ELSEVIER

Int. J. Production Economics 66 (2000) 255–268

international journal of
production
economics

www.elsevier.com/locate/dsw

Traditional and innovative paths towards time-based competition

Alberto De Toni[a,*], Antonella Meneghetti[b]

[a]DIEGM - Dipartimento di Ingegneria Elettrica, Gestionale e Meccanica, University of Udine, Via delle Scienze, 208, Udine, Italy
[b]DiEM - Dipartimento di Energetica e Macchine, University of Udine, Via delle Scienze, 208, Udine, Italy

Received 6 March 1996; accepted 16 December 1999

Abstract

Time performances and time-based competition concepts are analysed, introducing three types of time-based competitors. A traditional and an innovative path towards time-based competition are then recognised, the former achievable by over-resource applying, while the latter by practices related to just-in-time and concurrent engineering. It is explained how making a firm structurally faster leads a company to face a "conversion dilemma", i.e. to choose the proper strategic orientation that can be definitely regarded as affecting its external configuration, visible to the market, or only the internal one, transforming the time advantage into a cost one. Finally a matrix linking market sensitivity to external time performances and competitor typologies is proposed.

Keywords: Time performance; Time-base competition; Strategy; Just-in-time; Concurrent engineering

1. Introduction

In this decade time has been shown to be a new source of success for many companies. The literature provides enthusiastic assertions, describing time as the common denominator of all things vital to long-term competitiveness [1] and therefore "the next battleground" [2] or "the next strategic frontier" [3] for most firms.

Although time has always been considered a fundamental of any human activity, the great attention paid to it nowadays is due to a new awareness of its potential. Time-related characteristics of supply can change, in fact, consumer's perception of products and service and become the new dimension for differentiation. The term time-based competition, coined by George Stalk and his colleagues at the Boston Consulting Group, underlines how time can be the heart of renewed strategic movements.

The different nature of time performances and how they can be related to the new forms of competition have to be clarified. It is also important to analyse if there are distinct paths that lead firms towards time-based competition.

This work is organised as follows: initially external and internal time performances are described, the time-based competition concept is discussed and some distinctions concerning strategic orientation are introduced. Then two different ways to obtain a time-based competitive advantage are identified: a traditional path and an innovative

* Corresponding author. Tel.: + 39-0432-558330; fax: + 39-0432-558251.
E-mail address: detoni@uniud.it (A. De Toni).

0925-5273/00/$ - see front matter
PII: S0925-5273(99)00140-1

one, explaining how the latter leads a firm to a "dilemma" about its own potential. Finally, a matrix linking market sensibility to external time performances and strategic orientations is proposed.

2. Time dimensions

In the modern competitive environment the meaning of time can be analysed from two different points of view. It can be related to the external configuration of the firm, i.e. products and services provided, or to the internal one, concerning the set of resources used by the firm to perform its task [4].

Two classes of time performances are so identified: the external ones, visible to consumers and the internal ones, measurable by the company, but not manifest to customers.

2.1. External time performances

The new strategic role of time arises from the awareness that two dimensions of supply are able to condition customers' behaviour: innovativeness of products and speed and punctuality of deliveries.

As regards consumer goods, the taste for anything modern and unusual, coupled with the actual need of relieving common life difficulties, leads market to increase demand of products with an innovative content. On the other hand, modern day hustle and bustle makes clients prefer a quick response, so that no time is wasted on meeting their requirements. Demand is so revealing elasticity to time, i.e. customers' preference is conditioned by how fast their purchase orders can be carried out.

To each of these dimensions, significant for their competitive potential, an external time performance can be related. Innovativeness of supply can be measured by the frequency of introducing new products to the market or improving the existing ones (FI). The higher the frequency, in fact, the more correctly the product brought to the market can be considered as involving the more advanced technologies and the last stylistic trends. The ability of a firm to quickly satisfy customers' needs can be represented, instead, by delivery time (DT), defined as the period between a purchase order placement and its receipt by the client. When referring to this performance, attention shall be paid not only to the average value, indicative of delivery speed, but also to its deviation, which can be related to delivery punctuality, i.e. due date observing.[1]

The above-mentioned performances can really differentiate a company from its competitors, as they are able to modify the price–quality relation perceived by the consumer.

A firm that provides quick response to customers' needs is able to attract more clients and encourage brand loyalty, increasing its market share; it can even win a price premium for speed and punctuality of its deliveries. A certain degree of elasticity to delivery time characterises not only consumers' demand, but intermediaries' too, due to lower risk for less anticipated replenishment orders.

Analogous advantages (i.e. increased market share and price premiums) can be gained by frequently introducing new products to the market or improving the existing ones, because of the temporary monopolium enjoyed as a first mover [5,2]. A significant example is provided by the so called H–Y war for supremacy in the motorcycle industry. Honda, challenged by Yamaha, introduced or replaced 113 models in just 16 months, increasing technological sophistication and making motorcycle design fashionable. In this way products offered by Yamaha looked out-of-date and unattractive compared to Honda's, determining its defeat.

The great potential of time as a source of competitive advantage leads to new strategic orientations, giving companies a modern weapon to fight with.

2.2. Internal time performances

Time has recently assumed a growing relevance even from the point of view of internal configuration. The time concept is evolving from a labour efficiency indicator, as proposed by Scientific Management, into a resource in itself, which is

[1] Punctuality is one of the possible dimensions of delivery reliability, which can be referred to quantity and mix besides time.

consumed by a process [6]. Attention is therefore focusced on the length of lead times along the operation value chain (i.e. those related to development, procurement, manufacturing and distribution) [7].

The result of this is a great opportunity of improvement, as the portion of time during which value is added to products is generally less than 5% of the whole period they spend in the system [5,8]. Actions have to be taken to reduce waste, i.e. any activity that does not add value or consumes more time than needed.

The pursuit of internal time performances, as a matter of fact, represents for a firm a powerful means of improving in many directions. As Schonberger [9] underlines, lead times can be contracted only by solving problems that cause delays, and this makes a company discover its process inefficiencies. The results of the empirical research conducted by Schmenner [10] on both US and European plants show without any doubt how throughput time reduction[2] stimulates several complementary actions that enhance productivity and lead to positive indirect effects, quantifiable mainly as costs.

According to Little's law [12], lessening lead time (given a capacity) can lower work-in-process within a plant and therefore provide a greater inventory turnover and a decrease in working capital effort. As a significant amount of overhead costs is caused by managing products that linger in the factory [10], expenses can be cut down by speeding up the material flow. Shortening the length of not value-adding activities (e.g. set-up and handling) permits to considerably reduce the costs related to them. Removing scrapped output, rework and idle time for unusable machines by the adoption of more rigorous quality control and maintenance programs enhances productivity and consequently unit cost contracting. It is worth remembering, however, that reducing set-up times guarantees a firm also a greater flexibility to satisfy demand, in terms of both product mix and quantity.

Time performance / Phase	Internal	External
Product Development	TTM (Time-To-Market)	FI (Frequency of introducing) - new products - existing product improvements
Procurement Production Distribution	LT (Lead Time) - procurement - production - distribution	DT (Delivery Time) - speed - punctuality

Fig. 1. Internal and external time performances.

As George Stalk [13] asserts, as a strategic resource time is the equivalent of money, productivity and even innovation, thus for several companies it will become the indispensable weapon to fight with.

The matrix showed in Fig. 1 relates external and internal time performances to the operation value chain phases.

In the product development process, frequency of introducing new products to the market or improving the existing ones represents a remarkable external performance.

Regarding the internal point of view, instead, great importance is assumed by time-to-market (TTM), i.e. the period elapsed between idea generation and product launch on the market, encompassing concept generation, product planning, advanced planning, product engineering, process engineering, and pilot run lead times [14].

Delivery time, involving speed and punctuality, represents the fundamental external time performance of the other phases of the operation value chain, while procurement, manufacturing and distribution lead times (LT) are considered the internal time performances.

[2] The author defines throughput time as the calendar time it takes to make a product, from the time materials arrive at the factory and are available to be worked on until the finished product is awaiting shipment to a customer (1988). In APICS dictionary the following definitions of throughput or cycle time are proposed [11]. (1) In industrial engineering, the time between completion of two discrete units of production. For example, the cycle time of motors assembled at a rate of 120 per hour would be 30 seconds, or one every half minute. (2) In materials management, it refers to the length of time from when material enters a production facility until it exits.

3. Time-based competitor typologies

In Stalk and Hout's opinion (1990), a company only becomes time-based by developing a superior insight into what customers value and by building the company around it. Stonich (1990) considers as a starting point outlining a time-based strategy in finding market segments that value timeliness and estimating the impact of meeting customer needs.

Therefore, time-based competition deals with external time performances as a source of competitive advantages. The objective is gaining an improved delivery time and/or a higher frequency of introducing new products to the market or improving the existing ones, so that attributes able to modify customers perception are added to supply.

The generic appellation of time-based competitor, however, does not distinguish, in our opinion, the performance a firm decides to compete on, i.e. a quick response to clients or/and a superior product innovation rate. It is thus the right moment to suggest a classification of strategic behaviours based on the external time performance privileged by companies. Three different types of subjects within time-based competition are identified: the product time-based competitor, the process time-based competitor and the product and process time-based competitor (see Fig. 2).

A company can be defined a *product time-based competitor* if it aims at increasing its frequency of bringing new products to the market or modifying the existing ones, underlining the innovative side of supply. Focus, in this case, is set on product, which has to exhibit those characteristics of technology sophistication and design capable of meeting customer requests.

A firm is considered a *process time-based competitor* if it aims to speed up deliveries, providing a quick and on-time response to clients. Focus in fact is set on manufacturing and logistic process, which has to support a superior rapidity of demand satisfaction.

Finally, we can call a company a *product and process time-based competitor* if it fully exploits advantages coming from both external time performances: its efforts are directed towards a higher frequency and also an improved delivery time.

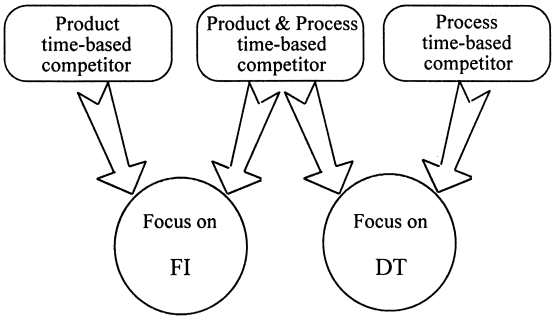

Fig. 2. Focus on external time performances and time-based competitor classes. FI = frequency of introducing new products or improving the existing ones, DT = delivery time (speed and punctuality).

Paths along which a firm can gain an increasing market share and price premium basing on its time performances, come, in our opinion, to two alternatives. A company may choose to achieve an intrinsic ability to make things fast by reengineering its process, or to reach the desired quickness by simply employing more resources, without leading to a systematic change. The latter can be defined a traditional path, while the former an innovative one.

4. The traditional path towards time-based competition

The traditional path towards time-based competition does not imply the achievement of actual speed-up processes, but leads to external time performances as a result of the application of over-resources.

A firm can, for example, pursue a higher frequency of product introduction and improvement and become a product time-based competitor by employing an excess of resources in planning and engineering phases, thus to increase its output pace, instead of shortening development lead time. The result appears identical to customers: the company is able to bring innovative products to the market at a superior rate, compared to competitors. An increase in market share or price premiums can so be gained.

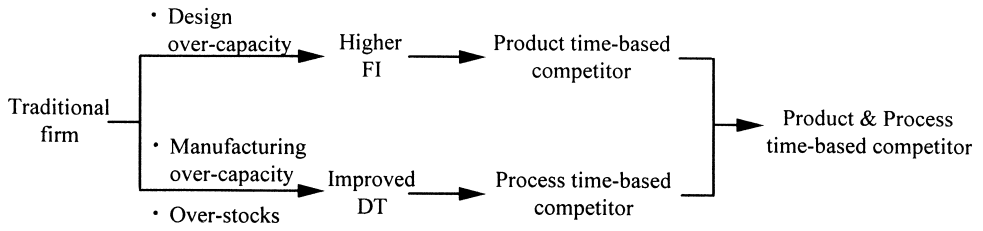

Fig. 3. Traditional path towards time-based competition. FI = frequency of introducing new products or improving the existing ones, DT = delivery time (speed and punctuality).

In a similar way, higher speed of delivering and punctuality can be reached by increasing inventory at all levels (end product, work-in-process, raw materials) or manufacturing capacity. Thus customer orders are quickly carried out and the company can be successful as a process time-based competitor (see Fig. 3).

An actual example of design over-capacity application comes from clothes industry, when "prompt-fashion" companies' performances are compared to the "planned" ones'. A prompt-fashion firm is able to prepare a collection of samples in a very short time, often by copying more successful models present on the market, and also their quick manufacture. In this way it can bring in a new collection every two months. A planned firm, on the contrary, is characterised by longer lead times. Trying to attract customers that are more and more sensitive to newness, the planned firm sometimes increases the number of collections launched at a fast rate. This is well known as the "flash collection" case. The only way to support such a pace without reducing development lead time is to employ design over-capacity, which shall be devoted to the realisation of models that do not belong to the usual autumn/winter and spring/summer collections.

A company sustains high costs to become a time-based competitor by applying excess resources. If this choice can be very effective in the short term, yet deep doubts arise as extending time horizon. It is right to wonder about the long-term maintainability of such an approach. Costs may reach, in fact, unsustainable levels when competition leads to a further increase in time-based differentiation. Concerning over-stocks, for example, the risk related to high levels of inventory rapidly grows when facing a more and more turbulent and unstable environment. Thus a company might undertake expenses without meeting expected results.

5. The innovative path towards time-based competition

A different approach to time-based competition consists in making a company structurally faster so that a higher frequency of introducing or modifying products and an improved delivery time are the results of internal-built capabilities. Unlike traditional path expedients, these capabilities are stable once achieved [15] and guarantee a firm the *agility* required to face turbulent and unstable environments. Kumar and Motwani [16] relate agility to a company's ability to accelerate activities on the critical path, while Gehani [17] underlines its flexibility coupled with responsiveness. Blackburn [2] clearly affirms:

> The power of a time-based strategy is that, by focusing on speed, the firm develops world-class quality and the process flexibility to deliver a wider variety of products and services without the burden of increased cost.

The path towards external time performance achievement implies a better use of time itself, regarded as an internal resource. Lead time reduction within the supply–production–distribution chain is, therefore, the mechanism for time-based competition [18].

The different role played by time performances within time-based competition is evident. External time performances represent, in fact, the objective

to be pursued in order to gain competitive advantages, while the internal ones are the means used to reach this purpose.

In the following sections some of the most important actions that lead a company to become a product or a process time-based competitor, as previously defined, are described.

5.1. Practices for product time-based competitors

In order to become a product time-based competitor a firm has to concentrate on the product development stage. Firms with fast new product development and introduction cycles are able to significantly increase their rate of innovation. In fact

> If development and introduction lead times are very long, a company must try very hard to be sure the introduction will be a success because the long lead times mean that there will not be much of an opportunity to modify the product … The traditional company is under great pressure to make each introduction a success. This company is necessarily risk-averse and slow to innovate. The faster company can risk a "near miss" because it can respond to new developments in the market. This company is less risk-averse and sets the pace of innovation in its industry [19].

In the traditional approach product development is considered as a succession of activities to be performed in chronological sequence and assigned to independent functions, which privilege their members' specialisation and are connected by information flows also carried in a sequential way.

The main opportunities for a time-to-market reduction lie in this logic overthrow. Practices to be applied are generally related to Concurrent Engineering. In particular, as analysed by several authors [2,5,14,20,21] the fundamental actions are:

(a) introducing a certain degree of parallelism or overlapping among the activities. Downstream stages can soon be triggered by temporary or incomplete information released by the upstream phases. Therefore information is no longer processed and transferred in large batches, whose completion causes idle time;
(b) creating cross-functional teams. In this way, people with different skills come into direct contact and make the reciprocal interdependence, which characterises the development process, easier to manage. Since the real challenge for such teams is to develop a metric that allows people from different disciplines to assess the impact of their decisions and their colleagues' ones on the entire project, the Return Map, a graphical representation of the contribution of all team members to product success in terms of time and money [22], can be introduced as a common standard of measurement;
(c) creating a "project layout", so that the project team is together in the same place. Collocation stimulates teamwork and fosters frequent, two-way communication between team members;
(d) emphasising project planning phase, involving all functions. Objectives have to be clearly explained, trying to anticipate problems that may arise in the following implementation stage and that need time-expensive recycles;
(e) early involvement of suppliers in project teams, to make their specific competence immediately available for problem solving;
(f) customer involvement. By bringing designers in touch with customers it is possible to determine the intersection between what is feasible and what is, instead, desired by the market. McKenna [23], describing Philips NV's experience, underlines how this interaction not only helps a company to better identify consumer needs, but also can speed up "time to acceptance", i.e. the time it takes the marketplace to accept a new product, thereby improving its chances of success;
(g) promoting institutional learning, by paying more attention to interiorising expertise during the project closing phase. Such know-how can then be made available for future projects, avoiding incurring the same errors or taking advantage of solutions successfully implemented. Editing the so called "lessons learned book" is an interesting example of how knowledge can be shared within an organisation;

(h) creating a common data base, so all members involved in the process can share information immediately;
(i) using Information Technology tools (CAD, CAD/CAM, etc.), that provide operators with new potential in terms of processing speed and communication.

Ward et al. [24], analysing Toyota's development process, argue that a "set-based" approach to Concurrent Engineering can make some of the previously described practices superfluous. While in the common "point to point" method designers iterate on one alternative until a satisfactory solution emerges, in the new approach they explicitly communicate and think about sets of alternatives, that are gradually narrowed converging slowly toward a single solution. The "design space" is broadly explored, but within clearly defined sets of constraints; the existence of lessons learned books, where each functional group has recorded infeasible designs, allows, in fact, each team to quickly identify the intersection between its own set of alternatives and sets acceptable to others. Therefore set-based concurrent engineering allows a greater parallelism in the process, with more effective, early use of subteams. The simultaneous transmission of a whole set of possibilities and the absence of changes moving outside of it lead to a lower frequency of communication and eliminate the need for collocation.

5.2. Practices for process time-based competitors

In order to pursue a faster and reliable material flow and become a process time-based competitor a company has to shorten the lead times of the remaining stages (i.e. procurement, production and distribution) of the operation value chain. Practices to be implemented can be mainly related to JIT. Although this philosophy initially emphasised reduction in waste and therefore especially in costs, it can be argued [2] that speed is its real linchpin. Thus the extension of JIT principles from the traditional manufacturing area to the whole value-delivery chain, from supply to distribution, leads a firm to systematic time compression.

As regards the procurement phase, lead time reduction is mainly related to shifting relations with suppliers from counterproductive tests of strength, focused on the lowest price, to mutually beneficial ones [25]. Thus a decrease in the number of suppliers, selecting them in order to assure frequent, on-time and quality consistent deliveries, can be included in a time-based approach. Some of the most effective practices are:

- improving information exchange with suppliers, exploiting Information Technology potentials such as EDI, etc. Different needs or conflicts can soon be reconciled and due dates observed. Besides a continuous interaction on product performances allows keeping aligned the efforts and expectations of both the involved subjects;
- introducing a pull philosophy into the replenishment process, so that materials are received only when needed;
- making packaging consistent with receiving systems, such as to increase the speed with which materials enter the shop-floor;
- pursuing incoming quality certification, so that time spent on input control can be removed.

Finally, considerable opportunities to shorten procurement lead time come also from the transactions of the purchasing office [26]. In fact processing orders individually, instead of in batches, avoids creating idle paperwork and leads to time saving. Leading administrative and overhead procedures towards a continuous, no longer in batches, processing flow can be related to the extension of JIT principles to "white-collar" activities [27].

Concerning manufacturing lead time, several authors underline how it can be shortened by applying those practices which were traditionally regarded as the JIT core [2,5,9,10,16,17,28].

In particular, concerning production planning:

- a pull logic implementation allows one stage to produce only after an actual downstream requirement has been communicated. Movement of excess items is so avoided and queue time reduced;
- observing daily production plans lead to an easier management of appointments, therefore removing undesirable delays;

- pursuing production flow steadiness and repetitiveness first induces adherence to planned times and then creates opportunities for their compression.

Concerning the manufacturing process:

- a plant layout consistent with production flow allows a lower move time and a fast feedback from downstream stages;
- application of group technology principles can significantly contract set-up times by identifying product or part families with similar routings. Lot sizes can so be decreased and their lead time shortened;
- design for manufacturability and assembly reduces complexity and prevents problems from arising in a strictly productive phase. A better flowing and lean process is achieved, with beneficial effects on lead times;
- preventive maintenance avoids idle time for breakdowns;
- statistical quality control allows throughput to be monitored more rigorously at every production stage, permitting early identification of defects and preventing them from spreading downstream. Therefore, time for scrapped output or rework is saved;

As regards human resource management:

- workforce training and education increase the ability to solve and prevent problems;
- empowerment for frontline decision making allows solutions to be implemented as soon as problems arise, avoiding delays;
- multi-skilled workers provide a firm with greater flexibility of personnel deployment, thus supporting work schedule adherence. Multifunctional employees also have a broader view of the process, therefore improving their problem solving capability;
- team work, keeping people with different skills in direct contact, fosters quick problem solving and encourages an interfunctional point of view;
- a faster flow of information in both horizontal and vertical directions not only allows corrections to be made, but also stimulates continuous improvement by encouraging the workers' suggestions;
- improving process visibility, by displaying, for example, work standards, instructions and status boards, makes information retrieve faster and helps workers to accomplish their tasks.

Finally, distribution phase efforts are first of all directed towards improving communication with clients. Continuous monitoring of service levels and customer reactions seems to be the first step in becoming more responsive to changing market conditions [23]. Stalk and Webber [29] underline how successful time-based companies have developed personnel with a superior insight into customer needs and superior skills when it comes to using this knowledge.

The extension of JIT principles to the last phase of the operation value chain leads to apply practices such as those of Millen [30], Ferrozzi et al. [31] and Daugherty and Pittman [32]:

- reducing levels of inventory locations in the distribution network. Some warehouses can be transformed into "transit points", where products arrive and are immediately dispatched, without lying in the structure for a long time;
- making distribution points "accessorisation centres". Significant lead time reductions are gained, in fact, by standardising products during the manufacturing process and customising them as late as possible in the distribution chain, lowering risks to meet demand;
- pursuing frequent small size lot deliveries permits to shorten time customers are compelled to wait. This can lead different companies to optimise transport, for example, by sharing the same tracks for a more efficient use of available space;
- reorganising packaging and loading/unloading activities, so that idle time can be removed;
- encouraging carrier job enlargement and empowerment, involving them in invoicing and loading activities, to gain significant time savings;
- applying information technology tools (e.g. bar coding, EDI, etc.). Real time data allow inventory items of multiple locations to be managed, and to satisfy requests based on a regional search, increasing speed of carrying out customer orders. Direct connection with carriers makes distribution more efficient. Point-Of-Sale system

implementation provides a manufacturer with up-to-date information about shelf item amount lying at every retail point and actual sales, so that future requirements are known in advance and forecasting reliability is improved.

Concurrent Engineering and Just-In-Time practices, therefore, can significantly improve the use of time as an internal resource and provide a company with that agility needed to become a time-based competitor.

Very little, instead, is known about the relation between practices and time-performances when moving from a single firm to the new forms of organisation such as networks of firms. As regards the textile–apparel industry it has been shown [33] how the decision variables of the production planning process (planning period length, material availability and the link between production orders and customer orders as regards colour mix) can really affect the system's time performances. Since in the textile–apparel industry production is fulfilled by successive campaigns, performances have to be evaluated in relation to a whole collection; consequently, global measures are required and the weighted average delivery anticipation (which provides an estimate of the system capacity to anticipate product realisation) and the weighted average anticipation of saturation (which describes the ability of a system to load its available capacity during the productive campaign) have been introduced as the proper external and internal system time indicators, respectively. Changes in the production planning process have been revealed to improve the internal system time performances and consequently the external ones, confirming the same relation highlighted for single firms.

6. The "conversion dilemma"

When a firm reaches significant internal time performances through the innovative path, it will face a "dilemma".

Lead time compression along the operation value chain, in fact, grants a firm the agility to become a time-based competitor and achieve competitive advantages based on its external time performances. On the other hand, it reveals also an excellent mechanism to decrease costs. These potentials related to time management have to be deployed by identifying their competitive priorities. A company has to decide if its strategic objective is to affect its external configuration, i.e. the side visible to the market, or only the internal one. Here the *conversion dilemma*, to be solved by choosing where time-based advantages have to be laid.

Referring to Fig. 4, by applying Concurrent Engineering (CE) practices to product development a shorter time-to-market can be achieved, which

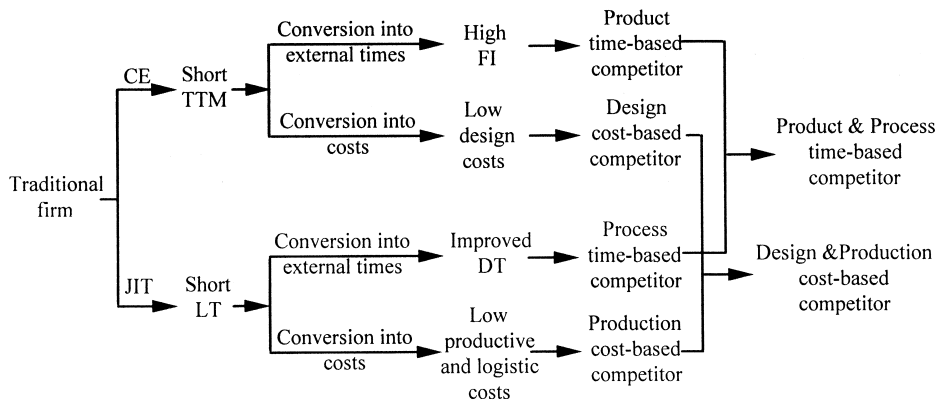

Fig. 4. Innovative path and strategic options. Legend: CE = Concurrent Engineering; JIT = Just-In-Time; TTM = Time-To-Market; LT = Lead Time; FI = frequency of introducing new products or improving the existing ones; DT = delivery time (speed and punctuality).

means either an increased frequency of introducing and improving products or, keeping frequency unchanged, a decrease in costs of resources required by development process. A firm, that transforms internal time performances into those visible to its customers, strategically decides to become a *product time-based competitor*. Otherwise, preferring to convert them entirely to lower costs, it chooses to be a *design cost-based competitor*.

Implementing JIT principles to supply–production–distribution chain grants a company shortened lead times and therefore the choice of gaining improved delivery times or lowered costs related to lower inventory levels, to non-value-adding activity elimination, to increased productivity, etc. The former option singles out a *process time-based competitor*, while the latter a *production cost-based competitor*.

By compressing lead times along the whole operation value chain, a company is able to become a *product and process time-based competitor* or a *design and production cost-based competitor*, according to which front is affected by conversion.

Consider, for example, an assemble-to-order firm (ATO), whose delivery time to customers (DT) is therefore the sum of assembling and distribution lead times, as described in Fig. 5.

After shortening lead times by JIT implementation, it may decide to convert them into an external performance, so that customers perceive a significant improvement in delivery time ($DT' \ll DT$). Internal time compression, on the other hand, allows the firm to diminish the number of activities performed in advance, before customer order receipt. Therefore, preferring to convert gained time advantages entirely into lower costs, it would be convenient to shift towards a purchase-to-order (PTO) way of meeting demand, removing risks related to forecast-based purchasing and manufacturing. In this case customers will continue to measure the same delivery time, without perceiving any change ($DT''' = DT$). An intermediate solution, affecting both external and internal configuration, is also possible. The firm, in fact, may convert internal time performances partially into a slightly shorter delivery time ($DT'' < DT$) and shift to a make-to-order condition (MTO) with lower risks than the initial assemble-to-order one.

Fig. 6a and b show the cost-external time performance curves, concerning respectively the product development process and the productive-logistic stages along the operation value chain. Similarly the cost–service curve proposed by Ferrozzi et al. [34], they represent the excellence positions, i.e. the set of limit points about the costs–performances relation, where an improvement along one axis implies a decrease in the other one.

A firm standing at point A can therefore achieve a higher frequency of introducing and modifying products (Fig. 6a, point B) or a greater delivery speed and punctuality (Fig. 6b, point B) by sustaining a significant increase in associated costs. The

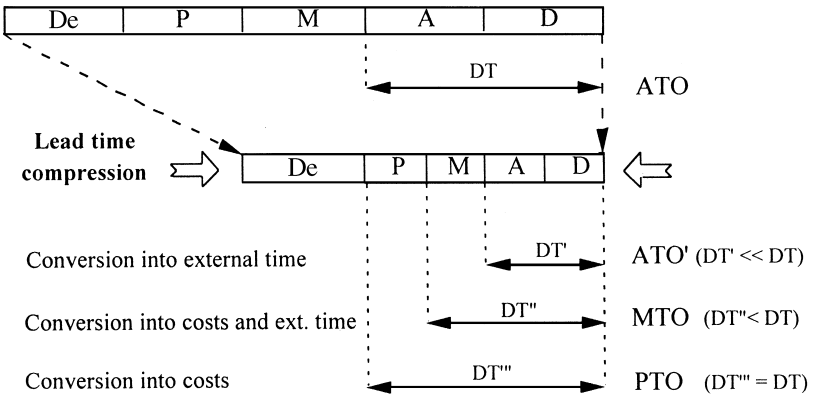

Fig. 5. Effects of time conversion on product environments. Legend: De = Development, P = Purchasing, M = Manufacturing, A = Assembling, D = Distribution, ATO = assemble-to-order, MTO = make-to-order, PTO = purchase-to-order.

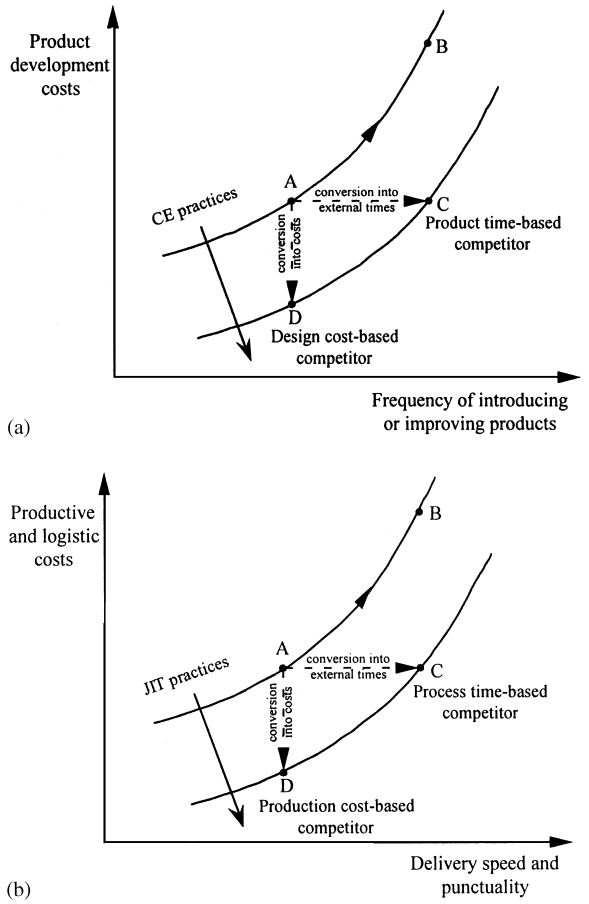

Fig. 6. (a) Product development costs/frequency of introducing or improving product trade-off: traditional (A–B) and innovative path with conversion to external time performances (A–C) or to costs (A–D). (b) Productive-logistic costs/delivery speed and punctuality trade-off: traditional (A–B) and innovative path with conversion to external time performances (A–C) or to costs (A–D).

firm chooses the dimension to compete on (times) and renounces the remaining one (costs). This is the case of the traditional path towards time-based competition that allows a company, by employing over-resources, to move along the initial curve of cost-external time performance.

The innovative path, instead, by applying Concurrent Engineering and Just-In-Time practices, is able to displace the frontier of possible solutions by shifting down the curve. The cost-external time performance trade-off is not overcome; the conversion dilemma, in fact, leads a firm at last to privilege one strategic dimension (times or costs). Nevertheless it can be dislocated, so that the new solution represents a competitive improvement as compared to the initial ones. A company can decide, in fact, to convert internal time advantages to performances perceived by customers, becoming a product time-based competitor (Fig. 6a, point C) or a process time-based competitor (Fig. 6b, point C), without sustaining the burden of increasing costs. The same levels of frequency of introducing and modifying products or delivery speed and punctuality previously achieved by the traditional path can so be gained at lower costs (compare point B to C in Fig. 6a and b). On the other hand, a company can become a design cost-based competitor (Fig. 6a, point D) or a production cost-based competitor (Fig. 6b, point D) without worsening performances measured by its clients. Intermediate solutions, represented by the arc C–D, can be chosen, which identify more favourable conditions than the initial point A.

The innovative path, unlike the traditional one, grants a firm a new capability of managing the costs–performances trade-off, shifting the competition towards more advanced frontiers than its competitors' curves.

7. Time-based versus cost-based competition

The conversion dilemma, whatever solution is taken, grants a firm the possibility of significantly increasing its profits (see Fig. 7).

By increasing frequency of introducing or modifying products, a product time-based competitor meets customers' desire for innovation and can gain a larger market share or higher price premiums. A process time-based competitor achieves similar results by differentiating its products with improved delivery times, i.e. increasing speed and punctuality. Time-based competition, therefore, raises cash inflows. It has to be recognised, however, that the innovative path leads to indirect benefits which enable to reduce cash outflows (see Section 2.2). For simplification effects on costs are not shown in Fig. 7.

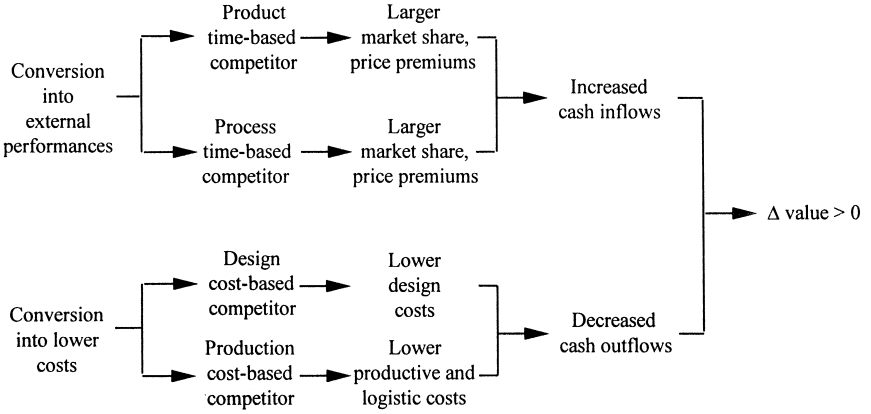

Fig. 7. Conversion effects on value.

A design cost-based competitor can engage fewer resources in the product development process, thus lowering related costs. A production cost-based competitor decreases, instead, productive/logistic costs due to lower inventories, higher productivity and a more efficient use of resources. Thus cost-based competition diminishes cash outflows. In conclusion, both strategic orientations grant a company a positive difference of value.

What factors can lead a company to a proper strategic orientation, i.e. time-based or cost-based competition, have to be promptly identified.

In our opinion, such a guideline derives from market characteristics and definitely from the degree of customer sensitivity to external time performances. A matrix that links strategies to market sensitiveness to frequency of introducing new products or improving the existing ones and to delivery time (i.e. speed and punctuality) is shown in Fig. 8.

When a market is strongly sensitive to product innovation but weakly to delivery time, the emerging strategy is product time-based competition. The motorcycle industry (remember the already mentioned H–Y War), as well as the mobile phone and computer ones provide several cases of such a successful strategic orientation. On the other hand, a high degree of customer sensitivity to delivery-related performances joined to a feeble disposition towards innovation recognises process time-based competition as the preferable strategic orientation,

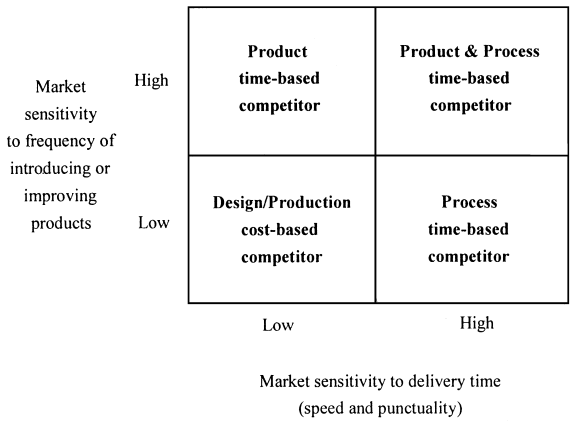

Fig. 8. Market characteristics and strategic orientations.

as recognisable in components, spare parts and shipment industries.

A market which reveals a significant appreciation of both the external time performances leads a company towards product and process time-based competition. A significant example comes from the textile-apparel industry, where successful companies (e.g. Benetton Group) maintain their leadership through both a high frequency of introducing new models, due to the already mentioned flash collections, and short delivery times, due to, for example, successful applications of the customising delay as postponing the dyeing phase to the knitting one [33].

The low-left quadrant identifies a type of client that does not regard frequency of introducing or modifying products and delivery time as dimensions able to differentiate products and services provided by a company (e.g. the built-in domestic appliance industry). In this case, a conversion to external time performance appears not to be a winning solution, while significant advantages could come from a cost-based strategic orientation.

A bond of coherence emerges, therefore, between a strategy adoption and the market configuration. This outlines how the choice of the proper kind of time-related competition cannot prescind from a deep understanding of customer expectations. They prove themselves a key factor for a company to suppose future scenarios.

For example, the cases of some German motor companies that meet with success in spite of a low innovation rate and slow deliveries if compared to competitors are well known. Product exclusiveness, in fact, rewards customers for the long wait and does not induce them to shift their preference. In such a situation time-based competition would not appear convenient, while greater advantages can be derived from a cost-based approach to time potential.

The proposed matrix has, however, to be considered not only as a static, but also as a dynamic framework. Changes in customer behaviour, deriving from the development of a different sensitivity to external time performances, can lead, in fact, to the need for a strategic adjustment. Then evolutive paths have to be taken into account. It is possible for a company to gradually become a product and process time-based competitor, by focusing at first on a single external performance and then shifting on both, displacing its position within the matrix.

8. Conclusions

Time reveals new opportunities for companies to gain competitive advantages. Great attention is ascribed to time-based competition, which considers external time performances as strategic weapons to gain success. They are in fact able to influence customer behaviour by inducing a perception of product and service differentiation among competitors.

Analysing the importance attached to the frequency of introducing new products to the market or improving the existing ones and to delivery time, three different types of time-based competitors have been proposed in this paper: product time-based competitor, process time-based competitor and product and process time-based competitor.

Then two paths towards time-based competition are recognised. The traditional approach consists in employing more resources in the development process or applying productive over-capacity and over-stocks, while the innovative one tries to link external success to internal capabilities built by focusing on lead time reduction along the operation value chain. The former leads a company to sustain conspicuous costs; the latter, instead, grants it an agility based on a better use of its own resources, achieving several benefits that can or not be displayed to customers. In this case the conversion concept is fundamental, i.e. the mechanism by which time compression potentials are transformed mainly into external time performances or into cost advantages. The factor leading a firm to the proper time-related strategic orientation (time-based versus cost based competition) is, in authors' opinion, the degree of market sensitivity to frequency of introducing or modifying products and delivery speed and punctuality. A relation has been so identified between environment characteristics and competitor types.

Stalk and Webber [29] outline the existence of the "dark side" of time-based competition that drives companies to more and more accelerated paces, without improving their competitive position. This corroborates the opinion that the main danger associated with time-related strategies is not to pay enough attention to market conditions. Whenever the customer sensitivity limit to external time performances is reached, as seems to happen to many Japanese firms, no further benefit can, in fact, be derived from pursuing a strategy that definitely standardises companies instead of differentiating them, leading them also to renounce more beneficial cost contractions. The authors' effort has been mainly addressed to calling attention to some aspects of time-based competition. In particular, we deemed it important to outline the different role played by external and internal time performances

within time-based competition: the latter as means, the former as objectives. This distinction made us recognise a new form of time-related strategy we have called the cost-based competition. A clear scenario of strategic opportunities and mechanisms associated with time management has so been identified. It could be usefully analysed by companies so as to avoid the "strategic trap" that, recent reports from Japan underline, might represent the danger or "dark side" of time-based competition.

References

[1] R. Merrils, How Northern telecom competes on time, Harvard Business Review (1989) 108–114.

[2] J.D. Blackburn, Time-based competition. The Next Battle Ground in American Manufacturing, Business One, Irwin, IL, 1991.

[3] P.J. Stonich, Time: The next strategic frontier, Planning Review 18 (6) (1990) 4–7, 46–48.

[4] G. Azzone, C. Masella, U. Bertelè, Design of performance measures for time-based companies, International Journal of Operations and Production Management 11 (3) (1991) 77–85.

[5] G. Stalk Jr., T.H. Hout, Competing Against Time: How Time-based Competition Is Reshaping Global Markets, Free Press, New York, 1990.

[6] E. Bartezzaghi, G. Spina, R. Verganti, Lead-time models of business processes, International Journal of Operations and Production Management 14 (5) (1994) 5–20.

[7] A. De Toni, R. Filippini, C. Forza, Manufacturing strategies in global markets: An operations management model, International Journal of Operations and Production Management 12 (4) (1992) 7–18.

[8] R.C. Barker, The design of lean manufacturing systems using time-based analysis, International Journal of Operations and Production Management 14 (11) (1994) 86–96.

[9] R.J. Schonberger, World Class Manufacturing: The Lessons of Simplicity Applied, Free Press, New York, 1986.

[10] R.W. Schmenner, The merit of making things fast, Sloan Management Review (1988) 11–17.

[11] T.F. Wallace, J.R. Dougherty, APICS Dictionary, American Production and Inventory Control Society, 1987.

[12] J.D.C. Little, A proof for the queuing formula: $L = \lambda W$, Operations Research 9 (1961) 383–387.

[13] G. Stalk Jr., Time: The next source of competitive advantage, Harvard Business Review (1988) 41–51.

[14] K.B. Clark, T. Fujimoto, Product Development Performance. Strategy, Organization and Management in the World Auto Industry, HBS Press, Boston, 1991.

[15] G. Stalk Jr., Time-based competition and beyond: Competing on capabilities, Planning Review 20 (5) (1992) 27–29.

[16] A. Kumar, J. Motwani, A methodology for assessing time-based competitive advantage of manufacturing firms, International Journal of Operations and Production Management 15 (2) (1995) 36–53.

[17] R.R. Gehani, Time-based management of technology. A taxonomic integration of tactical and strategic roles, International Journal of Operations and Production Management 15 (2) (1995) 19–35.

[18] R.J. Tersine, E.A. Hummingbird, Lead-time reduction: The search for competitive advantage, International Journal of Operations and Production Management 15 (2) (1995) 8–18.

[19] G. Stalk Jr., The strategic value of time, in: J.D. Blackburn (Ed.), Time-Based Competition. The Next Battle Ground in American Manufacturing, Business One, Irwin, IL, 1991, pp. 67–101.

[20] P.R. Nayak, Planning speeds technological development, Planning Review 18 (6) (1990) 14–19.

[21] M.A. Youssef, Design for manufacturability and time-to-market. Part 1: Theoretical foundations, International Journal of Operations and Production Management 14 (12) (1994) 6–21.

[22] C.H. House, R.L. Price, The return map: Tracking product teams, Harvard Business Review (1991) 92–100.

[23] R. McKenna, Real time marketing, Harvard Business Review (1995) 87–95.

[24] A. Ward, J.K. Liker, J.J. Cristiano, D.K. II Sobek, The second toyota paradox: How delaying decisions can make better cars faster, Sloan Management Review (1995) 43–61.

[25] D.N. Burt, Managing suppliers up to speed, Harvard Business Review (1989) 127–135.

[26] R.A. Inman, Time-based competition: Challenges for industrial purchasing, Industrial Management 34 (2) (1992) 31–32.

[27] J.D. Blackburn, Time-based competition: White-collar activities, Business Horizons 35 (4) (1992) 96–101.

[28] R.W. Hall, Catching up with the times, Business Horizons 35 (4) (1992) 6–14.

[29] G. Stalk Jr., A.M. Webber, Japan's dark side of time, Harvard Business Review (1993) 93–102.

[30] R. Millen, Time-based logistics, in: J.D. Blackburn (Ed.), Time-Based Competition. The Next Battle Ground in American Manufacturing, Business One, Irwin, IL, 1991, pp. 211–225.

[31] C. Ferrozzi, R.D. Shapiro, J.H. Heskett, Logistics Strategy. Cases and Concepts, West Publishing, 1985.

[32] P.J. Daugherty, P.H. Pittman, Utilization of time-based strategies. Creating distribution flexibility/responsiveness, International Journal of Operations and Production Management 15 (2) (1995) 54–60.

[33] A. De Toni, A. Meneghetti, The production planning process for a network of firms in the textile–apparel industry, International Journal of Production Economics, (2000) forthcoming.

[34] C. Ferrozzi, J. Hammond, R.D. Shapiro, 1993, Logistica and Strategia 2, ISEDI.