

# The Time Factor on Logistics

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**Abstract:** The study deals with the investigation of the critical factor of the supply chain, with regards to time. The literature review can give a background to understand and handle the reasons and consequences of the growing importance of time. It analyses the time- and place-value of products and it tries to value time by showing theoretical functions as well. By using utility functions to represent the value of various delivery-times for the different participants in the supply chain, including the final customers, it proves through the Kano-model, that the choices, behaviour and willingness of payment of time-sensitive and non time-sensitive consumers are different for varying lead times.

**Keywords:** *logistics, time-sensitivity, time-compression, Kano-model*

## 1. Introduction

The 21st century is referred to as the age of the fast paced society, in which several things work in different ways than we have gotten used to over a longer period [48]. The mainstream is the cause of the changes and this includes the attitude towards time [3] [25] [13]; the signs of can to be perceived in the fields of culture, lifestyle, customer needs, consumption, and customer behaviour [24]. The way of life is changing, time has limits, therefore consumers have become time-sensitive and choose the contents of their basket of commodities not only according to available money, but also to available time. The time necessary to obtain a product/service (access time) is involved in product utility to an increasing extent, the assurance of which is the task of logistics. There are more reasons for the shortening of this access time, one of the most important is the change in customer expectations, which can be related to new trends emerging in the most diverse areas with the time factor playing the main role [1]. The change in the attitude towards time can also be seen in the economy, where competition has been placed into a new field. Increasing rapidity is also encouraged by the sellers in the competition against each other based on time, because of the pressure to reduce costs and inventory, and to increase the efficiency and customer satisfaction [5] [23] [15]. After identifying the character of time as a resource it can be seen that there is a spread of new management technologies aimed at time compression and faster service. In addition to the actors are expected to achieve the traditional requirements such as cost

reduction, capacity utilization, increase in efficiency, quality improvement, and customer satisfaction [21].

By reviewing the literature the present study first presents some thoughts on the nature of time, in addition its perception and measurement, then takes a closer look at the social fields where changes in the time attitude can be traced, and explores the multiple ways in which people experience time-space compression in varying historical and geographical circumstances. Next it identifies trends prevailing in social and economical behaviour in the long term. After that it intends to deal with effects of the time-based competition (TBC) [21] [22] and, with the different responses given to the increasing need for being fast, while also trying to find out the reasons behind this. The final part is concerned with the time-sensitive and non time-sensitive customers' behaviour by using utility functions, and it tries to find optimal time-parameters for different time-demands by using logistical performance measures based on time.

## **2. Accelerating time**

The first part of this study deals with diachronic time that is how time was conceived, measured, and changed throughout history. Time brings an exceptionally wide variety of topics, from calendars and clocks to trade and telecommunications. The goal of this chapter is to briefly demonstrate how time awareness has changed in various societies depending on the varying historical and geographic impacts. Every society develops a different way of dealing with and perceiving time. Different social formations gave time widely variable meanings and every set of understandings proved to be temporary.

There is an acceleration of the rhythm of life. This aspect refers to the temporal compression of our daily actions. The quantity of actions contained in a lapse of time tends to increase. While the range of possibilities of action grows and expands its horizons, the temporal pressure weakens its quality. In more general terms the tension between interior rhythms and social rhythms is the distinctive sign of this form of acceleration [18]. Therefore, the time-sensitive segment of population continuously increases. The pace of progress has become faster with the coming of new generations. An example of this is provided by the duplication of scientific activity that occurs in every ten years; as a result, 90 % of all the scientists that have ever lived and worked are alive and working now in the world. For another example, if we wanted to depict the 4-5 million years of human history as a period of 1000 years then human civilisation would be crammed into the last 3-4 minutes. Life cycles shorten [4] [2] [13] and at present the Moore-law is often cited, indicating the time necessary for computer performance to duplicate is 18 months.

### **2.1. Changing time-awareness**

Defining time is a rather complicated and difficult thing. The problems in connection with time have already been discussed by St Augustine more than 1500 years ago. Since the time of St Augustine we have not been able to get much closer to the notion of time, we do not know if it has a beginning or end, however several other aspects have become known. In the field of physics, great progress has been made concerning the nature of time and its measurement. The laws of time-based physics by Max Planck and Einstein

have changed our worldview. Accordingly, there is no time without space. This thesis was published and interpreted in an understandable way by Hawking.

Time is a *relative* thing; its perception depends on the relative situation of the observer in space: hence time can be faster or slower. However in the age of Newton time was conceived as *absolute* phenomena. Time is a social symbol to manage our life according to philosophers.

The subjective experience of the objective flow of time can be possible only if something happens. In other words, experiencing time can be done only by experiencing events. There is no time without space. The subjective experience of time depends on our activity. This means, that there is an objective time that is perceived in a subjective way. So time is *objective* and *subjective*, that is it exists as an abstract entity that seems to take on a life of its own, and simultaneously as a living experience that is highly meaningful to the people who create and change it. The study of time is therefore much more than an abstract academic exercise but how societies are structured, change and how people live within it [25].

In practice, time units can be used properly without knowing etalons (etalon is a measurement instrument that embodies the measurement unit of a certain amount in a reproductive way) for most phenomena. Usually events or processes are connected to points or periods of time (their results can be categorized by time-state sequences or time-period sequences).

Measurement units of time and clocks give the opportunity to measure time. For measuring, the sequence of events can be used. With the development of astronomy and calendar-making, shorter and longer units than a day appeared along with separate number systems and as a consequence of the 365-day-long year (number-systems of 12 and 60). The first scientifically established unit of time has been the second (now SI unit), which was defined in 1820 as one over eighty-six thousand four hundred (1/86400) of the average Solar day (Solar day is the time passed by between the two successive culminations of the Sun). With the development of atomic physics, in 1967 a more exact definition was given for the length of a second. The atom-clocks – the most punctual constructions at present – still operate according to it. The actual definition is as follows: the time period of 9 192 631 770 periods of the radiation between two hyper energy levels of the basic-state caesium-133 atom.

The change in the attitude towards time is not a novelty and cannot be related to the formation of the pace society [3] [18]. The recognition of time as a value is related to the industrial societies where time passes not without purpose and not in a natural cycle but becomes the resource of material values. The events in nature have a regular system, a forced period with more or less permanent characteristics. The *cyclic time-sense* was decided by these events in a pre-modern age, while in the post-modern age it can be defined by *linear time-sense*. People in societies before Christ did not have time-awareness [13]. The attitude to time is not only determined by history but by space as well, there are huge differences between cultures also today [10]. Hofstede and Trompenaars, two significant scholars of intercultural research have also studied the differences between temporal dimensions within individual nations. In addition there is Levine who conducted research on the relationship between the attitude towards time

and the pace of life in different countries [14]. He came to the interesting conclusion that the more effective of a country's economy is, the faster the pace of life is; the more industrialised a country is, the less leisure time people have; and the more urbanised a country is (there are more cities) the faster people move. Our age is not by accident referred to as the digital age, namely the possibility to handle information is covering more and more fields, enabling the so-called real-time mode<sup>1</sup>, which is basically the idea that there is no break or pause between reacting or responding to activities [15]. We can say that information technologies (IT) create a new kind of spatial- and temporal structures by reshaping their use. Bridging the spatial gap can be achieved only through time sacrifices but the amount of this is declining with the increase in speed. Spatial and temporal boundaries are becoming relative, acceleration is diminishing economical space, however, the 'radius of action' is extending. These are the two different sides of the same phenomenon, so considerably less time (diminishing) is necessary to complete things and more things can be completed within the same amount of time (extension), respectively. In the context of time and space it means that the same distance can be covered in a shorter period of time and you can get further within the same time. This relationship can be depicted and it will be shown in the next subchapter.

## 2.2. Tools for represent different using of time

### 2.2.1. Time maps

Since aspects of movement other than optimisation based on time have emerged (optimisation based on time and cost) solutions are highlighted which concentrate on how to cover spatial distances in the shortest possible time with the lowest possible costs instead of getting somewhere in the shortest possible way. Thus between two geographical points not only a geographical space can be depicted but a time-distance as well, based on the time necessary to cover the distance between the two points and perhaps a cost space can also be depicted, based on the costs necessary to cover the distance [6]. The time space of the real-time telecommunication is concentrated on one point. The cost space of this, however, cannot be regarded one point.

There are two basic solutions for depicting time spaces (here we will not deal with introducing space informatics solutions in which optimisation based on time is also included). The first one is the group of isochron maps keeping the traditional geographical distances and depicts the points, which can be reached – from a determined place – within the same time with help of isolines. In the other group the distances depicted are proportional not to geographical distances but to the time necessary to reach them. The two points will be closely connected if it takes a short time to connect them and the points, which can be reached in a longer period of time, will get farther from each other.

On the isochron maps it can easily be seen that spaces expand where transport infrastructure is developing (motorways) and shrinking can be experienced where the transport conditions are poor (overcrowded roads and sparse transport network, etc.).

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<sup>1</sup> The definition is included in the FOLDOC (Free Online Dictionary of Computing)

From the maps showing time distances you can see the consequences of the changes in transport conditions. On these maps the same effects are quite the opposite.

### 2.2.2. Time scales

Besides managing material goods (money) and energy (health), the third factor one may and has to manage is time. At present it is common to refer to a universal trend prevailing in Europe and in Hungary as well that the time spent working is continuously decreasing. If we look at the statistics taking into account the different time consumptions - time scales<sup>2</sup> – the decrease proves to be true regarding the whole society, however, our time management is shaped depending on demographic, employment and cultural characteristics, and it is also affected by the trend of the economy beyond the actual development of it.

Today an analysing framework also exists being able to connect time scales to spatial dimension, thus social activities can be analysed within the framework of temporal-spatial scales. This framework is time geography based on Hagerstrand's research. The starting point of which is the survey of the individual's movement in time and space. The latest statistics on the time spent working (in minutes), within the segments of the ones working the least and the ones working the most, is based on the data collected in Hungary in 2000 ([www.ksh.hu](http://www.ksh.hu)). From this we can see that the a fifth of the society spends half of the day of 24 hours/1440 minutes working, as a result, it is typical that very little time is left for other activities. It can be seen that leisure time (19 %) exceeds working hours (15%) – however we need to keep emphasizing that it is true only regarding the society as a whole.

### 2.3. Consequences of the lack of time

In this part I deal with not only the changes of time awareness, but its impacts on everyday life and the reasons of changeable consumption and behaviour as well. There are more explanations for the changes that can be seen in the structure of consumption. One is the appearance of the time-barrier.

This barrier influences the decisions of buyers because the changing way of life [18] effects time orientation [24], which is typical in western culture, and we can see the positive time-preferences and appearance of time-sensitivity.

The pressure of time may lead to a conflict in the case where the time needed is longer than the time at our disposal. People try to optimize their behaviour on a time basis. While doing so, we have to face conflicts with ourselves and also with our financial possibilities because we have are forced to change our consumption habits. Our consciousness insists on having permanence. It protects itself against the more and more frequent and too fast changes coming from the western way of life. A certain part of mental illnesses is due to the fact that we are not able to make our consciousness accept

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<sup>2</sup> In statistics and sociology the data collection and the data gained from this is called time scales, which explores the time management of the society; its changes and differences.

the environmental forces around us. Our financial resources can also prevent us from changing our consumption habits on a time basis. When the modification of the basket of commodity cannot be financed, a consumption trade-off occurs, i.e., we have to give goods up that are affordable to others. This causes frustration and can spoil one's chances to reproduce. Under this pressure, there will be changes in the needs of societies and their traditions and culture [12] [24] [13] [3]. Technical development is changing according to the tendency, which always requires something new and much more in consumption. The use of time varies disproportionately in the case of those working a lot and those not working, with consequences arising in life style and in consumption structure as well. Those working a lot have an increasing need for products and services with which they can save time. They can be regarded as 'new' consumers having different features compared to the 'old' ones. The time-sensitive segment, which depends on time, expects shopping facilities without limitations; non-stop continuous opening hours (24/7, 24 hours a day every day of the week) [3] or availability due to their special schedule. This is the *trend of continuity*; its appearance can be noticed already today. The increasing time-preference allows us to enjoy life "here and now", instead of saving money for a future purchase. The intertemporal decision is present-asymmetric. This hedonistic attitude is becoming more and more popular, wasteful consumption is unlikely to scandalise people any longer (emphatic marketing). Lots of work is coupled with higher income [2] [26] so time becomes scarcer than money. Having time and money categorises the members of the society into different groups, as shown by figure 1.

<p><b>lots of time and little money</b></p> <p>(life-long students, poorer pensioners, bohemians)</p>	<p><b>lots of time and lots of money</b></p> <p>(wealthy pensioners, rich married, lottery winners, free loaders of the new wealth)</p>
<p><b>little time and lots of money</b></p> <p>(managers, entrepreneurs, well-paid families and families with two wage-earners)</p>	<p><b>little time and little money</b></p> <p>(poor workers, low-income families)</p>

Figure 1. The consumer segments increasing the fastest [3]

The above facts have consequences in relation to logistics as well, as customers lacking time take advantage of timesaving shopping possibilities (e.g., catalogue, internet), which transform the significance of the channels of distribution and creates new ones. Another effect is that logistics has to prepare for the end consumer as well to solve the so-called last-mile problem (with home delivery) extensively. A 'cocooning effect' is very typical, accompanied by the home as a spot for arranging more and more things (shopping, e-banking). Consequently, the task of logistics is not completed by forwarding the goods to the distributors and intermediaries, where the product was picked up by the consumer. It is becoming more and more widespread that the product goes to the consumer. The so-called CEP (Courier-Express-Parcel) is specialized in meeting such demands and is able to expand at a greater pace compared to the traditional carriers.

### 3. Time-compression approach

Logistics has to find delivery solutions adjusted to the consumption behaviour of products, which generates *many kinds of logistical needs* to be seen already today. However, the *deliveries of higher frequency and less volume* resulting from this trigger higher costs and higher damage to the environment. These trends make greater cooperation and tighter connections necessary within the supply chains, and they have to create logistical service providers being able to provide complex logistical services, for the changeable needs. In fact not the needs, but the demand preferences are changed. The importance of time is different according to production and consumption points of view, but it is different due to customer segments and groups of product as well. Relevant literature deals with consequences of time-based competition and those methods, which can respond to this challenge.

More research [16] has found that there is a close relationship between the entire lead time (defined as the period between a purchase order placement and its receipt by the client), the customer's demands, the willingness of payment and the customer loyalty. The decreasing delivery time classifies the product to a higher quality-category so that for it can be sold at a higher price. Increasing demands and higher price cause an increasing market share. Karmarkar [11] pointed out that shorter delivery times are most probably inversely related to market shares or price premiums or both. Customers highly appreciate short and punctual delivery time; therefore they will not turn to competitors.

The stability of customer market brought on by customer loyalty can decrease the searching cost of new customers (it can cost four times as much to replace a lost customer with a new one than it does to keep that customer) – not to mention the time required to attract a new one [21].

Customers may be willing to pay a price premium for shorter delivery times. We can find several methods and practices in operations management, which cause visible results in manufacturing. These time-based performances include sales growth, return of investment, market share gain, and over-all competitive position [16] [17] [19] [22]. Companies use three main strategies to utilize speed to attract customers:

- To serve customers as fast as possible
- To encourage potential customers to get a delivery time quote prior to ordering
- To guarantee a uniform delivery lead time for all potential customers

The customer's need for fast service follows in the same direction as the company's ambition to decrease lead time. Time management is rooted back to the Taylor-times when during the work organisation the working time need of each process was compiled from elements divided into movements. An analogous way of thinking may be required on the time-management of the supply chain. The application of management methods and philosophies during the production had already started, which influenced time consumption and time management as well. By now it has turned out that time itself also behaves like a resource that has to be managed. Therefore within the supply chain not only the interior solutions are aimed at time-saving within the company but the spatial and temporal expansion of remote processes arranged by different actors and with different time-consumption is also of high importance. Literature on the competition strategies based on time is also aimed at the temporal integration of the different levels of the supply chain. Among these we can find the methods being popular nowadays such as just-in-time (JIT), agile production, lean production, Quick Response (QR), Efficient Customer Response (ECR), cross-docking, etc. [5] [16] [19] [22] [4] [23] [26]. Based on these we can distinguish the internal – measurable only by the company - and the external – perceived also by the customers - forms of time performances [5]. Figure 2 depicts the internal and external appearance of time performance.

Phase \ Time Performance	Internal	External
Product development	Time to market	Frequency of introducing new product existing product improvements
Procurement Production Distribution	<b>Lead time</b> procurement production distribution	<b>Delivery time</b> speed punctuality

Figure 2. Internal and external time performance [5]

Time-based manufacturing, mass customization or just-in time philosophy are the strategies of a firm to emphasize a quick response to changing customer needs, to reduce end-to-end time, to eliminate unnecessary elements and additionally, their purpose is cost reduction. Planning of delivery time can be a part of the improved customization process development.

Mass customization is an ability of a firm to produce customized products on a large scale quickly at a cost comparable to non-customized (mass production) products. Mass customization can be defined as a low-cost, high-quality, large-volume delivery of individually customized goods and services. Customer responsiveness is an ability to reduce the time required to deliver products and to reorganize production processes quickly in response to requests. Speed is an indispensable criterion for evaluating an organization's activity.

A pull production system refers to production based on the demand of the final customer. Pull systems can greatly reduce the time that parts spend in the "system" (throughput time), especially the non-value-added waiting time and it can accelerate parts to customers. Manufacturing and delivering a product takes far less time than the actual time the service or product spends in the system [5] [19]. It highlights the poor time productivity of most organizations. A focus on time helps a company to reveal its quality problems [23] [21]. Most process quality problems appear in lost time – parts that cannot be used: information that does not arrive, work that must be done again and a customer service visit that does not solve the problem.

Improved customer responsiveness can be achieved through available inventory, which is close to buyers or faster delivery with shorter lead time and good connection to shipment logistics [21]. A flexible and faster response benefits the customers in a number of ways:

- They need less inventory
- Their cash flow cycle is speeded up
- They receive more special services and customized products
- They can make purchase decisions closer to the time of need
- Their customers are less likely to cancel or change their orders

To achieve these benefits, the firms need to differentiate their customers according to the basis of time sensitivity, while they need to know how time and their products along with their services are related to one another. This investigation cannot be separated from products value characteristics, using characteristics and competitive environment, which have to be clarified. It results in a basis of a strategy that will neither surpass nor underachieve the customer's time expectation (external time performance). In the meanwhile, lead time can be planned as well, according to the characteristics of the supply chain, the product and the market (internal time performance). Customer segments which are separated according to time expectation are different due to time sensibility, but for separation it is not enough to know the customers' desires about delivery time, it is also essential to know the payment willingness.

Time sensitivity dominates price sensitivity. This is underlined by personal research made in 2004 in which the variables of quality (speed and punctuality in service time) precede the service price. This empirical research has been studied amongst others the quality expectation of CEP services on a representative sample of Hungarian firms. Other Hungarian research has revealed that rapidity, punctuality and reliability are the first three demand-elements of quality, according to customers and potential customers

as well. Customers increasingly need reliable, short delivery time services and they are willing to pay more for it. Customers know exactly how fast is the service they buy. The faster the service is, the more expensive it is. It can be seen by increasing market volume and increasing price level (in contrast to the traditional shipment services).

#### 4. Value factors of goods

The possession-, consumer-, place- and time-value of products is different but it is the result of correlative processes. *Consumer-value* is created through production, which is basically determined by the quality of the product but it can be also influenced by the time and place of its access. These two latter values are value-categories created by logistics. Place- and time-value can be interpreted only in relation to consumer-value because we can decide the optimal time and place of consumption only by obtaining consumer-value and only in accordance with it.

*Time-value* becomes more important as it is determined by the lead time between the appearance and the satisfaction of demand [4] [27]. It is maximal when the search-production-obtaining of the product does not have any time-requirements, that is to say the demand can be fulfilled immediately at the moment of its appearance.

Time sensitivity is different with each consumer and product. We can speak about time sensitive consumer segments and also such kinds of products, which are very sensitive to any waiting or delay. The willingness of waiting is in relation to the importance of the product and its substitution. With the first one, the waiting-willingness is in direct proportion while with the latter one it is in the inverse ratio. Its formation determines the amount of the opportunity cost of waiting of a product for the consumer. Waiting means opportunity cost, the cost of which comes from wasted-time and wasted possibilities. Time – in a resource environment – behaves as a capacity, which we have to use efficiently. The consumer is always willing to wait as long as the advantage of sacrificed possibilities is lower than the benefit coming from the product, or the cost of waiting does not exceed it (for example unutilized capacities).

It is rather frequent in production-consumption that there are no possibilities for replacement (rare raw-materials, spare-parts waiting to be built-in, semi-finished goods, etc.). In this situation the consumer's willingness does not decrease with the progress of time, the time-value is constant. If the product is too distant, the time-value becomes zero. It can prevent consumption or the opposite situation, when time can be accelerated and when the product is worth everything (e.g., life-saving instruments, the prevention causes of disasters).

The main elements of consumption are the "then" and "there". So far we have discussed the topic of "then" but we cannot separate it from the problem of "there" either (the place of consumption). It is also the so-called *place-value* of products. The farther the product is from the consumer, the less valuable it is for the buyer. The decrease of place-value is in proportion with the distance, which is measured by the transportation cost. The extent of the willingness of payment depends on consumer value, more precisely how important it is considered to be by the consumer. Its importance can be separated from the real-product-utility.

#### 4.1. The value of time

Customers tend to make decisions based on acceptability, affordability and accessibility. In the literature these are the 3As framework in assessing potential benefits. Perceived benefits are determined by more elements in connection with product, provider and circumstances, against the perceived sacrifices; factors like cost, risk/uncertainty and time. Time appears like a hidden cost [27].

How we value time depends on several factors. First of all it depends on the customer type. We distinguish between the end user and the industrial customer. The final buyer gets more and more time-sensitive, so in his case the choice based on time can describe a utility function, which measures product usefulness depending on the quantity/lengths of time it takes to obtain it. Diagram 1 shows a possible form of such a function. The derivative function can also give information about how the marginal utility of time behaves. If we can compare it with the marginal cost function of service, we can see whether it is worth making efforts to have faster service in a certain segment.

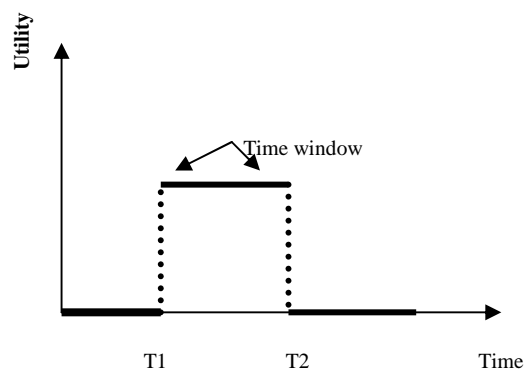


Diagram 1. Utility of time for the final buyers

For the buyers at higher levels of the supply chain, those who buy for further processing (producers), or for reselling (mediators/dealers), there is another kind of utility function to draw. This is shown in diagram 2. The limited time-utility is due to the larger time consciousness, because time costs money for companies. Like the aim to satisfy the consumer at a high level, the aim to operate efficiently as well leads to optimizing on a time basis.

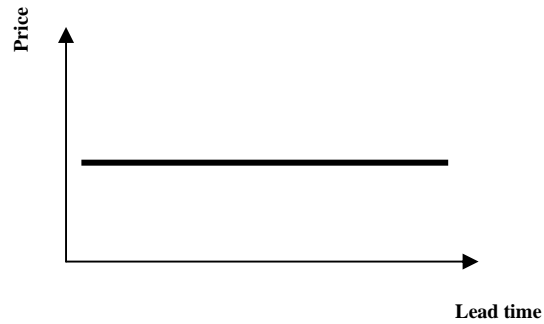


Diagram 2. Utility of time for the industrial buyer

#### 4.2. Elasticity of time

There are consumers who are not sensitive to time, who do not want to or are not able to afford rapidity. There are products (services) as well, where urgency is not necessary, just the opposite, quality is brought by time (e.g., process-centred services, or 12 years old Chivas Regal). The behaviour of these consumers is shown in diagram 3, where price is not increasing parallel to faster service (opposite direction on the lead time axis) price is constant, independent of time. The buyer does not pay more, even for a quicker service. His relation to time is totally inflexible.

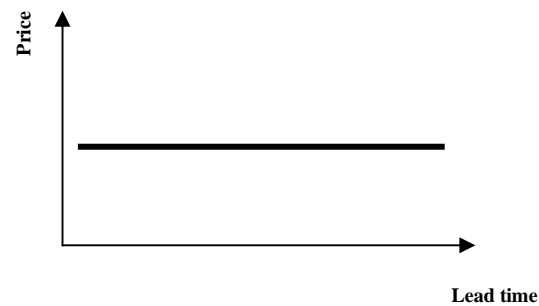


Diagram 3. Absolute time-insensitive consumer

Diagram 4 shows the opposite side, where, to get something at a certain time is worth everything; it means there is an endless time-elasticity.

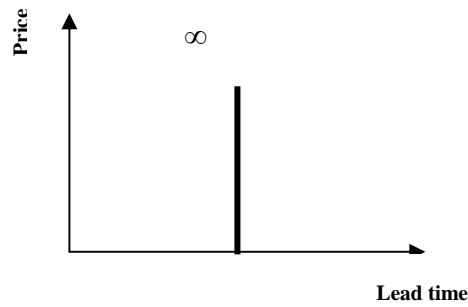


Diagram 4. Endless time-elastic consumers

Time-elasticity shows how much value there is for a buyer to get 1 % faster service. Diagram 5 shows the behaviour of a consumer who is not willing to appreciate the acceleration of delivery time in the same degree. Cutting the lead time from T1 to T2 he/she is only willing to pay the price P2 instead of the price P1, that means the relative decrease of T results only in a relative price increment  $(P2-P1)/P1$ .

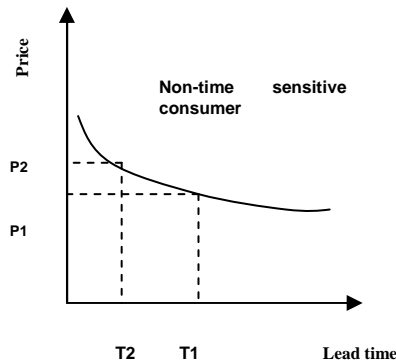


Diagram 5. Non-time sensitive consumers

Time-elasticity appears in a flexible behaviour, which means a 1 % relative decrease in lead time can realize a relative higher price-increment. Even a consumer surplus can arise if the reservation price (the maximum price the buyer is willing to pay for a certain time) is higher than the price fixed by the provider. Diagram 6 shows the behaviour of a time sensitive consumer.

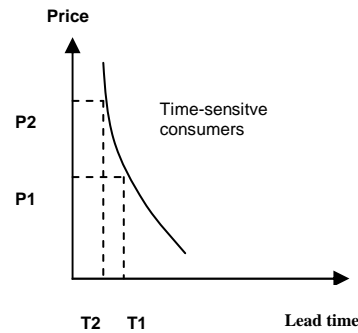


Diagram 6. Time sensitive consumers

Economics and marketing oriented research recognizes that longer lead times might have a negative impact on customer demand. There is a well-known model where demand is a function of actual delivery time and price [12]. The firm's objective is to maximize profit by optimal selection of price and delivery time.

## 5. Customer differentiation using the Kano model

The need to operate in a real-time manner is filtering through to other areas far away from technology as well. Getting used to immediacy we become impatient in other situations if we have to wait. However, our impatience is built not only by the information speed but other progresses taking place in other walks of life also influencing our changing time conscience. The roots of *immediacy* or rather the *real-time trend* have been discussed earlier, but we have to add that the fast-services developing in more and more fields have an accelerating effect on these needs. The dynamic character of the model by Kano explains the nature of the change in the expectations of time. Figure 3 shows the level of satisfaction accompanying each time performance. The grade of satisfaction is changing depending not only on quickness but also on getting used to it as well. It means that as time passes an inspiring level of performance – quickness, punctuality – is becoming expected and another inspiration can be reached only by achieving higher grades. Thus those providing services also themselves generate the need for faster and faster solutions.

The advantages of which are taken by the customers as well. However, through the Kano-model we can trace the phenomena of the customer evaluation of the obtained services - which shows a decreasing tendency as time goes by - and that of the sellers' pressure to assure higher and higher quality – externally influencing the customer to expect higher and higher quality. This way time utility can be traced back to endogenous and exogenous variables, which are rooted in the most important expectations for logistics along the temporal dimension.

Noriaki Kano (Japanese professor of quality management) has created the theory of quality elements classification [10] [20]. The service elements fall into three different

categories that have different effects on customer satisfaction or dissatisfaction (see figure 3).

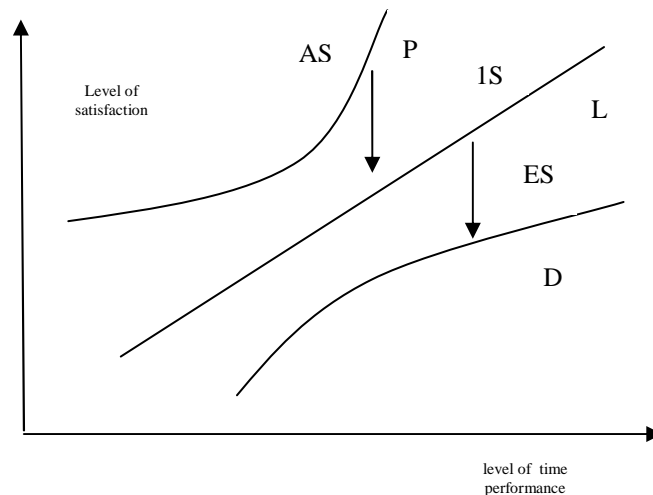


Figure 3. Kano model of the relationship between the parameters of customer satisfaction and obtaining products (services) [10]

Kano categories:

AS: Attractive service elements

1S: One-dimensional service elements

ES: Expected service elements

The relationship between the parameters of customer satisfaction and obtaining products (services) has three types (figure 3):

- Degrressive relationship, expected performance: the improvement of parameters increases satisfaction in a decreasing way, their non-performance triggers high dissatisfaction (negative satisfaction) (Curve D). The fact of obtaining products (services) can be regarded as an expected parameter in itself, which cannot be connected – or can be only in the long term – to temporal dimension, but the parameter of punctuality (the divergence between promised and performed dates) works in the same way (in judging this there are huge differences between different cultures).
- Linear relationship, quality of performance/one-dimensional service elements: the improvement of the parameters results in an increasing improvement in the satisfaction directly proportional to it
- (line L). Among the parameters regarded as performance we can mention rapidity. The shorter time it takes to obtain a product or a service (access time) the more satisfied we are.

- Progressive, inspiring quality/attractive service elements: an improvement in a unit results in an improvement in satisfaction by more than a unit (Curve P). The promise and performance evoking the sense of immediacy can be categorized here with other factors the customers have not thought of but when offered he/she finds it very useful (the judgement of the grade of usefulness differs within the different customer segments and product groups).

There is free access between the grades and by getting used to rapidity they change into the direction of the degressive relationship. The actual judgement of the temporal performances depends on the time culture of the external environment, the time attitude of the consumer and on the nature and role of the product/service.

## 6. Conclusions

There are changes taking place both in the economy, and in society, which result in an accelerating production process (product, circulation), in an accelerating pace of life. Both the buyers and the sellers are making efforts to shorten the access- and service-time of products. This effort has produced solutions in different fields of the economy, in forms of separate, independent branches (e.g., fast-service branches), or reformed variations of traditional service methods. This tendency can be traced back to the revaluation of the role of time, which is true in the case of the final consumers and the companies serving them. Logistics has new tasks as well because of the need to accelerate product-access. Logistics is the field, which is known to represent the largest portion of the time necessary to become an end-product. This time consumption is partly filled by the waiting period between each working process; the other part is filled by movement among different locations. It is important what kinds of efforts are made to ensure time- and place-value. It must be known what kind of rapidity and precision is expected by certain segments. Several studies have proved that there is a connection between rapidity, buyers' needs, buyers' loyalty and the willingness to pay. Both the levels of the supply chain and the service companies/messengers have to have a common strategy for time-compression. Changes in the individual consumers' needs are in accordance with an intensified increase of supply from the economy and a new demand-structure, where time is playing the main role. The technological development, global operation and the shortening product-life-cycles generate new methods, which are able to satisfy the demands. In our study based on the changes in the attitude to time we have reviewed the trends triggered by the network economy emerging in consumption and service. The increasing importance of time has originated from technological development, mobility and the change in use of time. We have introduced empirical devices (time scales, time-space scales, time maps), and theoretic utility and elasticity functions that are capable of studying the changing attitude, the use of time and to depict and visualize their consequences. We have also highlighted those methods, which are useful in connection with planning the time-based strategies.

## References

- [1] Adkins, LeHew, M. Cushman, L. M.: *Time-sensitive consumers' preference for concept clustering*, Journal of Shopping Center Research (1998)
- [2] Bosshart, D.: *Billig: wie die Lust am Discount Wirtschaft und Gesellschaft vetandert*, Redline Wirtschaft, Frankfurt (2004)
- [3] Castells, M.: *Az információ kora*. Gazdaság, Társadalom, Kultúra I. kötet Gondolat-Infonia Budapest (2005)
- [4] Christopher, M.: *Logistics and Supply Chain Management (Creating Value-Adding Networks)* Prentice Hall (2005) pp. 143-175, 190-193
- [5] De Toni, A. Meneghetti, A.: *Traditional and innovative path towards time-based competition*, International Journal of Production Economics 66 (2000) pp. 255-268
- [6] Dusek T., Szalkai G.: *Területi adatok ábrázolási lehetőségei speciális kartogramokkal*, Területi Statisztika (KSH) 10. évf. 1. szám (2007)
- [7] Földesi, P., Kóczy, L. T., Botzheim, J.: *Fuzzy solution for non-linear quality models*, Proceedings of 12th International Conference on Intelligent Engineering Systems, Miami, Florida (2008) pp. 269-276
- [8] Giddens, A.: *Consequences of Modernity* Cambridge Polity Press (1990)
- [9] Hofstede, Geert: *Culture's Consequences: Comparing Values, Behaviours, Institutions and Organizations Across Nations*, Thousand Oaks, CA Sage Publications, Second Edition (2001)
- [10] Kano, N. Seraku: *Attractive quality and must be quality*, Quality (1984) pp. 39-48
- [11] Karmarkar, U. S.: *Manufacturing lead times In*, Handbooks in Operations Research and Management Science, Vol. 4. Elsevier Science Publishers B. V., Amsterdam (1993)
- [12] Kósa, L.: *A „Kis Európa“ -eszme a magyar néprajzban* Forrás, XIX. 2.sz. (1987) pp. 41-46.
- [13] Lehmusvaara, A.: *Transport time policy and service level as components in logistics strategy*, A case study International J. of Production Economics 56-57 (1998) pp. 379-387.
- [14] Levine, R.: *Eine Landkarte der Zeit*. Wie Kulturen mit Zeit umgehen. München (1998)
- [15] McKenna, R.: *Real Time (The benefit of short-term thinking)* Harvard Business School Press, Boston, Massachusetts (1997)
- [16] Nahm, A. Y., Vonderembse, M. A., Koufteros, X. A.: *The impact of time-based manufacturing and plant performance*, J. of Operations Management 21 (2003) pp. 281-306
- [17] Pangburn, M. S. Stavrulaki, E.: *Capacity and price setting for dispersed, time-sensitive customer segments* European Journal of Operational Research 184 (2008) pp. 1100-1121
- [18] Rosa, H.: *Social Acceleration: Ethical and Political Consequences of a Desynchronized High-Speed Society* Constellation 10(1) (2003) pp. 3-33
- [19] Saibal, R. Jewkes, E. M.: *Customer lead time management when both demand and price are lead time sensitive* European Journal of Operational Research 153 (2004) pp. 769-781
- [20] Süle, E.: *Determinig quality functions of CEP (Courier, Express, Parcel) services* 7th International Congress Marketing Trends, Università Ca' Foscari, Venice (2008) pp. 1-18
- [21] Stalk G.: *Time-based competition and beyond: Competing on capabilities*, Planning Review 20(5) (1992) pp. 27-29
- [22] Tu, Qiang, Vonderembse, M. A, Ragu-Nathan, T. S.: *The impact of time-based manufacturing practices on mass custmization and value to customer*, Journal of Operations Management 19 (2001) pp. 201-217
- [23] Vanteddu, G. Chinnam, R. B. Yang, K. Gushikin, Oleg: *Supply chain focus dependent safety stock placement* International Journal of Flexible Manufacturing System (2007) pp. 463-485
- [24] Wajcman, J.: *Life in the fast lane? Towards a sociology of technology and time* The British Journal of Sociology, Vol. 59 Issue 1 (2008)
- [25] Warf, Barny: *Time-Space compression*, Historical Geographics, Routledge (2008)
- [26] Waters, C. Donald J.: *Global Logistics and Distribution Planning*, Kogan Page Publishers, Corby, (2003) pp.61-82