrelevant to our calculation) total organizational profits are then (for the two products and the functional unit): $\pi_D = v_p + \frac{v_f}{2}$.

Suppose instead the organization is centralized. Since the mean of the value of the functional synergies is $K/2$, and the expected costs of the lack of local adaptation is $2\bar{\Delta}$, profits in this case are given by :

$$\pi_c^i = \frac{K}{2} - 2\bar{\Delta} + v_p + \frac{v_f}{2}.$$

The difference in profits between both forms is then simply:

$$\pi_M - \pi_U = \left(2\bar{\Delta} - \frac{K}{2} \right)$$

That is, the decentralized form will be preferred whenever the expected value of adaptation to local conditions is high; while a centralized structure will be preferred when the synergies are expected to be.

Both of these organizational forms require the organization to commit ex ante to either decision rule. Ex-post, it may turn out that the functional synergies (the realization of k) are low or that the value of adaptation to local conditions Δ is low. But any ex post rule requires communication between the managers. We consider next how this may be achieved.

Before doing this, we further simplify the model. Our analysis is concerned mainly with the importance of the synergies versus local adaptation, and for this reason we will assume throughout, that effort is equally productive in both activities, that is $v_f = 2v_p = v$. That means that, for equal effort inputs, total effort output produced by the two row managers equals the effort output of the column manager. This implies that, reducing either s_p or s_f by a given amount then has the same impact on total effort output.

Assumption 1: $v_f = 2v_p = v$

Assumption II: Discrete effort: In order to analyze this extension, we simplify the incentive conflict, and assume that the non-contractible effort can only take two values, $e = 1$ or $e = 0$. Output on the non-contractible effort is like in the previous section, that is $v(e - \phi e)$. The parameter ϕ in the cost function is the marginal cost of effort and we assume $1/2 < \phi < 1$.⁷ Then we have that $e_i = 1$ if $s \geq \phi$. Since shares closer to $1/2$ always improve implementation and communication, the share chosen for all agents is either $s = \phi, e = 1$; or $s = 1/2, e = 0$.

3.3 Functional Authority

We start by describing the behavior and comparative statics of the model without CCR in order to compare the results with those in the previous section. This provides us with an opportunity to examine again the intuition of the previous section.

The communication constraint (??) with high incentives $s = \phi$ becomes:

$$\frac{(1 - \phi)^2}{\phi^2} \geq \frac{2\Delta_L}{\Delta_L + \Delta_H} \quad (1)$$

or still

$$\left(\frac{1}{\phi} - 1\right)^2 \geq \frac{2\Delta_L}{\Delta_L + \Delta_H} \quad (2)$$

While with low incentives $s = 1/2$ the communication constraint is simply $\frac{1}{2}(\Delta_H - \Delta_L) > 0$. That is, truthful communication is always possible with $s = 1/2$, at the cost of no effort incentives.

The incentive-communication trade-off takes a stark form in this section. If inequality (1) holds, then there is no communication-incentives trade-off – high incentives can be provided, and communication takes place. However, implementation is biased as long as $\phi > 1/2$, since it is still the case that functional manager cares less about divisional profits than about his own. If instead the constraint does not hold with high incentives, then the continuous trade-off discussed in the previous section takes a very stark form: either the organization does not provide effort incentives, and then communication takes place, or it provides effort incentives and communication does not take place since the agents interests conflict with each other.

Suppose first that inequality (1) holds, so that communication is possible with both high powered and low powered incentives. Then substituting $s_f = s_p = 1/2$ and

⁷Note that if ϕ is allowed to be $\phi = 1/2$, then the first best share is $s = 1/2$ with optimal communication and implementation, and all conflicts disappear.

$s_f = s_p = \phi$ in the separating profits (??) we have that the difference between high and low powered incentives is given by:

$$\pi_{s=1/2}^{sep} - \pi_{s=\phi}^{sep} = \frac{3(\Delta_H^2 + \Delta_L^2) + 2\Delta_H\Delta_L(1-2\phi)^2}{4k} - \frac{3(1-\phi)^2}{\phi^2} - 3(1-\phi)v$$

The first term is unambiguously positive: and reflects the implementation gain from balanced incentives. The second term is negative, and reflects the incentive loss.

Suppose instead that (1) does not hold, so that communication cannot take place under high powered incentives. Substituting $s_f = s_p = \phi$ in the pooling profits (essentially (??) without the effort part); and substituting $s_f = s_p = 1/2$ in the separating profits (similarly ??), we can obtain the difference in profits between the high incentives/pooling case and the low incentives/communication case:

$$\pi_{s=1/2}^{sep} - \pi_{s=\phi}^{pool} = \frac{1}{4k}(\Delta_H - \Delta_L)^2 - \frac{1}{2k}(\Delta_L + \Delta_H)^2\left(1 - \frac{1-\phi}{\phi}\right)^2 - 3(1-\phi)v$$

This allows us to characterize the trade-off between incentives, implementation and communication as follows

Proposition 1 *An increase in k or v leads a functional organization towards higher powered incentives, weakly worse implementation and communication. An increase in the mean cost of adaptation $\bar{\Delta}$ or a mean preserving spread in the distribution of value of local adaptation Δ leads the organization to lower powered incentives with better ex-post implementation and weakly better communication.*

Next, we compare profits given functional authority to those obtained in a fully decentralized organization. In a fully decentralized firm, synergies are never implemented and, hence, profits are simply given by

$$\pi^D = 3(1-\phi)v$$

Profits given functional authority can be obtained, depending on whether communication is or not possible, again substituting s_f and s_p in the relevant profit function (?? and ??) we can easily characterize the organizational choice as a function of v and k . First note that π^D does not depend on k , but increases in v and that π^F is increasing in k in either of the three cases but either does not depend on v (when incentives cannot be provided) or depends in the exact same way as π^D . Then the following proposition can be proved straightforwardly:

Proposition 2 *Consider values of $\Delta_L, \Delta_H, k, v, \phi$ such that the organization is indifferent between functional or decentralized authority. Then: (i) An increase in K may shift the organizational choice towards centralized authority but never the other way round. (ii) An increase in v may result in a shift from functional authority to decentralization, but never the other way around.*

4 Conflict Resolution: The role of senior management

In this section we analyze an organizational structure where, like in the previous section, there is a functional division manager and 2 product division managers. However, we now assume that none of these managers, by himself, has control over the operating units. Agreed upon strategies are implemented; if managers fail to agree, senior management chooses. We assume that reliance on senior management results in incremental costs to the division managers and to senior management. This captures the time and cost of preparing information for senior management, senior management's time to meet and process the information, and the costs to the organization from delaying decisions.

We analyze a simple extensive form. As previously, the product division managers communicate their observation on the importance of local adaptation, Δ , and the functional division manager proposes strategies for each operating unit in his division after observing the synergy parameter k and hearing the messages from the product divisions. Each product division manager observes the proposal and may engage in cheap talk with the other. They then simultaneously and independently decide whether to appeal the proposal or not. If any product division manager appeals, it goes to senior management. Each product division manager incurs a cost C_r if there is an appeal. There is potential an additional cost C_{org} if there is an appeal. If there is an appeal, senior management observes all random variables and decides what outcome to impose efficiently.

This extensive form allows us to avoid complex inference problems of signaling in the proposal and appeal stages, thereby greatly simplifying the analysis. A richer bargaining game among the division managers might improve matters by allowing more efficient outcomes without appeal, but also introduces the possibility of proposing strategies that are not optimal in order to signal private information.

Whenever a functional manager tries to standardize production against the will of product division managers, product division managers may choose to appeal.

4.0.1 The appeals choice in a separating equilibrium

We study next the appeals decision by an agent. In a case with communication, the appeals decision is based on the information available to the agents about the cost of adaptation for each of them. Since it is a separating equilibrium, they know whether it is high or low—but they know nothing about the private information about the value of synergies that the functional manager has observed. The value of appeal is in blocking the functional’s manager attempt to standardize and obtain the synergies whenever the synergies are lower than the efficient threshold. The cost is the appeals cost.

Consider for example the appeal decision of a manager who observed and communicated Δ_h . He decides to appeal if the expected value of blocking the functional manager is higher than the appeal cost. The functional manager is reversed whenever $k_{hh} < k < 2\Delta_h$, conditional on $k > k_{hh}$ (that is, synergies were attempted):

$$\frac{1}{K - k_{hh}} \int_{k_{hh}}^{2\Delta_h} [s_p \Delta_h - \frac{(1 - s_f)}{2} k] dk > C \quad (3)$$

We can define, similarly, two other inequalities that reflect the value of appeals for a product manager who observed Δ_h when the other manager observed Δ_l and the value of appeals for a product manager who observed Δ_l when the other manager observed Δ_h . The first of these is:

$$\frac{1}{K - k_{hl}} \int_{k_{hl}}^{\Delta_h + \Delta_l} [s_p \Delta_h - \frac{(1 - s_f)}{2} k] dk > C \quad (4)$$

and the second is:

$$\frac{1}{K - k_{ll}} \int_{k_{ll}}^{2\Delta_l} [s_p \Delta_l - \frac{(1 - s_f)}{2} k] dk > C \quad (5)$$

It is easy to show that the value of appeals is higher in the hh case than in the lh case and it is higher in the lh case than in the ll case. Then these three inequalities define a set of thresholds that can be shown to be ordered in the expected order.

Lemma 3 *There exist appeals cost $C^{hh} > C^{hl} > C^{ll}$ such that if $C < C^{ij}$ then ij appeal.*

4.0.2 Conflict Resolution and incentives

It is easy to see that CCR always weakly results in higher-powered incentives. The reason is that CCR has no affect if incentives are balanced, as there are then no appeals. In contrast, CCR may increase or reduce profits under high-powered incentives. In equilibrium, however, CCR will only be used if it actually increases profitability of high-powered incentives. In other words, the option of CCR increases the profit frontier under high powered incentives to the right, but leaves the profit frontier under balanced incentives unaffected. Note that the above intuition holds, regardless of whether CCR makes it easier to satisfy the communication constraint given high-powered incentives.

Lemma 4 *CCR weakly results in higher incentives.*

The attractiveness of centralized conflict resolution depends on how effective management can intervene in day-to-day affairs, as characterized by the conflict cost C_{org} . Keeping the divisional manager's cost of appeal C_r fixed, and decrease in C_{org} will increase profits under CCR. Since the adoption of CCR results in higher incentives, this yields the following proposition:

Proposition 5 *A decrease in the organizational cost of conflict C_{org} results in higher incentives*

4.0.3 Conflict Resolution and Communication

Now consider the effect of being able to appeal on communication. Do appeals make it more likely that communication will be credible?.The following lemma shows that appeals decrease the credibility of communication. The reason is that when a false message is transmitted by a product manager, the strategic effect is not only (like without CCR) to reduce implementation, but also, as a result, to reduce the possibility of conflict, as if synergies are less likely, conflict is less possible. We state now formally this result.

Proposition 6 *Allowing product division managers to appeal to senior management functional decisions makes the communication constraint weakly harder to satisfy.*

In a sense, truthtelling is harder when agents can appeal decisions to senior management. Leaving incentive compatibility aside, it is also the case that the cost of bad communication is also lower when appeals are possible. To see this clearly, note that no information on the cost of adaptation is used by a functional organization in a pooling equilibrium. Thus the value of high incentives is undercut substantially by the implementation losses. When product division managers can appeal and senior management can intervene, on the other hand, then the organization will incur less of a cost if agents cannot communicate, as appeals will solve those problems.

To sum up, the cost of lack of communication is lower, and providing incentives for communication is harder when CCR is present. For both of these reasons, CCR reduces communication among managers. The following proposition states this result formally.

Proposition 7 *Introducing the possibility of appeals unambiguously reduces communication between product divisional managers and functional managers.*

Proof. If communication would have been incentive compatible under high powered incentives without CCR, then introducing CCR makes truthful communication impossible, by the previous proposition.

If communication was not incentive compatible with high powered incentives, then CCR cannot make it IC. Since the value of low powered incentives is unchanged, and CCR will only be used if it increases profits, CCR weakly moves the organization towards higher powered incentives with pooling. ■