ISTRAŽIVANJE ODNOSA TEHNOLOŠKE SPOSOBNOSTI I BRZINE OSVAJANJA NOVOG PROIZVODA U INDUSTRIJI NAMJEŠTAJA OD MASIVNOG DRVETA

RESEARCH ON RELATIONSHIP OF TECHNOLOGICAL CAPABILITY AND SPEED OF NEW PRODUCT DEVELOPMENT IN THE INDUSTRY OF MASSIVE WOOD

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Ključne riječi:
Tehnološka sposobnost,brzina osvajanja novog proizvoda,industrija namještaja.

Keywords:
Technological capability, new product development speed, furniture industry

Paper received:
05.07.2018.

Paper accepted:
21.09.2018.

Originalan naučni rad

REZIME

Veći stepen finalizacije proizvoda i proizvodnja gotovog namještaja, danas je izazov za sve prerađivače drveta. Proizvodnja namještaja od masivnog drveta postaje sve zastupljenija i predstavlja izuzetnu šansu za drvoprerađivačku industriju BiH. Poznavanje sposobnosti procesa za određenu kompaniju kao i određenih procesa koji prethode izradi prototipa-uzoraka je od krucijalne važnosti za uspješno dogovaranje i provođenje dalje poslovne saradnje sa kupcima. Cilj ovoga rada je odrediti najutjecajnije faktore na sposobnosti tehnološkog procesa i izvršiti rangiranje kriterija koji utječu na stabilnost i uporediti ih sa faktorima koji utiču na brzinu osvajanja novog proizvoda i odrediti korelaciju između njih. Istraživanjem, koje je provedeno u ovom radu izvršena je ocjena tehnološke sposobnosti, zajedno sa menadžmentom kompanija, kao i istraživanje vezano za mogućnosti osvajanja i brzinu osvajanja novog proizvoda i traženje karakterističnih mjesta za poboljšanje upravljanja kvalitetom. Rezultati ovog istraživanja će biti polazna osnova za definisanje odnosa između tehnološke sposobnosti i brzine osvajanja novog proizvoda i njihov će se odnos istražiti putem $\chi 2$ testa te potvrditi pomoću testa kontigencije i Spearmanova koeficijenta korelacije ranga.

Original Scientific Paper

SUMMARY

Higher level of finalization of new product and production of furniture presents the challenge for all manufacturers of wood. Production of massive wood furniture becomes dominant and presents extraordinary chance for wood product manufacturing industry in B&H. Being introduced with the process capability of the certain company and certain processes, which preceded by built prototype-samples, is of crucial importance for successful agreement and further business cooperation with customers. The aim of this paper work is to determine the most influencing factors on the capability of technological process and to make ranking of criteria influencing on stability and to compare them with factors that have influence on the speed of new product development and to determine correlation between them. Research, carried out in this work, gave the result on estimation of technological capability, done with the company management, including the research related to the speed and development of new product development looking at the same time characteristic spots for improvement of quality management. Results of this research will be the starting point for defining relations between technological capability and the speed of new product development and their relations will be examined throughout $\chi 2$ test which will be confirmed throughout the contingency test and Spearman's rank correlation coefficient.

1. UVOD

Veći stepen finalizacije proizvoda i proizvodnja gotovog namještaja, danas je izazov za sve prerađivače drveta. Proizvodnja namještaja od masivnog drveta postaje sve zastupljenija u svijetu i predstavlja izuzetnu šansu za drvoprerađivačku industriju BiH. Nakon rata, veliki sistemi za preradu drveta su ili ugašeni ili pred zatvaranjem, dok su mala i srednja preduzeća u stalnoj ekspanziji i preuzimaju ulogu koju su ovi sistemi zauzimali.

Razvojni put malih i srednjih kompanija je gotovo isti. Postepeno se ulazilo u sve dalje faze obrade drveta i danas imamo situaciju da se većina odlučuje na proizvodnju namještaja od masivnog drveta ili kombinacije ploča vlaknatica sa masivnim drvetom.

Strategija razvoja drvne industrije BiH trebala bi da se zasniva na komparativnim prednostima u odnosu na proizvođače iz drugih država. Osnovna komparativna prednost drvne industrije BiH, ako se posmatra segment masivnog namještaja, je da trenutno u BiH postoje četiri kompanije za proizvodnju masivnih ploča, koje se i u evropskim mjerilima smatraju izuzetno značajne, i veliki broj malih proizvođača, tako da je sirovinska baza za krajnji proizvod, masivni namještaj sigurna i izuzetno visokog kvaliteta [8].

Kupci traže proizvođače za već postojeće proizvode na tržištu, koji mogu obezbjediti i poštovati kvalitet, rokove isporuka, količine i cijenu. Međutim, u ovoj fazi proizvođači najčešće i prave greške. Vrlo je bitno odrediti tehnološku sposobnost kompanije kao i poznavati model prerade sirovine od ulaza - rezanja trupaca sa visokim koeficijentima iskorištenja kao i odrediti ko su kupci naših proizvoda. Kako je, danas, najčešći oblik rada domaćih kompanija rad za poznatog kupca koji poznaje karakteristike potrebnog proizvoda poznavanje sposobnosti procesa za određenu kompaniju kao i određenih procesa koji prethode izradi prototipa-uzorka je od krucijalne važnosti za uspješno dogovaranje i provođenje dalje poslovne saradnje sa kupcima.

Cilj ovoga rada je odrediti najutjecajnije faktore na sposobnosti tehnološkog procesa i izvršiti rangiranje kriterija koji utječu na stabilnost i uporediti ih sa faktorima koji utiču na brzinu osvajanja novog proizvoda i odrediti korelaciju između njih.

1. INTRODUCTION

Higher level of finalization of new product and production of furniture presents the challenge for all manufacturers of wood. Production of massive wood furniture becomes dominant and presents extraordinary chance for wood product manufacturing industry in B&H. After the war, huge systems for wood manufacturing are either closed or near to be shutdown, while small and medium sized enterprises are in constant expansion and they take over the role which was in possession of these systems. Developing path of small and medium enterprises is almost the same. Gradually they have been accepting further phases of wood processing and today we have situation that most of them are oriented on the production of massive furniture or combination of fibreboard with massive wood.

Development strategy of wood industry in B&H should be based on comparative advantages in relation to wood manufacturers from other countries. If we take into consideration the segment of massive furniture, the basic comparative advantage of the wood industry in BiH is that there are four companies for production of massive boards in B&H, considered as very significant per European criterion, and a number of smaller manufacturers so the row-material basis for the final product (massive furniture) is safe and of extremely high quality [8].

Customers are looking for companies that will produce already existing products on the market, who are able to provide and meet deadline delivery, quality, quantity and prices. However, in this phase the most frequently, producers make mistakes. It is very important to define technological capability and to know the process model of raw-material entry- sawmill production with high efficiency of raw-material utilisation and to determine who are the customers of our products. Since nowadays the most common business way of domestic companies is the business with the known customer who knows characteristic of needed product, the competence of capability process for the certain company and processes preceded by made prototype-sample is of crucial importance for successful agreement and implementation of further business cooperation with customers

The aim of this paper work is to determine the most influencing factors on the capability of technological process and to make ranking of criteria influencing on stability and to compare them with factors that have influence on the speed of new product development and to determine correlation between them.

2. ODREĐIVANJE TEHNOLOŠKE SPOSOBNOSTI (TS)

Prema istraživanjima [1], [2], [3], [4], [5], dati su prijedlozi za ocjenu tehnološke sposobnosti koji će, u ovom slučaju, biti modifikovani i korigovani prema zahtjevima i karakteristikama proizvodnje masivnog namještaja. Ovaj model ocjene predstavlja kombinaciju više modela i jasno određuje karakteristike za industriju masivnog namještaja. Takođe, rezultati ovog istraživanja će biti polazna osnova za definisanje odnosa između tehnološke sposobnosti i brzine osvajanja novog proizvoda, gdje će se njihov odnos istražiti putem HI kvadrat -$\chi 2$ testa te potvrditi pomoću testa kontigencije i Spearmanove korelacije ranga.

Ovdje je vrlo važno naglasiti, što je i predmetom rada, da pronalaženje odnosa između tehnološke sposobnosti, brzine osvajanja novih proizvoda odnosno uvođenja i primjene inovacija , predstavlja krucijalnu ulogu u daljem opstanku kompanije.

Sve ove metode imaju za cilj da pokažu da li su proces, radni metod, radnik, sredstvo rada, alat i pribor u stanju da održe proizvodni proces unutar dozvoljenih granica.Takođe, kao svrhu imaju da se usmjere aktivnosti na sprečavanje pojave neusaglašenosti i stalno praćenje parametara procesa. Model definisanja tehnološke sposobnosti, dalje, treba da izvrši i obrazloži vrednovanje kriterija, koji utječu na sposobnost tehnološkog procesa u proizvodnji namještaja. Postoji više metoda određivanja tehnološke sposobnosti, a one sve imaju za cilj jasno definisanje kako sposobnosti tako i slabosti pojedinih procesa unutar kompanija. Model određivanja tehnološke sposobnosti koji će biti korišten u ovom radu je sublimacija više različitih alata i metoda upravljanja kvalitetom i analitičkih metoda. Određivanje i rangiranje kriterija koji utiču na kvalitet proizvoda i brzinu osvajanja novog proizvoda od izuzetne je važnosti za postizanje optimalnih rezultata poslovanja. Prethodna istraživanja grupe autora potvrđuju kako se upotrebom odgovarajuće metode koja uzima u obzir sve kriterije (kvantitativne i kvalitativne), omogućuje vrednovanje i određivanje i ponuđene alternative i u skladu sa tim poslovanje sa više sigurnosti [10].

Model koji je izabran za evaluaciju tehnološke sposobnosti kompanija, koje se bave proizvodnjom namještaja, sastoji se od sedam osnovnih elemenata [2]:

2. DETERMINATION OF TECHNOLOGICAL CAPABILITY (TC)

According to researches [1], [2], [3], [4], [5], proposals for estimation of technological capability are presented. These proposals, in this case, will be modified and adjusted to customers' demands and characteristics of production of massive furniture. This model of estimation presents the combination of more models and clearly defines characteristics for the industry of massive furniture. Also results of this research will be the starting point for defining relations between technological capability and the speed of new product development and their relations will be examined throughout HI- squared test ($\chi 2$) that will be confirmed through the contingency test and Spearman's rank correlation coefficient.

Here is very important to emphasize and it presents the subject of this work that identification of relations between technological capability, speed of new product development i.e. deployment and implementation of innovation present the crucial role in the further existence of the company.

All these methods have the aim to show whether the process, working method, worker, and means of work, tools and equipment are able to provide sustainable production process within authorized limits. The purpose of these methods is to direct activities on prevention of appearance of non-conformity and constantly follow parameters of the process. Further on, the model of defining technological capability needs to accomplish and explain validation of criteria that have influence on capability of technological process in furniture production. There are numbers of methods of determination of technological capability and all of them have the purpose to clearly define capability and weaknesses of certain processes within the company. The model of determination of technological capability, used in this work, is the sublimation of several different tools and quality management methods and analysis methods. Determination and ranking of criteria that have influence on the product quality and speed of new product development is of extraordinary importance for accomplishing optimal business results.

Preliminary researches, done by group of authors, confirm that the use of an adequate method taking into consideration all criteria (quantitative and qualitative) enables the valuation and determination and offered alternatives and in accordance with that offer business with higher security [10].

1. Liderstvo
2. Ljudski potencijal
3. Zadovoljstvo zainteresovanih
4. Rezultati
5. Upravljanje procesima
6. Proizvod
7. Sistemi upravljanja

U principu postupak se svodi na vrednovanje tehnološke sposobnosti za različite kriterije i ocjena od 1 (najslabiji rezultati i sposobnosti) do 5 (najbolji rezultati i sposobnosti). Model, koji je izabran u ovom radu oslanja se na EFQM model izvrsnosti [7]. Svi elementi moraju biti jasno definisani i dati podkriteriji koji će se ocjenjivati u postupku istraživanja tehnološke sposobnosti.

3. RAZVOJ NOVOG PROIZVODA

Proces razvoja novog proizvoda provodi se kroz slijedeće faze i podfaze:

- **definisanje strategije razvoja proizvoda:**
  - generisanje ideja o novom proizvodu,
  - testiranje i upoređivanje ideja o novom proizvodu,
  - razvoj i testiranje koncepcije novog proizvoda,
  - razvoj strategije marketinga za upravljanje novim proizvodom, i
  - procjena potencijala prodaje novog proizvoda.
- **razvoj proizvoda i procesa,**
- **komercijalizacija i testiranje tržišta, i**
- **lansiranje proizvoda i evaluacija.**

Brzina osvajanja novog proizvoda (BONP), za jednu kompaniju, zavisi od mnogo faktora. U suštini, razvoj (osvajanje) novog proizvoda u nekoj kompaniji potiče napore i uslovljava određene faze rada na rješavanju problema, po strukturi, neovisno od stepena složenosti, inventivnosti, vrsti i veličini ulaganja, korištenja i iskoristivosti naučnih, tehnoloških i stručnih potencijala, kao i vremena potrebnog za odvijanje pojedinih razvojnih faza.

Na primjer, vrijeme potrebno za razvoj, odnosno osvajanje novog proizvoda do plasmana na tržište i pune komercijalizacije sastoji se od :

- vremena u kojem se, od nastanka originalne ideje vrše osnovna istraživanja i ispitivanja vezana za stvaranje potrebnih saznanja o proizvodu, procesu i tehnologiji,

The model chosen for evaluation of technological capability of the company producing the furniture consists of seven basic elements [2]:

1. Leadership
2 .Human resources
3. Stakeholder Satisfaction
4. Results
5 .Process management
6 .Product
7. Management systems

Basically, the procedure is based on validation of technological capability for different criteria and it is evaluated from 1 (the weakest capability result) to 5 (the best capability result). The model chosen in this paper work relays on EFQM model of excellence [14].All elements have to be clearly defined and sub-criteria must be given which will be evaluated in the procedure of technological capability research.

3. NEW PRODUCT DEVELOPMENT

The process of new product development is implemented through following phases and sub-phases:

- **Defining the strategy of product development:**
  - generate ideas about the new product
  - testing and comparing ideas about the new product,
  - developing and testing design of new product,
  - developing the marketing strategy for the new product
  - estimation of sale potential of the new product
- **Development of the product and the process,**
- **Marketing and market testing, and**
- **Launching the product and evaluation.**

The speed of the new product development (NPD) in one company depends on various factors. Basically, development of the new product stimulate efforts and bring about certain phases of work on problem solving, regardless of the complexity level, inventiveness, type and amount of investment, usage and efficiency of scientific, technological and professional potential including the time needed for developing phase progress.

For example, time needed for new product development till it reaches the market and full marketing consist of:

- time when the original idea was created referring to conducted researches and testing related to generating knowledge of the product, production, process and technology ,

- vremena inkubacije, kada se od faze shvatanja da je za kompaniju moguće materijalizovati ideju o novom proizvodu u odgovarajuće tehničko rješenje - sve do trenutka njenog uvođenja u fazu komercijalne primjene,
- vremena komercijalnog razvoja - koji obuhvata vrijeme od momenta kada je utvrđena mogućnost komercijalizacije novog proizvoda - do realizacije proizvoda ili procesa, i
- vremena komercijalnog rasta - u kojem se proizvod ili tehnologija plasira kupcu i industriji.

4. EKSPERIMENTALNI DIO ISTRAŽIVANJA RADA KOMPANIJA ZA PROIZVODNJU NAMJEŠTAJA

Eksperimentalni dio počeo je definisanjem i određivanjem kompanija koje će učestvovati u istraživanju. Odabrano je deset kompanija koje se isključivo bave obradom drveta i proizvodnjom namještaja od masivnog drveta i u proizvodnji vrlo malo ili nikako ne koriste ostale drvne materijale. Takođe, iako je uzorak relativno mali, izvršeno je dubinsko istraživanje načina rada kroz konstantne kontakte i posjete izabranih kompanija i cilj je bio da dobijemo jasnu sliku o svakoj od istraženih kompanija. Istraživanje načina rada kompanija koje se bave proizvodnjom masivnog namještaja sastojalo se od:

- definisanja kompanija koje će učestvovati u istraživanju,
- posjeta kompanijama i praćenja rada,
- eksperimentalnog dijela i
- kvalitativne i kvantitativne analize rezultata sa menadžmentom kompanija.
-

Posjete i praćenje rada odvijalo se u kompanijama gdje su kao reprezenti uzete kompanije:

- sa različitim stepenom obrade ulazne sirovine,
- različitim stepenom tehnološke sposobnosti,
- različitim tržištima, i
- sa različitim vrstama kupaca.

U ovim kompanijama izvršena je ocjena tehnološke sposobnosti, zajedno sa menadžmentom kompanija, te na taj način data ocjena izvršena kombinovanom metodom.

- time of incubation, starting from the phase of understanding that the company is able to materialized the idea about the new product with suitable technical solution till the moment of its complete implementation into the phase of marketing,
- time of marketing development – taking the time from the moment of possible commercialization of the new product till realization of product or process, and
- time of commercial growth – when the product or technology is launched to customer and industry.

4. EXPERIMENTAL PART OF WORK MODE RESEARCH OF FURNITURE PRODUCTION COMPANIES

Experimental part started with defining and determination of companies which would take part in the research. Ten companies were selected that exclusively process the wood, produce massive furniture and use less or use not at all other wood materials. Although the sample is of small size, deep research of mode of work was conducted through constant contacts and visits of chosen companies and the aim was to get clear picture of each selected companies. Research of mode of work of companies producing the massive furniture consisted of:

- Defining companies taking part in the research
- Visits of companies and surveying the mode of work
- Experimental part and
- Quantitative and quality result analysis with the company management

Visits and surveying of work was done in the companies:

- with different degree of raw-material processing,
- different level of technological capability,
- different markets and
- with different customers .

The estimation of technological capability was done together with the management of companies and in that way we got estimation using the combined method. f

Princip prikupljanja podataka je bio takav da su podaci prikupljani za sve kompanije identično i ocjenjivanje tehnološke sposobnosti je provedeno zajedno sa top menadžmentom svih kompanija. Na taj način će se odrediti tehnološka sposobnost kompanija i odrediti uticajni faktori na tehnološku sposobnost. Drugi dio istraživanja, koji se odnosi na brzinu osvajanja novog proizvoda i definisanje karakterističnih mjesta za poboljšanje upravljanja kvalitetom je proveden na identičan način i svi podaci su jasno zabilježeni. Fokus istraživanja je na kvantitativnim karakteristikama, kroz prikupljanje podataka i analizu faktora koji utiču na **TS** i **BONP.** Rezultati ovog istraživanja će biti polazna osnova za definisanje odnosa između tehnološke sposobnosti i brzine osvajanja novog proizvoda i njihov će se odnos istražiti putem $\chi 2$ testa te potvrditi pomoću testa kontigencije i Spearmanova koeficijenta korelacije ranga.

Analizi načina rada i položaja kompanija mora se pristupiti kao višestrukom problemu. Njome moraju biti obuhvaćeni sljedeći segmenti [8]:

- aktivnosti koji prethode procesu proizvodnje kroz zahtjeve,
- okruženja i rješavanje odnosa sa dobavljačima,
- aktivnosti procesa koji rezultira proizvodom, i
- postprodajne aktivnosti (transport, servisiranje, način rješavanja reklamacija, pravci daljih mogućih poboljšanja).

Sve prethodne analize bi trebale da kao rezultat imaju određivanje odnosa i eventualne korelacije između brzine osvajanja novog proizvoda i tehnološke sposobnosti koji povezuje značajne informacije sa tržišta i zahtjeve za gotov proizvod, kao i određivanje kritičnih kontrolnih tačaka u proizvodnji što bi trebalo da rezultuje povećanjem kvaliteta proizvoda i poboljšanjem procesa kontrole kvaliteta. Kao rezultat, kompanije koje se bave proizvodnjom masivnog namještaja, mogle bi očekivati sljedeće:

- da se definiše odnos i postojanje korelacije između brzine osvajanja novog proizvoda (BONP) i tehnološke sposobnosti (TS),
- odrede potencijalna mjesta na koje se može uticati sa ciljem poboljšanja kvaliteta,

The principle of data collection was that data were identically collected in all companies and the estimation of technological capability was done together with the top management in all companies. In this way we are able to determined technological capability and influencing factors on technological capability. The second part of the research related to the new product development and definition of characteristic spots for improvement of quality management was identically conducted and all dated were clearly registered. The focus of the research is on quantitative characteristics through collection of data and analysis of factors that have influence on **TC** and **NPD**. Results of this research will be the starting point for defining relations between technological capability and the speed of new product development and their relations will be examined throughout $\chi 2$ test which will be confirmed throughout the contingency test and Spearman's rank correlation coefficient.

Analysis of working mode and position of companies must be viewed as multiplied problem. It must include the following segments [8]:

- activities preceding the production process through demands
- environment and settling relations with supplier
- process activity resulting in product and
- post-selling activities (transport, maintenance, way of handling complaints, directions for future possible improvements)

All previous analyses as the result should show determination of relations and possible correlations between the speed of the new product development and technological capability that connect significant information from the market and demands for the final product and determination of critical spots in the production what should result in enhancement of product quality and improvement of quality control process.

As companies producing the massive furniture, the following could be expected as the result:

- defining relation and correlation between the new product development (NPD) and technological capability (TC),
- determination of potential spots with possibility to have influence on them in order to enhance quality,

- trebao bi da predstavlja alat za unapređivanje sistema menadžmenta kvalitetom,
- obezbjeđenje preduslova za uključivanje u tokove globalnog tržišta, i
- primjena modela upravljanja kvalitetom za novi proizvod, uz poštovanje principa kontinualnog unapređivanja, omogućava postizanje zadovoljstva kupaca, što na kraju rezultuje boljim poslovnim rezultatima preduzeća.

Kako je prethodno navedeno, fokus istraživanja je na kvantitativnim karakteristikama, kroz prikupljanje podataka i analizu saglasnosti datih hipoteza koje se testiraju i pomoću kojih određujemo faktore koji utiču na TS. Kako je prije navedeno, **TS** je evaluirana na osnovu sljedećih faktora:

$$TS = f(X_1 LID, X_2 UP, X_3 LjP, X_4 ZZ, X_5 REZ, X_6 SU, X_7 PR) \quad (4.1)$$

gdje je:
LID - Liderstvo, koje je bilo predmetom rada [9], istražuje se u dijelu opredjeljenosti top menadžmenta za promjene, definisanje vizije, jasne strategije razvoja, kroz uvođenje novih tehnologija i izradu novih proizvoda.
UP - Upravljanje procesima, koje će biti istraženo u dijelu mogućnosti kompanija da brzo odgovore zahtjevima kupca za novim proizvodom, sa jasno definisanim glavnim i pomoćnim procesima, kriterijima za uspješnost te definisanim postupcima sa CNC mašinama. Ovdje će biti jasno naznačene i tražene sposobnosti kompanija da osvoje novi proizvod i dalje da ga tehnološki obrade.
LjP - Ljudski potencijal, će biti istražen u domenu tehnološke sposobnosti kompanija da mogu podržati osvajanje novih proizvoda i da će to biti podržano znanjem i osposobljenošću zaposlenih, kontinuiranom edukacijom i kulturom rada u timovima.
ZZ - Zadovoljstvo zainteresovanih, istražit će se u dijelu uticaja zainteresovanih strana kao što su kupci, radnici, nadležne institucije na TS kompanija i BONP.
REZ - Rezultati će se istražiti u dijelu uticaja TS i BON na konačne rezultate kompanija, uvođenju inovacija i tehničkih unapređenja te potražnji na tržištu.

- should present the tool to improve system of quality management,
- provide pre-condition for launching into flows of global market ,
- applying the model of new product respecting the principle of continuous improvement , and
- provides the customers' satisfaction what in the end results in better business of the company.

As previously mentioned, the focus of the research is on quantitative characteristics through collection of data and analysis of given hypothesis that are tested and through which we determined factors that have influence on TC. As previously mentioned and according to [24, 40, 44, 45, and 60], **TC** was evaluated on the basis of following factors:

$$TC = f(X_1 LEAD, X_2 PM, X_3 HR, X_4 SS, X_5 RES, X_6 SM, X_7 PR) \quad (4.1.)$$

where is:
LEAD - Leadership, that was the subject of work [9], is researched in the part of willingness of top management for changes,
defining the vision, clear development strategy, through applying new technologies and development of new products.
PM - Process management will be researched in the part of the company competence to react promptly on customers' demands for the new product with clearly defined main and assisting processes, criteria for successfulness and defined procedures on CNC machines. In this part, the company competences will be clearly specified and the company capability to develop the new product and further technologically processed the product will be requested.
HR - Human resources will be researched under domain of technological company capability able to assist the new product development that will be supported through knowledge and qualification of employees, continuous education and culture of teamwork.
SS - Stakeholder satisfaction will be researched in the part explaining the influence of all interested parties as workers, institutions authorized for company technological capability and new product development.
RES – Results will be researched in the part showing the influence of TC and NPD on the final results of the company, bringing innovations and technical improvements and market demand.

SU - Sistem upravljanja će biti obrađen u dijelu istraživanja kompanija te da li posjeduju neke od sistema upravljanja kvalitetom.
PR - Proizvod u dijelu sposobnostikompanije da osvoje novi proizvod u što kraćem vremenu sa traženom dobiti za kompaniju .

Istraživanje se sastojalo od tri povezane cjeline. U prvoj (1) je izvršena, zajedno sa top menadžmentom, ocjena TS kompanija, zatim, u drugom (2) za date uticajne faktore izvršeno je istraživanje koje se odnosi BONP i ti podaci su obrađeni pomoću $\chi 2$ testa te potvrđeni pomoću testa kontigencije i Spearmanova koeficijenta korelacije, te u trećem dijelu istražene su karakteristike poslovanja te postojanje karakterističnih mjesta (3) koja znatno utiču na kvalitet. Istraživanje-prikupljanje informacija u odabranim poslovnim sistemima u BiH izvršeno je kroz posjete kompanijama, razgovor sa mendžmentom te popunjavanjem upitnika.
U istraživanju su korištene tehnike koje se koriste za obradu podataka i to:

- za testiranje značajnosti distribucije frekvencija po kategorijama uticajnih faktora odnosno dobijenih varijabli , hi-kvadrat test,
- povezanosti između dvije takve varijable, koeficijent kontingencije-C, i
- povezanost ranga uticajnih faktora, odnosno korelaciju među uticajnim faktorima provedena po Spearman-u,

U ovom postupku, prvo smo sa statističkom značajnosti p=0,05, da nema značajnih razlika između dobijene i očekivane frekvencije u odgovarajućim kategorijama, analizirali varijable te pokazali da je njihov uticaj na TS i BONP značajan.
Nakon što je pomoću Hi-kvadrat test dokazana povezanost uticajnih faktora na TS i BONP i njihova značajnost, pomoću testa kontigencije određena je mjera povezanosti između uticajnih faktora na TS i BONP. Kako je vrijednost koeficijenta kontigencije 0. kada nema povezanosti a 1. kada je potpuna povezanost, za naše istraživanje imali smo da je prema testu kontigencije dokazana povezanost uticajnih faktora na TS i BONP te data mjera značajnosti pojedinih faktora. Dalje smo u istraživanju istražili da li postoji korelacija između uticajnih faktora na TS i BONP pomoću Spearmanove korelacije ranga te dokazali značajnost veze.

SM – System management will be covered in the part related to the research of companies whether they posses some systems of quality control.
PR- Product will be researched in the part of the company capability to develop the new product in short time as possible gaining the expected profit.
The researched was consisted of the three coherent parts. The first part (1) together with the top management covers the estimation of TC of companies; the second part covers the research of NPD based on provided influencing factors and those data are processed by using $\chi 2$ test and confirmed throughout the contingency test and Spearman's rank correlation coefficient; the third part (3) covers the research of business characteristics and existence of characteristic spots having significant influence on the quality. The research-collection of information in selected business systems in BiH was contacted through visits of companies, talks with the management and completion of questionnaire
Within the research, techniques applied for data processing were used as follows:

- HI-square - for testing the importance of distribution, frequency per categories of influencing factors i.e. obtained variables,
- Contingency coefficient C – correlation of two obtained variables, and
- Spearman's rank correlation coefficient – connection between rank of influencing factors i.e. correlation between factors

In this procedure taking the statistic value p=0,05 that there are no significant difference between obtained and expected frequency in relevant categories, we analyzed variables and showed that their influence on TC and NPD is of significant importance.
After the use of HI-square test proved the connection of influencing factors on TC and NPD and showed their importance, using the contingency test we determined the measure connection between influencing factors on TC and NPD. Since the value of contingency coefficient is 0, when there is no connection and 1 when is completely connected, for our research we had: according the results of contingency test the connection of influencing factors on TC and NPD was proven and importance measure of certain factors was provided. Further on, we researched whether there is correlation between influencing factors on TC and NPD and using the Spearman's rank correlation we proved the importance of that correlation.

Provođenjem ovih postupaka dobili smo vrijednosti za pojedine koeficijente date u sljedećoj tabeli (Tebela 1):

By implementation of these procedures we got values for certain coefficients that are presented in the following table (Table 1.):

Tabela 1. *Izračunate vrijednosti po kategorijama uticajnih faktora na TS i BONP*
Table 1. *Calculated values per categories of influencing factors on TC and NPD*

Criteria	Values χ2 TS-TC	Values χ2 BOND-NPD	Contingency Coefficient C TS-TC	Contingency Coefficient C BONP-NPD	Spearman's Correlation Coefficient
Leadership	0,75	2,08	0,264	0,415	0,714
Process Management	0,75	5,5	0,264	0,412	0,661
Human Resources	5,5	1,25	0,596	0,330	0,754
Stakeholder Satisfaction	1,3	1,8	0,339	0,391	0,813
Results	2,92	0,5	0,475	0,218	0,908
Management System	2	2	0,408	0,408	0,75
Product	5,83	2,62	0,607	0,456	0,34

Vrijednosti i interpretacija pojedinih koeficijenata prikazani su u sljedećim tabelama:

Values and interpretation of certain coefficients are shown in the following tables:

Tabela 2. *Vrijednosti χ2 za sve kriterije koji se odnose na TS*
Tabele 2. *Values χ2 for all criteria related to TC*

Criteria	Values χ2 TS-TC	RESULT
Leadership	2,08	Satisfactory
Process Management	5,5	Satisfactory
Human Resources	1,25	Satisfactory
Stakeholder Satisfaction	1,8	Satisfactory
Results	0,5	Satisfactory
Management System	2	Satisfactory
Product	2,62	Satisfactory

Tabela 3. *Vrijednosti χ2 za sve kriterije koji se odnose na BONP*
Tabele 2. *Values χ2 for all criteria related to NPD*

Criteria	Values χ2 TS-TC	RESULT
Leadership	0,75	Satisfactory
Process Management	0,75	Satisfactory
Human Resources	5,5	Satisfactory
Stakeholder Satisfaction	1,3	Satisfactory
Results	2,92	Satisfactory
Management System	2	Satisfactory
Product	5,83	Satisfactory

Table 4. Vrijednosti i interpretacija koeficijenata kontigencije za TS i BOND
Table 4. Values and interpretation of contingency for TC and NPD

Criteria	Contingency Coefficient C TS-TC	Interpretation of contingency coefficient for TC	Contingency Coefficient C BONP-NPD	Interpretation of contingency coefficient for NPD
Leadership	0,264	Low connection	0,415	Effective connection
Process Management	0,264	Low connection	0,412	Effective connection
Human Resources	0,596	Effective connection	0,330	Low connection
Stakeholder Satisfaction	0,339	Small Connection	0,391	Low connection
Results	0,475	Effective connection	0,218	Low connection
Management System	0,408	Effective connection	0,408	Effective connection
Product	0,607	Effective connection	0,456	Effective connection

Tabela 5. Vrijednosti i interpretacija Spearmanova koeficijenta ta TS i BONP
Table 5. Values and interpretation of Spearman's coeffcient for TC and NPD

Criteria	Spearman's Correlation Coefficient	RESULT
Leadership	0,714	High connection
Process Management	0,661	High connection
Human Resources	0,754	High connection
Stakeholder Satisfaction	0,813	Very high connection
Results	0,908	Very high connection
Management System	0,75	High connection
Product	0,34	Low connection

Na ovaj način je dokazano da postoji korelacija između svih traženih uticajnih faktora na TS i BONP i da se ona kreće od visoke do vrlo visoke povezanosti, kada govorimo o značajnosti korelacije, osim u slučaju uticajnog faktora *Proizvod* kada je ona interpretirana kao niska povezanost.
Na osnovu prije iznesenih stavova, TS je evaluirana na osnovu sljedećih faktora:

$$TS = f\ (\ X_1 LID\ \ X_2\ UP,\ \ X_3\ LjP,\ \ X_4\ ZZ,\ \ X_5\ REZ,\ \ X_6\ SU,\ \ X_7\ PR)$$

Istraživanjem je dokazana da postoji izuzetno jaka korelacija između uticajnih faktora kako na TS tako i BONP te možemo reći da vrijedi:

BONP = f (TS)......*(4.2.)*

In this way it has been proven that there is correlation between all searched influencing factors on TC and NPD and it goes from high to very high connection considering the importance of correlation except in the case of influencing factor *Product* that has been interpreted as low connection.
On the basis of previous presented statements, and in accordance to [24], [40], [60], TC was evaluated on the basis of following factors:

$$TC = f\ (\ X_1 LEAD,\ \ X_2\ PM,\ \ X_3 HR,\ \ X_4\ SS,\ \ X_5 RES,\ \ X_6\ SM,\ \ X_7\ PR)$$

The research has proven that there is extremely high correlation between influencing factors on TC and NPD and we can say that following form la is valid:

NPD = f (TS)……...…..(4.2.)

5. ZAKLJUČAK

Istraživanje koje je provedeno u deset najznačajnijih kompanija koje se bave isključivo proizvodnjom namještaja od masivnog drveta pokazalo je da postoji visoka i vrlo visoka povezanost između TS i BONP za sve postavljene kriterije izuzev za kriterij *Proizvod* za koji je dokazana niska povezanost. To znači da kompanije koje žele da opstanu na tržištu,u u svom radu, moraju predvidjeti jasnu proceduru prilikom razvoja novog proizvoda, preuzeti i poštovati poznate i jasno propisane faze razvoja te na samom početku jasno prepoznati uticajne faktore na razvoj novog proizvoda.

5. CONCLUSION

The research conducted in ten most significant companies that exclusively produce the massive furniture has proven that there is high and very high connection between TC and NPD for all set up criteria except the criteria *Product* for which it is proven low connection. It means that companies which want to survive on the market must foreseen the clear procedure while developing the new product, accept and respect already known and clearly defined phases of development and at very beginning to identify influencing factors on developing new product.

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