

# THE VALUATION OF THE ENTERPRISES AND PRODUCTS COMPETITIVENESS

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Preliminary notes

The increase of the enterprise competitiveness in the enlarged European Union imposes, firstly, a good knowledge of the competitiveness factors and a pragmatic rigorous valuation of the competitiveness at the micro level (cluster, firm, business, and product), in correlation with the competitiveness at the macro level (continent, country, and region) and the mezzo level (county, zone, and locality). New concepts, models and methods have been analysed and developed in this field: the competitiveness typology; the competitiveness metaperformances (flexibility, value, liquidity, efficiency) and factors at the micro level; the competitive capacity of enterprises; integrated valuations of the competitiveness (value in the market/segment/niche, competitiveness profile, score).

**Key words:** *competitiveness, factors, enterprise, product, valuation methods of the competitiveness*

## Procjena poduzeća i konkurentnost proizvoda

Prethodno priopćenje

Porast konkurentnosti poduzeća u proširenoj Europskoj uniji nameće, prvo, dobro poznavanje faktora konkurentnosti i pragmatično rigoroznu procjenu konkurentnosti na mikro razini (klaster – skupina tvrtki, tvrtka, posao i proizvod), u korelaciji s konkurentnosti na makro-razini (kontinent, država i regija) i među-razini (županija, zona i mjesto). Analizirani su i razvijeni novi koncepti, modeli i metode u ovom području: tipologija konkurentnosti; metauspjesi konkurentnosti (fleksibilnost, vrijednost, likvidnost, efikasnost) i faktori na mikro-razini; konkurentni kapacitet poduzeća; integrirana procjena konkurentnosti (vrijednost na tržištu/u segmentu/u grupi, profil konkurentnosti, rezultat).

**Gljučne riječi:** *konkurentnost, faktori, poduzeće, proizvod, metode procjene konkurentnosti*

## 1 Introduction

### Uvod

The classical literature [8, 9, 10] on competition and competitive advantage at micro level describes the way a firm can choose and implement a generic strategy to achieve and sustain competitive advantage. It addresses the interplay between the types of competitive advantage - cost and differentiation - and the aim of a firm's activities. The basic tool for diagnosing competitive advantage and finding ways to enhance it is the "value chain", which divides a firm into the discrete activities it performs in designing, producing, marketing, and distributing its product. The "competitive scope" can have a powerful role in competitive advantage through its influence on the value chain. Narrow scope (focus) can create competitive advantage through tailoring the value chain, and broader scope can enhance competitive advantage through the exploitation of interrelationships among the value chains that serve different segments, industries or geographic areas.

The globalisation process and the business practice in the XXI century claim the understanding, measuring and analysing competitiveness at the geographic level (micro, mezo and macro levels). Measuring (valuing) and analysing competitiveness has become a vital factor in creating a policy and managerial environment that is fully informed as to how we can enhance the economic performance of our nations [11, 12], regions, localities, clusters and firms.

The purpose of this paper is to define the total competitiveness, the competitiveness typology for the management practice, to develop a new model for the

competitiveness factors at micro level (business, firm, chain companies, cluster), and, on this basis, to develop the principles of the competitiveness valuation for enterprises and products.

## 2 The defining and competitiveness typology

### Definiranje i tipologija konkurentnosti

**The competitiveness** is the skill and the capacity of an entity to win in the competition in its external environments, through confrontation and/or co-operation, in a time period. This qualitative definition reflects the complexity of the concept and the variety of the competitiveness.

In the globalisation process, whose international roots have been developing since 1950, the **total competitiveness**  $K_{tot}$  of an entity (firm, chain companies, cluster, zone, county, region, country, continent) is more and more important in all the environments and for all the resources [4, 5, 6, 7]. Competitiveness is manifested in/and implies the environments and the resources of the entities.

As a result, **the competitiveness typology** can in detail be based on some morphological correlative models firstly according to environment & resources criteria (1) and secondly to value criteria (Table 1).

In principle, no matter if the hierarchical level of the human entity is considered, the total competitiveness  $K_{tot}$  integrates all **categories of the highlighted competitiveness K:**

$$K_{tot} = K_{nat} + K_{dsc} + K_{pja} + K_{tec} + K_{tmi} = K_{Rnat} + K_{Rumn} + K_{Rsoc} + K_{Rmar} + K_{Rinf} + K_{Rfin} \text{ [points]} \tag{1}$$

Where:  $K_{nat}$  is the natural competitiveness that characterizes the natural environment of the considered entity,  $K_{dsc}$  is the demo-socio-cultural competitiveness that characterizes the demo-psycho-linguistic and socio-cultural environments of the considered entity,  $K_{pja}$  is the political-juridical-administrative competitiveness that characterizes the political-juridical-administrative environment of the considered entity,  $K_{tec}$  is the technical-economic (in market/business) competitiveness that characterizes the business and innovation environment of the considered entity,  $K_{tmi}$  is the technical-military competitiveness that characterizes the military environment of the considered entity,

$K_{Rnat}$  is the natural competitiveness of the natural resources that the considered entity possesses,  $K_{Rumn}$  is the human competitiveness of the human resources that the considered entity possesses,  $K_{Rsoc}$  is the social competitiveness of the social resources that the considered entity possesses,  $K_{Rmar}$  is the material artificial competitiveness of the material artificial resources that the considered entity possesses,  $K_{Rinf}$  is the informational competitiveness of the informational resources that the considered entity possesses,  $K_{Rfin}$  is the financial competitiveness of the financial resources that the considered entity possesses.

Table 1. The competitiveness {K} typology for the management practice  
 Tablica 1. Tipologija konkurentnosti {K} za praksu upravljanja

Criterion	Sub-criteria and typology of {K}								
Hierarchical level of the field/entity and of the competitiveness {K}	Hierarchical levels			Field			According to the frontier		
	Super-system	System	Sub-system	Macro	Mezo	Micro	Internal	External	
Duration of the life cycle of the field / entity and of the competitiveness {K}	Ephemeral (Short term)			Temporary (Medium term)			Lasting (Long/very long term)		
Value and extension (Components of the total competitiveness $K_{tot}$ )	Total competitiveness $K_{tot}$								
	Global competitiveness $K_g$ (Global function $F_g$ )				"Economic" competitiveness $K_e$ (Consumption of resources & efficiency)				
	Integral		Partial		Integral		Partial		
	All performances in all environments		Performances in one / some environments		All the economic performances		Consumption of the resources "costs"	Economic efficiency Specific ratio /.../.../.../...	
Measurement/ evaluation method of the competitiveness {K}	Qualitative			Quantitative					Relative (Comparatively with a standard in the field / environment)
				Absolute					
	Aggregation [score]	Concise			Profile K				
		Value $K_g/K_e$	Value (position) in the field/ environment						
Hierarchical level of the technical-economic competitiveness (market/business) $K_{tec}$	World $K_M$	Continental $K_C$	National $K_N$	Regional $K_R$	Local $K_L$	Chain companies /Cluster $K_{I/C}$	Firm $K_F$	Business $K_A$	

$$K_{I/C} = f(C_K, \{i\} \& \{Q_i\} / \{T_{ij}\}, \{N_{gi} / P_{vi}\}, C_c, L, E_e, \{I_m\}, \{I_M\}, \{C_{ip/s/n}\}, \Delta t) \tag{2}$$

SUPPLY I/C  
 factors from  $M_{internal}$

DEMAND  
 factors from  $M_{external}$

At a micro level the following definitions can be detailed:

**The enterprise/cluster competitiveness:** the ability of the enterprise/cluster to successfully develop the competition through the majority of businesses on target markets (segments) niches,

**Business competitiveness:** the ability of the enterprise to successfully develop the competition through the considered business on target markets (segments) niches on the length of one or more contracts signed with clients and suppliers,

**Competitiveness of the i assortment** (product, service, work): the ability of the i product to be competitively placed and sold on the target market (segment) niche, on the basis of the global quality/price (cost) ratio.

### 3

#### Factors in the enterprise competitiveness determination

Faktori u određivanju konkurentnosti poduzeća

At a micro level **the technical-economic competitiveness  $K_{I/C}$  of the enterprise** (I - Chain companies, Firm, Business) or **cluster (C)** reflects the suitability of their SUPPLY to products DEMAND  $\{C_{i p/s/n}\}$  of the target market/segment/niche in a time period unit t.p.u. [3, 4, 5].

**Factors from the intern environment  $M_{internal}$**  of the enterprise are rather various:

►  $C_K$  [pcs, EUR/t.p.u.] is **the competitive ability (capacity) of the enterprise/cluster**, defined by the  $\{Q_{vi}\}$  quantities of the  $\{i\}$  products with intrinsic competitiveness  $\{K_i\} = \{N_{gi}/P_{vi}\}$  imposed by the exterior target (market/segment/niche with  $N_{gi}$  needs &  $Q_{ci}$  quantities and solvency specific  $C_{pli}$ ) that can be produced and/or efficiently purchased and sold in a time period  $\Delta t$ , satisfying the actual demand  $\{C_{i p/s/n}\}$  of the target exterior environment (Equation 2),

►  $\{i\}$  &  $\{Q_i\} / \{T_i\}$  is the **supply flexibility** of the enterprise/cluster defined by the variety & quantity/time period for the customers from the target market/segment/niche

- *Variety of the supply (range of goods) in the market* is given by the range of goods (assortment)  $i = 1, 2, \dots, p$  that the enterprise / cluster can produce and sell
- *Quantity of the supply in the market* is given by the ability of the enterprise / cluster to process in the considered time period unit (t.p.u.), defined
  - ~ physically  $Q_i$  [pcs, .../t.p.u.] production volume and physical selling
  - ~ value-oriented  $Q_r$  [EUR, USD, .../t.p.u.] turnover
- *durations of the supply in the market* of the enterprise/cluster are given by the following durations:
  - ~ of the life cycle of the offered assortment  $T_{cvi}$  [months/range]

~ of the new assortment assimilation  $T_{cai}$  [days/sort]

~ of the management, production and commerce  $T_{cpci}$  [days/pcs; lot]

►  $\{N_{gi}/P_{vi}\}$  is the **position (value) on the market of the enterprise/cluster supply** defined by the global quality  $N_{gi}$ /price  $P_{vi}$  for customers on the target market/segment/niche

- *quality of the supply in the market* is defined by absolute or relative quality level  $N$  (indicator  $r$ ) compared to a standard product (indicator  $e$ )
  - ~ of the market supply itself  $N_{gi}$  [points] or/and  $N_{rei} = N_i/N_e$
  - ~ of the processing and commerce (special indicators)

- *prices/tariffs and costs of the supply on the market* defined by

$P_{vi}$  [EUR, USD, ... /piece] selling price for the i product to the customers on the market

$C_{ci}$  [EUR, USD, ... /piece] complete cost for the i product

$C_c$  [EUR, USD, ... /t.p.u.] complete costs at enterprise / cluster level

►  $L$  [EUR, USD, ... /t.p.u.] is the **liquidity** of enterprise/cluster given by the cash solvability in bank(s) accounts by which the cashing, payment, crediting etc. operations are made,

►  $E_e$  is the **economic efficiency** of enterprise/cluster functioning by restructuring, characterized by a large number of indicators (with threshold values, respectively with specific objectives: maximization or minimization), of which the most important belong to

- Starting new businesses  $\{A\}$
- Assimilating new i products
- Restructuring the enterprise
  - $(D_r \leq D_m \rightarrow \min$  [years] period of recovery of the necessary investment (indicator  $r$ ), in comparison to standardized period (index  $m$ ) specific to the branch.)
- The economic efficiency of the enterprise/cluster functioning
  - ~ Profitability
    - $B_{ui}$  [EUR, USD, ... /pcs]  $\rightarrow$  max unitary gain
    - $B_i$  [EUR, USD, ... /t.p.u.]  $\rightarrow$  max net profit of enterprise
    - $R_B$  [%]  $\rightarrow$  max profitability rate
  - ~ Productivity
    - $W_{pa}$  [EUR, USD, ... /pers.year]  $\rightarrow$  max
    - $W_i$  [hour-man/pcs]  $\rightarrow$  max
    - ~ Loading of processing capacity  $I_{uc} = Q_{ct}/C_t$  [%]  $\rightarrow$  max
    - ~ Other efficiency indicators.

**Factors from the external environment  $M_{\text{external}}$**  of the enterprise/cluster are also, widely spread:

►  $\{I_m\}$ : external **conjuncture** indicators at a **mezo** level (economic increase/decrease: pollution, population, professional training, inflation, unemployment, monthly medium-sized income/person, investments, patented and applied inventions, artistic production, ...),

►  $\{I_M\}$ : external **conjuncture** indicators at a **macro** level (economic increase/decrease: pollution, population, professional training, political stability, inflation, unemployment, monthly medium-sized income/person, investments, patented and applied inventions, scientific production, artistic production, sport events, national defense, ...),

► **actual demand**  $\{C_{i\ p/s/n}\}$  of the target exterior environment (market/segment/niche) with needs

(global quality  $N_{gi}$  & physical quantity  $Q_{ci}$ ) and solvability  $C_{pli}$  specific in a time period.

This grouping of the essential objectives for the enterprise/cluster periodic restructuring functioning [3, 4, 6, 7] is a model that reflects much better the **reality of competitiveness determination**, included in the historic evolution of human society.

Both the liquidity  $L$  and the economic efficiency  $\{E_e\}$  are, actually, the reflection, the consequence of the flexibility and position performances (value) on the market, determined by the management and systems engineering specific to the considered enterprise/cluster. Without management and high-level engineering/innovation (Figure 1) it is impossible to ensure liquidity and economic efficiency (profitability, labour productivity etc.).

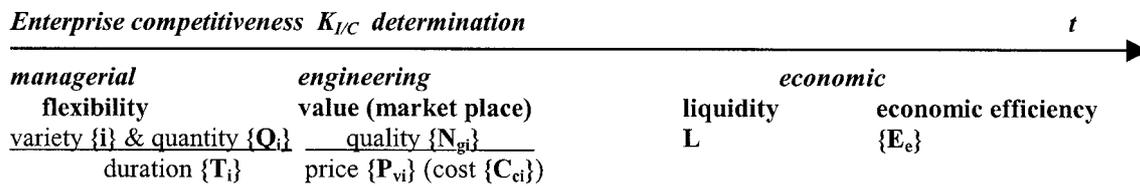


Figure 1. The intervention of internal factors in competitiveness  $K_{I/C}$  determination  
Slika 1. Intervencija unutarnjih faktora u odrađivanju konkurentnosti  $K_{I/C}$

#### 4 The enterprise competitiveness valuation

##### Procjena konkurentnosti poduzeća

After the 1970 decade at an international level it was the beginning of the "environment economy" and scientific research progressively developed the competitiveness measurement/evaluation methods, especially at macro level [4, 6, 10, 11, 12].

Nowadays the **annual** reports regarding international competitiveness are highly appreciated for **macro evaluations** [11, 12]. In fact, the total competitiveness is not rigorously evaluated at a continental level  $K_{Ctot}$  or at national level  $K_{Ntot}$  of the analysed countries and of approx. 60 countries [11] or 104 countries [12] annually classified. This is due mainly to difficulties of obtaining the information for the aggregated performance indicators. But, the methods IMD [9] of evaluating the competitiveness at a national level, which are in a continuous perfecting process (321/323/314 criteria in 2003/2004/2005), reflect more, from one year to another, what total competitiveness  $K_{tot}$  means.

The basic idea of this evaluation is that the **interdependence between national or regional competitiveness and enterprise/cluster competitiveness becomes essential**. The national states are the ones that mainly generate the characteristics of the business environment (socio-economical) and other environments so that these should be favourable to organizations competitiveness increase, and through real competitiveness

on the national and international markets the enterprises/clusters from the national/continental territory essentially determine the national/continental competitiveness.

For **mezzo and micro level competitiveness evaluation** the classical research does not approach this matter and the modern research is oriented to two directions:

- (a) *Competitiveness quantification* within the diagnostic analyses at a company level (can also be extended to chain companies,...), inevitably distorted/limited, as it mainly considers performances from the internal environment,
- (b) *Diversified complex quantification*, of the competitiveness within managerial analysis for competitiveness [6] which practically considers all performance categories from both the internal and external environment.

**The practical possibilities** of evaluating the competitiveness are theoretically presented in table 1:

- **The attributive evaluation** which considers the performance categories specific to the considered environment/environments; for example, **at a business, firm or cluster level** there are seven performances/factors categories which determine the **competitiveness level**: variety of the supply (range of goods); quantity of the supply; duration of the new product assimilation and of the lot production and commerce; quality of the supply; supply costs and prices; liquidity; economic efficiency of the product, business, firm or cluster in a time period,

- **Aggregation quantifying** which is used when establishing the score or the weighted arithmetic average, or weighted geometric average of the considered performances of the entity (3), (4),
- **Absolute concentrated evaluation** which considers the ratio  $N_{gi}/P_{vi}$  ( $C_{ci}$ ) between the level of global quality  $N_{gi}$  of the offered product type and its selling price  $P_{vi}$  or the complete cost  $C_{ci}$  (5), (6),
- **The relative quantification** made in comparison to a competing company on the market (index  $p$ ) of the  $K_g / K_p$  ratio or to the market leading company (indicator 0) on the basis of the  $K_g/K_0$  ratio,
- **The position (value) of the  $i$  product on the market**, comparatively defined according to the competition on the basis of the  $N_{gi}/P_{vi}$  ( $C_{ci}$ ) ratio, suggestively reflected [3, 4, 5, 6] and according to the capacity of the final customers payment from the markets / segments / target niches,
- **The profile of the enterprise competitiveness**, described according to the aggregation quantifying of the component of the competitiveness  $K_{I/C}$  (Figure 2).

The most convenient **aggregation method** is given by the use of the arithmetic/geometric weighted average. In case of a limited dispersion of the value ratios  $y_{pef}/y_{p0}$  it is recommended to use the arithmetic average ( $K_{aef}$ , points), and when a large dispersion of the value ratios  $y_{pef}/y_{p0}$  it is recommended to use the geometric average ( $K_{gef}$ , points):

$$K_{aef} = E \left( \sum_{p=1}^m g_p \frac{y_{pef}}{y_{p0}} + \sum_{p=m+1}^z g_p \frac{y_{p0}}{y_{pef}} \right) \quad (3)$$

$$K_{gef} = E \left[ \prod_{p=1}^m \left( \frac{y_{pef}}{y_{p0}} \right)^{g_p} \cdot \prod_{p=m+1}^z \left( \frac{y_{p0}}{y_{pef}} \right)^{g_p} \right] \quad (4)$$

Where:  $E = 10$  is the coefficient for scaling, in order to clearly separate the competitiveness  $K$ ,  
 $p = 1, \dots, m$  is the ensemble of the performances whose values raise along with competitiveness growth,  
 $p = m+1, \dots, z$  is the ensemble of the performances whose values fall along with competitiveness growth,  
 $g_p$  is the weight of the performance importance  $p$  in determining the competitiveness,

$$\sum_{p=1}^z g_p = 1$$

$y_{pef}$  is the actual performance at the considered entity level ( $i$  product/A business/F firm/RF chain companies/C cluster),

$y_{p0}$  is the reference performance at the entity level considered as a basis for comparison ( $i$  product/A business/F firm/RF chain companies/C cluster), usually this belongs to the market/segment/niche leader, possible to the competition.

In enterprises the evaluation relations (3) and (4) are difficult to use due to information obstacles regarding all performances of the competition. As a result, the competitiveness is frequently determined by using the **simplified evaluation (concentrated)**, making use of the performance ratio for product groups or for one product type,  $N_{gi}/N_{ei}$  [ $P_{vi}$ ] (ratio between the global quality level  $N_{gi}$  and the economic quality  $N_{ei}$ , or, if this cannot be exactly identified, the selling price  $P_{vi}$  of the considered product).

In business practice the position (value) of the  $i$  product on the market and the profile of the product competitiveness are used the most and they rely on aggregation quantifying.

**The basic correlation between the functions and the quality of a product type** is in the end dictated by the market/segment/niche, finally by the final customer/purchaser that is buying, and it is expressed by **different objectives of competitiveness  $K_i$** , according to processing type categories. For a product:

- **in serial and mass production and selling** the main objective is:

$$K_{ims} = \frac{N_{gi}}{N_{ei}(P_{vi})} \rightarrow \max \quad (5)$$

- **in producing and selling valuable unique products** (inventions, projects, design creation, prototypes, art works etc.) the objective is:

$$K_{iu} = \frac{N_{ei}(P_{vi})}{N_{gi}} \rightarrow \max \quad (6)$$

In practice setting the prices  $P_{vi}$  or tariffs  $T_{vi}$  and complete costs  $C_{ci}$  does not pose any problems. Setting the level of products and service quality is more difficult and laborious.

Based on variables  $P_{vi}$ ,  $N_{gi}$  the position of the global  $i$  product on the market [1, 3, 4, 6] reflecting its actual competitiveness on the target market/segment/niche, at the final customer.

**The profile of the enterprise competitiveness** describes the competitiveness level that forms the  $K_{ef}$  competitiveness, in comparison to reference competitiveness components  $K_0$ , of the leader on the market/segment/niche. In figure 2 it is assumed, in a simplified way, that the  $K_0$  profile of the leader competitiveness is linear. In reality this profile of the leader competitiveness is a broken line, and the studied enterprise ( $K_{I/Eef}$ ) can surpass one or more competitiveness components of  $K_0$  (for example,  $K_T$ , in Figure 2).

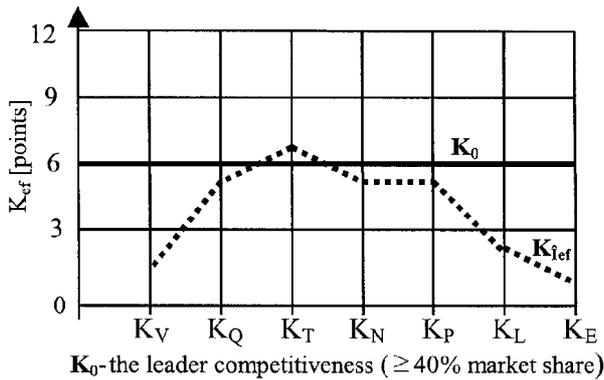


Figure 2. The principle of the enterprise competitiveness profile  $K_{ef}$  determination (indicator: V assortment variety; Q quantity; T duration; N quality level; P price; L liquidity; E efficiency)  
Slika 2. Princip određivanja profila konkurentnosti  $K_{ef}$  (indikator: V asortiman različitosti; Q količina; T trajanje; N razina kvalitete; P cijena; L likvidnost; E efikasnost)

## 5

### The correlation between quality – functions – competitiveness for products and services

Korelacija između kvalitete – funkcija – konkurentnosti za proizvode i usluge

**Products P** (technical systems, technological systems, production and retail structures etc.) and **services S** (productive: scientific research, design & consulting, storing & packing, maintenance, business information processing etc.; or non-productive: medical assistance, cultural, social services etc.) are the basic artificial entities of the human civilization. They can be placed in the following **structural-functional hierarchy** in the socio-techno-economic environment:

- 1) **Structural classes**  $s = 1, 2, \dots, v$ , corresponding to some general abstract functions  $F_{ga}$  on the market or the technosphere (for example, the motor vehicle structural class, respectively the motor vehicle maintenance service class),
- 2) **Functional types**  $f = 1, 2, \dots, t$ , in a  $s$  class, corresponding to some distinct global functions  $F_{gf}$  (for example, the functional car type, respectively the type of car maintenance service),
- 3) **Brands**  $m = 1, 2, \dots, s$ , within a class or a functional type, that has a name attached to it/a sign of the producing company (for example a Renault automobile, respectively the Renault automobile maintenance),
- 4) **Dimensional groups** (depending on weight, format, installed power, useful volume etc.)  $d = 1, 2, \dots, n$ , within a  $f$  type/brand  $m$ , corresponding to a type-dimensional global function  $F_{gd}$  and to certain values of the defining  $m$  parameters (for example, a car of medium fuel volume with an internal combustion motor having the cylindrical capacity of  $1.300 \dots 2.000 \text{ cm}^3$ , respectively the maintenance of the medium fuel volume cars),
- 5) **Range (of goods)**  $i = 1, 2, \dots, p$ , in  $m$  brands/ $d$  groups, corresponding to a global function  $F_{gi}$  of

range  $i$  and to some quality characteristics  $y_{ic}$  ( $c = 1, 2, \dots, z$ ) with nominal different values, a range of produced goods sold on the market by a variety of competing producing companies (for example, the model Dacia-Renault Logan car, with different motorization, having the cylindrical capacity of  $1.400/1.600 \text{ cm}^3$ ; respectively the maintenance of the Dacia-Renault Logan cars).

On a market / segment / niche and in a time period  $\Delta t$ , **the following can be defined:**

- For each dimensional group  $d$ : an **ideal using value** (the most favourable values of the quality characteristics  $y_{ic}$ ), considered at a mezzo-economic level (producing companies, purchaser/customers, suppliers) and macro-medium level (socio-economic, natural, demo-psycho-linguistic, socio-cultural, politic-juridical-administrative, technologic, military); the competitive producing companies aim to achieve this value of using ideally the portfolio  $\{i\}$  of different goods from a dimensional group  $d$ ,

- For each range of goods  $i$ : a **real use value**, synonymous to the  $N_i$  **quality level** of the product or service (the whole properties and characteristics of a product range, that gives it the ability to satisfy certain declared or implicit needs/necessities) in time and space; the real use value (quality level) of any product range must be adapted as much as possible in an optimal and multi-criteria, to the market/segment/the considered target niche demand,

- For each range of goods  $i$ : a **concentrated competitiveness  $K_i$  of the supply**, determined by value of the ratio between the **global quality level  $N_{gi}$  / price or tariff (complete cost  $C_{ci})$**  of the  $i$  product, the competitiveness that must be adapted as much as possible in an optimal and multi-criteria, to the market/segment/the considered target niche demand.

Table 2 presents in a developed form a **model of correlation between quality – functions – competitiveness for an  $i$  global product** (assortment) in a typo-dimensional group  $d$ .

First of all the **basic general correlation between the quality levels** is noticed:

$$N_i = N_{ti} + N_{sei} = N_{gi} + N_{ei} \quad (7)$$

Where:  $N_i$  is the total quality level of the  $i$  product, in points;

$N_{ti}$  is the level of technical quality, included in the product or service, where its quality corresponding characteristics  $y_{ic}$  are objectively measurable;

$N_{sei}$  is the level of social-economic quality, of reflecting/interpreting (physically not included in the product) and partially subjectively evaluative at the aesthetic characteristics level, respectively the social quality characteristics  $y_{ic}$ ;

$N_{gi}$  is the level of global quality, corresponding to the global function  $F_{gi}$  of the  $i$  considered product;

Table 2. The correlation quality – functions – competitiveness for an i product  
 Tablica 2. Korelacija kvaliteta – funkcije – konkurentnost za neki i-ti proizvod

Quality categories of the i product (Criterion: incorporation in the product)		Groups of the quality characteristics $\{y_{ic}\}$ for the i product		Function's categories of the i product		Quality categories of the i product (Criterion: competitiveness)		Competitiveness $K_i$
		Potentiality (t)	Availability (0...t)					
Total quality $N_i(y_{ic}) (c=1,...,z)$	Technical quality $N_{ti}(y_{ic}) (c=1,...,t)$	Characteristics of material and of the components j interconnections	Reliability & Maintainability	Intermediary functions $\{F_{ij}\}$		Global function $\{F_{gi}\}$	Global quality $N_{gi}(y_{ic}) (c=1,...,v)$	Total quality $N_i(y_{ic}) (c=1,...,z)$
		(required from the i range / assortment)						
		Defining structural, transformation and environments connection characteristics for the i product (required from FC)						
	Ecologic characteristics (required from NE)		Final functions $\{F_{fi}\}$	Performance functions $\{F_{pi}\}$				
	Ergonomic characteristics (required from HE)							
	Socio-economic quality $N_{sei}(y_{ic}) (c=t+1,...,z)$	Esthetical characteristics (required from HE, SE)		Collateral functions $\{F_{ci}\}$	Costs and economic efficiency at producer, final customer and macro-economic level, determinable from $F_{gi}$			
Socio-cultural characteristics (required from SE)								
Economic characteristics (required from EE)								

FC - final customers of the i product; NE - natural environment of the i product; HE - human environment of the i product; SE - socio-cultural environment of the i product; EE - economic environment of the i product

- $N_{ei}$  is the level of economic quality, corresponding to costs, prices and economic efficiency at the producing company, purchaser and at a macro-economic level (world, national, continental economy), the  $N_{ei}$  level being difficult to generate in practice due to information lack. Therefore, simplifying, for the first analysis,  $N_{ei}$  is replaced with the selling price  $P_{vi}$ /tariff  $T_{vi}$  negotiated on the market when selling the considered i product.
- Evidently, the function and quality characteristics categories are required both by the intern environment of the i product (in order to ensure the availability of the other required performances on the period of product service or services), and especially by its external environment (FC - final customers of the i product; NE - natural environment of the i product; HE - human environment of the i product; SE - socio-cultural environment of the i product; EE - economic environment of the i product). The final functions  $\{F_f\}$  of any product and its corresponding quality characteristics (identification quality) are, generally, primordial for the customer/purchaser. The more advanced the competition and legislation on the market, the more important the level and profile of the global quality  $N_{gi}$  in order to define the product competitiveness or the considered service. Differentiating the i product types on market/segments/niches is presently made firstly by the aesthetic quality level and ergonomic quality level, as in all fields, the rest of quality levels are practically equal.

## 6

### The principles of competitiveness valuation of products and services types

Principi procjene konkurentnosti tipova proizvoda i usluga

Services and products competitiveness can be theoretically evaluated in several ways [1, 3, 4, 5]:

- **Attributive evaluation** which considers the specific performance categories of the given i product and it uses attributes (exceptional, very good, good, satisfying, unsatisfying), **aggregation quantifying** which uses when establishing the score either the weighted arithmetic average, or weighted geometric average of the considered performances of the i product (3), (4),
- **Absolute concentrated evaluation** which considers the ratio  $N_{gi}/N_{ei}$ , or, even simpler than that, the ratio  $N_{gi}/P_{vi}$  ( $C_{ci}$ ) between the level of global quality  $N_{gi}$  of the offered product type and its selling price  $P_{vi}$  or the complete cost  $C_{ci}$  of the considered of the i product (5), (6),
- **The relative quantification** made in comparison to a competing company on the market (index p) of the i product  $N_{gi}/N_p$  ratio or to the market leading company (index 0) on the basis of the  $N_{gi}/N_0$  ratio,
- **The position (value) of the i product on the market**, comparatively defined according to the competition on the basis of the  $N_{gi}/P_{vi}$  ( $C_{ci}$ ) ratio, suggestively reflected [3, 4, 5, 6] and according to the capacity of the final customers payment from the markets/segments/target niches,
- **The profile of the product quality/competitiveness**, described according to the aggregation quantifying of the component quality levels of the global quality (Figure 3).

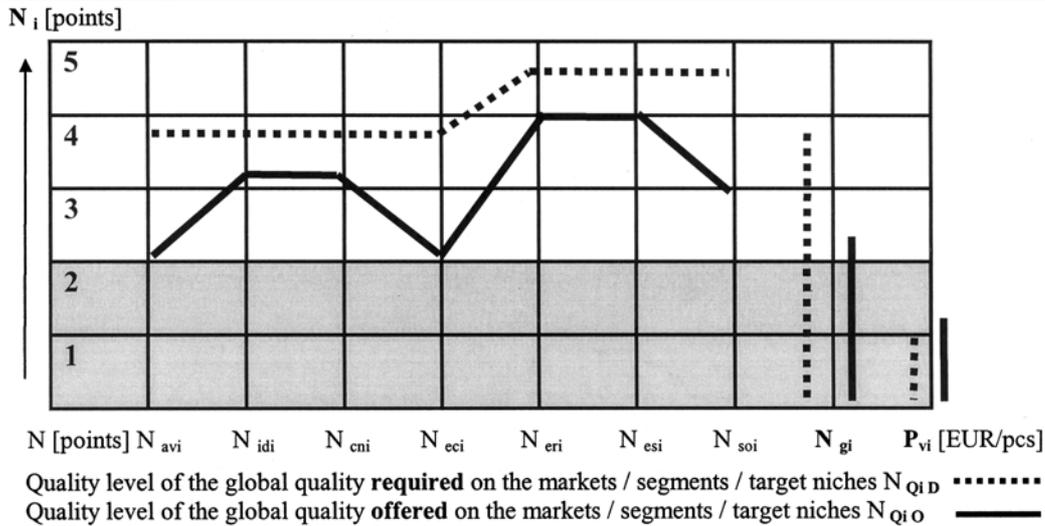


Figure 3. The profile of the global quality for an i automobile type  
Slika 3. Profil globalne kvalitete za neki i-ti tip automobila

In business practice the position (value) of the i product on the market and the profile of the product competitiveness are used the most and they rely on aggregation quantifying.

**The basic correlation between the functions and the quality of a product type** is in the end dictated by the market/segment/niche, finally by the final customer/purchaser that is buying, and it is expressed by **different objectives of competitiveness K<sub>i</sub>**, according to processing type categories. For a product:

- **in serial and mass production and selling** the main objective is (5) the maximization of the performance ratio value by uprising the level of global quality N<sub>gi</sub> simultaneously with price P<sub>vi</sub> or tariff T<sub>vi</sub> decrease (complete costs C<sub>ci</sub>) of the i considered product, or at least by the favourable variation for the competitiveness of one of the terms of this ratio;

- **in producing and selling valuable unique products** (invention, projects, design creation, prototypes, art works etc.) the objective is (6) the maximization of the performance ratio value by negotiating a highest possible selling price P<sub>vi</sub> or tariff T<sub>vi</sub>, considering the special quality (acknowledged by partners) N<sub>gi</sub> of the considered i product.

In practice setting the prices P<sub>vi</sub> or tariffs T<sub>vi</sub> and complete costs C<sub>ci</sub> does not pose any problems. Setting the level of products and service quality is more difficult and laborious.

7

**Estimating the level of products and service quality**

Proračun razine kvalitete proizvoda i usluga

The correlation between quality – functions – competitiveness for an i product (Table 2) also allows the definition of the categories **"standard" total quality components**. The "standard" total quality components are correlated to the standard functions of the product

F<sub>1</sub>,..., F<sub>7</sub> [3, 5]:

- N<sub>avi</sub> = N<sub>1</sub> level of availability, generated by quality characteristics y<sub>ic</sub> of the materials and the connections of product components, accessibility, spare parts, maintenance etc. (N<sub>1</sub> ↔ F<sub>1</sub>),
- N<sub>idi</sub> = N<sub>2</sub> level of product identification quality, settled by quality structural – functional specific characteristics y<sub>ic</sub> (correspondence N<sub>2</sub> ↔ F<sub>2</sub>),
- N<sub>cni</sub> = N<sub>3</sub> level of functional connection quality of the product with its external environments, established by the attached quality characteristics y<sub>ic</sub> (power networks, informatics connection, infrastructure elements connection etc.) (correspondence N<sub>3</sub> ↔ F<sub>3</sub>),
- N<sub>eci</sub> = N<sub>4</sub> level of the ecologic quality of the product, generated by the quality characteristics y<sub>ic</sub> that could change the natural environment, over a standard reference level, (correspondence N<sub>4</sub> ↔ F<sub>4</sub>),
- N<sub>eri</sub> = N<sub>5</sub> level of the ergonomic quality of the product, settled by de quality characteristics y<sub>ic</sub> that characterize the product's interconnection with the human operator (correspondence N<sub>5</sub> ↔ F<sub>5</sub>),
- N<sub>esi</sub> = N<sub>6</sub> level of the aesthetic quality of the product, determined by the quality characteristics y<sub>ic</sub> that define the degree of closeness to the subjective ideal beauty (correspondence N<sub>6</sub> ↔ F<sub>6</sub>),
- N<sub>soi</sub> = N<sub>7</sub> level of the social-cultural quality of the product, established by the quality characteristics y<sub>ic</sub> that generate such effects (correspondence N<sub>7</sub> ↔ F<sub>7</sub>),
- N<sub>8</sub> level of the economic quality of the product, established by the economic quality characteristics y<sub>ic</sub>: costs, prices, economic efficiency of the producing company, purchaser, macroeconomic level (evidently, *the economic quality* is a defining component of the product competitiveness and it cannot have a functional correspondence).

Given the multitude and great diversity of the quality characteristics  $y_{ic}$  of the products, generally incomparable characteristics, **partial or global quality level evaluation** can be made through aggregation, based on the principle described when quantifying the competitiveness level (relations 3 and 4).

**The absolute level of global quality** is established based on the weighted arithmetic average ( $N_{ga}$  – recommended at values of the ratios  $y_{ic}/y_{0c}$  respectively  $y_{0c}/y_{ic}$  which do not have a large dispersion – in points) or based on weighted geometric average ( $N_{gg}$  – recommended at values of the ratios  $y_{ic}/y_{0c}$  respectively  $y_{0c}/y_{ic}$  which have large dispersion – in points):

$$N_{ga} = K \left( \sum_{c=1}^m g_c \frac{y_{ic}}{y_{0c}} + \sum_{c=m+1}^v g_c \frac{y_{0c}}{y_{ic}} \right) \quad (8)$$

$$N_{gg} = K \left[ \prod_{c=1}^m \left( \frac{y_{ic}}{y_{0c}} \right)^{g_c} \cdot \prod_{c=m+1}^v \left( \frac{y_{0c}}{y_{ic}} \right)^{g_c} \right] \quad (9)$$

Where:  $K = 1.000$  (or  $K = 100$ ) is the quality level of the 0 reference product (the leader/competing company on the target market etc.),

$c = 1, \dots, m$  is the multitude of performances  $y_c$  whose values grow along with quality level,

$c = m+1, \dots, v$  is the multitude of performances  $y_c$  whose values decrease along with quality level growth,

$g_c$  is the weight of the quality characteristic importance  $y_c$  in establishing the quality level, evidently satisfying the relation

$$\sum_{c=1}^v g_c = 1,$$

$y_{ic}$  is the quality characteristic of the studied product,  $y_{0c}$  is the quality characteristic of the reference product, usually of the leader on the market/segment/niche, possible of the competing company.

It is required that the degree of trust in acknowledging the quality characteristics  $y_c$  should surpass a minimum level, of approx. 60 % from the total number of characteristics ( $v = 10 - 1.000$ ), and the products  $i$  and 0 should belong to the same dimensional group (depending on weight, format, installed power, useful volume etc.).

When establishing the absolute quality level  $N_{gi}$  the necessary information can be systematized according to the model in table 3. The  $g_c$  weights are established using the classic method [5], and the evolution of the quality characteristics  $y_c$  is made in comparison to the evolution of the global quality level  $N_{gi}$  it is suggestively marked:  $\uparrow$  increase;  $\downarrow$  decrease.

Evaluating by aggregation the level of the global quality  $N_{gi}$  (relations 8 and 9) allows a very good quantification of the product/service position on the market and the  $i$  product quality profile.

Table 3. Quality functions and characteristics for the  $i$  product  
 Tablica 3. Funkcije kvalitete i karakteristike za  $i$ -ti proizvod

Quality characteristic $y_c$		Quality functions and characteristics $y_c$ of the products	Identification of the quality characteristics $y_c$		Values for ranges of products	
Nr. crt.	Weight $g_c$		M.U.	Evolution with $N_{gi}$ evolution	Studied $i$	Reference 0
....	....	....	....	....	....	
....	....	....	....	....	....	

**The relative level of global quality** is established according to the absolute levels of the settled quality  $N_{roi} = N_i/N_0$ .

## 8 Conclusions

### Zaključci

The accelerated process of globalisation after 1970 has gradually imposed the competitiveness priority at all levels and in all fields. The national competitiveness is based on products and services competitiveness. In any company and cluster the competitiveness optimisation imposes:

- A rigorous establishment of the quality – functions – competitiveness correlation for the target markets, concerning all ranges of goods and services,

- An evaluation of the products and services quality profile and level in comparison to the competitors on the target market,
- The integrated use of all global quality profile / level optimisation methods, and services and products costs reduction.

Without developing and generally practicing some new innovative resource, - "the integrative management of competitiveness and value" [4, 6, 7] - the extended European Union has no real chances of becoming on a medium-long term the world leader in competitiveness.

## 9

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