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Internal Disagreement and Disruptive Technologies

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Abstract. This paper models the adoption by established firms of internally disruptive technologies in that different parts of an organization stand to lose or gain from adoption. When agents disagree with a decision, they impose costs on the firm. The paper shows that any resistance to change that this yields is often accompanied by others who are aggrieved should change not occur. Thus, the firm likely cannot avoid disagreement costs regardless of whether they adopt the technology or not. In some cases, depending on their ability to impose costs, such firms may be more likely to adopt technologies due to internal disagreement.

Keywords: disruption • innovation • internal disagreement • shading

1. Introduction

This paper formally evaluates the notion that internal disagreement can constrain the adoption of radical, or as they are often termed today, disruptive technologies. Careful analyses of cases where established market leaders have faced decisions to evaluate and adopt radical technologies have identified such disagreement between distinct sets of losers and winners as playing an important role in those decisions (Bresnahan et al. 2011). This stands in contrast to the dominant thread in the literature that treats established firms as a single internally aligned entity when making exploration and exploitation decisions associated with radical technological opportunities.¹

A simple intuition suggests that internal disagreement or “politics” is an additional cost established firms face in adopting disruptive technologies. The formal model of internal disagreement developed in this paper, however, demonstrates this simple intuition does not hold in a straightforward manner. It is shown that the very notion of disagreement implies that there are countervailing forces in favor of change and that, whereas on average, resistance to change may dominate, there may, in fact, be settings where such prochange forces cause overadoption.

This has important implications for common prescriptions when faced with resistance to change within organizations. Specifically, if there are internal frictions that increase the costs of adopting disruptive technologies, this is seen as a problem of organizational design to balance the tradeoffs these imply in dealing with frictions directly.² By contrast, the analysis here suggests that internal disagreement may be a natural consequence of facing opportunities to adopt disruptive

technologies and may not be a strong force against such adoption at all.

1.1. Motivating Examples

Examples abound of situations where divisions within an organization were not aligned with respect to how to respond to new technological opportunities. IBM famously pioneered standards for personal computers sold to individual users but eventually exited that business because of conflict with its salesperson-driven model to sell mainframes to businesses. As Bresnahan et al. (2011) document, this was not simply channel conflict but an increase in the daily management of internal political issues.

It was ultimately impossible for the firm to manage both the PC business and its existing large-system business within the same organization. Conflicts arose over the deployment of fundamental strategic assets, IBM’s reputation as a firm, and its relationship to its corporate customers (Bresnahan et al. 2011, p. 239).

Ultimately, the engineering skills required of the two businesses were distinct, and the conflict could not be resolved in a way that allowed both businesses to operate in one company. Similar tensions arose with Microsoft’s response to the threat of the web browser to its operating system (Bresnahan et al. 2011), Blockbuster’s physical retailing conflicts as it invested in meeting the threat from Netflix (Keating 2012), and BlackBerry’s troubles in de-emphasizing hardware priorities for software ones in the wake of the iPhone (McNish and Silcoff 2015).

These are all examples where adoption was arguably delayed on the part of established firms. However, equally, there are cases where overadoption seemingly

occurred. There are numerous examples of the adoption of disruptive technologies occurring ahead of startup entrants who, by definition, face no internal disagreement costs. For example, in the early 2000s, Blockbuster became the first firm to roll out a video-on-demand Internet service. It floundered because of the low take-up of broadband at the time. In 1995, Encyclopedia Britannica was the first encyclopedia to be published on the World Wide Web. It floundered because of conflicts from Britannica's salesforce. Kodak, in the mid-2000s, had the first commercially successful digital camera: the Kodak EasyShare. However, smartphones came to doom the point-and-shoot camera category.³ Finally, there are many recent examples of established firms investing heavily in drone delivery and self-driving vehicles without these technologies finding a sustainable level of use. This paper provides a *potential* explanation of such over-adoption. However, without deeper narratives from historians (like that conducted for IBM), it is not possible to say whether and what caused an internal resolution of disagreement in favor of those who were proadoption.

1.2. Previous Literature

There is a well-established literature across a variety of fields whereby groups opposed to a change can engage in various actions to block or resist that change.⁴ Examinations are more limited using formal theory in the organizational economics literature. Schaefer (1998) builds on the notion of influence costs (Milgrom 1988, Milgrom and Roberts 1988) that are activities undertaken by organization members to alter the distribution of rents in their favor (Muller and Warneryd 2001). Schaefer (1998) observes that when organizations engage in transformational change, perhaps in response to new technology adoption, this can increase the effectiveness of influence and, hence, encourage such costly activities to be associated with that change. Anticipating this, as these costs reduce performance, organizations may be reluctant to engage in transformations except when necessary for survival.

In an unpublished paper, Dow and Perotti (2013) note that when firms are market leaders, they have a cushion, which they term "goodwill," which allows groups who are resistant to change to engage in costly activities to raise costs on the organization if such change is adopted. Faced with credible resistance, organizations cannot achieve valuable change and so choose not to attempt change. This effect is a variation on the notion of cannibalization but with a microfoundation related to vested interests within organizations. Similar to the cannibalization case, this implies that new entrants can have an advantage in adopting radical technologies.

The present paper is in the spirit of Dow and Perotti (2013) in that it focuses on internal disagreement/conflict as an issue that impacts the adoption of radical

technologies. Where it differs is that no agent has the power to subvert change by eliminating its value. Instead, agents can reduce overall firm performance. As will be discussed in detail, the model here is drawn from the literature on contracts with reference points. This literature, which began with Hart and Moore (2008), was itself a response to the need to adjust the microfoundations of contract theory to explain organizational structure and, importantly, the boundaries of the firm.⁵ The model here is based on Hart and Holmstrom (2010), but although their research question centered on the allocation of decision rights centrally (integrated) or dispersed (nonintegrated), here the decision in question, the adoption of a radical or disruptive technology, is one that would be optimally handled centrally in their model. What is examined is how that fact, including the costs associated with it, impacts the technology adoption decision itself.⁶

1.3. Summary of Results

Focusing on the implications of internal disagreement allows for new insights into the challenges established firms face in adopting radical technologies. Beyond simply being a competitive threat to the existing firm's business (what might be called external disruption), the previous motivating examples of internal disagreement and, in some cases, outright conflict highlight the fact that such technological opportunities are internally disruptive. That is, they threaten some parts of an organization but, of necessity, represent positive benefits to others. Without the latter, there would be no incentive to adopt the new technology at all: just to resist it through competition in the marketplace. Thus, this paper defines disruptive technology precisely by its ability to create internal disagreement.

This leads to two further insights. First, although those who will not benefit from a technology's adoption resist change, creating costs if the firm does choose to adopt, those who do benefit promote change. Those agents create costs for the firm if it does not adopt. In other words, once the technology opportunity appears and there is an adoption decision point, the firm cannot "win" in terms of returning to the status quo. It faces the costs associated with internal disagreement regardless of what it chooses to do.

Second, this implies that resistance to change does not occur in isolation. It is accompanied by resistance to the status quo. One will push against adoption, the other toward it. In other words, internal disagreement is not a one-way force but two opposing forces. It could easily be the case, therefore, that internal disagreement could promote adoption as it could resist it. The balance between these two forces determines the outcome. Interestingly, it is shown that this impact on the ultimate technology adoption decision is driven by the joint impact on divisions rather than disproportionately favoring some divisions over others, save for other

factors driving their relative scope to impose costs on others if their preferences are not met. When their relative abilities to impose such costs are equal, the technology adoption decision is unchanged by the potential for internal disagreement, even if that disagreement does ultimately result in costs for the firm.

The remainder of the paper proceeds as follows. In Section 2, the model is set up, and the important elements are introduced. In Section 3, the technology adoption decision is explored in the face of internal disagreement. Section 4 then examines whether restructuring can be used to mitigate internal disagreement costs. A final section concludes.

2. Model Setup

The model environment here is based on Hart and Holmstrom (2010). That model was created to explore the scope of the firm and whether decision rights are allocated centrally or to division managers. As will be demonstrated within the scope of their model, here, the decision in question, whether to exploit a radical/disruptive technology, is one that is optimally undertaken centrally. Thus, the issue is not whether it ought to be decentralized (it should not) but instead the outcomes of the decision itself.

In the economy, there are two classes of resources: A -resources and B -resources. They can be used separately or combined to produce different outputs q_A , q_B , and q_{AB} . Let v_i be the value accruing to the firm producing q_i and v_{AB} be the value to the firm producing q_{AB} . In what follows, we assume, for simplicity, that $v_{AB} = \gamma(v_A + v_B)$; that is, the contributions of A - and B -resources are additive as γv_A and γv_B , respectively. It is also assumed that $\gamma > 1$, which, as will be seen, will capture the notion that combining the resources of A and B can, in the status quo, generate more value than could be achieved if they were separate (assumed to be v_A and v_B , respectively).

A firm comprises two divisions, $i \in \{A, B\}$. Each has its own manager, a and b , respectively, and each exclusively provides one of the two classes of resources. There is also a central manager, c , who has the authority to take decisions that impact both divisions. Specifically, c can choose to undertake actions that redeploy resources in each division to other activities.

Here it is supposed that the resources of the two divisions can be deployed in a coordinated or noncoordinated manner. In the status quo (i.e., prior to the emergence of any new technological opportunity), if the resources of the two divisions are deployed to separate ends (e.g., to produce distinct products), each division generates value of v_i for a total of $v_A + v_B$. If the resources are deployed in a coordinated manner, they generate γv_i , which comes to $\gamma(v_A + v_B)$ in total. As $\gamma > 1$, it is optimal to pursue the coordinated outcome, and it will be assumed that is the case unless otherwise explicitly reverted in what follows.⁷

2.1. Technological Opportunity

At some point, a new technological opportunity arises. The action to be decided, denoted by $x \in \{0, 1\}$, that is the focus of its paper, is whether to adopt the new technology (that is, set $x = 1$) or to not adopt it and continue with the status quo (that is, set $x = 0$). If the technology is adopted it is assumed that this will use only B -resources and not A -resources.⁸ If the firm wishes to exploit that opportunity (i.e., set $x = 1$), it must redeploy its internal resources.⁹ We assume that redeployment of each resource type costs $D > 0$ incurred at the division level; that is, redeployment reduces the value created by D for each division and $2D$ in total. The new opportunity can generate V in value from the use of B -resources alone. This means, however, that the output that combines the use of both resource classes would no longer be supplied. In this case, the A -resources would be devoted to their independent activity. We will assume that $v_A \geq D$ so that redeploying A -resources is worthwhile.

It is instructive to set a benchmark for adoption. Absent internal disagreement consequences to be outlined later, a profit-maximizing firm will want to adopt the new technological opportunity if $V + v_A - 2D \geq \gamma(v_A + v_B)$ or rearranging terms:

$$V \geq \bar{V} \equiv \gamma(v_A + v_B) - v_A + 2D.$$

Thus, we will say that an adoption decision is *efficient* (in that it maximizes value created by the firm) if adoption occurs when $V \geq \bar{V}$ and does not occur when $V < \bar{V}$. However, this criterion for efficiency still takes into account the *replacement effect*, that is, the profits earned in the absence of adoption (i.e., $\gamma(v_A + v_B)$). Therefore, when we talk about efficiency, it is with respect to the position of an established firm.

It is also instructive to note here what adoption would do to the payoffs of each division. For b , their payoff would change from γv_B to $V - D$. It is easy to see that if adoption is valuable for the firm as a whole, then $V - \gamma v_B > D$. However, it is possible that $V - \gamma v_B > D$ even if $V < \bar{V}$. For a , however, their payoff would change from γv_A to $v_A - D$. Given this, it is clear that $\gamma v_A > v_A - D$ holds regardless of V . This illustrates a key feature of a radical/disruptive technology: It creates internal discord as the benefits fall disproportionately to one division rather than another relative to the status quo (of $x = 0$).

In the Hart and Holmstrom (2010) world, this conflict implies that the only agent who can take the decision to adopt the new technology would be c (see also Hansmann 1996). If the coordination of a and b was required to adopt the technology, a would effectively veto that change absent another coordinating mechanism. Thus, the decision of whether to adopt this technology optimally must lie with c .

2.2. Aggrievement and Shading

Absent any issues or disagreement internal to the firm, c will choose to adopt the new technology if it is profitable for the firm as a whole; whenever $V \geq \bar{V}$. However, the main question being examined here is what happens if there is internal disagreement? Addressing this requires including both internal disagreement and, more critically, its consequences. Disagreement itself is straightforward as division managers, a and b , are assumed to care about how the adoption decision for the technology impacts the profits from their own divisions. However, how does this disagreement translate into costs or, more to the point, costs that impact the decision maker, c ?

In considering this, the modeling choice made here is to follow the approach of Hart and Holmstrom (2010) where disagreement leads to aggrievement, which, in turn, leads to shading: a way in which costs are internalized (partially) by c . Their approach is to assume that aggrievement arises when there are changes to default or status quo positions when those changes have distributional consequences. The end result is that c , due to those costs, will take into account the intensity of internal disagreement that arises from their decision. Hart and Holmstrom (2010) offers a way of microfounding those costs that have the advantage of being straightforward. However, as we will see, it also involves extremely strong behavioral assumptions in its precise specification. There are possibly more elaborate specifications that can relax some of these assumptions (and these will be commented on shortly), but here the choice is made to follow Hart and Holmstrom (2010) as closely as possible to provide a clear bridge to the previous literature. Taken at face value, the model here is an exercise in exploring the implications of their specification on the choice of disruptive technology adoption.

The starting point for analysis is the status quo (or $x = 0$) that determines the utility, $u_i(0)$, of each of the three agents, $i \in \{c, a, b\}$ in the model. That is, $u_c(0) = \gamma(v_A + v_B)$, $u_a(0) = \gamma v_A$, and $u_b(0) = \gamma v_B$. This status quo is one element that drives expectations of division managers in terms of what they believe they are entitled to from employment. Specifically, they will feel aggrieved if a decision is taken that reduces their utility below this status quo baseline; that is, if $u_i(1) < u_i(0)$. However, in addition, both a and b are also assumed here to feel entitled to the additional utility that would come if an opportunity to increase their well-being were made available; that is, if $u_i(1) > u_i(0)$. Although in Hart and Holmstrom (2010), agents' aggrievement is solely driven by a potential utility loss from the status quo, here, precisely because production is taking place in a dynamic environment that may be impacted by technological change, part of what agents "signed up for" is that opportunities to improve their utility would be taken. As we will see, when those opportunities involve

differential losses and gains to different agents, internal disagreement arises.

It is on the consequences of aggrievement that the model here follows the specification of Hart and Holmstrom (2010). That approach itself uses the Hart and Moore (2008) setup regarding how decisions can generate aggrievement (in our case, for the managers a and b), and the costs of that aggrievement can be pushed back onto the decision maker (in our case, c).¹⁰ Specifically, a "... party who does not receive what he feels entitled to is aggrieved and shades on performance. We assume that shading reduces the payoff of the shaded against party but does not affect the payoff of the party doing the shading. Shading creates deadweight losses" (Hart and Holmstrom 2010, p. 492).

The origin of this notion is Hart and Moore (2008). They were examining rigidity in contracting and noting that contracts that are more rigid (i.e., in constraining decision rights) have the benefit that there are fewer ways a decision maker can take actions that impact what parties to the contract are entitled to. If, however, there is a desire for contractual flexibility, this comes at the cost that decisions may be taken that impact what parties feel they are entitled to. Such decisions will lead to aggrievement for those parties, and they will reduce their performance. The mechanism by which Hart and Moore (2008) model this reduction in performance is what Hart and Moore (2008) refer to as shading. Shading is a form of retaliation. Here aggrievement arises, not solely because of a loss in terms of entitlement, but when those with decision rights make decisions that are not others' preferred outcomes. Importantly, we will follow Hart and Holmstrom (2010) that there are no opportunities to engage in ex post renegotiation once a decision to adopt or not adopt the new technology is made.¹¹ However, also because c is the holder of decision rights, it is assumed here that c does not feel aggrieved with their own decision even if it is influenced by the need to take into account the disagreement costs imposed by shading.¹²

How shading works is as follows: suppose that agent i 's payoff if an action, x , is taken is reduced by $k_i(x)$ relative to their preferred action. Then, if that action is actually taken, their utility becomes

$$U_i = u_i(x) - \max\{\theta_i k_i(x) - \sigma_i, 0\},$$

where $0 < \theta_i < 1$. Agent i faces a cost of aggrievement, $\theta_i k_i(x)$, but that cost can be alleviated by their own choice of shading, σ_i . It is clear here that under this specification for costs, i has an incentive to set $\sigma_i \geq \theta_i k_i(x)$; however, as they are indifferent to $\sigma_i > \theta_i k_i(x)$, it is assumed here (again following Hart and Moore (2008) and Hart and Holmstrom (2010)) that i will choose $\sigma_i(x) = \theta_i k_i(x)$. This specification embeds a strong behavioral assumption that shading is an individual

choice of an agent to alleviate their own aggrievement costs but not a tool aimed at directly influencing c 's decision. Nonetheless, even without a direct influence motivation, c 's utility from choosing x becomes

$$U_c = u_c(x) - \sigma_a(x) - \sigma_b(x) \\ = u_c(x) - \max\{\theta_a k_a(x), 0\} - \max\{\theta_b k_b(x), 0\}.$$

Thus, shading represents a deadweight loss to the firm and is a mechanism by which the decision maker will partially internalize the losses felt by some agents.¹³ Although there are numerous interpretations of such shading, one convenient interpretation is that it represents a reduction in productivity by the aggrieved agent due to what would otherwise be intrinsically motivated or motivated by career concerns to maintain a good internal reputation.¹⁴ However, operationally, shading transfers utility from the aggrieved agent to the decision maker. As described by Hart and Moore (2008, p. 5), “the idea [is] that aggrievement of \$1 causes a direct psychic loss to the party experiencing it of \$ θ , but that the party can offset this by shading, that is, in effect by transferring the hurt back to the other party, up to the point where the aggrievement disappears.”¹⁵

As we will see, other than shading choices, the only decision being made is whether to adopt the new technology or not; that is, $x \in \{0, 1\}$. That decision is being made by c . Thus, the only other agents being affected are a and b , the division managers of A and B that we take as proxies for all the affected agents on those divisions and whose shading, if any, represents the aggregate total of shading by affected (and aggrieved) agents. Therefore, the anticipation of shading and any payoff impacts felt by c will play a role in c 's choice of technology adoption. Specifically, c will be reluctant to choose an action that will reduce the payoffs of other agents relative to the status quo.

2.3. Timeline

With these elements in place, the model timeline can be specified. As is depicted in Figure 1, the model begins when a technological opportunity emerges. This precipitates a decision on the part of c as to whether to adopt the new technology or not. Following this, if they are aggrieved, a and b choose whether to shade or not, after which the payoffs to c , a and b are realized. As we have already noted, it is a best response for a and b to shade

up to a point that offsets their own aggrievement as a result of c 's decision. In anticipation of this, c makes the adoption decision. In what follows, therefore, we focus on subgame perfect equilibria that result from this model setup.

3. Technology Adoption Decision

We are now in a position to analyze the technology adoption decision that the firm faces when the technological opportunity appears. In particular, absent internal disagreement and its consequences, the firm (that is, c) must still consider the replacement of current activities, and its profits, $\gamma(v_A + v_B)$ if they choose to adopt. They must also consider the cost of adoption in terms of the redeployment of resources, $2D$. Finally, the firm must consider the loss arising from aggrievement and shading.

Taking this all together, if c chooses to adopt the new technology, the expected payoff is

$$V + v_A - 2D - \theta_a((\gamma - 1)v_A + D) \\ - \theta_b \max\{D + \gamma v_B - V, 0\}.$$

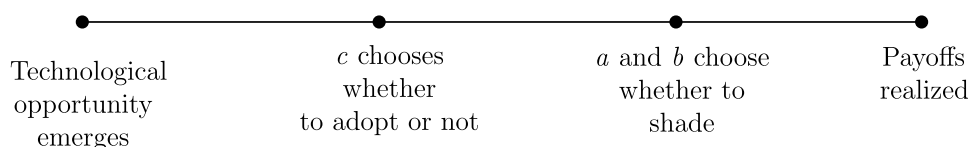
The two last terms arise because adoption reduces a 's payoff by $\gamma v_A - (v_A - D)$ and potentially reduces b 's by $\gamma v_B - (V - D)$, and so they shade on this basis. If, however, the firm chooses not to adopt the technology, its expected payoff is

$$\gamma(v_A + v_B) - \theta_b \max\{V - \gamma v_B - D, 0\}.$$

Note that a is never aggrieved by a decision not to adopt the technology. This also implies that the firm will never adopt the technology if b is aggrieved by adoption; that is, if $V - D < \gamma v_B$. Therefore, for ease of exposition in what follows, we will simply assume that $V - D > \gamma v_B$. An implication of this assumption is that the payoff from not adopting the technology is potentially different from the status quo payoff of $\gamma(v_A + v_B)$. This is because the arrival of the technological opportunity means that b will be aggrieved if the firm does *not* adopt the technology. In other words, internal discord implies that the firm may suffer from disagreement and its consequences regardless of whether it adopts the technology or not. It is the very fact that the opportunity arises that means that the firm can potentially not escape internal disagreement.

Given that $V - D > \gamma v_B$, a necessary and sufficient condition for the firm to adopt the technology is if the

Figure 1. Model Timeline



following inequality holds:

$$\begin{aligned} V + v_A - 2D - \theta_a((\gamma - 1)v_A + D) \\ \geq \gamma(v_A + v_B) - \theta_b(V - \gamma v_B - D). \end{aligned} \quad (1)$$

This arises from a comparison of c 's expected payoffs from adoption and nonadoption. This comprises the replacement effect identified earlier, which is a constraint on adoption and the cost from internal disagreement. That cost is $\theta_a((\gamma - 1)v_A + D) - \theta_b(V - \gamma v_B - D)$ and may not be positive if V and θ_b are sufficiently high.

The interesting question is how does this compare with the efficiency benchmark for adoption noted earlier; that is, the decision of a firm that did not face internal disagreement?

Proposition 1. (i) If $\theta_a = \theta_b$, then the technology is adopted if and only if it would be adopted in the benchmark with no shading (i.e., $V \geq \bar{V}$). (ii) If $\theta_a > (<) \theta_b$, then there is too little (too much) adoption relative to the benchmark with no shading.

Proof. We will first prove part (ii) of the proposition with part (i) as its implication.

Suppose that $\theta_a \neq \theta_b$. From Equation (1), the technology is not adopted if and only if $(1 + \theta_b)(V - \gamma v_B - D) < (1 + \theta_a)((\gamma - 1)v_A + D)$. Rearranging, we have:

$$\frac{1 + \theta_a}{1 + \theta_b} > \frac{V - \gamma v_B - D}{(\gamma - 1)v_A + D}.$$

The right-hand side (RHS) is strictly increasing in V . When a and b have the same power to shade (i.e., $\theta_a = \theta_b$), the left-hand side (LHS) becomes one, and the inequality holds with equality only when $V = \bar{V}$. When $\theta_a > \theta_b \geq 0$, the LHS is strictly greater than one, implying that at $V = \bar{V}$, the condition for nonadoption would be satisfied. Thus, there is underadoption relative to the case without shading. Conversely, the technology is adopted if and only if

$$\frac{1 + \theta_a}{1 + \theta_b} \leq \frac{V - \gamma v_B - D}{(\gamma - 1)v_A + D}.$$

In this case, when $\theta_b > \theta_a \geq 0$, then the LHS is strictly less than one, and so at $V = \bar{V}$, this inequality is satisfied strictly implying that there is overadoption relative to the case without shading.

If $\theta_a = \theta_b$, the previous inequality for adoption becomes

$$1 \leq \frac{V - \gamma v_B - D}{(\gamma - 1)v_A + D} \leftrightarrow V + v_A - 2D - \gamma(v_A + v_B) \geq 0,$$

where the LHS is nonnegative if and only if $V \geq \bar{V}$. $\square$

The result that adoption can be deterred if θ_a is relatively high is not surprising because a is guaranteed to be aggrieved should adoption take place.¹⁶ The more surprising result is that there can be too much adoption in the presence of shading. This arises because, if the firm chooses not to adopt the new technology, b , who

stood to benefit from that adoption, will become aggrieved. In other words, when a technological opportunity creates disagreement among divisions in a firm, this generates both resistance to change and resistance to the status quo. With shading, c partly internalizes each of these effects, which may constrain or push them toward adoption, as the case may be. Critically, this means that, just because a new technological opportunity is radical/disruptive, does not mean that we should presume that an established firm will be less likely to adopt that technology when there is internal disagreement. The finding here is that the decision depends on the net impact of the conflicting preferences.

In summary, it is the arrival of technological opportunity giving rise to an adoption decision that represents a disruption to the status quo. When each $\theta_i > 0$, there is no going back to status quo outcomes for c ; c must either adopt the technology and face aggrievement from a or not adopt it and face aggrievement from b . The possibility of aggrievement distorts the adoption decision and may diminish or increase adoption depending on the capacity/ability of each division to shade effectively. If their ability to shade is symmetric (i.e., $\theta_a = \theta_b$), there is, interestingly, no distortion in the adoption decision, although internal disagreement does emerge. Thus, there is an incentive to counter internal disagreement, although potentially not to ensure the adoption decision is not distorted.¹⁷

4. Countering Internal Conflict

Given that internal disagreement imposes costs when disruptive decisions arrive, it is instructive to consider some tools that might potentially mitigate those costs. These will be reviewed in this section, although these have their own costs that may render them ineffective.

4.1. Side Payments

Aggrievement arises because division managers are potentially disadvantaged by a decision taken. A natural tool to mitigate this disadvantage is to use side payments. That is, suppose that a decision is made that causes aggrievement by agent i of k_i . Then c could create a payment to i of k_i , causing i to have no aggrievement and hence, no incentive to engage in shading. Would c find it worthwhile to commit to that payment when making the decision?

To consider this, suppose that if the technology is adopted, then a payment to a of $(\gamma - 1)v_A + D$ could be made, eliminating a 's potential aggrievement. However, this would change c 's payoff from technology adoption to

$$V + v_A - 2D - (\gamma - 1)v_A - D = V + 2v_A - \gamma v_A - 3D.$$

This is *lower* than its payoff without a side payment to a because $\theta_a < 1$. Thus, this means of countering the costs

of internal disagreement is, under the shading assumptions of Hart and Moore (2008), more costly than just bearing those costs.¹⁸

It is arguable that dismissing side payments in this way could be taking the model too seriously. For instance, the cost to a may be personally lower than $(\gamma - 1)v_A + D$ even if the effect of shading is as modeled.¹⁹ However, it is equally the case that shading and aggrievement involve more than just a but all employees of the A division. In this case, the magnitude of side payments may be considerably higher. Finally, side payments would themselves require commitments that may be hard for the firm to make upfront payments that may themselves not discourage continual aggrievement. The point here is that a simple monetary payoff is unlikely to be an effective practical tool to counter internal disagreements.

4.2. Shared Control

Side payments were designed to reduce aggrievement directly, which meant turning a conflict of interest into an alignment of interests for decisions the potentially aggrieved had no rights over. Meyersson-Milgrom et al. (2022) offer a model whereby control over decisions might be shared by awarding veto rights to affected groups. In terms of the model considered here, such shared control may be achieved by allowing a and b veto rights over decisions to adopt or not adopt the new technology.

On the face of it, such shared control seems like it might only enhance the disruption caused by internal disagreement and create a deadlock (e.g., as suggested by Hansmann (1996)). However, it allows bargaining to take place in the shadow of such veto power. By not exercising a veto, a potentially aggrieved party participates in the decision and so is not aggrieved. Thus, the internal dispute moves to explore tools by which a or b can be persuaded not to use their veto.

Nonetheless, it is worth noting that Meyersson-Milgrom et al. (2022) find that such shared control typically does not lead to the optimal decision being taken. Thus, although it may mitigate the costs of internal disagreement, there may be too little or too much adoption regardless. A full exploration of this issue, however, is left for future research.

4.3. Independence and Restructuring

A final set of tools that could potentially mitigate internal disagreement involve changing the structure of the firm. For instance, the potential for disagreement and resistance was recognized by Christensen and Raynor (2013), who recommended that, in lieu of such disruption, incumbents set up separate independent units to explore and exploit the technology. Bresnahan et al. (2011) showed that IBM did this when it launched its PC

business, only to reverse course when the disruption costs to its mainframe business became too large.

One method of achieving independence is through *acquisition*. Rather than disrupt the business that combines A and B resources, c could draw B resources externally and build a separate division to pursue the technological opportunity. If those resources were previously in their separate use (earning v_B), then as long as $V - v_B > D$, this would be feasible.

However, an open question is what impact this would have on b ? There are two cases to consider:

1. **b remains managing the original business.** It is entirely possible that b could end up shading $\theta_b(V - \gamma v_B - D)$ as they miss out on being redeployed to the new opportunity. In this case, c would choose to adopt the technology if

$$V - D - \theta_b(V - \gamma v_B - D) \geq v_B \Rightarrow (1 + \theta_b)(V - D) \geq \theta_b \gamma v_B.$$

Thus, there would be a lower level of technology adoption than if shading was not possible. This would, however, be preferable to redeploying existing resources if

$$\begin{aligned} V - \theta_b(V - \gamma v_B - D) - (v_B - D) &\geq V + v_A - 2D \\ &\quad - \theta_a((\gamma - 1)v_A + D) \\ \Rightarrow \theta_a((\gamma - 1)v_A + D) - \theta_b(V - \gamma v_B - D) &\geq v_A + v_B - D. \end{aligned}$$

If $\theta_a = \theta_b = \theta$, this becomes

$$V + v_A - 2D - \gamma(v_A + v_B) \leq -\frac{v_A + v_B - D}{\theta}.$$

Thus, acquisition, when the technology is adopted, is only preferable if $V < \bar{V}$, which under these assumptions would make technology adoption undesirable.

2. **b is transferred to manage the acquired B division and the new opportunity.** In this case, b will not be aggrieved. The issue is whether b 's transfer would impact the legacy business and hence itself cause a to be aggrieved. This would depend on how scarce b 's skills/talent are.

What this analysis shows is that resource acquisition, if possible, might mitigate some aggrievement but only if the relevant human skills were not scarce. This highlights that resource and talent scarcity are really what drive internal disagreements and their consequences. As Bresnahan et al. (2011) emphasize, these shared resources are a source of organizational diseconomies of scale. If these are present, then restructuring to simply acquire more resources may be insufficient to mitigate the costs of internal disagreement when pursuing a new technological opportunity.

A final restructuring option is a divestiture, in this case, of the A division. However, if c internalized the value of these assets, the decision to divest the A

division would itself involve shading within that division, lowering its value accordingly.

Thus, we see that a form of restructuring would not mitigate internal disagreement and may result in distorted technology adoption decisions.

5. Conclusion

The academic literature on disruption focuses on the characteristics of technologies that make such technologies difficult to evaluate by established firms in the face of a wedge between the incentives of those firms compared with new entrants to adopt those technologies (Gans 2016). Although this may lie behind the failure of successful firms, many outside of management academia emphasize the disruptive nature of those technologies based on the plain meaning of the word “disruption.” They see such technologies as creating conflict within organizations that cause those organizations to struggle to adopt those technologies (Lepore 2014). Academics studying disruption have paid relatively scant attention to the role of internal conflict.

This paper considers that conflict by explicitly using, as a framework for the costs of internal conflict, the model of Hart and Holmstrom (2010). It finds that informal intuitions that internal conflict would clearly lead to resistance to adopt more radical technologies are not borne out. Instead, conflict can also arise from decisions not to adopt those technologies from internal divisions that may benefit from them. As such technologies are characterized by their being internal winners and losers, it is the very *opportunity* to adopt such technologies that leads to internal conflict, makes it impossible to completely avoid, and makes it hard to predict unambiguously that such conflict will be a restraint on technology adoption. Instead, that adoption decision is molded by the balance of competing interests, and in an important case, those balance each other out. Conflict does not distort the adoption decision of technology at all.

Nonetheless, the model presented here is a first step in understanding how new technological opportunities shape internal conflict and its costs. Firms may structure themselves to reduce such costs and that may in turn impact long-run performance. Startup firms not facing such costs still have to procure resources from potentially reluctant outsiders, and that may make a comparison between their incentives and those of incumbents more subtle (Gans 2022). All these areas remain fruitful paths for future research that looks to understand disruption with a broader lens than past academic focus in corporate strategy and innovation management.

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Endnotes

¹ Typically, the focus is on how such technologies replace/cannibalize existing assets or product lines (Arrow 1962), face resistance from existing customers (Christensen 1997), or do not fit within existing product development processes (Henderson and Clark 1990). In each case, by virtue of being an established incumbent, these firms face incentives and costs that can make them slow or unable to adopt those technologies (Schumpeter 1942, Arrow 1974). That there are factors that appear to hold established firms back in the adoption of significant or radical innovations has received empirical support (Henderson 1993, Igami 2017).

² Sometimes, those design decisions, which often create conditions where firms can be insulated from outside shocks, may leave those firms exposed and slower to respond than others (see the excellent review by Garicano and Rayo 2016). At the same time, such design decisions focussed on insulating the firm from disruption push aside significant internal discord that these opportunities might surface (Lepore 2014).

³ Details of all these examples can be found in Gans (2016).

⁴ See the review by Garicano and Rayo (2016), who note this research question being addressed in the politics and political economy literature and being implicit in the literature on control rights when contracts are incomplete.

⁵ See, for example, Hart and Moore (2007); Hart (2008, 2009); Fehr et al. (2009, 2011); and Frydinger and Hart (2019).

⁶ van den Steen (2010) provides another approach to disagreement based on differing beliefs regarding how, say, a new technology will perform. This perspective is also explored in Gans (2022).

⁷ It is assumed that divisional managers are incentivized to care about the monetary profits of their divisions only. This could be justified by assuming that it is impossible for a firm to commit to cross-subsidized incentives that are beyond the value attributed to each division. Thus, in contrast to Hart and Holmstrom (2010), we do not assume any separate incentive conflict between divisional managers and the central manager. They had assumed that in addition to the monetary division profit, v_i or γv_i as the case may be, divisional managers also received a private benefit they termed “job satisfaction” that accrued to divisional managers only and was maximized when they did not coordinate with other divisions. In other words, this drove a wedge between the interests of the divisional and the central manager that made coordination more difficult to achieve if divisional managers had decision rights. Here, however, without these private benefits, in the status quo, the firm can operate smoothly and achieve coordination regardless of whether divisional or central managers have decision authority over whether to coordinate or not. Thus, the outcomes under centralized versus decentralized control are the same. This allows us to focus on how, when a new technological opportunity arises, this disrupts the firm as this change, as will be discussed in detail later, does drive a wedge in interests between the agents.

⁸ This is an extreme assumption, and the following would hold if the new opportunity involved a significantly higher share of B -resources than A -resources.

⁹ Later, we will explore what happens if the firm can procure the necessary resources externally.

¹⁰ There are other ways of achieving similar results. For instance, the costs could be direct as in Milgrom (1988) or the ability to simply reduce the stock of intangible firm assets as in Dow and Perotti (2013).

¹¹ Hart and Holmstrom (2010) justify this assumption based on the fact that ex post, there are only opportunities for a redistribution of the rents available and, thus, there is no avoiding one or more parties feeling aggrieved.

¹² Hart and Holmstrom (2010) who examine the allocation of decision rights rather than a particular decision assume that when the equivalent to c here holds decision rights, c will feel aggrieved and shade their overall performance if they are forced to change their decision to minimise the costs of shading by others. Here, however, c , is really the residual owner of the firm, and so the view is taken that they do not feel aggrievement when there are potential disagreement costs they are trying to avoid.

¹³ There is some empirical (Coviello et al. 2022) and experimental evidence (Fehr et al. 2011) that this occurs.

¹⁴ See Hart and Moore (2008) for a more extensive discussion including shading by cutting quality, cost-padding, working to rule, or incessant complaining.

¹⁵ Rather than shading, it is possible to imagine wage effects that may have a similar implication of transferring utility from an aggrieved agent to c . For instance, suppose that agent i 's utility in alternative employment is $\bar{u}_i$. Prior to the technological opportunity arising, the wage is set so that $u_i(0) + w = \bar{u}_i$. In this case, if i 's utility is reduced by $\theta_i k_i(x)$ as a result of a decision of x , then the wage would have to rise from $w = \bar{u}_i - i_i(0)$ to $w = \bar{u}_i - (u_i(x) - \max\{\theta_i k_i(x), 0\})$. Thus, rather than shading, c would have to take into account any resulting change in wages caused by a loss of i 's perceived utility in their current employment. This is only a sketch of a mechanism, of course, since care would need to be taken about the full labor market and how aggrievement and other performance incentives may coalesce in a full equilibrium. Such mechanisms are left for future work.

¹⁶ The expression $\theta_a > \theta_b$ could arise from loss aversion as a may feel more strongly about the loss of their status quo position than b who is reacting to the loss from a potential position (Kahneman and Tversky 1979). It is beyond the scope of this paper to analyze the determinants of such outcomes. The contribution here is to identify the relative strengths of θ_a and θ_b as being the drivers of whether there is overadoption or underadoption of disruptive technologies by established firms.

¹⁷ There are additional considerations that can be explored with regard to the main result here. First, it is possible to add uncertainty regarding the technological opportunity and its value and how the need to persuade agents internally might guide the type of experiments a firm might use to reduce that uncertainty (see Gans (2022) for an exploration of this situation). Second, the model here has a high level of aggregation. It would be of interest to explore lesser degrees of aggregation, especially those that might match specific empirical settings. Finally, this paper has focussed on incumbents and that a startup would not face the costs associated with replacing the profits from older technologies (Arrow 1962). The model, therefore, is not built to properly compare startup versus incumbent incentives to exploit new technologies. This issue is taken up in Gans (2022).

¹⁸ In Hart and Holmstrom (2010), this argument may not hold because, in their environment, it is assumed that division managers also have their own private benefits from making decisions that do not accrue to the central manager but are not realized for certain central manager decisions.

¹⁹ This is the case in Dow and Perotti (2013) whose model has the equivalent of a only imposing costs on the firm if the benefits to them from doing so outweigh their own costs. Thus, it may be here that $\theta_A(\cdot)$ is generated alongside a net private benefit to a that could be somehow taxed.

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