The Pursuit of Global Opportunities: The Role of Central Managers

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I study a local manager's incentives to invest in the research of new opportunities, when the implementation of some projects requires the participation of more than one unit. A central manager can select projects or delegate that decision. Delegation matters even when local managers select the same project mix, because the sharing rule changes from accounting to bargaining based. Predictions depend, for example, on the structure of the research tasks, how different local opportunities the managers are expected to have, whether or not global projects require cooperation in the implementation phase, and the level of competition between managers. It is argued that central authority is important to understand the boundaries of firms. The discussion is illustrated with examples from three case studies.

1. Introduction

In a dynamic world, a company's success rests to a very large degree on its ability to pursue new opportunities. It could be a new product or service, a new marketing strategy, or a new delivery process for an existing product or service. To realise the full potential of many of these opportunities, several business units must be involved. For example, in a vertically integrated company the input from the upstream party must fit new product requirements, and the delivery processes must be coordinated across units to allow modern production management, such as just-in-time production. And, when horizontally integrated, standardisation is necessary to allow joint sourcing, large-scale production and efficient transfer of skills and competencies across units.

Under a market organisation, where each unit is an independently owned firm, the managers of the business units must negotiate an agreement on what global changes to implement and how to split the extra joint surplus. When the business units are under the same ownership, however, a central manager can intervene. This paper is an attempt to understand better under what circumstances we would expect such intervention to further the pursuit of global opportunities. The predictions coming out of the analysis are relevant both for the level of decentralisation in an integrated company and for the boundaries of firms.

All change that is the result of active managerial involvement can be seen as projects. In its most basic form, a project includes, first, a project research phase, second, a decision on whether to go ahead with the project or not (project selection), and, third, an implementation phase. The problem is that local managers and their subordinates typically underinvest in the research of global opportunities and overinvest in the

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research of local projects. They may also choose a suboptimal portfolio of projects to implement, when they are allowed to make that decision.

One way to alleviate these problems could be to design a better incentive contract. That is not my focus. Instead I assume simply that a local manager maximises the profits of the unit he leads. In the case where he is part of a larger corporation he does so maybe because unit profits are thought to influence pay, career opportunities, resource allocation, or simply the manager's standing and popularity. It suffices for the results that the local manager takes a special interest in local profits, which seems to always be the case in practice.

I consider two situations where centralisation can improve the project selection decision. I argue that for projects where local managers ignore important benefits, for example because the project contributes to the long-term build-up of core competencies (Prahalad and Hamel, 1990), one would expect more centralised project selection. And, I discuss how a competitive company culture (were a local manager cares about *relative* unit profits) can make negotiations break down.

In the main part of the paper, however, I assume that any bargaining outcome is Pareto optimal, reflecting all relevant project benefits and costs. Then the project selection under decentralisation and centralisation will be the same (given that decision-makers have the same information and competencies). Even so, the degree of centralisation remains important, because it affects the incentives to perform project research locally.

When local project research is not directed and controlled by central managers, a local manager will do the research activities that maximise his unit's profits. The sharing rule used to determine the split of the profits from global projects is therefore critical. Under centralised project selection it is accounting-based, while under decentralisation it is the outcome of a bargaining process. The main difference between the ways these two mechanisms are used in practice is that only the bargaining outcome reflects a manager's outside option (what he could have achieved on his own if no global project was to be implemented).

Centralisation and decentralisation are in the model therefore equivalent when global projects can be implemented independently of local projects. Under both organisational forms, local managers underinvest in the research of global projects. But, when global projects come instead of local projects, a manager invests more under decentralisation to strengthen his bargaining position.

If the same project research task contributes to both the cooperative and the outside option, here called a single-task setting, the stronger incentives tend to reduce the underinvestment problem, but it can lead to overinvestment. When different tasks contribute to global and local projects (a multi-task setting), so that the research for global projects is wasted when other units fail to participate, the extra incentive to invest under decentralisation must be unproductive, since it is now related only to the research of local projects (for which a manager already has strong incentives). But that does not mean that decentralisation is always bad. The negative effect of local managers skewing

their investments to influence centralised project selection can be even more costly. This latter effect is shown to be neutralised when the units and their managers are identical in every respect. It tends to be more severe, the larger the differences are.

So, in both the single-task and the multi-task case, centralised decisions can improve or damage local incentives. But, for a large range of parameters, decentralisation is best in the single-task case, as some overinvestment is better than severe underinvestment. And, when the managers face similar conditions, we can conclude that centralised decision-making is better in the multi-task case.

Some projects, for example the development of a new marketing strategy or advertising campaign, have externalities but do not require the participation of more than one unit in the implementation phase. For these projects the outside option of a local manager is "closer" to the bargaining solution than for a truly global project (requiring cooperation to implement). In addition, a manager will skew his investments more under centralisation to influence the project selection decision. Both factors lead us to expect more delegation when projects have externalities only; compared to when implementation requires cooperation.

In other words, I go through a variety of settings and analyse under what circumstances one would expect to see more centralised decision-making in companies. The discussion is illustrated with examples taken from three Scandinavian companies that I have recently studied; producing paper, foods and electricity respectively. The companies range from 1 000 to 10 000 employees, and two of them have extensive international operations. The information was collected through around 20 interviews with senior managers and other employees in each company.

Since in the model decentralisation is equivalent to market organisation (where the units operate as independent firms), the results are relevant also for a discussion on the boundaries of firms. If centralisation is of little or even negative value, we would expect to see less integration. On the other hand, under those circumstances where centralised decision-making can be of great value, the paper provides an explanation for why hierarchies can sometimes deal better with the hold-up problem than markets, as discussed by Klein, Crawford and Alchian (1978) and Williamson (1985). My approach contrasts sharply with the property-rights model developed by Hart and Moore (1990), where managers own assets directly and there is no room for a central manager with coordination authority. Their approach can be seen as a theory appropriate for smaller entrepreneurial firms, while my work is also relevant for larger companies, where managers do not own assets.[1]

Other papers on centralised authority include Aghion and Tirole's (1995, 1997) discussions of formal and real authority; Nault's (1998) work on the location of investment decision authority when local managers have superior information; Hart and Moore's (1999a) paper on coordination and specialisation; Hart and Holmstrom's (2002)

1. For a discussion on the limitations of the property-rights approach, see Holmstrom and Roberts (1998) and Holmstrom (1999).

work on vision and firm scope; and Stein's (2000) discussion of information production and capital allocation.

Albeit with a different focus, Holmstrom and Tirole's (1991) paper on transfer-pricing policies is probably the one closest to my approach, as both study the importance of sharing rules for organisational form. But, while an upstream party in their set-up will not enjoy any benefits from relationship-specific investments under centralisation, I allow for a sharing of global benefits based on standard accounting rules, making the theory relevant for a much wider range of applications. Furthermore, the ex-post decision in my model is more sophisticated, with a choice between local and global projects, so that the model can capture local managers skewing their investments to influence central decisions.

The paper proceeds as follows. The basic model is developed and discussed in section 2. In section 3, I compare centralisation and decentralisation in a base case, where all projects are global. I introduce local projects in a single-task environment in section 4, while a multi-task environment is studied in section 5. In section 6, I discuss projects with externalities that can be implemented independently of other units. And, in section 7, I allow a more competitive environment, where the managers care about relative profits. Finally, in section 8, I make some concluding remarks.

2. The model

The timeline of the model is illustrated in figure 1. First, managers search for and process information about potential projects (project research). Then uncertainty is resolved. Projects are selected. And they are implemented. Uncertainty in the project implementation phase, and any multi-period effects, are ignored.

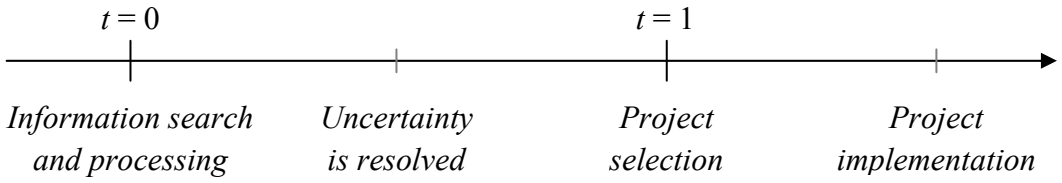

Figure 1. The timeline.

For simplicity we are studying a company with two units only (*Unit 1* and *Unit 2*). To make the problem interesting, there must be some link between the two. The standard link considered in the theory is one of vertical integration, where one of the units manufactures a product that is used in the other unit's production process. A *global project*, affecting both units, is then for example the development and introduction of a new product manufactured by unit 2 for which a new input from unit 1 is needed. It could also be a change in the delivery process, such as the introduction of "just-in-time" production.

In this paper I illustrate some of the theoretical discussion with examples taken from two horizontally integrated companies, with a regional organisation. In this context a

global project could be to coordinate the sourcing, to develop a common e-commerce concept or to standardise products to allow for larger-scale production.

A *local project*, on the other hand, does not affect the other unit at all, for example a cost-cutting initiative. In section 6, I also discuss *projects with externalities* "only," such as a new marketing strategy or an advertising campaign, which can be implemented by a unit independently, even if it does affect the results of the other unit.

There is a manager or a management team in each of the two units, as well as centrally. Potential incentive problems within management teams are ignored. In other words, the central authorities are seen as one person, as is a local management team. While central authorities include the benefits and costs of all sub-units to maximise total surplus, a local manager cares only about the profits of his own unit. I ignore risk aversion, private costs of individual managers, and their search for perquisites, since I believe these mechanisms to be less important to the organisation design problem than a manager's drive to improve the results of the unit for which he is responsible.[2]

Consider a situation where only local managers perform project research at $t = 0$, and ignore for now projects with externalities only. A manager can, at the most, choose between two research tasks, x^{Mi} and y^{Mi}, where *Mi* denotes the manager that performs the task ($i \in \{1,2\}$).

The net (discounted) benefits from the global projects that are selected for implementation at $t = 1$ are given by the managers' investments in project research, the resources allocated to the implementation of these projects, γ, and the state of the world, $\omega \in \Omega$:

$$\pi^{G}\left(x^{M1}+x^{M2}, y^{M1}+y^{M2}, \gamma; \omega\right). \tag{1}$$

Having the project research investments enter the benefit function in an additive way will simplify later exposition (of the derivatives) but is not necessary for the results. On the other hand, it can be given an economic interpretation, which I discuss below. For simplicity assume that there is a given capacity for project implementation in each of the two units, that these capacities are identical, and that the implementation of a global project will require the same capacity in both units. Let $\gamma \in [0,1]$, so that $\gamma = 1$ denotes that all available implementation capacity is used for the global projects, while $\gamma = 0$ when no global project is implemented. The benefits at $t = 1$ from local projects in *Unit i* are independent of the research investments in the other unit:

$$\pi^{Li}\left(x^{Mi}, y^{Mi}, 1-\gamma; \omega\right). \tag{2}$$

2. As indicated in the introduction, a local manager might maximise the sub-unit profits because that is the main criterion for rewards of different kinds. The suboptimisation problem could also be based on assumptions similar to those made by Stein (1997, 2000), who assumes in his models of internal capital markets that although agents are non-responsive to monetary incentives, they enjoy private benefits that are proportional to output under their control.

Costs of project research at $t = 0$, $C^{Mi}(x^{Mi}, y^{Mi})$, are unverifiable to central managers and third parties, maybe because they are opportunity costs of a manager's time, which otherwise could have been spent helping subordinates with the (not modelled) day-to-day operations of the business. To monitor a manager's use of time is impossible in practice. But the central manager does care about these costs. He cares about profits that could have been made with some other use of the resources. And, he cares if the aggregate use of resources increases, even if some of these resources are in the form of time spent, because in the long-run all employees must be compensated for their private costs (see for example the model by Holmstrom and Milgrom, 1991). The problem is that a central manager does not observe what the costs are for, not that he does not care about them. When choosing between organisational forms, the central manager will thus maximise the joint surplus, $\pi^G + \pi^{L1} + \pi^{L2} - C^{M1} - C^{M2}$.

All the functions are assumed to be non-decreasing and take non-negative values only. The benefit functions are (separately) concave in each of the variables, and the cost functions are (separately) convex in each variable. Note that overall convexity is too strong an assumption when the model is to allow for benefits from specialisation.[3] Any uncertainty that affects cost functions is suppressed. The cross-derivatives of the benefit functions between project research and implementation capacity are assumed to be positive, as information about a class of projects must be more valuable the more important these projects are for the organisation. And, to include management overload effects, so are the cross-derivatives of the cost functions.

The additive way research investments enter the global benefit function can reflect an information structure where all the information elements of a particular class (x or y) are identical *a priori*, in the sense that they look the same before they are processed. That is, the expected value of information processing depends only on the aggregate number of elements that have been processed, regardless of whether it was one or the other of the manager who did the work (although their costs may differ).

A very simple interpretation of the model would be that project research as such is predictable, but that the environment is not. In other words, a manager knows in advance what kind of information or knowledge that his research will reveal, but environmental shocks (that occur after the information processing) can affect the attractiveness of some projects.

However, the model can also be interpreted as including uncertainty in the information search and processing phase. Each information element can for example be interpreted as corresponding to the value of a particular project, as in the search theory initiated by Stigler (1961, 1962). The search is then seen as draws from the same probability distribution. A fundamental result from this theory is that whatever the

3. With for example a cost function such as $C(x,y) = [x^{\alpha} + y^{\beta}]^{\delta}$, $\alpha, \beta < 1$ would imply learning effects (and thus benefits from specialisation). This cost function is not convex for $C_{11}, C_{22} \geq 0$, because $C_{11}C_{22} - C_{12}^2 < 0$.

precise distribution happens to be, increased search will yield positive, but diminishing expected returns (Stigler, 1961).[4]

The investment level would then correspond to the number of local and global projects to be ranked. γ could be the percentage of implementation capacity used for the best global project, so that 1-γ of the capacity is used for the best local project in each unit. The state of the world determines the value of each project that has been evaluated, and it impacts thus both the ranking and the absolute value of the projects (as in the models by Hart and Moore (1999b) and Segal (1999) that provide a foundation for incomplete contracts).[5]

Another possible interpretation could be to see the initial activities as investments in an information system. The more one invests in an information system, the finer future signals will partition or classify the states of the world, for example in the Blackwell (1951) sense (Laffont 1993, chapter 4). With higher-quality information, the decision-maker can select projects (strategies) with better precision. This interpretation is in accordance with the team-theoretic analysis by Marschak and Radner (1972) and the information analysis by Demski (1980).

When local project research is sufficiently costly to verify, the project selection decision is the only management activity that can be performed centrally. We distinguish between Centralisation (C), where a central manager selects the projects, and Decentralisation (D), where the decision is delegated. It is assumed to be impossible ex-ante to contract on what projects to implement, either because it is too "costly" (Grossman and Hart, 1986) or because no contract can do better than the "null contract" (Hart and Moore, 1999b). Note that a contract specifying a certain percentage of the implementation capacity that is to be used for global projects (and nothing more) would be impossible to enforce as well, since a unit then could suggest a global project that would almost only benefit itself.

Under Centralisation the benefits from global projects are shared according to the company's accounting rules, while under Decentralisation the sharing rule is the outcome of a bargaining process at $t = 1$ among the local managers. If the bargaining outcome resembles the one discussed by Nash (1950, 1953), the division of surplus is under Decentralisation based on what each manager *could have* achieved on his own and then a split of the *extra* joint surplus that cooperation generates. With standard

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4. With project values uniformly distributed between zero and one, the expected maximum project value with n searches will be $n/(n+1)$. When the values are normally distributed with mean m and standard deviation σ, the expected maximum value at the nth observation is approximately $m + \sigma\sqrt{2 \ln n}$ (Alchian, 1970).

5. Following the tradition of Stigler (1961, 1962) and Alchian (1970) dynamic aspects of the search problem are suppressed to focus on the expected search intensity, which is the only relevant variable for the organisation design problem. The optimal stopping rule is of no interest. But the model could be seen as reflecting a more complex search process over many (shorter) periods, with the searcher determining his search intensity in any given period at the start of that period if he continues the search (Morgan and Manning, 1985). The search intensity corresponds then to the allocation of attention between *parallel* information-gathering processes.

accounting rules, however, a unit will under Centralisation enjoy the full net profits from any local project that is implemented, and then some share of the benefits from global projects. The difference between these two sharing rules is the main driver of the comparative results and is illustrated in figure 2.

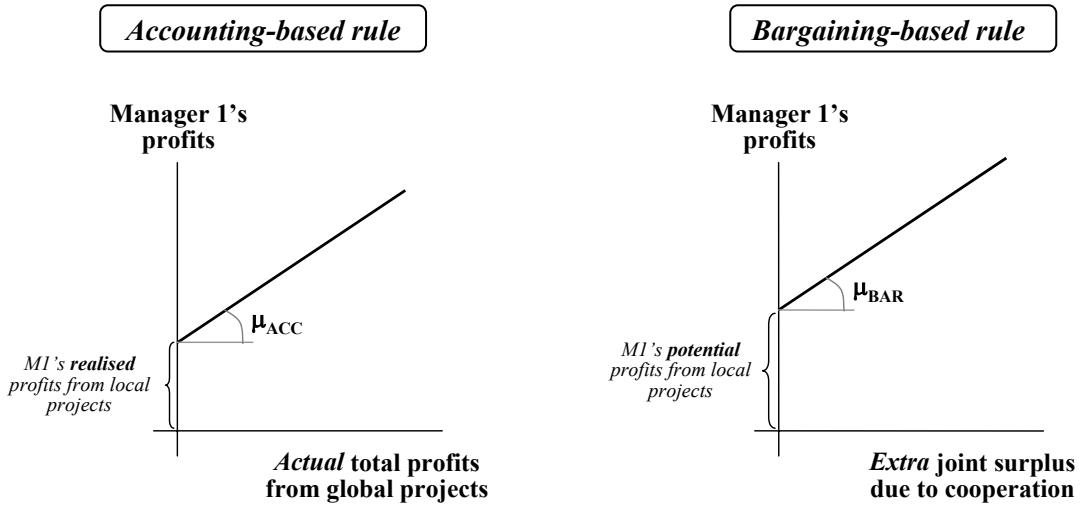

Figure 2. Sharing rules.

Since project research investments are unobservable to the central managers and other third parties, neither the split of actual total profits from global projects under Centralisation (μ_{ACC}), nor the split of extra joint surplus due to cooperation under Decentralisation (μ_{BAR}), will reflect these sunk investments. Instead, μ_{ACC} is the result of arbitrary accounting rules, while μ_{BAR} reflects the managers' bargaining powers.[6]

Of course, in practice, the sharing rule is not necessarily linear in profits as assumed in figure 2. The profit stream typically consists of several classes of costs and revenues. Accounting rules can attribute different shares of each class to each unit, as can differentiated bargaining powers. On the other hand, as long as shares are not related to $t = 0$ investments, a more complicated sharing rule cannot improve ex-ante incentives; at least in a setting with sufficient uncertainty over the nature of upcoming projects.

The assumed link between the degree of centralisation and the sharing rule deserves some extra comments. In theory there is nothing in the model set-up that stops central managers from choosing a sharing rule that resembles the bargaining-based one also under Centralisation. But in practice (to my knowledge) this is not observed. Instead the companies use the more inflexible and bureaucratic standard accounting rules, maybe to avoid costly influence activities with respect to the allocation of revenues and costs (Milgrom and Roberts, 1988).

6. μ_{BAR} is equivalent to the power index used in the expression that is maximised to find a bargaining outcome satisfying the Nash (1950, 1953) axioms, except the one on symmetry. When P_i denotes the payoff to Manager i, and d_i the payoff he would obtain in the case of a breakdown of negotiations, the expression that is maximised is: $(P_1\text{-}d_1)^{\mu}\ (P_2\text{-}d_2)^{1\text{-}\mu}$. See for example theorem 9.2 in Eichberger (1993: 255).

A cooperative bargaining-based sharing rule is used (or at least should be used) under Decentralisation, since it assures that all units benefit from cooperation when that is profitable from a corporate point of view. If instead local managers were to negotiate over project selection using an accounting-based sharing rule (without side transfers), they will make very suboptimal project selection decisions. Of course, a side transfer can in practice take other forms than an immediate monetary transfer, for example that a unit promises to accept another global project for which it otherwise would have required compensation or that it later will provide access to development work. Profit sharing can also take place through the adjustment of transfer prices.

3. The base case

We start with a simple setting, where both the two local managers are needed for the implementation of all available projects. In other words, all projects are global, and the project research is wasted if no global project is implemented. Furthermore, there is only one class of information elements (y) to perform research on. The total benefits at $t = 1$ are thus given by the function

$$\pi^G\left(y^{M1}+y^{M2},\gamma;\omega\right). \tag{3}$$

The optimal project selection decision at $t = 1$ is then always $\gamma^* = 1$, since the implementation capacity is given in any period. And with the assumed cooperative Nash bargaining, that optimal project selection will be made, regardless of whether the decision is delegated or not.

Under Centralisation, Manager 1 receives a share, μ_{ACC}, of the benefits, as determined by the company's accounting rules. In practice, this share will typically vary across different states of the world, but in this model we will for expositional reasons simply assume that the share is the same in all states of the world, regardless of investment levels and the project selection decision. Manager 1's expected net gains, Φ_C^{M1}, from investing in project research at $t = 0$ are then

$$\Phi_C^{M1}=\sum_{\omega\in\Omega}\mu_{ACC}\pi^G\left(y^{M1}+y^{M2},1;\omega\right)f\left(\omega\right)-C^{M1}\left(y^{M1}\right), \tag{4}$$

where $f(\omega)$ is the probability density function with respect to the state of the world at $t = 1$. The expression for Manager 2's gains is identical, except that μ_{ACC} is replaced by $(1-\mu_{ACC})$. Here, and throughout the paper, I show therefore only the expressions for Manager 1.

Under Decentralisation, with Nash bargaining, the share Manager 1 receives, μ_{BAR}, is determined by the managers' bargaining powers. And, assuming that also this share is the same in all states of the world, Manager 1's expected net gains are

$$\Phi_D^{M1}=\sum_{\omega\in\Omega}\mu_{BAR}\pi^G\left(y^{M1}+y^{M2},1;\omega\right)f\left(\omega\right)-C^{M1}\left(y^{M1}\right). \tag{5}$$

Since there is no outside option available to the managers, the expressions in (4) and (5) are identical but for the shares that Manager 1 is to receive. And there is no reason to believe that the share should be systematically larger for one of the regimes. In fact, with equally important managers and no systematic accounting bias, one would expect $\mu_{ACC} = \mu_{BAR} = ½$. The benefits from global projects are split 50-50 by the accounting rules, and the managers have equal bargaining power.[7]

Under asymmetrical conditions, the accounting rules could credit one of the units with more of the benefits, but the bargaining power distribution can be skewed as well. While accounting rules can benefit a unit that tends to be more important for global projects over time, the same unit might have more bargaining power in negotiations with other units. In the remainder of the paper I therefore assume identical shares:

Assumption. Accounting-based and bargaining-based sharing rules lead to the same marginal shares from global projects: $\mu_{ACC} = \mu_{BAR}$.

However, the subscripts are kept throughout to help the reader keep track of what regime I am discussing. Note that attention is restricted to situations where $0 \leq \mu_{ACC} = \mu_{BAR} \leq 1$, since the bargaining outcome otherwise would be unacceptable to one of the managers. We see from (4) and (5) that with these assumptions, the model is neutral to delegation:

Proposition 1. When the implementation of global projects does not come at the cost of other projects, decentralised and centralised project selection are equivalent with respect to suboptimisation. One would expect the same level of underinvestment in the research of global projects, although the sharing rule is accounting based under Centralisation and bargaining based under Decentralisation.

Coordinated sourcing of rather standard products or raw materials is a real world example of a global project that seems to fit this environment. The implementation of coordinated sourcing should not take much implementation capacity away from other projects (such as for example local cost cutting initiatives), as it comes instead of the stand-alone purchasing activities in each unit. When research activities (the exploration of possibilities for coordinated sourcing) are performed locally, it should thus not matter whether the decision to actually buy from a common supplier is decentralised or not. Including also communication cost considerations, the decision should be made by those who do the research, which is exactly what I found in the paper company that I studied.[8]

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7. Note that the underinvestment problem under Centralisation is dampened if μ_{ACC} increases in Manager 1's investments. That could be the case if the project design better reflects problems and opportunities of a unit the more its manager has been involved in the project research. On the other hand, one could also argue that the bargaining power should increase with investments. Since both these effects are very uncertain, they are not included in the model.

8. Of course with decentralised research the company must accept less focus on global sourcing activities than desirable from a corporate point of view, due to the underinvestment result in proposition 1. To encourage a stronger focus on global opportunities, the paper company has therefore established a global

4. Single-task environment with outside option

Now, consider a setting where there is still only one class of information elements (a single-task environment), but where the project research can be used to design profitable local projects if the managers were to not implement global projects. Assume, though, that for the same implementation capacity local projects always generate less joint surplus than global projects, so that $\gamma^* = 1$ as before.

Under Centralisation, nothing is then changed from the base case, and Manager 1's first-order condition is given by

$$\frac{\partial \Phi_C^{M1}}{\partial y^{M1}} = \sum_{\omega \in \Omega} \mu_{ACC} \pi_1^G \left(y^{M1} + y^{M2}, 1; \omega \right) f(\omega) - C_1^{M1}\left(y^{M1} \right) = 0 , \tag{6}$$

where a subscript j indicates the first-order derivative of a function with respect to the jth variable. But, under Decentralisation, the bargaining outcome will reflect a manager's outside options. At $t = 1$, Manager 1 receives

$$\pi^{L1}\left(y^{M1}, 1; \omega \right) + \mu_{BAR} \left[\pi^G \left(y^{M1} + y^{M2}, 1; \omega \right) - \pi^{L1}\left(y^{M1}, 1; \omega \right) - \pi^{L2}\left(y^{M2}, 1; \omega \right) \right].$$

The first term is what he would get on his own ($\gamma = 0$), and the second term is his share of the extra joint surplus from cooperation. Maximising his expected net gains with respect to y^{M1}, Manager 1's first-order condition under Decentralisation is given by

$$\begin{aligned} \frac{\partial \Phi_D^{M1}}{\partial y^{M1}} = \sum_{\omega \in \Omega} & \left[\mu_{BAR} \pi_1^G \left(y^{M1} + y^{M2}, 1; \omega \right) + \left(1 - \mu_{BAR} \right) \pi_1^{L1} \left(y^{M1}, 1; \omega \right) \right] f(\omega) \\ & - C_1^{M1}\left(y^{M1} \right) \; = \; 0 . \end{aligned} \tag{7}$$

In other words, a manager will invest as if there was some positive probability of negotiation breakdown, although he knows that the units always end up working together. And the incentives are strengthened:

Proposition 2. A manager invests more under Decentralisation than under Centralisation when the project research could also benefit local projects, since investing extra strengthens his bargaining position.

At first glance, the extra incentives to invest seem great. The problem is that a local manager may overinvest, if the expected marginal gains from research is larger for the local opportunities than for the global ones, that is π_1^{L1} (for $\gamma = 0$) > π_1^G (for $\gamma^* = 1$) in many states of the world. That could be the case if the managers know in advance how to design some very profitable global projects (so that π_1^G is negligible).

"supply council" where global issues can be discussed in a structured way. The council must also report on the progress to the corporate management team. This council can be interpreted as an attempt to direct the research activities of the regions. Such influence on local research is not captured in my model.

When picking organisational form, a central manager chooses between which of the first-order conditions that he wants the manager to use. Under Centralisation Manager 1 uses (6), while under Decentralisation he uses (7). Again the expressions for Manager 2 are similar and thus omitted. Maximising joint surplus we can conclude that:

Proposition 3. Decentralised project selection is attractive to stimulate local project research when the research activities (potentially) add value to both local and global projects, as long as the research is sufficiently important to global projects. However, when local project research is not expected to add much value to global projects, Decentralisation can be bad, because wasteful research activities are encouraged that contribute only to a manager's bargaining position and not the realised joint surplus.

Note that some overinvestment is better than severe underinvestment. And, there are limits as to how attractive a local project can be in a marginal sense for it not to dominate a global project also in an absolute sense. This is especially true when projects are divisible. Decentralisation seems therefore to dominate Centralisation under these circumstances for a very large range of parameters.[9]

As an example of an environment satisfying proposition 3, consider a project to develop a common e-business concept across regions (so that ordering and billing can take place over the internet). This research task was in the paper company performed by a group in one of the regions, but with the intention that the solution would be implemented in all regions. The research can contribute to both local and global projects, because the region doing the research is free to implement a local solution based on the same research if the regional managers should fail to agree on a common global solution. And, as expected from proposition 3, the implementation decision was delegated.

Albeit in a different (multi-task) setting the basic insights in propositions 2 and 3 are also found in Holmstrom and Tirole (1991). In their model more delegation raises the incentives for quality provision (which enhances the value of a good for both inside and outside trade) and investments in market orientation (which enhances only the value for outside trade). Delegation is then only attractive when the first (positive) effect is more important than the latter (negative) effect.

The simple model illustrates another important result as well:

Proposition 4. When there is no special relation between the two units, centralised decision-making with an accounting-based sharing rule can only do harm.

Proof. When there is no special relation between the two units, the marginal benefits from project research must be the same, regardless of whether the two units cooperate or not: π_1^{L1} (for $\gamma = 0$) = π_1^{G} (for $\gamma = 1$). The manager who invests in project research will

9. If the marginal return on investment increases with the number of units that participate, as is assumed by for example Hart and Moore (1990), overinvestment can be ruled out.

then receive the entire surplus generated by his investments under Decentralisation independent of his bargaining power μ_{BAR}, and he chooses first-best investment levels. There cannot therefore be any gains from centralisation. But centralised decision-making is harmful when accounting rules do not replicate the bargaining solution (by setting $\mu_{ACC} = 1$).

The proposition points to the problem that central intervention is more vulnerable to mistakes than decentralised bargaining. When Unit 2 is only one of many (equally good) potential partners, Manager 1 can break off negotiations when he is not happy with his slice of the pie. In effect, the market forces ensure that Unit 1 receives the full benefits from its research. While with centralised decision-making, the local manager must rely on the central manager's ability and willingness to arrive at the right allocation of profits. And, if the allocation of profits under Centralisation is decided by some standard accounting rules that use actual revenues and costs, it will (almost) always deviate from the bargaining outcome.

In the model the two units could under Decentralisation just as well be seen as two separately owned firms. Proposition 4 is thus also an argument for the limit of firms.

Product development and changes in the delivery process have been mentioned as examples of global projects in vertically integrated companies. The analysis in this section has shown that we should expect more delegation of decisions on new products when a unit could also buy the required input or sell the output externally, than when an internal unit is crucial to the commercialisation process. Similarly, we would expect more delegation with respect to changes in the delivery process when these changes can be carried out independently in the two units, than when simultaneous changes in both units are needed to realise the benefits. These results are, of course, also reflected in the size of the corporate headquarters. A conglomerate has typically much leaner headquarters than a company with more related divisions and business units (Chandler, 1991; Collis and Montgomery, 1998).

5. Multi-task environment with outside option

In this section we extend the model to include two classes of information elements. Call the x-elements for *local* elements, and the y-elements for *global* elements, and assume that the local and global information elements contribute only to the value of local and global projects respectively. The benefits from the global and local projects at $t = 1$ are then $\pi^G(y^{M1} + y^{M2}, \gamma; \omega)$ and $\pi^{Li}(x^{M1}, 1\text{-}\gamma; \omega)$. Not only the level of research investments but also the choice among research tasks is then important.

In the two previous sections, we assumed that the project selection decision at $t = 1$ was trivial, with the global projects always dominating the local ones. In this section the interesting results surface exactly when we relax that assumption (while that would only have complicated matters unnecessarily before). With an interior solution, the optimal implementation capacity, $\gamma^*(x^{M1}, x^{M2}, y^{M1} + y^{M2}; \omega)$, is given by

$$\pi_2^{L1}\left(x^{M1},\,1-\gamma;\,\omega\right)+\pi_2^{L2}\left(x^{M2},\,1-\gamma;\,\omega\right)=\pi_2^{G}\left(y^{M1}+y^{M2},\,\gamma;\,\omega\right)\quad\text{for all }\omega\in\Omega. \tag{8}$$

Under Centralisation, Manager 1 receives the full benefits from any local projects that are implemented and a share, μ_{ACC}, of the benefits from global projects. His first-order conditions are:

$$\frac{\partial \Phi_C^{M1}}{\partial x^{M1}}=\sum_{\omega\in\Omega}\pi_1^{L1}\left(x^{M1},\,1-\gamma^*(\cdot);\,\omega\right)f(\omega)-\sum_{\omega\in\Omega}\{\cdots\}\frac{\partial\gamma^*(\cdot)}{\partial x^{M1}}f(\omega)$$
$$-\,C_1^{M1}\left(x^{M1},y^{M1}\right)\;=\;0 \tag{9}$$

and

$$\frac{\partial \Phi_C^{M1}}{\partial y^{M1}}=\sum_{\omega\in\Omega}\mu_{ACC}\pi_1^{G}\left(y^{M1}+y^{M2},\,\gamma^*(\cdot);\,\omega\right)f(\omega)-\sum_{\omega\in\Omega}\{\cdots\}\frac{\partial\gamma^*(\cdot)}{\partial y^{M1}}f(\omega)$$
$$-\,C_2^{M1}\left(x^{M1},y^{M1}\right)\;=\;0, \tag{10}$$

where, after using (8) to substitute for $\pi_2^G(\cdot)$,

$$\{\cdots\}=(1-\mu_{ACC})\pi_2^{L1}\left(x^{M1},\,1-\gamma^*(\cdot);\,\omega\right)-\mu_{ACC}\pi_2^{L2}\left(x^{M2},\,1-\gamma^*(\cdot);\,\omega\right). \tag{11}$$

If we could ignore the second terms, the first-order condition with respect to the research on local projects in (9) would have been as if the local manager did not suboptimise. And the condition with respect to the research of global projects in (10) would have been identical to the one found in (6), in section 4.

The second terms reflect that the project selection decision is no longer given, and that a local manager under Centralisation skews his investments to influence the choice. How much he skews his investments depends on the magnitude of two opposing effects. First, a local manager ignores part of the benefits from global projects. And, second, he ignores benefits from local projects in the other unit. The first effect leads the manager to do more local and less global project research, while the second effect works in the other direction.

Proposition 5. When the two managers and their units are identical in absolutely every respect under Centralisation, the managers will invest as if they ignored how the project research affects the project selection decision centrally. They will then underinvest in the research of global projects and overinvest in the research of the global ones compared to first best.

Proof. With identical managers and units, $(1-\mu_{ACC})\pi_2^{L1}(\cdot)=\mu_{ACC}\pi_2^{L2}(\cdot)$ in every state of the world (since μ_{ACC} = ½ and $\pi_2^{L1}(\cdot)=\pi_2^{L2}(\cdot)$). The second terms in (9) and (10) vanish, and we are left with the distortion introduced by μ_{ACC} in (10). This leads to the underinvestment in the research of global projects and the overinvestment in the

research of the global ones (through the positive cross derivatives of the cost function). Although the objective function need not be concave, but only separately so, it suffices to study the first-order derivatives for this and later results, due to Milgrom and Shannon's (1994) theorems 5 and 6 on supermodular functions, which again are due to Topkis (1978). (The objective function is supermodular in x^{M1} and $-y^{M1}$.)

The assumption of identical managers and units in every respect is unrealistic. With some uncertainty in the information search or the environment there will usually be states of the world where the local projects of one of the units are more valuable than the local opportunities of the other unit. And, when both $\pi_2^{Li}(\cdot)$ and $\partial\gamma(\cdot)/\partial x^{M1}$ are affected by the state of the world, we have the following result:

Proposition 6. A local manager will skew his investments to influence centralised project selection even when the local managers have identical expectations with respect to the economic consequences of their research investments, as long as the outcome can be asymmetric in some states of the world. With reasonable assumptions, this effect leads to a more severe under- and overinvestment problem.

Proof. See the Appendix.

The more dissimilar the managers and their units are, the more severe the problem will be. Consider for example a situation where only Manager 1 expects to have local opportunities, maybe because the other manager lacks the competencies or the capacity to do project research (as was the case in the paper company for one of the regions). Then the fact that Manager 1 ignores local projects in the other unit will no longer dampen his tendency to skew investments to influence project selection, as there are no such projects ($\pi_2^{L2}(\cdot) = 0$).

Let us now turn our attention to the situation under Decentralisation. The local manager will then, as in the single-task setting, consider how investments in project research might affect his outside option and thus his bargaining position. But the outside option depends now only on the research of the local information elements. Manager 1's first-order conditions are thus given by

$$\frac{\partial \Phi_D^{M1}}{\partial x^{M1}} = \sum_{\omega\in\Omega}\left[\mu_{BAR}\pi_1^{L1}\left(x^{M1}, 1-\gamma^*(\cdot);\, \omega\right) + \left(1-\mu_{BAR}\right)\pi_1^{L1}\left(x^{M1}, 1;\, \omega\right)\right] f(\omega) - C_1^{M1}\left(x^{M1}, y^{M1}\right) = 0 \tag{12}$$

and

$$\frac{\partial \Phi_D^{M1}}{\partial y^{M1}} = \sum_{\omega\in\Omega}\mu_{BAR}\pi_1^{G}\left(y^{M1}+y^{M2},\, \gamma^*(\cdot);\, \omega\right) f(\omega) - C_2^{M1}\left(x^{M1}, y^{M1}\right) = 0\,. \tag{13}$$

As in the single-task case, the local managers are motivated to invest extra under Decentralisation, and the first-order condition with respect to the research of local projects in (12) is in some respects similar to the one found in (7). But the extra incentives to invest are now always unproductive, because it does not help the research of global projects. The first-order condition with respect to the research of global projects is the same as it was in the base case, see (5). Note that with a bargaining-based sharing rule a local manager will not use his investments to influence the project selection decision anymore. (Mathematically, the envelope theorem holds.)

Proposition 7. In the multi-task setting, a local manager will also under Decentralisation always underinvest in the research of global projects and overinvest in the research of the local ones compared to first best.

Proof. The derivative in (12) is larger than under first-best for the same investment levels, since $\pi_1^{L1}\left(for\ \gamma^*\right) < \pi_1^{L1}\left(for\ \gamma = 0\right)$, while the derivative in (13) is smaller than under first-best. Again the result then follows from the theory on supermodular functions.

The interesting question is therefore how severe the incentive problem is compared to under Centralisation:

Proposition 8. When the managers and their units are identical in absolutely every respect, the suboptimisation is worse under Decentralisation than it was under Centralisation.

Proof. A manager needs then under neither regime consider how investments affect the project selection decision (the second terms of the derivatives in (9) and (10) vanish). And it is easily seen that the derivative in (12) is larger than the derivative in (9) for the same investment levels, while the derivative in (13) is the same as the derivative in (10). These observations are sufficient to establish the result.

But, as we showed earlier, when the values of the two managers' outside options are not identical in every state of the world, the suboptimisation problem under Centralisation is worsened by the fact that a manager will use his investments to influence the project selection decision. This is not a problem when the decision is delegated to the local managers, and we can state the following result:

Proposition 9. Centralisation is less attractive in terms of joint surplus when the local managers face very different conditions. For $\mu_{ACC} = \mu_{BAR} = ½$, Manager 1's incentives to invest under Decentralisation are better if the following inequality is satisfied:

$$-\sum_{\omega\in\Omega}\left\{\pi_2^{L1}\left(x^{M1},\,1-\gamma^*(\cdot);\,\omega\right)-\pi_2^{L2}\left(x^{M2},1-\gamma^*(\cdot);\,\omega\right)\right\}\frac{\partial\gamma^*(\cdot)}{\partial \mathrm{x}^{\mathrm{M1}}}f(\omega)$$

$$>\sum_{\omega\in\Omega}\left[\pi_1^{L1}\left(x^{M1},\,1;\,\omega\right)-\pi_1^{L1}\left(x^{M1},\,1-\gamma^*(\cdot);\,\omega\right)\right]f(\omega). \qquad (14)$$

where $\frac{\partial\gamma^*(\cdot)}{\partial x^{M1}}<0$.

Proof. $\frac{d\Phi_D^{M1}}{dx^{M1}}<\frac{\partial\Phi_C^{M1}}{\partial x^{M1}}$ and $\frac{d\Phi_D^{M1}}{dy^{M1}}>\frac{\partial\Phi_C^{M1}}{\partial y^{M1}}$ are sufficient (but not necessary) conditions for the result. It is straightforward to show that the second condition is always satisfied when the first one is, which is true if (14) holds.

The expression on the left hand side of the inequality (14), which tends to be more positive the larger the differences between the parties, drives how much Manager 1 will skew his investments (extra) under Centralisation to influence the central project selection decision. And the expression on the right hand side drives how much he would skew his investments (extra) to influence his bargaining position under Decentralisation. When the former effect is more costly than the latter for both managers, Decentralisation is better.

To test proposition 9 empirically one needs to look at a large number of cases using some standardised operational measure of asymmetry. This task is outside the scope of this paper, but one example from the foods company can at least illustrate that (in that case) full decentralisation was not a successful strategy to realise gains from standardisation across countries; to allow for coordinated sourcing (of ingredients and packaging) and larger-scale production (while at the same time allowing for local variation in taste by adding different spices at the end of the production process). Although top managers believe substantial gains can be realised by such standardisation, they have not materialised in the decentralised organisation that has been in place since the international expansion started a decade ago.

This example is taken from a multi-task environment, where the research effort on standardisation is wasted if the other units choose not to follow. To implement standardisation is considered very costly by local managers (both in terms of attention and in terms of it blocking local projects). And the units are not that different in nature (as they sell the same kind of products). Propositions 8 and 9 indicate that under these circumstances a more centralised organisation could have performed better.[10]

Of course, also under Centralisation one must expect substantial local underinvestment in the research on standardisation, as shown by propositions 5 and 6. It could therefore be the case that in this particular setting a centralisation of the project selection decision is not enough. The top managers should therefore consider to control

10. In fact corporate executives have lately taken steps to become more actively involved.

also the project research, maybe by establishing a group responsible for product development across regions.

Finally, note that propositions 3 and 9 clearly show that:

Corollary. There need not be a monotonic relationship between the level of delegation and the magnitude of the agency problem.

More delegation can lead to higher *or* lower agency costs – depending on the circumstances. When project research is separate for local and global projects, as we have assumed in this section, Centralisation is best for a large range of parameters, but Decentralisation can be better when local managers face sufficiently dissimilar conditions. And when the same project research activity contributes to both local and global projects, as in the previous section, Decentralisation tends to be best, unless it results in overly destructive overinvestment.

6. Projects with externalities

When a global project has externalities "only," a local manager can implement it without the consent of the other manager, unless a central manager intervenes. The outside option under Decentralisation is thus different from what it was in the previous section, where implementation required cooperation. A marketing project with positive spill-over effects is one example of such a project. The point of this section is to compare the agency problems for projects with externalities to the problems we have seen arise for "truly" global projects. Focus therefore on the case where the projects generate positive benefits for both units ($0 < \mu_{ACC} < 1$).

Let z^{M1} refer to research investments in projects with externalities. π^E are the benefits at $t = 1$ from these projects. And $\varepsilon^*(\cdot)$ is the optimal implementation capacity dedicated to them in unit 1. Only Manager 1 is assumed to invest in project research on "his" projects. Under Centralisation, the first-order conditions are then basically the same as they were with a "truly" global project, as given in (9) and (10):

$$\frac{\partial \Phi_C^{M1}}{\partial x^{M1}} = \sum_{\omega\in\Omega} \pi_1^{L1}\left(x^{M1}, 1-\varepsilon^*(\cdot); \omega\right) f(\omega) - \sum_{\omega\in\Omega} \{\cdots\} \frac{\partial \varepsilon^*(\cdot)}{\partial x^{M1}} f(\omega) - C_1^{M1}\left(x^{M1}, z^{M1}\right) = 0 \tag{15}$$

and

$$\frac{\partial \Phi_C^{M1}}{\partial z^{M1}} = \sum_{\omega\in\Omega} \mu_{ACC}\pi_1^{E}\left(z^{M1}, \varepsilon^*(\cdot); \omega\right) f(\omega) - \sum_{\omega\in\Omega} \{\cdots\} \frac{\partial \varepsilon^*(\cdot)}{\partial z^{M1}} f(\omega) - C_2^{M1}\left(x^{M1}, z^{M1}\right) = 0, \tag{16}$$

except for the second terms, where $\{\cdots\}$ is now given by

$$\{\cdots\} = (1-\mu_{ACC})\pi_2^{L1}\left(x^{M1}, 1-\varepsilon^*(\cdot);\, \omega\right). \tag{17}$$

Since this kind of project requires implementation capacity in only one unit, the manager will always invest extra in the class of projects for which he receives the highest share of the benefits (and less in the other class of projects) to influence the project selection decision. Even with identical managers, the problem is not neutralised, because the projects by nature are extremely asymmetrical. The suboptimisation problem under Centralisation tends therefore to be worse when the projects have externalities only than when the projects are truly global (assuming that the projects otherwise are identical):

Proposition 10. The underinvestment problem is worse under Centralisation for the research of projects with externalities only than for truly global projects (for which implementation requires participation from more than one unit). The overinvestment problem for the research of local projects is also larger.

Proof. The derivative in (9) is larger than the derivative in (15) for the same investment levels, while the derivative in (10) is smaller than the derivative in (16). These observations are sufficient for the result.

With decentralised project selection, the first-order conditions are given by:

$$\frac{d\Phi_D^{M1}}{dx^{M1}} = \sum_{\omega\in\Omega}\left[\mu_{BAR}\pi_1^{L1}\left(x^{M1}, 1-\varepsilon^*(\cdot);\, \omega\right) + (1-\mu_{BAR})\pi_1^{L1}\left(x^{M1}, 1-\bar{\varepsilon}(\cdot);\, \omega\right)\right] f(\omega)$$

$$- C_1^{M1}(x^{M1}, z^{M1}) = 0 \tag{18}$$

and

$$\frac{d\Phi_D^{M1}}{dz^{M1}} = \sum_{\omega\in\Omega}\left[\mu_{BAR}\pi_1^{E}\left(z^{M1}, \varepsilon^*(\cdot);\, \omega\right) + (\mu_{ACC}-\mu_{BAR})\pi_1^{E}\left(z^{M1}, \bar{\varepsilon}(\cdot);\, \omega\right)\right] f(\omega)$$

$$- C_2^{M1}(x^{M1}, z^{M1}) = 0. \tag{19}$$

Compared to for truly global projects, see (12) and (13), the threat point of Manager 1 has changed as he will use some of his implementation capacity, $\bar{\varepsilon}(\cdot)$, for the projects with externalities even if his unit is not compensated for that by the other unit. Unit 1 receives then the accounting-based share, μ_{ACC}, of the benefits from these projects. The second term in (18) differs therefore from the one in (12), as $\gamma = 0$ is replaced by $\bar{\varepsilon}$, while the second term in (19) is new. The threat point, $\bar{\varepsilon}(\cdot)$, is given by

$$\pi_2^{L1}\left(x^{M1}, 1-\varepsilon;\, \omega\right) = \mu_{ACC}\pi_2^{E}\left(z^{M1}, \varepsilon;\, \omega\right) \quad \text{for all } \omega \in \Omega, \tag{20}$$

while the optimal implementation capacity, $\varepsilon^*(\cdot)$, is given by

$$\pi_2^{L1}\left(x^{M1},\, 1-\varepsilon;\, \omega\right) = \pi_2^{E}\left(z^{M1},\, \varepsilon;\, \omega\right) \quad \text{for all } \omega \in \Omega, \tag{21}$$

where $0 < \bar{\varepsilon}(\cdot) < \varepsilon^*(\cdot)$ (as long as $0 < \mu_{ACC} < 1$). With truly global projects the threat point was zero. A manager's incentives to invest are therefore better aligned with overall company interests:

Proposition 11. Overinvestment is reduced under Decentralisation when the projects have externalities only compared to when they were truly global. The underinvestment in the research of local projects is also less of a problem.

Proof. With $\mu_{ACC} = \mu_{BAR}$, the second term in (19) vanishes and the first-order derivative with respect to z^{M1} is identical to the derivative with respect to y^{M1} found in (13). The derivative with respect to x^{M1} in (18) is, however, smaller than the derivative in (12). There is therefore less overinvestment, which again (indirectly) reduces the underinvestment problem.

Note that the assumption of equal shares under Centralisation and Decentralisation ($\mu_{ACC} = \mu_{BAR}$) is just as valid now as it was for truly global projects, even though the projects with externalities by nature are asymmetrical in nature. If, for some reason, the accounting rules favour the unit that does the research (which by no means is obvious for example for a marketing project in a vertically integrated company), it is equally likely that the manager that controls implementation should have more bargaining power ($\mu_{BAR} > ½$).

Propositions 10 and 11 imply that:

Proposition 12. Delegation is more attractive when global projects have externalities only compared to when implementation required participation from more than one unit.

In other words, the stronger the interdependence between the units, the higher the agency costs associated with delegation. We would therefore expect to see more delegation, the weaker the interdependencies; an insight similar in spirit to the one found in proposition 4. And, with respect to the boundaries of firms, we would expect to see less integration when interdependencies between two units are mostly in the form of externalities; such as the positive effect advertising campaigns have on those firms that supply input. Or, rephrased, we would expect to see more integration the more activities there are on which the units must work together in a coordinated fashion, which is exactly what we seem to observe in the business world (at least after the diversification wave of the 1960s and 70s was reversed in the 1980s, see Shleifer and Vishny, 1994).

In the above discussion I have assumed that when the project selection decision is delegated, a unit benefiting from projects implemented elsewhere can take active part in a $t = 1$ bargaining process to influence the project selection decision. There is one important class of projects, however, where that may not be the case: Projects that are important to the development of *core competencies* (Hamel and Prahalad, 1990). First,

these extra benefits will come at some time in the future, when a local manager might expect to have moved on. And, second, the future project that is expected to benefit from the core competencies could be organised in a new unit. The local managers that are to negotiate the implementation of projects may therefore consider only part of the total benefits and not implement these projects to the extent that a central manager would have wanted. Under these circumstances centralisation will improve the quality of the project selection decision, which again will strengthen a local manager's incentives to invest in the research of competence-building projects.

One would also expect negotiations to be less desirable when externalities are negative in nature. To have to bribe another unit to change a project that otherwise would lead to bad publicity for the whole company will probably be against the values and norms of many managers. An example of this was found in the vertically integrated energy company that I studied, where a development project in the unit producing electricity can affect the unit selling to consumers quite severely if it is considered by the public to be bad for the environment (when consumers are free to switch supplier as they are in Norway). The top managers were indeed very conscious of these effects, and decisions that could lead to bad publicity were made by the corporate management team, with the CEO having the final say.

7. Competitive environment

So far we have assumed that a manager cares only about the profits of the unit he leads. But a local manager may very well take some interest also in the profits made by other units in the company. Some of his compensation might be based on corporate profits, he could be afraid of bankruptcy costs, or he may simply identify with the corporation as such. If a manager would like other units to do well, the environment can be characterised as cooperative. And it is straightforward to show that this will dampen the incentive problems discussed so far, but not eliminate them, as long as a manager takes some special interest in the unit he leads.

More interesting, perhaps, is the question of what will happen if the environment is more competitive, in the sense that a local manager cares about relative profits, Φ^{M1}/Φ^{M2}. Relative performance can be important for a manager because different kinds of rewards are determined by it, such as recognition, bonus payments (from a fixed pool), promotions (Lazear and Rosen, 1981), and the allocation of capital for investments (Scharfstein and Stein, 2000).[11]

With Nash bargaining on utilities, the managers will also now reach the same $t = 1$ decision as the central manager would, as long as the local managers put some weight on

11. In Scharfstein and Stein (2000) weak divisions are allocated more capital, because their managers spend more time at rent-seeking activities. I suspect, however, that to use the profits of earlier years to judge how capable a division is in transforming capital to profits might be an empirically more relevant mechanism. If that is the case, the allocation of capital should be positively correlated to historical profit figures.

absolute unit profits. But the suboptimisation problem in terms of the $t = 0$ investments becomes more severe, as a local manager not only worries about the limited share he gets from these investments but also about how global projects increase the profits of other units.

Consider, for illustration, the extreme case, where a local manager does not care about anything but relative profits. Manager 1 invests then in the research of global projects only if Φ^{M1}/Φ^{M2} increases as a result thereof. Under Centralisation, in the multi-task case discussed in section 5, this fraction is given by

$$\frac{\Phi_C^{M1}}{\Phi_C^{M2}} = \frac{\sum_{\omega\in\Omega}\left[\pi^{L1}\left(x^{M1}, 1-\gamma^*(\cdot);\, \omega\right) + \mu_{ACC}\pi^{G}\left(y^{M1}+y^{M2},\, \gamma^*(\cdot);\, \omega\right)\right] f(\omega) - C^{M1}\left(x^{M1}, y^{M1}\right)}{\sum_{\omega\in\Omega}\left[\pi^{L2}\left(x^{M2}, 1-\gamma^*(\cdot);\, \omega\right) + (1-\mu_{ACC})\pi^{G}\left(y^{M1}+y^{M2},\, \gamma^*(\cdot);\, \omega\right)\right] f(\omega) - C^{M2}\left(x^{M2}, y^{M2}\right)}$$

Assume neutral accounting rules, so that $\mu_{ACC} = ½$. A larger investment by Manager 1 in global projects (y^{M1}) will then increase the net profits of Manager 2 more than the net profits of Manager 1, since only the costs of the latter increase while the gross profits are shared equally. The fraction Φ^{M1}/Φ^{M2} cannot therefore increase in y^{M1} when $\Phi^{M1} \geq \Phi^{M2}$:

Proposition 13. With centralised project research and accounting rules that lead to 50:50 sharing of global profits, a local manager who maximises relative profits will not invest in the research of global projects unless the other profits of his unit are expected to be significantly lower than the profits of the other unit.[12]

The result is perhaps best illustrated with a simple example: Manager 1 contemplates investing 10 000 in the research of a global project, which he expects then will generate a whopping 40 000 in profits to be shared equally among the two units. There are no other projects. The profits without the project (from ongoing operations) are expected to be 50 000 in Unit 2. Even though this global project is clearly profitable for both units, Manager 1 will not go through with the research of it unless his profits without the project are expected to be less than 25 000. Otherwise his relative profits go down. For example, if his stand-alone profits were expected to be 50 000, Φ^{M1}/Φ^{M2} would go down from 1 to $^6/_7$.

In other words, we would under Centralisation expect considerably smaller investments in the research of global projects when the managers are very competitive, compared to when they care about absolute profits. And, we would expect to observe such investments only in the unit that has the poorest prospects otherwise.

Under Decentralisation, the only acceptable bargaining outcome for both managers is the one where the fraction Φ^{M1}/Φ^{M2} remains the same. The problem is that at the time of

12. Note that in the proof one must also consider the indirect effects (as investments influence central project selection). These indirect effects are clearly supporting the result, however, when the marginal benefits from more implementation capacity to a class of projects increase in the absolute level of benefits from those projects, which is a very plausible assumption.

negotiation investment costs are sunk and thus ignored. The fraction that is kept constant is the one with profits from local projects minus the costs of project research. Investing in global projects is therefore always bad:

Proposition 14. With very competitive local managers we would not expect any investments in the research of global projects when the project selection decision is delegated, as investments always will be damaging to the relative profits.

So the delegation of decision authority is a bad idea incentive-wise when the environment is very competitive. Under Centralisation there was at least some chance that one of the managers would invest in global project research.

With Nash bargaining on utilities, there was no need to worry about the $t = 1$ decision. But, it is not obvious that one can expect such efficient bargaining. Because the extreme competitiveness that we discuss here is damaging, it is frowned upon by the central authorities (and others), and a manager will typically not openly disclose his preferences.

In a company where preferences differ among the local managers, maybe because they are at different stages in their careers or their identification with their units and the company differs, hidden preferences can lead to negotiation breakdowns. A local manager who maximises unit profits will perhaps enter the negotiations thinking that a 50:50 split of the extra profits from cooperation would be fair, while the other unit manager would have to get much more than that to not have his relative profits reduced. As is shown in many experiments on the Ultimatum game (Güth et al., 1982; Roth et al., 1991), the former manager may then choose not to accept the demands put up by the latter, to punish him for his unreasonable stance.

To summarise the insights from this section, the more competitive the environment, the more likely the negotiations are to break down when preferences are hidden. And even if the bargaining is efficient, the competitiveness is more damaging to the incentives to invest when the project selection decision is delegated. In other words:

Proposition 15. When there are important benefits from cooperation across units, the delegation of decision authority is less attractive the more competitive the environment.

8. Concluding remarks

A central manager can sometimes make better project selection decisions (for example when significant benefits are ignored by local managers as discussed in section 6). But his intervention has also important incentive implications, as it is followed by the use of a different sharing rule. The focus of this paper has mainly been on the latter effect.

Compared to a bargaining-based sharing rule, the accounting-based rule used under centralisation was shown to perform better in a multi-task environment when managers face similar conditions (section 5). A local manager's incentives to influence his bargaining position (under decentralisation) is then more damaging to local project research than his incentives to influence centralised decisions. For a large range of

parameters, it was, on the other hand, shown that decentralised bargaining is attractive in the single-task case, due to the stronger incentives to invest in productive research on global projects (section 4).

Developing a concept for e-commerce was mentioned as an example of a single-task project, since the project research can be used for local projects if it is not implemented globally. Standardisation work (considered very important by for example Mintzberg, 1983) is typically wasted if the project is not implemented and is thus an example of a multi-task environment.

It was also shown that centralisation with a standard accounting-based sharing rule was less attractive the weaker the interdependencies between the units, either in the sense that other outside parties can fill the partnering role in global projects (section 4) or in the sense that implementation of the project does not require more than one unit (section 6). On the other hand, centralisation is more attractive the more competitive the preferences of the local managers (section 7).

Central managers can do more than (rather passively) select projects at the suggestion of lower-level managers and other employees. They can try to also control the project research work in a more direct way, for example through research units, centres of excellence and corporate-wide work groups. From the theory developed in this paper we can conclude that such central activities are more likely to be observed the more dedicated research that is needed to realise global benefits (for example because they are based on standardisation and economies of scale), the more competitive the environment (for example because benchmarking is used extensively), and the less local managers can be expected to appreciate the full benefits from projects that have long-term strategic value (for example because the pressure for short-term profits is so great).

Of course, in empirical studies one should be careful about also including explanation variables that are ignored in this paper, such as the distribution of knowledge and competencies between central and local managers (Jensen and Meckling, 1986) and the costs of communication (Bolton and Dewatripont, 1994).

Finally, a note on the implications of the theory on the boundaries of the firm: Throughout the paper I have argued that the more room there is for value-creating centralised activities, the more likely we are to observe integration. This conclusion is based on the assumption that centralised authority can be exercised only in an integrated firm. In theory that is not necessarily the case. Also independent firms could negotiate an agreement on the establishment of a centralised authority structure.

In practice, though, there are several problems with such a structure. The vaguer the tasks, and the higher the uncertainty, the more difficult it will be for independent firms to agree on the role of some central authority, since the firms will not worry only about the joint profits but also fight for their own special interests. And, the enforcement of a decision made by the third party can be particularly difficult, even if it is in the best joint interest, since it may have a significant distributive impact. Future losses from being excluded can discipline a firm, but if such and other reputation mechanisms are not

effective, one must rely on court enforcement, which can be slow and ineffective in nature.[13]

An integrated company will not have the same problems. Then the owners of the company, who have the joint surplus in mind, decide the central management team's responsibilities and authority. No bargaining among the sub-units is necessary. Furthermore, the enforcement of central decisions tends to be swifter, as unit managers do not have the same opportunity to appeal to a slow and bureaucratic court system. In a multilayered organisation, a manager may have the opportunity to appeal to executives higher up if she is unhappy with a decision made by her immediate superior. But the company can design much swifter appeal procedures than in an independent court system, and an executive can even refuse to listen to such complaints at all.

And, if an individual in an integrated company refuses to adhere to central directives, then he can be fired as a person. While if the manager is the head of an individual firm (and has the support of the owners of that firm), one must exclude the entire firm, which tends to be less damaging to the manager, since he might keep his job. In other words, a manager in an integrated company will be more inclined to accept centralised decisions that are unfavourable to his unit (but are maximising joint surplus).

Appendix

Proof of proposition 6. Assume identical expectations of the two managers (with respect to both benefits and costs) so that they invest the same in project research at $t = 0$. But allow for states of the world where one unit has much more valuable local opportunities than the other unit. When the local projects of a unit are very attractive, more can be gained from a marginal increase in the implementation capacity that is allocated to the projects. $\pi_2^{L1}(\cdot)$ must therefore be positively related to a state parameter that affects the attractiveness of the local opportunities in Unit 1. And, so should $-\partial\gamma(\cdot)/\partial x^{M1}$: If a local opportunity is very unattractive due to some environmental shock, it will not be implemented regardless of how much research that has been done on it. In other words it is reasonable to assume that $\pi_2^{L1}(\cdot)$ and $-\partial\gamma(\cdot)/\partial x^{M1}$ are positively correlated. Similarly, it is reasonable to assume $\pi_2^{L2}(\cdot)$ and $-\partial\gamma(\cdot)/\partial x^{M1}$ to be negatively correlated. With identical expectations ex-ante for each term, the inequality

$$\mathrm{E}\left[\pi_2^{L1}(\cdot)\frac{\partial\gamma(\cdot)}{\partial x^{M1}}\right] < \mathrm{E}\left[\pi_2^{L2}(\cdot)\frac{\partial\gamma(\cdot)}{\partial x^{M1}}\right]$$

must hold, and the second term in (9) is positive. There is no reason to believe the correlation between $\pi_2^{L1}(\cdot)$ and $\partial\gamma(\cdot)/\partial y^{M1}$ to be systematically different from the correlation between $\pi_2^{L2}(\cdot)$ and $\partial\gamma(\cdot)/\partial y^{M1}$, so the second term in (10) can under these

13. The threat of exclusion can work quite well if the brand name is strong enough, as for hotels under the non-profit membership association Best Western International. Williamson (1985) discusses in detail the shortcomings of court ordering.

circumstances be ignored. The larger derivative in (9) leads to more overinvestment in the research of local projects, and indirectly also to a more severe underinvestment problem in the research of global projects.

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