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Time-based competitiveness in Brazil: whys and hows

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Many authors in the literature suggest that, mainly in the 1990s, there is an increasingly strong relationship between time and competitive success. For them, time should be utilized as the next competitive weapon (Azzone *et al.*, 1991; Blackburn, 1990; Bower and Hout, 1988; Goldsbrough and Deane, 1988; Kumar and Motwani, 1995; McKenna, 1997; Peters, 1990; Ruch, 1990; Slack, 1993; Stalk, 1988; Stalk and Hout, 1993; Stalk and Istvan, 1989; Stewart, 1989; Tersine and Hummingbird, 1995; Thomas, 1989; Tunc and Gupta, 1993).

Although many authors have announced their beliefs that compressed times are important for the world competition of the 1990s, the literature still shows an imbalance between "conceptual" and empirical work which could clarify how actual companies are dealing with the new trends toward time as a competitive priority. Out of 32 references analyzed by Kumar and Motwani (1995), only eight included some sort of empirical backing – using case studies or field study in their methodologies. All the others, albeit very valuable, did not use field study, at least explicitly. They used "discussion" as the main approach. The current literature has also overemphasized "what to do" but not as much "how to do." In other words, managers still miss empirical-based frameworks and management models which could better support them in their efforts to become "time-based competitors." If this is so in world terms, in South American terms the literature is almost nonexistent. Although most of the prescriptions found in the literature seem also plausible for South America, some of the idiosyncrasies of the South American environment may deserve some investigation with regard to the appropriateness of the suggested emphasis on time in the 1990s. The research, partially described in this paper is an attempt to contribute to filling these gaps in the literature: through a combined approach which encompasses literature review and field research of Brazilian "best practice" companies with regard to time reduction programs, two questions are addressed:

(1) Why become time-based competitors?

(2) How to become time-based competitors?

Objectives of the research

As stated in the previous section, the objective of the research is two-fold. First, the question "why compete based on time?" will be addressed. The aim here is to assist Brazilian managers (and managers from other countries which present

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similar environmental conditions, such as some South American and Asian countries) who are considering whether to trigger efforts to become time-based competitors but are somewhat unsure that this is actually a priority for them. Answers from the field in fact show some differences from what is usually found in the literature.

Second, the question "how to compete based on time?" is addressed with the aim of supporting managers who have decided to become time-based competitors but do not know how to do it: where to start, who to involve, where to put money on, and so on.

Methodology

Methodologically, the research was conducted in phases (see Figure 1).

After the definition of what the project would be in terms of objectives and scope, a literature review was done aiming to identify the state-of-the-art of time-based competitiveness. A survey of the different arguments which authors use to justify why companies should pursue shorter cycle times was done and criticized. A compilation of different models (some were found to be quite comprehensive and some were found to address the issues only partially) found in the literature was done, categorized, compared and criticized.

As a result, some theoretical categories were found which are recurrently present in many authors' models. These categories were identified using "affinity diagrams" and became the core guidelines for the research design. Case studies were chosen as the research design because of several reasons:

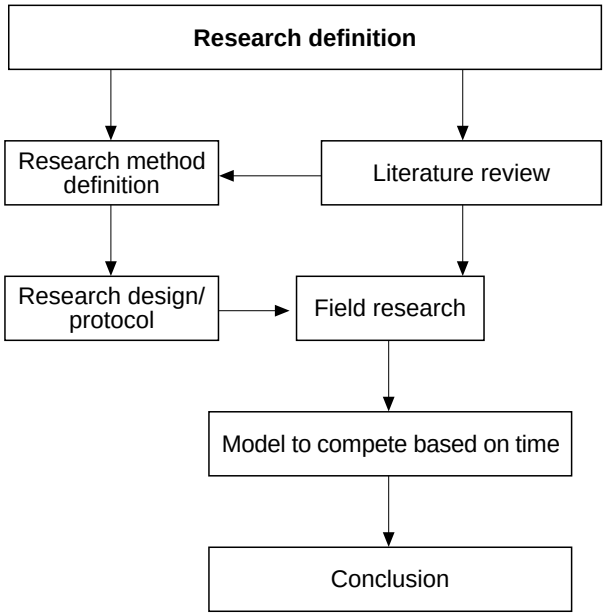

Figure 1.
Scheme of the methodology phases

- some of the categories initially identified as worth investigating were ambiguous concepts (e.g. “logistics” or “capacity management”), so the presence of the researcher was a pre-requisite of the research to ensure construct validity: to make sure the companies clearly understood what was asked);
- the confines of what could be found were not well defined at the outset of the research, therefore a method which would allow for adjustments during the course of the research was desirable; and
- the research question was a “how” question, in other words the idea was to build theory, so an in-depth understanding of the decision making process of the elements of the sample would be required.

A semi-structured questionnaire was designed based on the categories identified in the literature review and applied to the sample through interviews with the management, taking care that the respondents were representative and well informed and also that multiple sources of evidence (more than one person per company, documental analysis in addition to the interviews, factory tours and less formal chats with direct workers) were researched.

The sample, as is advisable in case study research (Pettigrew, 1988) was not random, but carefully chosen to provide polar examples: all companies have recently undertaken formal programs aiming to reduce their cycle times, all are leaders in their fields, all have manufacturing as their core operation, all are part of large multinational corporations with large operations in Brazil. The field work was completely conducted in the Brazilian operations of the case-companies. The researched companies were:

- Metal Leve (piston rings, Brazilian).
- Xerox (electronics, American).
- Ericsson (communication equipment, Swedish).
- NIFE (industrial batteries, French).
- Krupp (forged parts, German).
- Kodak (photographic equipment, American).
- Magnetti Marelli (fuel injection systems, Italian).

Additionally to their approach with regard to the categories in the research protocol, their time reduction programs were analyzed and the results achieved were identified. Unfortunately, for confidentiality reasons, the particular models used by each of the case-companies will not be presented here.

After having collected data in the field, intra-case and cross-case analyses were performed and conclusions were drawn. The model building exercise represented by the last box in the diagram draws from all the previous stages and is an attempt of deriving a step-by-step prescriptive model to support managerial decision regarding the pursuit of time-based competitiveness.

A brief literature review

The objective of the literature review was to develop a starting point from which to design the field research (including the research instruments) and also to define one of the building blocks for the model building exercise. A considerable number of research pieces on the themes and/or under the labels "time-based competition," "fast cycle time," "competitive strategy," "operations strategy," "time," "speed," "flow," among others were analyzed.

The main theoretical categories of each were identified, analyzed, compared and re-grouped and then a set of representative categories was developed. These categories comprehensively represent aspects which a composite view of some of the most relevant authors (Azzone *et al.*, 1991; Barker, 1993; Bertehzzaghi *et al.*, 1993; Blackburn, 1990; Bower and Hout, 1988; Merrils, 1989; Peters, 1990; Ruch, 1990; Stalk, 1988; Stalk and Webber, 1993; Stewart, 1989; Tunc and Gupta, 1993) in the literature consider as important to be taken into account when companies decide to become time-based competitors:

- *Logistic system*: characteristics/techniques suggested for the logistics system including order entry, manufacturing planning and control, inventories, relationship with suppliers and consumers.
- *Production system*: characteristics/techniques suggested for the production system, including working methods, equipment, setup, automation, flexibility, continuous improvement systems.
- *Capacity management*: related to defining how to manage the capacity of a company which competes on time.
- *Information system*: related to characteristics of time-based competitors' information systems.
- *Performance measurement*: related to defining what to measure, how to measure, how frequently to measure time-related performance.
- *Human resources/infrastructure*: related to the desirable attitude (and the techniques used to foster this attitude) for time-based competitors' human resources.
- *Strategy*: related to the need to develop and implement time-based strategies and the desirable characteristics of such strategies.

Some aspects should be noticed. Not every author emphasizes or even mentions every category. Normally, each author emphasizes certain areas which are closer to his/her area of main interest or areas he/she considers as more relevant. In this sense, a composite view of the authors can provide a more comprehensive approach than each one of them.

All authors point out that time is a source of competitive advantage, but interestingly enough, little empirical evidence is presented to back the point. Although the authors seem to prescribe time-based competitiveness as a sort of "panacea," it seems to be plausible, given the "trade-off" paradigm (Hill, 1995; Slack, 1991) of the manufacturing strategy field, that an advantage in time will

be achieved, at least in the short term, at the expense of other competitive criteria. If this is true, it seems to be advisable that companies analyze their specific competitive stance before deciding to emphasize time as their main competitive priority.

It seems plausible that time-based competitiveness will be more important when delivery speed is an order-winning criteria. This is particularly important when the customers work under high levels of uncertainty (the South American environment has been relatively uncertain, for example). When a customer works under low uncertainty in terms of its future, it is relatively easy for him to inform his supplier of his needs well in advance. In this case, the supplier would not have much competitive advantage in having very short lead times, mainly if the supplier charges a premium price for the short lead times. For another company which can not forecast its future with minimum levels of accuracy or which works under high levels of uncertainty, short lead times will be a critical criterion for choosing a supplier, because under uncertainty, long term forecasts are prone to errors and therefore the likelihood of incurring costs of wrong purchases is higher, as illustrated in Figure 2.

It is somewhat surprising to notice that none of the authors in the surveyed literature pointed out the level of uncertainty under which the customers work (and the related characteristics such as industrial sector, geographical area and other factors) as one of the points to be taken into account in the decision to pursue (or not) time-based competitiveness, since it seems plausible that faster suppliers would be more valued in an unpredictable environment.

Azzone *et al.* (1999), Barker (1993), Bower and Hout (1988), Stalk (1988) and Tunc and Gupta (1993) suggest that time-based competitiveness is based on the extension of just-in-time and total quality principles to the complete manufacturing system (which includes logistics and customer order management, for example). This seems to be somewhat vague, since just-in-time and total quality are constellations of different techniques. Some of the

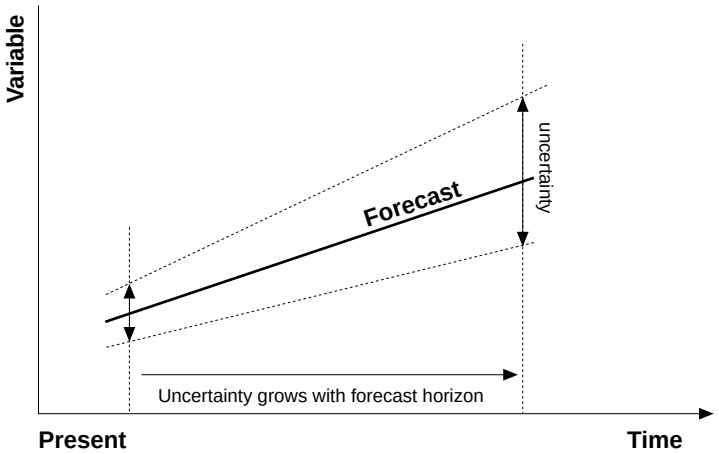

Figure 2.
Relationship between forecast uncertainty and horizon

techniques are certainly useful in terms of shortening lead times but others are less so. As companies in general work with scarce resources, it is important that managers know exactly where to put their resources and efforts and therefore it would be important to delve into a more detailed analysis in terms of what techniques of just-in-time and total quality to prioritize. It is interesting to notice that Barker (1993) prescribes that equipment utilization is maximized in order to reduce cycle times. This prescription appears to have some weaknesses since resource utilization is usually considered an enemy of fast response. Let us think of a fire brigade. They surely "compete based on time." Additional response minutes can represent huge material costs to customers and, worst of all, they can even cost lives. And fire brigades are surely (and thankfully) over-resourced. We would not like to see ourselves in a situation of giving an urgent call to the fire brigade and have to queue up for attention because of "high resource utilization"!

A more in-depth analysis of the literature on time competitiveness is beyond the scope of this research. However the aforementioned are the examples of problems and gaps which can be found in the literature and which also represent opportunities for an improved approach. For a more comprehensive survey of the literature in the field see Hum and Sim (1996).

Field research – results and discussion

The seven in-depth case studies were developed over one year. Below are some results of the intra-case and cross-case analyses:

Time is considered a strategic priority for most of the companies researched. However, interestingly enough, most of the companies researched (six out of seven) pursue time reduction programs not to gain competitive advantage based on shorter lead-times, but to reduce costs and to increase flexibility and delivery reliability. Time has indeed been used as a competitive weapon, but as a means rather than an end. This is not exactly in accordance with some authors' views in the literature which, although recognizing the "second order effects" of time reductions, usually point out competing based on short demand lead-times (the lead-time perceived by the customer) as the main rationale behind time compression initiatives. This difference in perception could well be caused by regional factors. These authors could be basing their analysis and discussions on environments which are substantially different to the environment in which the case companies of this study are. This is only a hypothesis and is still to be empirically tested. The other possibility would be that the reason for the different perception between the authors' views and the literature can not be explained by regional reasons and therefore it could mean that the second order effects (relations between time compression and criteria other than short customer lead-times) of time compression should deserve more attention. This is illustrated by Figure 3.

Most of the time reduction programs adopted by the researched companies varied when compared to those models proposed by the literature and varied among themselves, mainly in form. However, in general, in terms of content, the

categories identified in the literature were broadly present in the programs and were considered relevant by the managers. The composite view of the categories identified in the literature and in the field work enabled the definition of the decision areas that compose the proposed model: strategy, capacity management, process technology, layout, supply chain, learning skills, information flow, performance measures, production organization, setups, maintenance practices, inventories, organization structure and human resources.

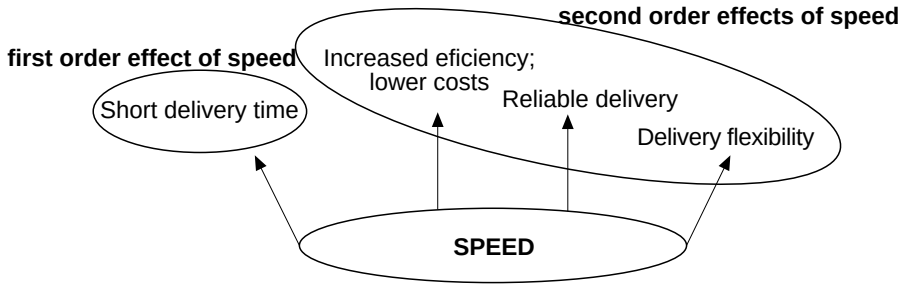

Figure 3.
First and second order effect of speed identified in the field study

Most of the studied companies were relatively successful in their pursuit of cycle time reduction. Many more than halved their cycle times with relatively little effort. One company for instance reduced its production lead-time from 43 days to 4 days. This shows that there is a lot to be gained by a great number of companies who are not "best practice" companies.

Although impressive results could be achieved with little effort, there is a common feeling among the managers that there is much yet to be gained. However, the more is gained the harder it gets (marginal costs of improvement are increasing). As one can attack cycle time reduction problems from different sides, this indicates that there may be a "right (or better) sequence" of actions – first those which are least costly and bring relatively most benefit.

The time reduction programs adopted by the sample companies are partial, emphasizing manufacturing throughput times and many times neglecting order entry management, decision time, among other sources of delay. This means that more systematic and comprehensive approaches could be of help in terms of improving the efficiencies of the time reduction projects or programs.

In general, the researched companies tended to focus their actions on the elimination of non-value added activities (such as transport, inspection, etc.). They sometimes neglected other forms of reducing cycle times, such as working on the relationships between value added activities (changing them from sequential to concurrent, via for example, smarter planning and control systems) or in the reduction of the value-added activity time (see Figure 4).

Most (five out of seven) of the companies researched triggered their time reduction programs as part of larger improvement projects, which also comprise TQM, TPM, *Kaizen*, among others. Managers complained that many

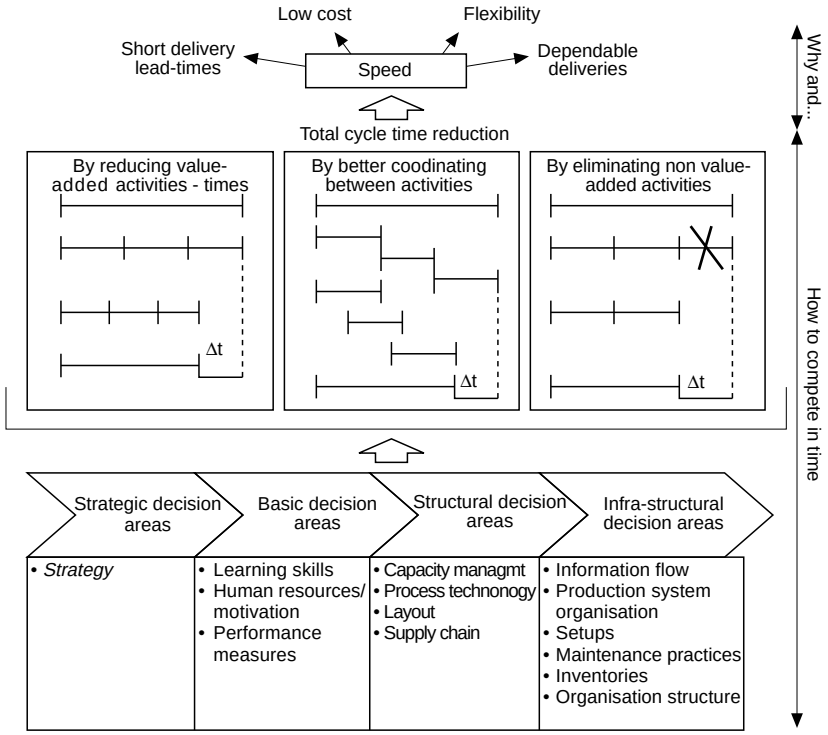

Figure 4.
Diagram representing the framework for time-based competition

times this forced them to divide their attention among a number of commissions and improvement teams which, although generically valuable, can be very dispersing if a clear notion of focus is not present. In the words of one of the managers interviewed:

> …trying to simultaneously improve a thousand things can sometimes mean achieving mediocre improvements in those few things that actually matter.

Before triggering time reduction programs, it is therefore advisable to make sure that the pursuit of reduced times is consistent with the priorities set by the manufacturing strategy of the company, be the priority reduced lead-times or some other criterion which is indirectly influenced by reduced times (e.g. cost).

Most time reduction projects researched were triggered reactively, responding to (sometimes extreme) market conditions, e.g. crises and competitive threat. We argue that on-going time reduction programs developed proactively can bring more significant and less costly results: in proactive conditions, companies tend to have more resources available, more time to plan things, more managerial attention, among others.

Based on the analysis of the relevant literature and on the contribution and insights gained from the field work, the following model is proposed for companies which decide to become time-based competitors.

The outline of a model for time-based competitiveness

The outline of the proposed prescriptions regarding the reviewed categories are shown in Table I.

The categories were classified in terms of their relative ease/effort to act on. They were split into:

- *Strategic* – company wide, top management-related: strategy.
- *Basic* – decision areas which actually sets the ground for other decision areas: learning skills, performance measures and human resources and motivation.
- *Structural* – difficult/costly/time-consuming to change, difficult to revert: capacity management, process technology, layout and supply chain.
- *Infra-structural* – relatively easier to change: information flow, production system organization, setups, maintenance practices, inventories and organization structure.

The objective is to be able to prioritize actions among the areas. A step-by-step procedure is proposed:

Step 0

Check that cycle-time reduction is a priority within your current manufacturing strategy

Step 1

Make explicit all the cycle times which are relevant: from order entry procedures to delivery or after sales services. Define what type of reduction is more likely to pay: reducing value added activities time, coordinating between activities or eliminating non value added activities.

Decision area	Prescription
Strategy	Define, develop and implement time-focused strategy
Capacity management	Keep some well managed over-capacity
Process technology	Flexibility, automation and integration
Layout	Product-based plant layout or cells
Supply chain	Lean supply adapted to emphasize cycle time reduction
Learning skills	Focus on reducing cycle time/creating a “speed” culture
Information flow	Information must be complete, timely, available and precise
Performance measures	Time-related measures as the main focus, time-focused benchmarking
Production organization	Selected just-in-time principles adapted/used to emphasize cycle time reduction
Setups	Minimize, eliminate setups
Maintenance practices	Total productive maintenance
Inventories	Flow-related inventory: minimize; strategic inventory: plan
Organization structure	Emphasis on process, simplification, teams, autonomy, empowerment
Human resources	Focus on time/creating a “speed” culture

Table I.
Prescriptions for time-based competitors regarding selected decision areas

Step 2
Define, develop, implement and execute a time-focused strategy. Create the time-focused learning organization, create a culture devoted to time reduction, develop and implement a time-focused performance measurement system with time-related measures in its very heart, establish time-focused benchmarking, keep an eye on your actual and potential competitors' time-related performance and practices; establish motivational schemes accordingly.

Step 3
Assess the potential for improvement on cycle time reduction of infrastructural decision areas. Prioritize them based on their improvement potential for the type of reduction defined in Step 1, and, costs, organizational effort and time of the alternatives. More than one decision area can be approached simultaneously. If an objective assessment of the potential improvement proves to be impossible, start from the easiest or more likely to be successful.

Step 4
Compare the performance achieved through the actions over the infrastructural decision areas with that of the competitors. If the achieved performance surpasses the competitors, keep your efforts focused on strategic and basic decision areas. If the achieved performance is not enough to overwhelm the competition, choose other/more infrastructural areas to act on.

Step 5
If the possibilities of improving further infrastructural decision areas are worn out, prioritize, on the basis of "best potential for improvement" for the type of reduction defined in Step 1 (if possible) or on the basis of "highest likelihood of success," the structural areas to act on.

Step 6
Compare the achieved performance with that of the competition. If the achieved performance beats the competition, keep your attention on the basic decision areas. If not, start again with actions on the infrastructural decision areas, with maybe step changes.

The general approach can be represented by the diagram in Figure 4.

Main characteristics of the proposed model when compared to the ones found in the field

In general terms, the following differences between the proposed model and the time reduction programs used by the researched companies can be mentioned.

The proposed model does not have the temporary character of a project (as was the case in most studied companies). On the contrary, it is an ongoing program based on the principle of continuous improvement with a moving target: the performance of the best competitors.

The definitions regarding the actions which each decision area should follow consist of a coherent and focused decision pattern. Although the present and future markets are increasingly requiring good performance in several competitive criteria, we are assuming that one cannot be oblivious to the fact that trade-offs still exist and focus is desirable. On top of that we are convinced that the "second order effects" of time compression can help companies improve performance in a multitude of competitive criteria (e.g. cost, dependability and flexibility).

The proposed model adopts a systems approach not focusing in specific functions or processes, which was usually the case with the approaches adopted by the case companies.

We propose that three possible time compression actions are systematically explored:

(1) elimination of non value added activities;

(2) time compression of value adding activities; and

(3) better coordination between sequential value added activities.

Normally, the researched projects are partial and non systematic in this sense, with a stronger emphasis on the elimination of non value added activities.

The proposed model intends to have a proactive rather than a reactive characteristic whereas the analyzed projects were mostly triggered in response to some sort of crisis (see Table II).

Proposed model – "fast factory"	Programs practised by the case-companies
Continuous approach	Temporary approach
Based on the definition of the companies' operations strategy and its submission to the corporate strategy	No explicit or defined strategy behind the programs
Systems approach - all functions involved	Focuses on specific functions or processes
Consistent pattern of decisions	Decisions restricted to specific areas or processes
Overall cycle time reduction through the reduction of productive activities time, better coordination between activities and elimination of non value adding activities	Overall cycle time reduction through a dominant emphasis on the elimination of non value-added activities
Proactive approach	Reactive approach

Table II.
Proposed model against models used by the case-companies

Conclusion and avenues for further research

Some conclusions can be drawn from the research.

Time is actually being used by the researched companies as a competitive weapon. However, many of them use time not to be able to compete with shorter lead times but to improve performance in other competitive criteria such as cost, delivery reliability and flexibility.

The time reduction programs of the researched companies are generally partial and focus on manufacturing throughput times, sometimes neglecting

important sources of time reduction such as decision time and order entry practices. This is also true for many of the frameworks proposed in the literature.

A framework was developed based on the relevant literature and on "best practice" case studies to help companies develop efforts to become time-based competitors. The framework is not technologically new but it is innovative in the sense that it orchestrates techniques already in use but with a prioritization logic and emphasizing time.

The proposed framework presupposes the definition of a manufacturing strategy which prioritizes time-based competition Although we have used a "specialist panel" to validate the proposed model, further research is needed to test and empirically validate the proposed framework.

Some topics were not contemplated by this research and surely deserve more attention in the future.

The "second order" influence of time compression in other competitive criteria such as cost, delivery dependability and flexibility is still not fully understood. Additionally, most of the case studies pointed out that the second order influence was actually the main reason for them to be interested in time compression. These two reasons appear to justify further research.

We did not explore the strategic decision processes of defining time compression as a strategic objective or program. In terms of the first order effect of time compression – the reduction of customer lead-time, we suggested that this would probably be more important for customers who are subject to less predictable environments, but this should be analyzed in more depth in the future.

Still regarding the first vs. second order effects of time compression, further research is necessary to identify the reasons why the rationale behind the time compression projects in the analyzed companies were mostly related to second order effects whereas the literature seems to emphasize more the first order influences.

The proposed model is still to be empirically validated, although it has been submitted to and in a way validated by specialist panels.

The extension of the concepts discussed here and their application beyond the company borders, with the more comprehensive approach of the whole supply network, seems also to deserve further research. Certainly relevant gains can be achieved with time compression in supply networks.

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