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Joshua S. Gans

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ABSTRACT

This paper models the adoption by established firms of technologies that are internally disruptive 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 this yields is necessarily accompanied by others aggrieved should change not occur. Thus, the firm 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 as a result of internal disagreement.

Joshua S. Gans
Rotman School of Management
University of Toronto
105 St. George Street
Toronto ON M5S 3E6
and NBER
joshua.gans@rotman.utoronto.ca

1 Introduction

There is a sizeable literature that examines the challenges successful, established firms face in adopting radical, or as they are often termed today, disruptive technologies. 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 technology adoption costs that other firms, in particular, entrants or startups, do not face. This 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 (notably, Henderson (1993) and Igami (2017)).

A common presumption the literature is that the firm acts as a single, internally aligned entity when evaluating and making exploitation decisions regarding these new technological opportunities. This is not to say that internal frictions do not exist. However, the literature treats them as being resolved in organizational design decisions that balance trade-offs. Sometimes those design decisions may leave those firms exposed and slower to respond than others (see the excellent review by Garicano and Rayo (2016)) but, at the same time, these push aside significant internal discord that these opportunities might surface (Lepore (2014)).

Examples abound, however, of situations where internal divisions within an organisation 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 allow 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 to meet 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)).

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.[1] Examinations are more limited using formal theory in the organisational economics literature. Schaefer (1998) builds on the notion of influence costs (Milgrom (1988), Milgrom and Roberts (1988)) that are activities undertaken by organisation members to alter the distribution of rents in their favour (see also Muller and Warneryd (2001)). Schaefer (1998) observes that when organisations 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, organisations 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 organisation if such change is adopted. Faced with credible resistance, organisations cannot achieve valuable change and so choose not to attempt change. This effect is a variation on the notion of cannibalisation but with a microfoundation related to vested interests within organisations. Similar to the cannibalisation 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 on 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. Here the model is motivated by 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 organisational structure and, importantly, the boundaries of the firm.[2] The model here is based on Hart and Holmstrom (2010) but while their research question centered on the allocation of decision rights centrally (integrated) or dispersed (non-integrated), 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, impact on the technology adoption decision itself.[3]

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

[2] See, for example, Hart and Moore (2007), Hart (2008), Hart (2009), Fehr et al. (2009), Fehr et al. (2011) and Frydlinger and Hart (2019).

[3] 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).

Taking this perspective 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 above 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 organisation 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, in this paper, we define disruptive technology precisely by its ability to create internal disagreement.

This leads to two further insights. First, while 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 towards 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 how this impacts on the ultimate technology adoption decision is not related to the extent of harm or benefits to different organizational divisions as it is to the degree to which they can impose costs if a decision is not made according to their preferences. 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 setup and the important elements 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 optimally is undertaken centrally. Thus, the issue is not whether it ought to be decentralised (it should not) but instead the outcomes for 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}, respectively. 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 $v_{AB} = \gamma(v_A + v_B)$.

A firm is comprised of 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 on 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 non-coordinated 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. If $\gamma > 1$, it is optimal to pursue the coordinated outcome and it will be assumed that is the case unless otherwise explicitly reverted in what follows.

It is assumed that divisional managers are incentivised to care about the monetary profits of their divisions only.[4] 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 maximised when they did not coordinate with other divisions. In other words, this drove a wedge between the interests of 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 centralised versus decentralised 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 below, does drive a wedge in interests between the agents.

[4]This could be justified by assuming that it is impossible for a firm to commit to cross-subsidised incentives that are beyond the value attributed to each division.

2.1 The technological opportunity

At some point, a new technological opportunity arises. That opportunity is assumed to utilise only B-resources and not A-resources.[5] If the firm wishes to exploit that opportunity, it must redeploy its internal resources.[6] We assume that redeployment of each resource type costs $C > 0$ incurred at the division level. 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 $v_A \geq C$ so that redeploying A-resources is worthwhile.

It is instructive to set a benchmark for adoption. Absent internal disagreement consequences to be outlined below, a profit maximising firm will want to adopt the new technological opportunity if:

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

Thus, we will say that an adoption decision is *efficient* if adoption is made if $V \geq \bar{V}$ and not if $V < \bar{V}$. Note, however, that this criterion for efficiency still takes into account the *replacement effect*, i.e., the profits earned in the absence of adoption (i.e., $(\gamma-1)v_A+\gamma v_B+C$). This is a measure of *external disruption*.[7] 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 $V - C$. It is easy to see that if adoption is valuable for the firm as a whole, then $V - \gamma v_B > C$. Note, however, that it is possible that $V - \gamma v_B > C$ even if $V < \bar{V}$. For a, however, their payoff would change from γv_A to $v_A - C$. Given this, it is clear that $\gamma v_A > v_A - C$ which holds regardless of V. This illustrates a key feature of a radical/disruptive technology – it is *internally disruptive* and that, relative to the status quo, it will improve the prospects for one division and reduce those for the other.

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 were required to adopt the technology, a would effectively veto that change absent another coordinating mechanism. Thus, the decision of whether to adopt

[5] 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.

[6] Below we will explore what happens if the firm can procure the necessary resources externally.

[7] This is a measure of the opportunity cost to an established firm in adopting the technology. For a startup, the B-resources do not come for free and perhaps must be procured from an independent use earning v_B. Thus, note that the established firm opportunity cost will exceed that of a startup if $(\gamma-1)v_A+C+\gamma v_B > v_B$ which holds as $\gamma(v_A + v_B) > v_A + v_B - C$.

this technology optimally must lie with c.

2.2 Aggrievement and shading

If the new technological opportunity were merely internally disruptive, this would not prevent adoption being chosen by c if it was profitable for the firm as a whole. However, as Hart and Holmstrom (2010) emphasise, frictions arise when there are changes to default or status quo positions when those changes have distributional consequences. Specifically, they argue that the decision will leave some agent (or agents) aggrieved and those agents have an ability to push some of their own costs on other decision-makers.

Here we follow Hart and Holmstrom (2010) by utilising the Hart and Moore (2008) approach to accounting for the extent of aggrievement and also the mechanism by which that aggrievement is translated into costs on the decision-maker.[8] Suppose that agent i's payoff if an action is taken reduces their payoff by k_i. That agent can, by engaging in what Hart and Moore (2008) term 'shading,' reduce the total value accruing to the firm (aka c's payoff) by $\theta_i k_i$ where $0 < \theta_i < 1$. This represents a deadweight loss to the firm and is a mechanism by which the decision-maker will partially internalise the losses felt by some agents.[9] While 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.[10]

3 The Technology Adoption Decision

We are now in a position to analyse the technology adoption decision that the firm faces when the technological opportunity appears. In particular, absent internal disruption and its consequences, the firm 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, $2C$. Finally, the firm must consider the loss arising from aggrievement and shading.

Taking this altogether, if c chooses to adopt the new technology, the expected payoff is:

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

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

[9] There is some empirical (Coviello et al. (2022)) and experimental (Fehr et al. (2011)) that this occurs.

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

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

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

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 $V < \bar{V}$ if $V < \gamma v_B - C$. Thus, in equilibrium, b will not be aggrieved by a decision to adopt the technology. Therefore, for ease of exposition in what follows we will simply assume that $V > \gamma v_B - C$. Note also 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 the technological opportunity means that b may potentially be aggrieved if the firm does *not* adopt the technology. This will happen if $V - C > \gamma v_B$. In other words, internal disruption 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 disruption.

Given this, we can demonstrate the following:

Proposition 1 *The firm will choose to adopt the technology if:*

$$V + v_A - 2C - \theta_a((\gamma - 1)v_A + C) \geq \gamma(v_A + v_B) - \theta_b(V - \gamma v_B - C)$$

Proof. Note first that if $V + v_A - 2C - \theta_a((\gamma - 1)v_A + C) \geq \gamma(v_A + v_B)$ this implies that $V - C > \gamma v_B$; so b will be aggrieved if the technology is not adopted. Thus, a sufficient condition for adoption is that the post adoption payoff exceeds the original status quo payoff.

Second, suppose that $V + v_A - 2C - \theta_a((\gamma - 1)v_A + C) < \gamma(v_A + v_B)$. In this case, if $V - C \leq \gamma v_B$, then the firm will not adopt the technology but if $V - C > \gamma v_B$, they will adopt the technology if the condition in the proposition holds. ■

The proposition provides a sufficient condition for the firm to choose to adopt the technology. Earlier we referred to $(\gamma - 1)v_A + \gamma v_B + C$ as a measure of external disruption that put a constraint on an established firm in adopting the technology. The constraint from internal disruption is $\theta_a((\gamma - 1)v_A + C) - \theta_b(V - \gamma v_B - C)$. Note that it is entirely possible that the internal disruption costs are negative and offset the external disruption costs completely if:

$$(\gamma - 1)v_A + \gamma v_B + C < -\theta_a((\gamma - 1)v_A + C) + \theta_b(V - \gamma v_B - C)$$

$$\implies V > \tfrac{1}{\theta_b}\left((1+\theta_a)(\gamma-1)v_A + (1-\theta_b)\gamma v_B + (1+\theta_a+\theta_b)C\right)$$

which holds for V and θ_b sufficiently high.[11]

The interesting question is how this compares to a benchmark adoption decision.

Corollary 1 *If $\theta_a = \theta_b$, then technology is adopted if $V \geq \bar{V}$. If $V - C \geq \gamma v_B$ and $\theta_a > (<)\theta_b$, then there is too little (too much) adoption relative to the benchmark with no shading.*

Proof. If $\theta_a = \theta_b = \theta$, then the condition for technology adoption becomes:

$$(\theta+1)\left(V + v_A - 2C - \gamma(v_A + v_B)\right) \geq 0$$

where the left hand side is non-negative if and only if $V \geq \bar{V}$. Suppose that $\theta_a \neq \theta_b$ and $V - C \geq \gamma v_B$. Let $\theta_a = \theta_b + \epsilon$. Then note that the technology is not adopted if:

$$\frac{\theta_a}{\theta_b} > \frac{V - \gamma v_B - C}{(\gamma-1)v_A + C} \implies \theta_b\left(V + v_A - 2C - \gamma(v_A + v_B)\right) > -\epsilon\left((\gamma-1)v_A + C\right)$$

The left hand side is positive (negative) if $V > (<)\bar{V}$. If $\epsilon < 0$ (i.e., $\theta_a > \theta_b$), then there exists $V > \bar{V}$ such that this condition does not hold. If $\epsilon > 0$ (i.e., $\theta_a < \theta_b$), then there exists $V < \bar{V}$ such that this condition does hold. ■

The result that adoption can be deterred if θ_a is relatively high is not surprising since a is guaranteed to be aggrieved should adoption take place. The more surprising result is that there can be too much adoption 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 amongst divisions in a firm, this generates both resistance to change and resistance to the status quo. With shading, c partly internalises each of these effects and it may constrain or push them towards adopt 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 disruption to the status quo. When each $\theta_i > 0$, there is no going back

[11] Note that compared with the start-up opportunity cost of $v_B - C$, the established firm opportunity cost will be lower if $(\gamma-1)v_A + \gamma v_B + C + \theta_a((\gamma-1)v_A + C) - \theta_b(V - \gamma v_B - C) < v_B$. Note that if $\theta_a = \theta_b$ this is more likely to hold if $V > \bar{V}$.

to status quo outcomes for c. c must either adopt the technology and face aggrievement from a or not adopt it an face aggrievement from b. The possibility of aggrievement distorts the adoption decision and may diminish or increase adoption depending upon 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 even though internal disagreement does emerge. Thus, there is an incentive to counter internal disagreement although potentially not to ensure the adoption decision is not distorted.

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 it will be noted that these have their own costs that may render them ineffective.

4.1 Side payments

Aggrievement arises because division managers are potentially disadvantaged with a decision taken. A natural tool to mitigate this disadvantage is to use side payments. For instance, if the technology is adopted, then a payment to a of $(\gamma - 1)v_A + C$ could be made. This will eliminate a's potential aggrievement. Note, however, that this would change c's payoff from technology adoption to:

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

This is actually 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.

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 $(\gamma - 1)v_A + C$ even if the effect of shading is as modelled.[12] However, it is equally the case that shading and aggrievement involves 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 or up-front

[12]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 so-doing outweigh their own costs. Thus, it may be here that $\theta_A(.)$ is generated alongside a net private benefit to a that could be somehow taxed.

payments that may themselves not discourage continual aggrievement. The point here being 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 exploring tools by which a or b can be persuaded not to utilise 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, while 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 recognised 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 separated use (earning v_B), then so long as $V - v_B > C$, 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 $\theta_b(V - \gamma v_B - C)$ as they miss out on being redeployed to the new opportunity. In this case, c would choose to adopt the technology if:

$$V - C - \theta_b(V - \gamma v_B - C) \geq v_B \implies (1 + \theta_b)(V - C) \geq \theta_b \gamma v_B$$

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:

$$V - \theta_b(V - \gamma v_B - C) - (v_B - C) \geq V + v_A - 2C - \theta_a((\gamma - 1)v_A + C)$$

$$\implies \theta_a((\gamma - 1)v_A + C) - \theta_b(V - \gamma v_B - C) \geq v_A + v_B - C$$

Note that if $\theta_a = \theta_b = \theta$, this becomes:

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

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 on 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 drives internal disagreements and its consequences. As Bresnahan et al. (2011) emphasise, these shared resources are a source of organisational 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 divestiture, in this case, of the A division. However, if c internalised 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 to new entrants to adopt those technologies (Gans (2016)). While this may lie behind the failure of successful firms, many outside of management academia emphasise the disruptive nature of those technologies based on the plain meaning of the word 'disruption.' They see such technologies as creating conflict within organisations that cause those organisations to struggle to adopt those technologies (e.g., Lepore (2014)). Academics studying disruption have paid relatively scant attention to the role of internal conflict.

This paper considers that conflict explicitly using as a framework for the costs of internal conflict from the model of Hart and Holmstrom (2010). It is found 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 characterised 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 adopt decision is moulded by the balance of competing interests and, in an important case, those balance each other out and conflict does not distort the technology adoption decision at all.

Nonetheless, the model presented here is a first step in understanding how internal conflict and its costs are shaped by new technological opportunities. Firms may structure themselves to reduce such costs and that may, in turn, impact on 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 (see Gans (2022)). All of 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.

References

Arrow, Kenneth J, "Economic Welfare and The Allocation of Resources for Invention," in "The Rate and Direction of Inventive Activity," Princeton University Press and NBER, 1962.

_ , *The Limits of Organization*, WW Norton & Company, 1974.

Bresnahan, Timothy F, Shane Greenstein, and Rebecca M Henderson, "Schumpeterian competition and diseconomies of scope: illustrations from the histories of Microsoft and IBM," in "The Rate and Direction of Inventive Activity Revisited," University of Chicago Press, 2011, pp. 203–271.

Christensen, Clayton M, *The Innovator's Dilemma: when new technologies cause great firms to fail*, Harvard Business Review Press, 1997.

_ **and Michael Raynor**, *The innovator's solution: Creating and sustaining successful growth*, Harvard Business Review Press, 2013.

Coviello, Decio, Erika Deserranno, and Nicola Persico, "Counterproductive Worker Behavior After a Pay Cut," *Journal of the European Economic Association*, 2022, *20* (1), 222–263.

Dow, James and Enrico C Perotti, "Resistance to change," *Available at SSRN 2356936*, 2013.

Fehr, Ernst, Christian Zehnder, and Oliver Hart, "Contracts, reference points, and competition—behavioral effects of the fundamental transformation," *Journal of the European Economic Association*, 2009, *7* (2-3), 561–572.

_ **, Oliver Hart, and Christian Zehnder**, "Contracts as reference points—experimental evidence," *American Economic Review*, 2011, *101* (2), 493–525.

Frydlinger, David and Oliver D Hart, "Overcoming contractual incompleteness: The role of guiding principles," Technical Report, National Bureau of Economic Research 2019.

Gans, Joshua S, *The Disruption Dilemma*, MIT Press, 2016.

_ , "A Theory of Visionary Disruption," Technical Report 2022.

Garicano, Luis and Luis Rayo, "Why organizations fail: Models and cases," *Journal of Economic Literature*, 2016, *54* (1), 137–92.

Hansmann, Henry, *The ownership of enterprise*, Harvard University Press, 1996.

Hart, Oliver, "Economica Coase lecture: Reference points and the theory of the firm," *Economica*, 2008, *75* (299), 404–411.

_ , "Hold-up, asset ownership, and reference points," *The Quarterly Journal of Economics*, 2009, *124* (1), 267–300.

_ **and Bengt Holmstrom**, "A theory of firm scope," *Quarterly Journal of Economics*, 2010, *125* (2), 483–513.

_ **and John Moore**, "Incomplete contracts and ownership: Some new thoughts," *American Economic Review*, 2007, *97* (2), 182–186.

_ **and** _ , "Contracts as reference points," *The Quarterly Journal of Economics*, 2008, *123* (1), 1–48.

Henderson, Rebecca, "Underinvestment and incompetence as responses to radical innovation: Evidence from the photolithographic alignment equipment industry," *The RAND Journal of Economics*, 1993, pp. 248–270.

Henderson, Rebecca M and Kim B Clark, "Architectural innovation: The reconfiguration of existing product technologies and the failure of established firms," *Administrative Science Quarterly*, 1990, pp. 9–30.

Igami, Mitsuru, "Estimating the innovator's dilemma: Structural analysis of creative destruction in the hard disk drive industry, 1981–1998," *Journal of Political Economy*, 2017, *125* (3), 798–847.

Keating, Gina, *Netflixed: The epic battle for America's eyeballs*, Penguin, 2012.

Lepore, Jill, "The disruption machine," *The New Yorker*, 2014, *23*, 30–36.

McNish, Jacquie and Sean Silcoff, *Losing the signal: the untold story behind the extraordinary rise and spectacular fall of BlackBerry*, Macmillan, 2015.

Meyersson-Milgrom, Eva, Paul Milgrom, and Ravi Singh, "When Should Control Be Shared?," *Management Science*, 2022.

Milgrom, Paul and John Roberts, "An economic approach to influence activities in organizations," *American Journal of sociology*, 1988, *94*, S154–S179.

Milgrom, Paul R, "Employment contracts, influence activities, and efficient organization design," *Journal of Political Economy*, 1988, *96* (1), 42–60.

Muller, Holger M and Karl Warneryd, "Inside versus Outside Ownership: A Political Theory of the Firm," *The RAND Journal of Economics*, 2001, *32* (3), 527.

Schaefer, Scott, "Influence costs, structural inertia, and organizational change," *Journal of Economics & Management Strategy*, 1998, *7* (2), 237–263.

Schumpeter, Joseph A, "Capitalism, Socialism, and Democracy," *Nueva York*, 1942.

van den Steen, Eric, "Disagreement and the Allocation of Control," *Journal of Law, Economics, and Organization*, 2010, *26* (2), 385–426.