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Coordination Game:
The Leadership Challenge*

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Abstract

Empirical evidence, especially in case studies, shows that individual leaders often have a crucial role in successful enterprise transformation in transition economies. Conventional economic analysis alone cannot explain this role of leadership. In this paper we use coordination games to analyse transitions from one Nash-equilibrium to another. We argue that the creation of common knowledge among stakeholders by a leader allows firms to overcome coordination failures. This is crucial for enterprise transformation because of the multiplicity of stakeholders who need to coordinate their action to implement radical organizational change.

Key words: Enterprise transformation, Eastern Europe, coordination games, leadership.

JEL Codes: P31, C79, L29.

Introduction

Widespread malaise characterizes the progress of enterprise transformation (ET) in Eastern Europe (e.g. Nellis 1999). At the same time, scholars express a sense of dissatisfaction with agency-based corporate governance analysis as the main avenue for analysing ET (Stiglitz 1999, Kogut and Zander 2000, Spicer, McDermott and Kogut 2000). Notably, few performance differences can be explained by the differences in ownership and governance structure, especially in the former Soviet Union (Estrin and Wright 1999).

Case evidence points to an aspect scarcely considered in the literature: the role of individuals at the helm of the enterprise. This paper presents a theoretical logic that can explain the progress in ET, independent of the principal-agent logic of corporate governance that has dominated the transition literature so far. Successful ET requires to solve a major coordination game. Yet coordination games frequently fail, even in simple experimental settings (Ochs 1995). A mechanism is thus needed that induces agents to choose routines that provide the mutually best outcome. Leaders can resolve coordination games not only by changing the structure of the game but by creating common knowledge among players on which routines shall be pursued in the future. They can therefore overcome the extensive coordination problems faced by firms during ET.

The next section introduces the coordination problems of economic transition, which are analysed in a game-theoretic perspective in section three. Section four concludes with the implications for policy and further research.

Enterprise Transformation as a Coordination Problem

ET requires a radical change of the enterprise (Newmann and Nollen 1998, Meyer 1998) changing not only the production process but also the nature of its external relations and thus its 'inner logic'. Enterprises are complex social organizations that bring together a large number of individuals with very diverse and potentially conflicting interests. This holds especially true in enterprises undergoing the transformation from plan to market as not only internal but also many external *stakeholders* aim to influence its restructuring strategy (Berglöf and v.Thadden 1999, Mygind 1999). The success or failure of ET depends on the combined effort of *inter alia*,

- ❑ employees, who are a very heterogeneous group, and may have ownership rights too,
- ❑ shareholders (after privatization), who may be dispersed, or linked to the firm in ways other than ownership,

- ❑ providers of non-equity capital,
- ❑ providers of technological and managerial knowledge,
- ❑ suppliers and customers, some related by a long-term cooperation,
- ❑ government bureaucrats and politicians, whose support is necessary not only in firms in state-ownership, but also for private firms with a restructuring plan that depends on the regulatory environment, or direct or indirect financial support.

Case research on privatization and restructuring provides plenty of evidence of ET being derailed by conflicts between multiple agents. In Hungary, Antal-Mokos (1998) observed that internal 'politicking' between different groups and the involvement of political interest groups has prevented the implementation of a coherent strategy. In Poland, the need to obtain support from employees and their elected worker council has inhibited many restructuring plans (Carlin et al. 1995, Brada and Singh 1999, Bak and Kolawcuk 1998). In the Baltic states and Russia, insider-ownership necessitates building broad support within the organization for major strategic decisions. Throughout the region, conflicts between multiple stakeholders, or with individuals holding restitution claims, delayed substantive investment in restructuring.

Scholars have recognized coordination problems as a major cause of market failure during transition. Swaan (1997) argues that several types of transaction costs are involved in establishing new relationships because agents have few contacts and reference points for future business. Agents not only have to engage in search and negotiations, but they have to develop new competences required for market-based transactions. This transaction problem has been formalized by Blanchard and Kremer (1997) who show that the output drop in transition economies can be largely explained by coordination failure, which they model based on information asymmetries. Roland and Verdier (1999) present a similar model based on the search costs of finding business partners.¹ However, scholars have to date not addressed coordination failures *within* enterprises.

The complex bargaining situations with multiple diverse agents related to any firm are hard to analyse with principal-agent theory, because agency relationships are poorly defined, or non-existing. The policy advice of principal agency theorists thus focusses on the creation of clear

¹ Formal models on markets in transition are also presented by Aghion and Schankerman (1999), who analyze how investment in infrastructure development can, by reducing transaction costs, intensify competition and thereby induce industrial restructuring, and by Atkeson and Kehoe (1996) who model labour market frictions.

governance structures that define agency relationships. Yet this is easier said than done. Formalizing the negotiation setting is complex and, while a Nash-equilibrium may exist, finding it may take far longer than the pressures of competitive markets permit.²

Case evidence shows, however, that some firms have been successful over the past decade. We have collected in-depth case studies on ET and identified those positive outliers that according to the respective authors, excel in terms of performance (table 1). These firms developed a proactive strategy pursuing a niche market strategy and/or acquiring complementary assets internationally. As would be expected, they have some valuable technological assets and a workable governance structure with hard budget constraints.

insert table 1 approximately here

Yet in addition, the authors in most cases of outstanding performance emphasize the role and personality of the individual, or the management team, leading the enterprise. Like Krystof Piotrowski of Szczecin Shipyard (Johnson and Loveman 1996), they are not just executives, but Schumpeterian managers, or, in other words, leaders. They have managed the formidable challenges to create and implement new corporate strategies.

The importance of bringing in new managers, rather than creating stronger incentives for incumbents is also highlighted in empirical studies. Barberis et al. (1996), who analyse 452 shops in Russia, find that *change* of the manager stimulates restructuring. Hence they argue that “restructuring requires new people, who have new skills more suitable to a market economy”, and that “equity incentives for old people might not be particularly effective in bringing about significant change” (1996:488). Also, Claessens and Djankov (1998) find that performance in the Czech Republic is improved by *changing* managers, but *not* by providing managers with *incentives* in form of equity stakes. All their performance indicators are negatively correlated with the length of tenure of the general manager of the firm, but positively correlated to the external recruitment of

² Moreover, the concept of Nash-equilibrium may be unsuitable to identify an optimal strategy for a firm because it is by definition stable under the condition of non-cooperative behaviour. However, most firms would be far better off if they can achieve cooperative behaviour. This requires a mechanism that encourages cooperation, which our approach provides.

managers.³ Djankov (1999) finds that general management training, independent of its functional specialization, has a substantive positive effect on firm performance.

What distinguishes a leader from an administrative head of a business unit, as many of them were before 1989? First, they have to develop a corporate strategy. They have to identify business opportunities through continuous analysis of the business environment and of the position of the firm and its resources. On this basis, strategies have to be developed, assessed, and adjusted, which requires both analytical skills and creativity. The strategy may be expressed in a business plan that shows how the firm shall be repositioned. It establishes how the resources of the firm shall be combined and organized in innovative ways to create a competitive edge in whatever markets the firm chooses to be in. Among the infinite number of possible restructuring strategies, the leader has to identify one path that the enterprise shall pursue.

Secondly, the strategy has to be implemented. This requires coordination of the activity of all the stakeholders that provide resources for the operations of the firm. They, or at least a critical mass of them, have to be convinced of the path to pursue. An important step in doing so is to create appropriate incentive structures for the individual agents. Notably, those who would lose out, may have to be compensated by side payments. If the incentives faced by individual agents are not compatible, e.g. due to prisoners' dilemma type problems, non-cooperative games can emerge. To resolve such incentive conflicts, (Dewatripont and Roland (1995) propose sequential coalition building. This has been essential at several stages of the Russian reform process as stakeholders have been expropriated or co-opted (Shleifer and Treisman 1999).

Yet, even if all stakeholders would become better off with the new *strategy*, they may fail to coordinate their individual *routines* accordingly.⁴ They may face cognitive barriers to understanding the structure of the game and other players' likely actions. Leadership can overcome the coordination failure and bring all members of an organization on a common path of change - by creating the expectation that everyone else is pursuing the same path (Foss 2000). We analyse a 'coordination game' to demonstrate this role of leadership. Coordination games may appear simplistic relative to non-cooperative games, yet they provide a powerful tool to analyse

³ Moreover, Dyck (1997) presents a theoretical model that presumes that a change of managers is a key objective for privatization.

⁴ We adapt the following terminology: *strategy* refers to the action of the firm, and *routine* to the actions by individuals within the firm.

organizational realities, and the emergence or design of institutions in particular (Camerer and Knez 1994, Cavert 1995).⁵ To focus the argument, we thus assume henceforth that incentive-compatibility problems have been resolved.

A Coordination Game Analysis

Transition can be depicted as moving socialist firms from a low-level equilibrium to a higher level one. It should, in theory, be obvious to all agents involved that they can achieve higher returns for their firms and for themselves personally, if they change their individual routines to market-based ones. Yet why are they not changing?

Figure 1 illustrates the dilemma of agents in a firm undergoing deep restructuring as a ‘coordination game’ (cf. Farrell 1988, Colman 1997). Two players, 1 and 2 both face a choice between two routines A and B. The pay-off matrix appears to suggest, at first sight, that both players ought to play strategy B, and collect the pay-off of two units each.

Figure 1: A coordination game

		Player 2	
		A	B
Player 1	A	(1,1)	(0,0)
	B	(0,0)	(2,2)

Note: in the initial situation, all agents play routine A (shaded area).

Yet, suppose the two players have played routine A for the past forty years, currently earning pay-offs of (1,1). They may become aware that due to changes in the environment, routine B becomes feasible, but they individually have incentives to stay with strategy A, if expectations over other player’s strategy are formed based on past behaviour. No one has incentives to divert from (A,A), which is a Nash-equilibrium. Such a backward formation of expectations is commonly assumed in adaptive learning and evolutionary models of game theory (e.g. Fudenberg and Kreps 1993), and fairly realistic unless potential losses are small. Experiments of repeated games have

⁵ For a recent review of coordination games, formal models and macroeconomic applications see Cooper (1999).

shown strong path dependency: “learning commonly yields convergence to an equilibrium in the stage game, *but the outcome is frequently history-dependent*, and the effects of strategic uncertainty may persist long after it has been eliminated by learning” (Crawford 1997: 235, emphasis added).

A move to the higher level equilibrium will occur if both players believe that the other will play the new routines. The switch to the higher level-equilibrium requires players to change their *beliefs* about the other player.⁶ Recognizing the new strategic option, players do not know if the other player has the same information. Neither do they know when the other player will move to routine B. The agents will only act if they share ‘common knowledge’ (Lewis 1969, Geanakoplos 1992) on the structure of the new game, and when the switch to the new routines is to occur. Common knowledge refers to a situation where A knows that B knows that A knows that B knows, and so on, i.e. *all agents know that others also share the knowledge*, inclusive the fact that everyone else knows it too. Without common knowledge, on both the new pay-off structure and the timing of the switch, the higher-level Nash-equilibrium may never be reached.⁷

Let us take the timing issue first. In our simple example, the coordination can be achieved through modifications in the assumptions, e.g. by allowing pre-play communication (Farrell 1988, Myerson 1989, Kim and Sobel 1995). Suppose, one player is appointed leader allowing her⁸ to make (non-committing) announcements about the strategy. This suffices for her to lead the game to a Pareto-optimal Nash-equilibrium if she announces a strategy, from which she has no incentives to divert. Communicating it, she creates a *focal point* that becomes common knowledge.

⁶ There has not been any systematic experimental research on how shocks that change the pay-off influence the likelihood of observing convergence to an equilibrium, let alone a specific equilibrium (Ochs 1995). The outcome is likely to be highly sensitive to how the information on the changes reaches the players.

⁷ Dependent on the structure of the game, it may suffice that agents share *common beliefs* rather than *common knowledge* (Monderer and Samet 1989). Agents’ successful coordination of routines depends on the beliefs they hold about each others beliefs. The more well-founded these beliefs are, the better they are able to coordinate (Foss 2000).
On the other hand, in certain situations, even *almost common knowledge* may not suffice to coordinate on the most efficient outcome: Suppose coordination occurs via e-mail, yet a message gets lost. As agents do not know whose message got lost, they may fail to coordinate on the most preferable outcome (Rubinstein 1989).

⁸ Analogous to convention in the principal agent literature, we refer to the leader as *she*, and to the players (agents, employees, stakeholders) as *he*.

Experimental studies show that one-sided announcements increase the likelihood of reaching the efficient outcome substantially (Cooper et al. 1994).⁹

Moreover, a leader can overcome coordination failure by creating common knowledge about the strategy to be pursued (Foss 2000). She takes the necessary decisions on corporate strategy and the future role of the agents. Since the strategy is new - strategy formulation is a creative act - we cannot assume, as most game-theoretic analysis does, that the structure of the new game is common knowledge. Two-person two-routine games are very simplifying approximations of the real world, where games are large, with imperfect recall, state-contingent uncertainty etc. Agents are likely to have incomplete information (or, especially in a transition context, none at all) about other players and available strategies (Calvert 1995, Foss 2000). In other words, the common knowledge about the game has to be created. Strategic decisions have to be communicated to all stakeholders in such ways that everyone knows that this knowledge is shared with all other relevant parties.

Thus the leader can facilitate the move to a higher level equilibrium by coordinating the complementary actions of agents through designing incentive compatible routines and by creating a common knowledge concerning their implementation. The techniques employed by leaders to create common knowledge may be culturally bound. Western business leaders and scholars stress the need to create a tangible *vision* to focus the organisation's activities and learning (e.g. Ireland and Hitt 1999, Finkelstein and Hambrick 1996). A shared vision implies common knowledge on the organisation's objectives. It may be created through, for example, public speeches to communicate in person and simultaneously to many agents, who thus know that they share the new knowledge with everyone else who also attended the event. Increasingly, video-conferencing and e-mailing to 'everyone in group x' provide alternative, though imperfect, means.

Participatory decision processes that involve public debate on the underlying issues facilitate the creation of common knowledge on challenges facing the organization, and alternative strategic responses (though not the decision itself). In Russia, Vlachoutsicos (1998) observed a traditional participatory process, which ends with a decision that is taken at the top and communicated 'top-down'. This process, even if ritualized and with little impact on the actual decision in socialist and

⁹ The situation is more complex if both players are permitted to send messages to each other before the game. If played infinitely, they too reach the superior Nash equilibrium eventually (Kim and Sobel 1995). Yet, as shown in the experiments by Cooper et al. (1994), coordination failure in the initial stages of the game is likely.

post-socialist firms, provides an important means to share knowledge. Moreover, it informs the leader where she has to fill in gaps of the common knowledge of the organization.

Figure 1 depicts the simplest form of a coordination game. Yet, the real world is more complex, even without conflicting interests. Complexity, however, reinforces the inertia, i.e. the stability of the inferior Nash-equilibrium. Let us consider some related challenges facing enterprises during transformation using coordination games as framework. Small variations can make the game a more appropriate reflection of the situation of firms facing ET:

- Suppose, a sunk cost is required to change the routines, which may moreover be higher the earlier a player changes his routine.
- Suppose, stakeholders face several new strategies B, C, D, ... that yield higher returns only if *all* pursue the same routine, but lower returns otherwise. The game has multiple Pareto-ranked equilibria, but no selection mechanism to choose among them,¹⁰ or
- Suppose, the new routines require considerable learning in the organization, as is common in the case of ET (e.g. Child and Czegledy 1996). All agents have to be educated *how* to implement their new routines. This may involve fundamental changes, e.g. in communication patterns or in attitudes towards quality and efficiency. Agents aiming for a new routine B may thus erroneously play routine B*, which results in an inferior outcome. Figure 2 illustrates such a situation, making the positive assumption that one player's failure does not affect the other player's pay-off. Even so, it makes a change of routines more risky, and thus reinforces inertia.

Under less favourable assumptions, the coordination challenge becomes even more complex: If the higher level pay-off is dependent on both players playing B correctly, then the choice of action depends additionally on each players' *belief* of the other player knowing how to play B. In addition to training, effective communication between the participants about their capabilities, facilitated by the leader, is essential to solving this coordination game.

¹⁰ This situation is similar to 'stag hunt games' where routines are associated with different efforts and returns depend on the lowest effort by any player. Experiments have shown that, although groups often reach an equilibrium, failure to coordinate on the Pareto-optimal equilibrium was observed in several of the experiments reviewed by Crawford (1997) and Ochs (1995).

Figure 2: Coordination game with a faulty strategy

		Player 2		
		A	B	B*
Player 1	A	(1,1)	(0,0)	(0,0)
	B	(0,0)	(2,2)	(2,0)
	B*	(0,0)	(0,2)	(0,0)

Note: in the initial situation, all agents play routine A (shaded area).

Furthermore, ET requires the coordination of a large number of stakeholders. Theoretical and empirical research suggests that with the number of players, the probability of coordination failure increases. This is caused by the fact that in most of the games analyzed, defection of a single agent significantly reduces returns for all others. Theoretical models show such failure for instance if mutations or inertia influence the selection of routines (Cooper 1999:14). Experimental research mostly uses 'weakest-link games', and find that groups of 10 persons or more mostly fail to coordinate on the optimal equilibrium (e.g. Camerer and Knez 1994).

However, such strict necessity of all agents co-operating is not an appropriate reflection of ET, which is the focus of this analysis. It is more fitting to assume that superior outcome is reached if many but not necessarily all agents cooperate. Figure 3 considers a game where many players need to coordinate their shift from an established but inferior routine 'old' to a superior one called 'new'. The new routine yields a higher pay-off if, and only if, a substantial proportion of the agents shift to the new regime. If only a small number of agents change, everyone may in fact become worse off. This leads to a *critical mass* problem: it is necessary that a sufficiently large number of agents believe that a critical number of others will shift to the new routine. This is illustrated in the dynamic coordination game with ten agents in Figure 3:

Figure 3: Coordination Game with a Critical Mass
 Payoff for players playing 'old' and 'new', respectively.

	number of agents playing 'new'										
	0	1	2	3	4	5	6	7	8	9	10
old routine	3	2	2	2	2	1	1	1	0	0	n.a.
new routine	n.a.	0	1	1	2	2	3	4	4	5	6

Note: Individual payoff for players playing old / new routine, dependent on the number of players that switch to the new routine. Initially, all agents play the old routine (shaded area).

In the initial situation, all ten players follow the old routine and collect a payoff of 3, as illustrated by the shaded area. If some agents change to the new routine, this will reduce the benefits for those staying with the old routine. If all ten switch to the new routine, they will all be better off. However, the initial position is a stable Nash-equilibrium: with adaptive expectations (based on other agents' past behaviour), no agent, not even a pair of agents, has an incentive to change. It requires a coordination of - in the example - at least six agents to play 'new' to create a situation where playing 'new' yields at least equal return of 3 units.

Considering the evolutionary dynamics of the game, it has three equilibria, of which two are stable. In repeated rounds of this game, with expectations formed based on past outcomes, the dynamics of the game will lead to a convergence to an equilibrium where all agents play the same strategy, 'old' or 'new', though it may temporarily rest at the inferior unstable equilibrium where four player pursue the new strategy. If at least five agents shift to 'new' (e.g. because they trust their leader), then the game will converge to the new equilibrium where all play 'new'. Notice, however, that during the adjustment, the return here falls from 3 units to 2 units before increasing to 6 units, a transitional crises as observed in many firms during radical change.¹¹

If less than four agents shift to the new regime, the dynamics of a repeated game will lead to a return to the original, low-level equilibrium. The leader thus does not need to convince all

¹¹ In real life situations, such a transitional crises may undermine the credibility of the leader, or of the announced strategy. If the structure of the game and its payoffs is not common knowledge, this can thus lead to a resistance to change, and in fact attempts to return to the original equilibrium, even though under the above assumptions the game would converge to the superior Nash equilibrium.

stakeholders to adopt the new routine, but only a critical mass of agents. This critical mass is ‘five out of ten’ in the example, but may be anywhere from 0.1% to 100% of the workforce in real life, and some agents may carry more weight than others.

The critical mass game, however, requires less strict assumptions about agents sharing common knowledge on the structure of the game. It suffices that a critical mass of agents believes that a critical mass understands the game, and will thus switch. With evolutionary dynamics like those depicted in Figure 3, large groups are easier to coordinate. The leader thus to create common beliefs among a large number of her employees, but does not need to fulfil the strict assumptions associated with the theoretical concept of common knowledge.

Conclusion and Extensions

ET in transition economies requires radical changes not only at the organizational level, but for each individual related to it. *To induce an agent to change his behaviour, he not only needs to learn the new routines, but he has to form the belief that other agents will also change their routines in such way that his new routine will make him better off.* We have argued that this kind of coordination problem can be overcome by a leader of the organization, who performs the following tasks:

- to define the strategy of the firm out of a subset of alternative transformation strategies.
- to create incentives that minimize conflicts of interest among the stakeholders, i.e. the new corporate strategy becomes a Nash equilibrium of individual routines.
- to create common knowledge about the new strategy among a critical mass of agents who will thus switch and initiate evolutionary dynamics which in turn will lead to a superior Nash-equilibrium.

This leadership challenge emerges not only in enterprise transformation. Similar dynamic coordination games emerge at several levels in transition economies (Shleifer and Treisman 1999). For instance, firms are integrated into business networks, especially if there is limited entry. They will move from the old-boy survival and rent-seeking type of networks (Huber and Worgötter 1998) to entrepreneurial networks when a critical mass of firms finds it more beneficial to leave the old networks. Also the protectionism of regions within Russia suffers from a dynamic coordination game default as individual regions try to protect their local industry through trade

barriers (Broadman 1999). Most would benefit from trade liberalization, but - as in international trade - strong lobbying by local firms inhibits the liberalization. At every level, a critical mass of agents changing to the new set of routines, attitudes and business strategies is necessary to move the group as a whole to a new, better world. A leader can play a pivotal role in moving society from one stable equilibrium to another one, usually a superior one.

Further research should incorporate this crucial role of leaders. In particular, empirical studies on enterprises in transition should include vectors of personal characteristics of leadership, such as the prior experience and reputation of both the CEO and the top management team. The empirical research by Barberis et al. (1996) has pointed to the importance of managers as leaders of firms in transition, yet this needs to be taken further. Theoretical research should deepen the analysis of coordination problems in transformation processes, analysing for instance under which circumstances agents behave cooperatively and/or follow the direction proposed by a leader. Moreover, how can one create selection mechanisms that bring individuals with coordination skills into leadership positions, and how can incentives be designed for top managers to act as leaders, and in the best interest of the organization?

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Table 1: Outlier Analysis:
Cases of former state firms that successfully transformed themselves*)

Case	Sources	Success factors
Jenaglas (precision optical instruments, East Germany)	Peng (2000), Kogut and Zander (2000)	<ul style="list-style-type: none"> * Visionary Western management team, pushing through radical restructuring, even if opposed by local interest groups. * World-leading technological competence, yet without brand (due to the loss of the Zeiss brand name to West German Zeiss AG). * Financial resources from government support.
Veba (textile, Czech Republic)	Newman and Nollen (1998), Matesova (1999)	<ul style="list-style-type: none"> * Leadership, esp. in terms of strategic thinking, decisiveness and initiative, and cost awareness. * Continuous learning from customer contact and competition, and from Dutch consultants.
Revda (lighting, Russia)	Gallagher (1999), Gallagher and Scott (199x)	<ul style="list-style-type: none"> * Entrepreneurial leadership: innovative, decision maker, visionary, creative. * “Changing the cultural norms of non-acceptance of responsibility, the desire for certainty and the reticence to cope with increased levels of ambiguity.”
Szczecin Shipyard (shipyard, Poland)	Johnson and Loveman (1996), Johnson et al. (1996).	<ul style="list-style-type: none"> * Leadership: the chosen new manager came with a comprehensive restructuring plan. * Consensus of key stakeholders, especially workers and creditors, was gained by making a persuasive case that a smaller viable shipyard was preferable to a bankrupt shipyard; hard budget constraints.
Drumet S.A. (Steel wire, Poland)	Urbanek (1999)	<ul style="list-style-type: none"> * The change of management in 1990 was of crucial importance. * Some export experience, and sufficient resources to finance investments internally.
CHEM_H (chemical engineering, Hungary)	Lieb-Doczy (2000).	<ul style="list-style-type: none"> * The end of political interference and new management team pursuing socially responsible restructuring. * Resources: cheap inputs based on long-term supply contracts, strong technology, and development of related firms in the vicinity.
Graboplast (textile, Hungary)	Grayson and Bodily (1996).	<ul style="list-style-type: none"> * “The most important element which made this company turn around is the attitude of the CEO ... the manager’s support to bring in outside consultants to cut the fat around the company. * cost leadership and high efficiency.

*) We include only firms that are not foreign-investment firms, and not newly established firms, and we rely on the original authors’ assessment of the importance of the success factors.

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