Managing change: Communication, managerial style and change in organizations

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ABSTRACT

We model the interplay between communication, manager attributes and the probability that an establishment successfully implements a significant change. Although change requires both sufficiently strong advocacy and enough communication to help overcome inertia inside the firm, we posit that frequent communication can be costly, particularly with strong managers and in larger establishments. These theoretical predictions are consistent with our empirical analysis. Utilizing uniquely detailed establishment-level data we find that, on their own, firm size, regular communication and result-oriented managers are all positively associated with change. However, the use of frequent communication in firms that successfully implemented a significant change is moderated: (i) when managers tend to be strongly focused on results; and (ii) in larger establishments. This suggests that organizations wishing to foster change should consider the interaction between manager attributes and the communication protocols.

1. Introduction

Implementing change in organizations is inherently difficult (Colombo and Delmastro, 2002). Not only does it require knowledge about what to do, this information needs to be communicated to those charged with its implementation. But even this might not be enough. Organizations can become sclerotic; routines and practices become entrenched over time, as do vested interests of both managers and workers. Effective change needs to overcome this inherent organizational inertia; it needs support from enough people in relevant positions throughout the firm to work together to ensure its success. In this paper we examine the relationship between managerial attributes, communication protocols and the implementation of successful change in an organization.

The intuition underlying our theoretical model, outlined in Section 2, is as follows. Firstly, communication is a necessary precursor to change: as well as providing information about what to do, it can allay fears about the prospective change. This suggests that there will be a positive relationship between the amount (or frequency) of communication inside the firm and implementation of a significant change.

Secondly, to overcome people's preference for the status quo, managers – who we broadly define as anyone involved in managing the implementation process – need to advocate for change with sufficient conviction, persistence and energy to ensure its success. To aid our empirical investigation of these predictions (Sections 3 and 4) we categorize managers into two types: (i) managers focused on outcomes or results like profit or customer satisfaction (result-oriented); and (ii) managers who emphasize personal relationships (people-oriented).[1] Using these categories, we predict that result-oriented managers are more likely to have the advocacy skills, the drive and passion to convince their colleagues to implement the required change.

While these direct relationships highlighted above–namely between (i) communication and change and (ii) managerial style and change–need not be a surprise, in our empirical analysis we are particularly interested in the interplay between these factors. To capture this, we posit that there is a potential negative side-effect of communication for a firm; it creates an opportunity for argument, disagreement and conflict that can make it more difficult for the group to cohesively and effectively implement change. This is particularly problematic with result-oriented managers, who are more likely to dig in and argue for

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their preferred change than to just 'go-with-the flow', and acquiesce to what they see as a lesser idea.[2] From this, we have our third prediction; a firm successfully implementing a significant change with more result-oriented managers will, other things equal, communicate less.[3]

Lastly, consider the interaction of manager style and communication with other aspects of the firm's structure, in relation to its propensity to successfully implement change. A downside of communication about the change process is that it provides a forum for dissention and argument, which can foster conflict and render change more difficult. This is particularly pertinent for larger organizations. Consequently, we predict successful change in organizations requires less frequent internal communication as the size of the firm increases.[4]

To illustrate the intuition underlying our empirical predictions, consider the example of communication and management style within an academic department. Firstly, let us focus on departmental communication. In a small department, many key decisions are often made in department meetings, even if the head of the group has formal decision-making rights. Regular meetings discussing proposals might be the norm. Hiring decisions, for instance, could be brought to the group as a whole, as could tenure decisions and proposals for new courses or programs. With a small group, a high level of engagement is typically necessary to properly assess candidates, or to fully flesh out the implications for changes to the department's teaching program. In terms of our framework, a small department requires frequent communications and a high degree of participation to help facilitate successful change.

Such an inclusive and collegial communication process is less likely in a larger academic group. Change could be problematic if everyone in the department is involved. Too many meetings create opportunities for disagreement and politicking, stymieing effective change. This could be true for hiring decisions – advocates in each subfield might argue for a new hire from their area. A similar issue could arise with proposals about degree structures or the direction of the department. Rather than involving everyone continually through the process, decisions are often instead made by subcommittees, and only then communicated to the group. This limits communication (and involvement) of the group as a whole; in other words, effective change in a larger group requires less frequent communication about change than might be otherwise appropriate for a smaller department.

Secondly, consider how management style affects communication about a significant change within an academic department. Again, take hiring as an example. A strong-minded academic or chair of department might be able to push through bureaucratic and other impasses to successfully champion the hiring of a promising candidate where a less strident supporter might fail; that is, strong management facilitates change. But if the senior professors in a department are relentless advocates for hiring in their own sub-fields, involving them in the hiring process will invariably lead to conflict. As a result, the chair in a department with uncompromising colleagues might try limit their involvement in hiring or other key decisions, preselecting a field for

the position or by setting up a committee charged with making the decision. More involvement might be possible with less driven, more compromising professors; fruitful discussions could involve more people in the department, but only if they are willing to compromise and listen to others.

We examine evidence of these relationships using unique establishment-level data that details: whether or not an establishment successfully implemented a significant change; communication strategies regarding both technological and organizational change; and management style (or attributes) in regards to the factors that motivate its managers. We find that successful change is more likely in establishments that: (i) regularly communicate about the prospects for new technological and organizational developments; and (ii) have result-oriented managers. We also find that these direct relationships are moderated taking into account the key interactions between communication protocols, manager attributes and the size of the firm. Specifically, establishments that successfully implemented a significant change communicated less regarding technological change if they have: (iii) result-oriented managers; and (iv) more employees. These results are consistent with our empirical hypotheses – while communicating relevant information is crucial to successful change, its effectiveness depends on the firm's other internal characteristics, notably its size and the attributes of its managers.

There is a growing literature on the allocation of decision-making rights and communication in firms. Communication can aid effective decision making by allowing agents to specialize in processing particular types of information (Bolton and Dewatripont, 1994). In Dessein (2002), Rush et al. (2010) and Garfagnini et al. (2014) communication allows information to be (imperfectly) transmitted to an uninformed principal. Similarly, in Aghion and Tirole (1997) an uninformed principal with formal decision-making rights has an incentive to communicate with their agent so as to learn about what project can be implemented. Recent papers empirically analyze decision-making processes in firms. For example, McElheran (2014) examines the tradeoff between delegation (allowing for adaption) and centralization (aiding coordination) of IT purchases within US manufacturing firms.[5] Acemoglu et al. (2007) find delegation is more likely in establishments closer to the productivity frontier. Meagher and Wait (2014) find that the decision to implement a significant change is more likely to be delegated when a firm exports its output and when it faces more competition in the product market.

Much of the inspiration for our focus on the difficulty for organizational change comes from Colombo and Delmastro (2002), who analyze the factors related to structural inertia (with respect to a reorganization of the number of hierarchical layers) in Italian manufacturing establishments. They find that while there is strong evidence of significant inertia, organizational change is more likely if the establishment adopted new technologies and human resource management practices. On the other hand, the likelihood of organizational change is decreasing in the sunk costs associated with the change process and in the presence of influence activities. Our study on the interaction between communication and change supplements the findings of Colombo and Delmastro (2004) that communication technologies aid the delegation of decisions relating to significant organizational change.[6] Furthermore, our focus on managerial style and communication complements previous research on managerial practices and firm performance, such as Bloom and Van Reenen (2007); Bloom et al. (2014) and Nemlioglu and Mallick (2017). Nemlioglu and Mallick (2017), for example, find that better managerial practices, when coupled with R & D activities, contribute to higher performance levels (profit margins) in firms.

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[2] Here we focus on the possibility that greater communication makes it more likely for result-oriented managers to disagree and argue, rendering effective change problematic. While some disagreement may be valuable in the reform process (Van de Ven and Grazman, 1997 and Markham, 1998), too much conflict consumes resources and reduces the likelihood of successful change (Venkataraman et al., 1992; Chakrabarti and Hauschildt, 1989; Markham, 2000 and Klerkx and Aarts, 2013). For tractability we do not consider this potential positive effect of conflict in our model.

[3] For example, the founder of Amazon.com, Jeff Bezos, commented that '[c]ommunication is a sign of dysfunction...We should be trying to figure out a way for teams to communicate less with each other, not more' (Stone, 2013).

[4] It is noteworthy that a similar tradeoff is highlighted by Couzin et al. (2005). Motivated by honeybee swarms where only a few individuals (about 5%) guide the group to a new nest with a high degree of accuracy, Couzin et al. (2005) study leadership and information-transfer in animal groups looking for the location of food or a migration route. They show that: the proportion of informed individuals needed to successfully guide a group is decreasing in its size; and that the proportion of leaders in a group is smaller when these leaders 'push' for their preferred direction more strongly.

[5] See also Castiglione and Infante (2014) for a study of firm investment in information technology, management practices, R & D and productivity.

[6] For a further discussion of these issues, also see Colombo and Delmastro (2008).

We also draw on the economics literature on leadership. Hermalin (1998) examines leadership in a moral-hazard-in-teams model. Team effort is essential for a good outcome and the leader can signal her private information (about the technology) by taking a costly action.[7] In our story, rather than leading by example, managers encourage agents to adopt their proposed idea through the frequency–and force– of their communication.

In Rotemberg and Saloner (1993) a firm considers how a leader's style affects workers' incentive to invest. They show that hiring a more empathic leader can induce agents to put in greater effort in discovering new projects.[8] In this way, hiring a particular type of manager is a commitment by the firm to adopt the corresponding ex post strategy in an incomplete contracting environment. We also emphasize leadership or management style; our focus is on the interaction between communication and the type of managers a firm has.

Bolton et al. (2013) show that leader resoluteness can aid the implementation of a proposal by helping overcome coordination issues.[9] Here we argue that a strong manager–that is, a manager focused on results rather than personal advancement–can also play this coordination role. However, critically, we note that managerial steadfastness has the potential downside of provoking disagreement, rendering the change process ineffective.[10]

2. Theoretical framework and empirical predictions

In this section we develop a parsimonious model to highlight the key tradeoff between generating and disseminating innovative ideas within an organization and the cost of potential conflict that can arise. Necessarily it abstracts from many fundamental aspects of an organization, including agency issues and the structure of hierarchies. In our approach we consider organizational change to come from the collective action of many actors within a firm, rather than simply from a directive (which will be automatically followed) from senior management. This presupposes that the *implementation* of a change is vital, and it cannot be introduced without the willing participation of (enough) people throughout the firm. To be explicit, successful change needs a manager or managers to select and champion an idea, and for these managers to drum up sufficient support within the group for the change. Within this framework, organizational change is a tradeoff between advocacy and inertia. In Lewin's (1951) force-field theory of change, adaptation occurs when the forces for change overcome resistance, be it at the organization, group or individual level. In our context, pressure to change arises from the influence that managers exert on the organization to promote their projects, and are related to the frequency of communication/information and the style of management.

Firstly, assume an organization/firm is made up of s individuals. Each firm has a management team that is charged with discovering new ideas for change and promoting these ideas with the rest of the group. Managers are characterized by their strength of advocacy for change ω.[11] Secondly, successful change involves the firm reforming itself in some way. This requires that managers exert sufficient pressure or generate enough excitement about the new idea such that there is sufficient support in the firm to overcome individuals' tendencies for

inertia. To drum up enough support for the change, the management team communicates information about the change to other workers. Let $m \in [0, \overline{m}]$ stand for the frequency of communication by managers regarding new technology to other employees.[12],[13] The amount of pressure for change depends on the voracity of the managers' advocacy (how hard they push) for their preferred change and also on how much support they gather within the firm. To capture this explicitly, we assume that with probability $p(m, \omega, s)$ there is a successful change, in which case a firm receives a normalized benefit of one. With complementary probability $1 - p(m, \omega, s)$ there is no change and so benefit is normalized to zero. We make the following assumption about function $p(m, \omega, s)$:

Assumption 1. $p(m, \omega, s) \in [0, 1]$ and is twice differentiable with respect to all variables. $\frac{\partial p(0, \omega, s)}{\partial m} > 0$, $\frac{\partial p(m, \omega, s)}{\partial \omega} > 0$, $\frac{\partial^2 p(m, \omega, s)}{\partial m^2} < 0$, $\frac{\partial^2 p(m, \omega, s)}{\partial m \partial \omega} < 0$ and $\frac{\partial^2 p(m, \omega, s)}{\partial m \partial s} \leq 0$.

The intuition for the various parts of Assumption 1 is as follows. Firstly, for low levels of communication the probability function is increasing in frequency of communication m at a decreasing rate. Given change is a group activity, the idea needs to be communicated with others in the firm. Moreover, this communication is especially important when there is a lack of any available information. Consequently, we assume that for low levels of communication there will be a positive (but declining) relationship between communication regarding new technology and the likelihood of successful change.

Secondly, the probability of successful change is increasing in the strength of advocacy ω. As noted above, effective advocacy is more likely with driven managers who vociferously believe in and agitate for change, as captured by higher values of ω; it is these types of advocates who are most likely to be able to overcome the inherent bias towards the status quo. This suggests *result-oriented managers*–that is, managers whose primary concern is about outcomes or results–are more likely to successfully engender change. After all, advocates for change must convince others in the organization that their proposal is the right way forward. Next, we assume that the marginal effectiveness of communication is declining in managers' advocacy strength. Given that the probability of change is bounded above, this effectively means that m and ω are substitutes for an organization wishing to implement a reform. With driven managers less communication is required for a successful change as they are able to overcome organizational inertia without relying on widespread consensus regarding the proposed changed (built up by frequent communication, discussion and reassurance). On the other hand, managers with less inherent advocacy strength need to communicate their ideas frequently with the team, so as to engender broad support for the proposal. Finally, the marginal effectiveness of communication frequency is weakly declining in the size of the organization; that is, at least the same amount of communication is required in a bigger group to achieve the same probability of change.

There are also costs associated with communication regarding new technology, $C(m, \omega, s)$. Our next assumption summarizes the relationship between costs and firm characteristics:

Assumption 2. $C(m, \omega, s) \geq 0$ and is twice differentiable. $\frac{\partial C(m, \omega, s)}{\partial m} \geq 0$, $\frac{\partial^2 C(m, \omega, s)}{\partial m^2} > 0$, $\frac{\partial^2 C(m, \omega, s)}{\partial m \partial \omega} \geq 0$ and $\frac{\partial^2 C(m, \omega, s)}{\partial m \partial s} > 0$. In addition, $\frac{\partial C(0, \omega, s)}{\partial m} = 0$ and $\lim_{m \to \overline{m}} \frac{\partial C(m, \omega, s)}{\partial m} = \infty$ for $m \in [0, \overline{m}]$.

The intuition for the Assumption 2 is as follows. First, costs are strictly convex in m and always non-negative; consequently, costs are increasing with communication frequency at an increasing rate. More communication, as well as disseminating information about the

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[7] In his survey on leadership and corporate culture, Hermalin (2012) also emphasizes that leadership style matters; in particular, see Section 2.3.4.

[8] Aghion and Tirole (1997) make a similar argument in their model of formal and real authority; the principal can induce greater effort from the agent if she can commit that the agent will have greater real decision-making authority.

[9] In Dessein and Santos (2006) communication is also required inside the firm so as to coordinate on adopting changes, but there are no leaders in their model.

[10] In Bolton et al. (2013) resoluteness has the potential cost that the leader does not change the proposed project in the light of new evidence. Also see Bolton et al. (2010).

[11] Advocacy strength could come from either more strident leaders (who are all of the same strength) or a greater number of strong leaders in the team. For the sake of tractability, we consider that ω is a reduced-form way of capturing both situations. For instance, ω would be an index of advocacy strength in the case of heterogeneity.

[12] Note that $\overline{m} > 0$ and it is possible that $\overline{m} = \infty$.

[13] While we couch our discussion in terms of frequency, the model could also relate to the amount of content included in communication with employees, or the portion of employees who receive these messages.

proposal, creates an environment or forum (almost an invitation at times) for discussion and criticism. This could take the form of questioning the necessity for change and its proposed form; this questioning can often easily move into politicking and bickering as the winners and losers from the reform become more evident. Thus, frequent communication can facilitate disputes between aggrieved individuals and factions, which leads to higher costs associated with conflict and dissent creating a less productive work environment. Note that these costs are general in the sense that they relate to the overall productivity of the firm, and are separate from the probability of change (captured directly in Assumption 1).

Second, the marginal costs of communication are weakly increasing with the strength of advocacy. With a high ω, head-strong (possibly argumentative) and intransigent managers are less likely to compromise on their preferred proposals. Uncompromising managers are less able to present a united front if there are more opportunities to break ranks and voice dissent. Moreover, result-orientated managers, as leaders, set the tone and expectations for others in the organization, affecting their behavior (Burke et al. (2006) and Norrgren and Schaller (1999)). With more result-oriented agents in the firm, communication provides forum for voicing alternative opinions and to criticize proposals. Consequently, frequent communication is particularly costly in an organization with result-oriented managers who are unwilling to let go of what they see as the right thing to do and to compromise.

Finally, the marginal cost of communication is increasing with firm size. As the number of participants involved (s) increases, frequent dialogue provides more opportunities for conflict, increasing the cost of communication.

A firm maximizes the following expected net benefit[14]

$$\Pi(m, \omega, s) = \max_{m \geq 0}\{p(m, \omega, s) - C(m, \omega, s)\}. \tag{1}$$

The optimal level of communication m^* solves:[15]

$$\frac{\partial \Pi(m^*, \omega, s)}{\partial m} = \frac{\partial p(m^*, \omega, s)}{\partial m} - \frac{\partial C(m^*, \omega, s)}{\partial m} = 0. \tag{2}$$

Due to Assumptions 1 and 2, the solution exists and is unique. This gives rise to the following theorem.

Theorem 1. *The following comparative statics hold*: (1) $\frac{\partial m^*}{\partial \omega} < 0$; and (2) $\frac{\partial m^*}{\partial s} < 0$.

Proof. See Appendix A.□

Part (1) of the Theorem states that, in equilibrium, the frequency of communication is declining in advocacy strength amongst change prioritizing firms. Result-oriented managers can be more convincing and convey the message, carrying the proposal forward, with less communication. Part (2) of the Theorem states that, in equilibrium, larger firms communicate about the change less frequently as communication for them is more costly.

This theoretical framework, as noted above, does not include many other important aspects of real organizations. It is designed to provide clear empirical predictions relating to significant change in organizations and their size, communication protocols and managerial style. In doing so, we have suppressed some of the potential choice variables for a firm,

such as the advocacy strength of its managers. We discuss some of these issues in more detail in Section 4.1.[16] It is also worth noting that if an organization is not prioritizing change, this will weaken the observed empirical relationships between our variables of interest; this potential attenuation bias makes it less likely that we find significant results.

2.1. Empirical predictions

Here we explicitly state our empirical predictions. As noted earlier, greater participation necessitates more communication. More communication (higher m) means there are more informed individuals. Consequently, we hypothesize that there will be a positive relationship between communication regarding new technology and the likelihood of successful change. This discussion is summarized in Prediction 1.[17]

Prediction 1. Change in organizations is positively related to communication.

Not all managers are the same. Our rich data allows us to ascertain the motivating attributes of different managers so that we categorize them as being either: (i) result-oriented goals such as maximizing profit, implementing the best possible change, implementing the firm's objectives and so forth; and (ii) people-oriented goals such as personal betterment and social standing. Other things equal, the greater the personal weight managers place on objective results, the more strongly they will advocate for a value-enhancing change, even if it is difficult and is likely to face resistance. This, in turn increases the likelihood that the firm will successfully implement change. On the other hand, the less weight a manager places on objective (value-adding) motivations, the more likely it is that they will compromise and avoid the conflict inherent in difficult change. Consequently, we propose that: result-oriented managerial attributes are positively associated with change; and people-oriented managerial attributes are associated with lower rates of organizational change. This is summarized in the following prediction.[18]

Prediction 2. Change in organizations is positively related to the presence of result-oriented managers.

Theorem 1 leads to the following two empirical hypotheses. While result-oriented managers are more able to strongly advocate for change, overcoming inertia, it is also the case that with a high ω, head-strong (possibly argumentative) and intransigent managers are less likely to compromise on their preferred proposals. It follows that to mitigate this potential problem, an organization might wish to reduce the frequency of communication about the change proposal, so as to reduce opportunities for dissent and breakdown. This hypothesis is summarized in Prediction 3.

Prediction 3. Change in organizations requires less communication in a firm with result-oriented managers.

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[14] Our assumption here is that firms wish to maximize profit, and that successful innovation or change is a way to do this. There is an established relationship in the literature between profitability and change; see for example, Geroski et al. (1993) and Mouelhi (2009). Similarly, as mentioned above, using UK data Nemlioglu and Mallick (2017) find that firms that jointly undertake R & D and adopt better managerial practices have higher profit margins. It is worth noting that our predicted relationships between communication, organizational design and innovation could still hold if the firm has a broader objective than purely profit, as in Saha (2014) for instance.

[15] Note that from Assumption 1, for higher levels of communication it is possible that the probability of successful change decreases with frequency of communication. As the costs of communication are always increasing, it would be self-defeating for a firm to choose a level of communication in this range.

[16] Note, an alternative theoretical approach could be taken, as in Bel et al. (2015), to produce equivalent theoretical predictions. The model in Bel et al. (2015) emphasizes the tradeoff between overcoming organizational inertia inside the firm and disagreement and failure to execute change, and how this tradeoff depends on managerial style. The approach taken in this paper simplifies the underlying determinants of inertia and breakdown, but in so doing it allows us to more clearly articulate the firm's maximization problem.

[17] In terms of our model we are considering the relationship between two endogenous variables. To ensure a positive relationship all we require is that the direct effect of communication on the probability of change dominates the indirect effects through the other exogenous variables. An example of such a negative indirect effect would be firms with weaker advocates that communicate more in equilibrium. Note that this prediction is consistent with the literature, for example Ebadi and Utterback (1984); Fidler and Johnson (1984); Lievens and Moenaert (2000) and Maltz (2000) all find a positive relationship between communication and innovation.

[18] Here there is a direct and indirect effect (through communication m) of a marginal increase in advocacy on the probability of change. To ensure a positive relationship between advocacy and change all we require is that the direct effect dominates the indirect effect. Note that this prediction is consistent with the literature; see for instance Norrgren and Schaller (1999); Howell and Boies (2004) and Howell (2005).

Next, while value-adding change in a firm requires support for a good idea, there is greater likelihood of problematic dissent arising from frequent communication in larger firms–there is more chance that an agitator (or agitators) will be present in a larger group. As a result, other things equal, we predict that less frequent communication about technological change is required to ensure successful change in larger firms. This discussion is summarized in Prediction 4 below.

Prediction 4. Change in organizations requires less communication in larger firms.

Going back to our example from the Introduction, a large academic department is unlikely to employ the same collegial process adopted by a smaller group. In a large department many key decisions are made by an executive of a few key professors or by the chair alone. Indeed, final decisions could be reported to faculty meetings as a *fait accompli*, or circulated by email, not to solicit contributions but purely to inform the group that the decision has been made.

3. The data set and variables

We use the L'enquête REPONSE 2004-05, a French matched employer-employee survey of almost 3000 commercial establishments with more than 20 employees in the non-agricultural sectors of the economy.[19] This survey provides a unique opportunity to study the relationship between the business strategy of a firm, its communication protocol, the style of its managers and the change outcomes achieved.

3.1. Dependent variable: change

We identify establishments that during the previous three years introduced: (1) a significant technological change; (2) a major organizational change; or (3) a new product or service. Firm directors indicated the different types of change that their firm made in the last three years and the one that was the most important.[20] We consider a firm successfully implemented a *Change* if it introduced: (i) a technological change; (ii) an organizational change; or (iii) a new product/service in the last three years, provided that it was the most important change for the establishment in that time period, coded 1 if this is the case and 0 otherwise. For our estimation sample of 2227 plants, 646 plants implemented an important *Change*: 122 adopted an important technological change, 350 adopted an important organizational change and 174 introduced a new product or service. We focus on these three changes as they are all crucial for a firm's success and they are internally instigated in that they depend on the organization's architecture and the attributes of the managers. Moreover, by only considering important changes we reduce the likelihood of including trivial changes that might have been introduced as part of a routine process or involve little resource cost or risk. Rather, we would like to examine significant changes in the organization that involve a deliberate decision and the collective action of those in the firm.

3.2. Explanatory variables

Table 1 provides summary statistics for the main variables of interest. While being careful to not imply causation, a strong case can be made that our variables capture some important elements of our theoretical framework described above and that our results highlight some interesting relationships between managerial attributes, communication and change in organizations. The key predictions from Section 2 and their relationship to our explanatory variables are outlined in Table 2.

Table 1
Summary statistics of the sample (N = 2227).

VARIABLE	MEAN	STD DEV.
DEPENDENT VARIABLE		
Change	.290	.454
EXPLANATORY VARIABLES		
Size	3963.74	6651.408
ω (Managerial attributes)	.543	.094
Result-Oriented (RO) managers	10.631	1.663
People-Oriented (PO) managers	9.233	2.681
Communication Technology	1.293	.687
Communication Strategy	1.423	.689
Communication Technology*size	1820.027	4952.842
Communication Strategy*size	2738.28	5994.605
Communication Technology*ω	.234	.277
Communication Strategy*ω	.292	.278
Comm Technology*RO managers	4.608	5.444
Comm Technology*PO managers	3.969	4.946
Innovation important	.303	.460

Notes: a. Source L'enquête REPONSE 2004-05.

Table 2
Key predictions from conceptual framework.

VARIABLE	ECONOMIC PREDICTION	COEFF SIGN
ω (Managerial attributes)	Prediction 2	(+)
Result-Oriented (RO) managers	Prediction 2	(+)
People-Oriented (PO) managers	Prediction 2	(−)
Communication Technology	Prediction 1	(+)
Communication Strategy	NP	(.)
Communication Technology*size	Prediction 4	(−)
Communication Strategy*size	NP	(.)
Communication Technology*ω	Prediction 3	(−)
Communication Strategy*ω	NP	(.)
Comm Technology*RO managers	Prediction 3	(−)
Comm Technology*PO managers	Prediction 3	(+)
Innovation important	NP	(+)

Notes: Positive, negative and ambiguous predicted estimated coefficient sign from the conceptual framework are represented by (+), (−) and (.), respectively. NP indicates no prediction from the theoretical framework.

Size of the organization. *Size* indicates the total number of people working at a firm. There is a large literature on the direct relationship between a firm's size and its propensity to innovate.[21] Firms of different sizes might also differ in their capacities to implement changes to the products they sell and to their organizational structure; while smaller firms are often thought of as more nimble and able to adapt to exogenous changes, larger organizations might be able to employ greater resources and know-how in the process.

Communication. From our data, we know whether a firm disseminates information to all employees about (a) the strategies and guidelines of the company or group and (b) the prospects for organizational or technological change either: (i) regularly; (ii) occasionally; or (iii) never. In the estimation sample, approximately 54 percent of establishments regularly disseminate information regarding strategies and objectives, while roughly 35 and 12 percent of establishments do so occasionally or never, respectively. Similarly, 43, 44 and 13 percent of establishments disseminate information to all employees about the prospects for technological or organizational change, respectively.

Focusing on communication about prospective technological or organizational change, we generate a variable *Communication Technology*, coded as 2 if an establishment communicates regularly with its employees, 1 if it communicates occasionally and 0 if it never

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[19] This data has also been used by other researchers, such as Acemoglu et al. (2007).
[20] The possible changes were: (i) a change of ownership, (ii) a change of top management, (iii) a significant increase or decrease of staff, (iv) a change of salary policies or working hours, (v) a physical move, (vi) a technological change, (vii) an organizational change, or (viii) an introduction of a new product/service.

[21] See for example Camisón-Zornoza et al. (2004) for a meta-analysis of 53 empirical studies between 1970 and 2001.

communicates. We use this variable as a proxy for the inclusiveness of the communication process a firm adopts. Similarly, *Communication Strategy* is coded as 2 if an establishment communicates regularly on strategy or the overall objectives of the group, 1 if it opts to communicate occasionally and 0 if it never communicates with its employees on this issue.

Prediction 1 suggests a positive relationship between successful change and communication about future technological or organizational changes (*Communication Technology*). Successful adoption requires new ideas to be disseminated in order to develop and effectively implement a new plan. Notably, this prediction relates to communication about technology, as opposed to communication on the firm's overall strategy, captured by *Communication Strategy*.

Further to this, Prediction 4 suggests larger firms that successfully change will have relatively less communication about new prospective technological or organizational changes than smaller firms. To empirically examine this prediction, we include an interaction term *Communication Technology*size*, which is the size of the workplace multiplied by the variable indicating whether the firm communicates regularly about technology or organizational changes (coded as 1) or it communicates occasionally or never (0). The predicted sign of the coefficient on this interaction term is negative. For completeness, we include *Communication Strategy*size*, the interaction term between size and if a firm communicates regularly (coded as 1) or occasionally or never (0) on strategy.

Managerial attributes. Managers are driven by different motivations or innate personal traits. Some seek the satisfaction derived from performing tasks well, overcoming of challenges and the sense of duty working towards the goals of the organization. Others, however, are motivated by pay or promotion, the need for love, affection, and belonging or from seeking approval from their superiors or from the group.[22] Our data allows us to capture these differences in managerial attributes. Firm directors were asked whether their managers were (i) totally, (ii) somewhat, (iii) not really or (iv) not at all, driven by: (a) satisfaction from good achievement; (b) identification to company's objectives; (c) satisfaction from overcoming challenges; (d) desire to satisfy customers; (e) fear of losing job; (f) hope for a promotion; (g) financial incentives; (h) attracting regard by the boss; and (i) attracting colleagues' regard. We assign a score for each motivating factor of: 3 for totally; 2 for somewhat; 1 for not really; 0 for not at all.

To create an index of manager attributes, we divide these possible motivating factors into two groups, *Result-Oriented (RO)* and *People-Oriented (PO)* factors. To measure the strength by which managers are motivated by *Result-Oriented* concerns, we sum the scores for factors (a)-(d), namely: satisfaction from good achievement; identification with a company's objectives; satisfaction from overcoming challenges; and desire to satisfy customers.[23] Similarly, to measure the degree of *People-Oriented* factors, we sum the score of variables (e)-(i), specifically: fear of losing job; hope for a promotion; financial incentives; attracting regard by the boss; and attracting colleagues' regard.[24] Managers who find their motivation in achieving results, satisfying customers or overcoming challenges are more prone to convey this sense of purpose to their team members. On the other hand, managers more concerned about a promotion or losing their job, and who are motivated by attracting their colleagues or boss's regard will be more likely to put an emphasis on personal relationships and group cohesion – these managers are less likely to rock the boat for a new idea or a proposed change. We have opted to include financial incentives and the

fear of unemployment in the second category as these two factors also tend to depend on the boss's (personal) opinion of the individual.

Our two categorizations of managerial styles parallel those in the leadership literature. In their meta-analysis, Fleishman et al. (1991) note that leadership could be essentially split into two broad categories: task-focused and person-focused behaviors.[25] In a similar way Burke et al. (2006) suggest that the latter of these leadership styles emphasizes maintaining close social relationships and group cohesion. Sarin and O'Connor (2009) distinguish between achievement-oriented leadership that emphasizes the end result of the project, and a consideration style of leadership where the leader is friendly, approachable and demonstrates interest in the well-being of team members.

Of course, a manager's style will be a combination of their objective (result-orientated) and political priorities. To reflect this, we measure the relative importance of each type of attribute by ω, where $\omega = \frac{RO}{RO + PO}$. Note that by definition $\omega \in [0, 1]$; $\omega = 1$ for fully *Result-Oriented* managers, whereas $\omega = 0$ if managers are totally *People-Oriented*. Prediction 2 suggests a higher ω will be associated with change. We predict, as a consequence, a positive relationship between the probability of successful change and ω.

However, if managers are relatively more result-oriented (with a high ω) there are higher potential costs of disagreement (Prediction 3). It follows that with result-driven managers, less frequent communication is required to successfully implement significant change. To capture this empirically we interact communication of technology (coded 1 if regularly and 0 if occasionally or never) with ω, labeled as *Communication Technology*ω*. We predict a negative relationship between *Change* and this interaction term. We also include an interaction term for ω and communication on strategy, *Communication Strategy*ω*, coded 1 for frequent communication regarding strategy and 0 if communication is occasional or never occurs.

Other controls. Other control variables are also used. A firm's business strategy could well be a crucial factor in determining its change outcomes. Directors were asked to assess the three key elements on which their firm's strategy is based and rank them by importance (from first to third). We created the variable *Innovation Important* (coded 1) if 'innovation' was mentioned as one of the three elements, and 0 otherwise. We predict a positive relationship between *Change* and *Innovation Important*.

Several alternative specifications were estimated. All estimations include NAF industry dummy variables, at the 2-digit level. Models III and IV include dummy variables that indicate: (a) union interference with the conduct of the establishment, the categories being (i) absolutely, (ii) somewhat, (iii) somewhat not and (iv) not at all; and (b) whether union activity in the labor pool outside the establishment is (i) very intense, (ii) intense, or (iii) not very intense. These two sets of dummy variables aim to control for the effect on change from union activity inside the firm and in the labor market in which a firm draws its employees. Dummy variable for the type of change implemented were also generated, be it a new product or an organizational change (with technological change being the omitted category).

4. Results

The pairwise correlations for the key variables of interest are illustrated in Table 3. *Size* is significantly correlated with *Change*, indicating that larger firms tend to implement more changes. Both types of communication within the firm–*Communication Technology* and *Communication Strategy*–are associated with successful change. The pairwise correlations with *Change* are .124 and .130 for communication on technology and strategy, respectively. Both are significant at the 1% level.

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[22] See for example Barbuto and Scholl (1999); Barbuto (2005) and Gumusluoglu and Ilsev (2009).

[23] For example, if a manager is somewhat motivated by each of these factors, she/he would achieve a *Result-Oriented* score of 8.

[24] As another example, if managers are motivated totally by fear of losing their jobs, somewhat by the hope of promotion, not really by financial incentives and not at all by the other two factors, their *People-Oriented* score would be 6.

[25] The dichotomy between directive and participative leadership styles is similar to the categorization of leadership in Blake and Mouton (1964).

Table 3
Pairwise correlations for estimation sample (N = 2227).

	CHANGE	SIZE	Ω	RO MANAGERS	PO MANAGERS	COMM TECH	COMM STRAT
CHANGE	1.000						
SIZE	0.095	1.000					
	(.000)						
Ω	−0.012	−0.067	1.000				
	(0.565)	(0.001)					
RO MANAGERS	0.050	0.015	0.346	1.000			
	(0.020)	(0.489)	(0.000)				
PO MANAGERS	0.028	0.071	−0.820	0.161	1.000		
	(0.173)	(0.001)	(0.000)	(0.000)			
COMM TECH	0.124	0.068	−0.006	0.128	0.073	1.000	
	(0.000)	(0.001)	(0.765)	(0.000)	(0.001)		
COMM STRAT	0.130	0.191	−0.044	0.109	0.093	0.379	1.000
	(0.000)	(0.000)	(0.039)	(0.000)	(0.000)	(0.000)	

Notes: Source L'enquête REPONSE 2004-05. p-values in parentheses. Comm Tech is the variable *Communication Technology* and Comm Strat is *Communication Strategy*.

The relationship between our managerial attribute variables and successful change is also of interest. ω is negatively correlated with *Change*, but not at a significant level. On the other hand, *Result-Oriented* management is positively correlated with *Change*–this unconditional correlation is consistent with Prediction 2. We will explore this relationship further below in our econometric modeling. *People-Oriented* management is not significantly correlated with successful change by firms.

Some of the other correlations are worth noting. First, ω and *Size* are negatively and significantly correlated (-0.067, at the 1% level). This relationship suggests that larger firms have less head-strong, results-focused managers, and instead have more people-oriented managers. The attributes of a manager in a small firm that implements a desired change may well be different from those required to get ahead in larger, more bureaucratic organizations; getting on with people and pleasing superiors and colleagues might be more important in a larger firm to get ahead than in a smaller operation. This relationship is further borne out by the positive and significant correlation between *Size* and *People-Oriented*.

To investigate the conditional relationships between organizational change, communication protocols and managerial styles we estimate a maximum-likelihood probit of the probability of change. Let c_i be firm i's *Change* outcome, where $c_i = 1$ indicates that a significant change was implemented and $c_i = 0$ otherwise. Letting $\mathbf{x}_i$ be a vector of explanatory regressors and β' the vector of coefficients to be estimated, the latent variable c_i^* can be expressed as

$$c_i^* = \beta' \mathbf{x}_i + \varepsilon_i, \tag{3}$$

where ε_i is a normally-distributed error term. The probit can then be estimated as

$$Pr(c_i = 1) = \Phi(\beta' \mathbf{x}_i) \tag{4}$$

and

$$Pr(c_i = 0) = 1 - \Phi(\beta' \mathbf{x}_i), \tag{5}$$

where $\Phi(.)$ is the standard cumulative normal.

The estimation results are shown in Table 4. Models I, III and V include ω and its respective interaction terms with *Communication Strategy* and *Communication Technology*. Models II, IV and VI use the *Result-Oriented* and *People-Oriented* measures of managerial attributes, and their respective interactions. Models III-VI include union-activity dummy variables. Models V and VI include dummy variables for a change in new product and organizational change, with technological change being the omitted category. All models use

clustered standard errors on the 2-digit level industry categories. Of course, given the reduced-form structure of our estimates, we do not imply any causality from our results. Further comment on causality is made below in Section 4.1.

Concentrating on Model III, which includes the full set of industry and union controls, there is a positive and direct relationship between *Change* and *Communication Technology*, significant at the 1% level. This positive relationship is consistent with Prediction 1; change requires future innovative prospects to be communicated to those in the organization.

Prediction 2 suggests that successful change is more likely with driven or strong managers. This prediction is consistent with the estimated positive and significant relationship (at the 1% level) between ω and *Change*.

Our results also show a positive relationship between *Change* and *Size*; the corresponding estimated coefficient is significant at the 1% level. In addition, the significance of the estimated coefficient for *Innovation Important* suggests change is more likely when it is a key part of an establishment's business strategy.

Several of our predictions relate to the estimated coefficients on the interaction terms included in the conceptual framework. As discussed in Section 2, the presence of result-oriented managers moderates the need for frequent communication in an establishment. Consistent with Prediction 3, the estimated coefficient for the interaction variable of *Communication Technology**ω is negative (at the 5% level of significance); this suggests that the probability of change is dampened in the presence of both strong managers and regular communication on technology or organizational change. Frequent communication has the potential cost of increasing conflict and breakdown, and this is particularly problematic in organizations with result-oriented managers.

The estimated coefficient on *Communication Technology**size is negative and significant (at the 1% level), suggesting that, other things equal, larger firms that communicate about technology frequently with their employees have a lower probability of successful organizational change. This result supports Prediction 4 that successful change in larger organizations is facilitated by less communication.

Note that while the direct estimated coefficient for *Communication Strategy* is positive and significant (at the 10% level in Model III), the interaction terms *Communication Strategy**size and *Communication Strategy**ω are all insignificant. Our predictions relate to communication about technical changes (and related matters), and not about communication about other issues, such as a firm's overall objectives, which can be very broad and have limited direct connections with possible specific technological, organizational or product changes.

Table 4
Successful significant change in an organization: probit coefficients (clustered standard errors in parentheses).

	MODEL I Coeff (SE)	MODEL II Coeff (SE)	MODEL III Coeff (SE)	MODEL IV Coeff (SE)	MODEL V Coeff (SE)	MODEL VI Coeff (SE)
Size*1000	.023*** (.006)	.024*** (.006)	.023*** (.006)	.024*** (.006)	.018** (.007)	.020*** (.007)
Communication Technology	.448*** (.115)	.458*** (.089)	.455*** (.113)	.461*** (.090)	.272** (.118)	.274*** (.098)
Communication Strategy	.170* (.089)	.112** (.050)	.171* (.090)	.113** (.049)	.135 (.104)	.005 (.059)
Communication Technology*size*1000	−.026*** (.007)	−.025*** (.007)	−.025*** (.007)	−.024*** (.007)	−.021** (.009)	−.021** (.009)
Communication Strategy*size*1000	−.006 (.008)	−.005 (.008)	.005 (.008)	.004 (.007)	.007 (.009)	.003 (.009)
ω (Managerial style)	.918*** (.283)	–	.944*** (.292)	–	1.128*** (.410)	–
Communication Technology*ω	−.599* (.317)	–	−.620** (.308)	–	−.300 (.299)	–
Communication Strategy*ω	−.155 (.239)	–	−.155 (.240)	–	−.360 (.296)	–
Result-Oriented (RO) Managers	–	.055*** (.021)	–	.056*** (.021)	–	.059*** (.020)
People-Oriented (PO) Managers	–	−.024 (.016)	–	−.026* (.015)	–	−.035* (.019)
Comm Technology*RO Managers	–	−.045* (.027)	–	−.047* (.026)	–	−.037 (028)
Comm Technology*PO Managers	–	.014 (023)	–	.015 (.022)	–	.025 (.025)
Innovation important	.240*** (.067)	.235*** (.069)	.237*** (.068)	.233*** (.070)	.181** (.072)	.176*** (.074)
OTHER VARIABLES						
Industry DVs controls	YES	YES	YES	YES	YES	YES
Union DVs controls	NO	NO	YES	YES	YES	YES
Change type controls	NO	NO	NO	NO	YES	YES
Log pseudo likelihood	−1229.707	−1227.849	−1226.877	−1225.008	−963.936	−962.981
Pseudo R^2	.083	0.085	.0852	.087	.281	.282
No. of obs.	2227	2227	2227	2227	2227	2227

Notes: *** Significant at 1% level, ** significant at 5% level, * significant at 10 % level. Standard errors clustered at the 2-digit industry level. Estimates include 2-digit industry dummy variables, union control variables (Models III-VI) and new product or organizational change controls where technological change is the omitted category (Models V and VI).

These results are consistent with the notion that firms distinguish between communication regarding strategy and technology and that they adopt different protocols when communicating different things.

As noted above, Models II and IV include alternative measures of managerial attributes, estimating the probability of change using the *Result-Oriented* and *People-Oriented* measures separately, as well as their interactions with *Communication Technology*. Focusing on Model IV, which again includes the full set of industry and union dummies, it is notable that the estimated coefficients for *Size*, *Communication Technology* and *Innovation Important* remain positive and significant, all at the 1% level. Similarly, the coefficient on the interaction term *Communication Technology*size* is negative and significant (1% level), consistent with our theoretical prediction that, in equilibrium, a larger innovative organization will have less frequent communication about change.

The results relating to our alternative measures of managerial style are consistent with our estimates using ω (Models I and III).

Specifically, having *Result-Oriented* managers is associated with a significantly higher probability of change, whereas the presence of *People-Oriented* managers is associated with a lower likelihood of change (significant at 1% and 10%, respectively). The interaction terms are also consistent with the estimates in Model I and with Prediction 3 – establishments with result-oriented managers that communicated frequently about technological change were significantly less likely to successfully implement change (*Comm Technology*RO Managers*, 10% significance level). This accords with the arguments that frequent communication in organizations with head-strong managers can harm the innovative process. Rather, less frequent communication in establishments with result-oriented managers seems to improve the prospects for change.

Finally, the inclusion of the type of change controls do not significantly alter our estimated finding. In particular, there remains a strong relationship between *Change* and firm *Size*, *Communication Technology* and *Communication Technology*size*.

4.1. Note on causality and the theoretical framework

As noted earlier, given the fact that we estimate a reduced-form model, it is not possible to imply causality from our econometric analysis. While we framed our empirical predictions in Section 2 as a question of the impact of manager style and communication on the likelihood of successful change, it is plausible that all of these variables are jointly determined, or that there is some reverse causality at play. For example, if change is highly desirable, a firm's owner or senior management might be careful to implement communication protocols or to promote or hire the required types of managers. Alternatively, in a firm with a culture of change (or risk taking), managers might be less concerned about personal relationships, and more focused on out-comes.[26] Similarly, result-oriented managers might prefer to work in an environment that is conducive to change. In many ways we are agnostic to the precise causal effect at play here – rather, a contribution of this paper is to highlight the nuanced interrelationship between communication, managerial style and organizational change, along with their relationship to other firm characteristics, like size. These nuances have not previously been analyzed in the empirical literature. That is, our analysis is the first of its kind; previous studies have not examined the mitigating relation that manager style has on communication in a firm that successfully implements change. Given this, we leave to future research the development of a structural approach that can possibly identify more specific causal channels between communication, manager attributes and change in organizations that have been highlighted here.

In this context, it is worth reconsidering the theory model in Section 2. The theoretical framework presented is a springboard for our empirical analysis; it does not, consequently, provide a complete description of the internal workings of an organization. For tractability, the choice variable for the firm in the model is m, the frequency of communication by managers regarding prospective change. Of course, alternative specifications are feasible. For example, in Bel et al. (2015) the strength of a firm's managerial advocacy (ω) is endogenously determined by the tradeoff between the need to overcome organizational inertia to engender change, and the possibility of conflict between head-strong managers promoting different ideas that can stymie change (referred to as breakdown). Their framework affords similar empirical predictions as derived here: communication and advocacy strength are positively related to change; less communication is required to engender change when a firm has result-oriented managers; and less communication is required in larger innovative firms. Stepping beyond the confines of these models, it is also worth noting that a firm would (ideally) choose an internal structure (the style of its managers, communication protocols, and so on) to help implement its business strategy. A firm could tailor its recruitment process so as to hire managers with the desired attributes; for instance, firms pursuing an innovative strategy might hire stronger advocates for change. While an exploration of all of these possibilities is outside of the scope of this paper, it does suggest that care is needed not to imply causality from our empirical results.

4.2. Extensions

As a check on our empirical results outlined above, we estimate several alternative models. Firstly, qualitatively very similar results hold for all specifications using a logit model (not reported). Secondly, we estimate a multinomial logit for change (with the three categories being technical change, the introduction of a new product or service and a reorganization of the plant, with no change as the base outcome). The results are shown in Table 6 in the Appendix A. While there are

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[26] The possible reverse-casual link between the key interaction terms *Communication Technology*size*, *Communication Technology*ω and *Comm Technology*RO Managers* is less obvious.

Table 5

Probability of successful significant change in an organization: discrete-choice semi-nonparametric coefficient estimates (robust standard errors in parentheses).

	MODEL VII Coeff (SE)	MODEL VIII Coeff (SE)	MODEL IX Coeff (SE)	MODEL X Coeff (SE)
Size*1000	.025** (.011)	.027*** (.013)	.023 (.017)	.027 (.027)
Communication Technology	.637*** (.182)	.692** (.283)	.472** (.218)	.451** (.217)
Communication Strategy	.262*** (.172)	.148* (.080)	.654*** (.229)	.034 (.105)
Communication Technology*size*1000	−.021** (.010)	−.021* (.012)	−.018 (.018)	−.025 (.019)
Communication Strategy*size*1000	.006 (.010)	.004 (.011)	.010 (.020)	−.004 (.022)
ω (Managerial style)	1.406** (.596)	–	3.144 (.609)	–
Communication Technology*ω	−.962*** (.356)	–	−.607 (.565)	–
Communication Strategy*ω	−.302 (.370)	–	−1.724*** (.550)	–
Result-Oriented (RO) Managers	–	.069** (.034)	–	.160*** (.049)
People-Oriented (PO) Managers	–	−.022 (.018)	–	−.052** (.024)
Comm Technology*RO Managers	–	−.062* (.034)	–	.056 (.038)
Comm Technology*PO Managers	–	.008 (.024)	–	−.083* (.044)
Innovation important	.246*** (.087)	.259*** (.117)	.144 (.128)	.137 (.111)
OTHER VARIABLES				
Industry controls	YES	YES	YES	YES
Union controls	YES	YES	YES	YES
Change type controls	NO	NO	YES	YES
χ^2	4.719 (p=.030)	3.247 (p=.072)	50.200 (p=.000)	47.956 (p=.000)
Log pseudo likelihood	− 1246.359	−1245.510	−954.678	−954.883
No. of obs.	2227	2227	2227	2227

Notes: *** Significant at 1% level, ** significant at 5% level, * significant at 10 % level. Estimates include 1-digit industry dummy variables, union control variables and new product or organizational change controls where technological change is the omitted category (Models IX and X). The χ^2 statistic is the likelihood ratio of probit to SNP model.

differences between the types of change, the qualitative results are very similar to the results discussed above.

Thirdly, the estimation residuals of the probit models above, adjusted for heteroscedasticity, are not normally distributed. To check the robustness of our results from the probit model, following Gallant and Nychka (1987), we estimate a semi-nonparametric discrete-choice model; this method has the advantage that it both requires less distributional assumptions and produces consistent estimates (De

Table 6
Successful significant change in an organization: multinomial logit coefficients (clustered standard errors in parentheses).

EXPLANATORY VARIABLE	TECHNOLOGICAL CHANGE	ORGANIZATIONAL CHANGE	NEW PRODUCT
Size*1000	.034 (.027)	.045*** (.015)	.036* (.022)
Communication Technology	.684** (.315)	.976*** (.273)	.065*** (.830)
Communication Strategy	.053 (.358)	.130 (.259)	−1.934** (.985)
Communication Technology*size*1000	−.013 (,027)	−.025 (.017)	−.097*** (.026)
Communication Strategy*size*1000	−.031 (.025)	.005 (.017)	.032 (.022)
ω (Managerial style)	2.668*** (1.029)	1.137 (.764)	2.263*** (.828)
Communication Technology*ω	−1.182 (.928)	−1.862*** (.686)	.065 (.830)
Communication Strategy*ω	−.057 (1.059)	.453 (.646)	−1.934** (.985)
Innovation important	.584*** (.204)	.345*** (.139)	.375* (.221)
Log likelihood	−1772.871		
LR χ²	0.108		
Pseudo R²	0.108		

Notes: *** Significant at 1% level, ** significant at 5% level, * significant at 10 % level. Standard errors clustered at the 2-digit industry level. The model includes 2-digit industry dummy variables and union control variables. The base case is when no significant changes were implemented.

Luca, 2008). This semi-nonparametric approach is possible here because of our relatively large sample size.

The results are displayed in Table 5; Models VII and IX use ω and its interaction terms, whereas Models VIII and X include *Result-Oriented* and *People-Oriented*, and their respective interaction terms. All models include industry and union control dummy variables. Models IX and X include type of change dummy variable controls (new product and organizational change dummy variables, with technological change being the omitted category) .

These semi-nonparametric estimates are largely consistent with the probit estimates above. In Model VII ω is again positively related to *Change*. Similarly, *Communication Technology* is also positively related to *Change* (1% level of significance). The estimated coefficient of the interaction between these two variables, *Communication Technology*ω is negatively and significantly related to change, again at the 1% level of significance. This suggests frequent communication is mitigated in presence of managers focused on objective results in innovative establishments. As in the probit estimates above, the coefficient for *Size* is positive and significant. On the other hand, the estimated coefficient for *Communication Technology*size* is negative and significant. This is consistent with Prediction 4: successful change requires less frequent communication in larger organizations.

Models VIII and X utilize the alternative measures of managerial attributes. In Model VIII the coefficient for *People-Oriented* managers is not significantly related to change in organizations, but the estimated coefficient for *Result-Oriented* managers is positive and significant at the 5% level. The interaction *Comm Technology*RO Managers* has a negative and significant relation to *Change*. Again, this is consistent with our prediction that result-oriented managers mitigate the use of frequent communication; while communication is necessary, too much communication can be costly as it can facilitate conflict in an organization with driven managers.

5. Implications and concluding comments

Managers play many roles–one of the most important of these roles is mapping out an organization's strategic direction and implementing the changes necessary to achieve these goals. We posit that managerial style and an organization's communication protocols are important factors in a firm's ability to successfully implement a change. Specifically, our empirical results using French establishment-level data are consistent with the following predictions: both (i) frequent communication and (ii) the presence of result-oriented managers is positively associated with significant change in firms; (iii) change requires less communication in firms with result-oriented managers; and finally (iv) in equilibrium less communication is required for successful change in larger organizations.

There are several managerial implications of our analysis worth noting. First, managerial attributes matter. While it is possible to motivate individuals somewhat through the use of incentive contracts and the like, internal drivers for managers are also very important. This is critical when trying to foster change that is notoriously nebulous ex ante making it difficult to describe in a formal contract. Consequently, self-motivated managers who pursue change for its intrinsic value can be valuable in innovative organizations.

Second, a firm's communication protocol can make or break a potential change. Communication within an organization can facilitate change–it can inform, convince and reassure, helping agents rally around the implementation of a new project or change. But communication can come at a cost. Too much communication can provide a forum for disagreement. This is particularly true with intransigent managers, who might be good advocates but poor compromisers. This implies that a firm's communication protocol need to be designed to complement its managers' style; for example, less communication is needed with more result-oriented managers. It also suggests that there is no one-size-fits-all approach to organizational change.

Third, the size of an organization, and the number of individuals involved in the change process are important. Specifically, a firm needs to be wary of having too many people as part of the organizational change process. It is notable that many of the most innovative firms are small start-ups. Moreover, as these firms grow, many of them try to maintain a structure that emphasizes small independent team, with the aim of spawning change.[27] This suggests that effective change often requires small team, reducing the need to involve and communicate with the broader organization.

In summary, here we argue that the internal processes of the firm significantly affect a firm's ability to implement change. Our focus is on communication protocol, managerial style and their interaction. No doubt other aspects of firm's internal organizational architecture are also important. Our findings are suggestive that internal organizational structure can help explain the dramatically different performance of seemingly comparable firms (see Bloom and Van Reenen, 2007, for example); not only do firms need the right type of manager, they also need the appropriate communication process.

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[27] This is true for companies such as Google and Microsoft. See Cook (2012) and Stross (1996) for example.

Appendix A

Theorem 1

Proof. Applying the Implicit Function Theorem with respect to m^* and ω to the FOC in (2) yields

$$\frac{\partial m^*}{\partial \omega} = -\frac{\dfrac{\partial^2 p(m^*, \omega, s)}{\partial m \partial \omega} - \dfrac{\partial^2 C(m^*, \omega, s)}{\partial m \partial \omega}}{\dfrac{\partial^2 p(m^*, \omega, s)}{\partial m^2} - \dfrac{\partial^2 C(m^*, \omega, s)}{\partial m^2}}. \tag{6}$$

From Assumptions 1 and 2 both the numerator and the denominator of (6) are always negative, guaranteeing that $\frac{\partial m^*}{\partial \omega} < 0$.

Applying the Implicit Function Theorem with respect to m^* and s to the FOC in (2) yields

$$\frac{\partial m^*}{\partial s} = -\frac{\dfrac{\partial^2 p(m^*, \omega, s)}{\partial m \partial s} - \dfrac{\partial^2 C(m^*, \omega, s)}{\partial m \partial s}}{\dfrac{\partial^2 p(m^*, \omega, s)}{\partial m^2} - \dfrac{\partial^2 C(m^*, \omega, s)}{\partial m^2}}. \tag{7}$$

From Assumptions 1 and 2 both the numerator and the denominator of (7) are always negative, guaranteeing that $\frac{\partial m^*}{\partial s} < 0$. □

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