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Tehnologija in skrajševanje časov razvoja novih izdelkov

Technology and Reducing the Product Development Times

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Spremembe v poslovnem okolju v zadnjem desetletju so izjemno močno vplivale na razvoj novih izdelkov, kar je povezano tudi z drugačno vlogo tehnologije. Odpravo večnega nasprotja med konstrukterjem in tehnologom je omogočil nov način razvoja izdelkov, ki temelji na načelih projektnega vodenja. V takšnem okolju pa metode, kakršna je Hiša kakovosti (HK-QFD), dajejo najboljše rezultate in jih podjetja uporabljajo pri načrtovanju dejavnosti, da bi zadovoljili kupca, pa naj bo ta notranji (v podjetju) ali pa zunanji. Rezultat tega je skokovito skrajševanje rokov uvajanja novih izdelkov, ki je še posebej izrazito v avtomobilski in elektronski industriji ter v vseh tistih panogah, v katerih je konkurenca največa, kar terja hitre odzive na zahteve trga.
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(Ključne besede: razvoj izdelkov, časi razvoja, skrajševanje časov, tehnologije)

Changes in the business environment during the last decade have significantly influenced the new product development process. As a result, the position of the technology, as a part of this process, has also been modified. The neverending conflict between design and technology functions was overcome by a new type of product development process which is based on project management principles. On this basis, powerful methods such as quality function deployment (QFD) can also be used to ensure target oriented work which will result in satisfied customers (inside or outside of the company). The effects can be seen as an enormous reduction in new product launching times, which is particularly noticeable in the automotive industry, electronic industries and other branches where competitiveness requires fast responses to market changes.
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(Keywords: product development, launching time, time reduction, technology)

1 USMERITEV V ZADNJEM DESETLETJU

Glavne spremembe v zadnjem desetletju, ki so vplivale na vlogo tehnologije, bi lahko razdelili na spremembe na strateški ravni, sistemske spremembe in spremembe na delovni ravni.

Na vrhu vseh sprememb se pojavlja globalizacija z največjim vplivom na svetovno gospodarstvo. Rezultat tega je prenos tehnologije na področja, ki do sedaj niso bila industrializirana. Zaradi tega imamo v tem primeru ponavadi opraviti z običajno tehnologijo, medtem ko nove vrhunske tehnologije še vedno ostajajo v razvitejših okoljih, ki so bila sposobna razviti in uvesti nove procese, ki pomenijo strateško prednost.

Različne sistemske spremembe so omogočile oblikovati procese, ki so temelj za konkurenčno prednost. Nekatere od njih imajo pravzaprav strateški pomen, čeprav jih podjetja ponavadi uvajajo bolj kot vpeljavo novih metodologij in sistemov. Vzporedni inženiring je

1 THE TRENDS DURING THE LAST DECADE

The major changes, which influenced the role of technology during the last decade, can be structured as changes on the strategic level, changes of the system and changes in the field of processes.

Of all the changes taking place, globalization has had the greatest impact on world business. The outcome is a technology transfer to regions which were not previously industrialized. Logically, due to a lack of development in the new environment, these technologies are usually very conventional, while the new advanced technologies are still located in the environments which were able to develop and implement new processes which represent a strategic advantage.

On the second level, different system changes were launched which helped to create the processes as a tool for increasing competitiveness. Some of them could also be stated as strategic, however, in reality the companies are usually approaching these changes more in the way of changing system, rather than changing the original strategy. The

predvsem vplival na način vodenja projektov, ki sloni na skupinskem delu. To načelo je delno zastopano tudi v COK (celovito obvladovanje kakovosti - TQM) načelih, kjer pa bi COK kot idejo prej uvrstili na strateško raven, še zlasti zaradi širokega vpliva na celotno poslovno okolje.

Na delovni ravni postajajo novi neobičajni postopki vedno bolj običajni, novi razvoji materialov pa spet zahtevajo nove tehnologije. Računalniška podpora proizvodnje in procesa razvoja novega izdelka je omogočila bistveno skrajšanje časov in stroškov uvajanja novih izdelkov.

Te in še druge, podobne usmeritve so povzročili spremembo podobe podjetij, kjer so najbolj uspešna tržno usmerjena podjetja. Znotraj podjetja je to pomenilo organizacijske spremembe in uporabo novih metod.

concurrent engineering brought new systems, especially in project management, where team work became the standard principle. This approach also partly involves total quality management (TQM) principles, where TQM as an idea could surely be classified as a strategic direction, especially due to the extensive approach to the complete business environment.

On the operation level, new non-conventional processes have become more and more conventional, however, new materials development has required further development of technology. The computerization of the production floor, together with the designing phase, enabled a significant reduction in the launching times as well as adecrease in the costs.

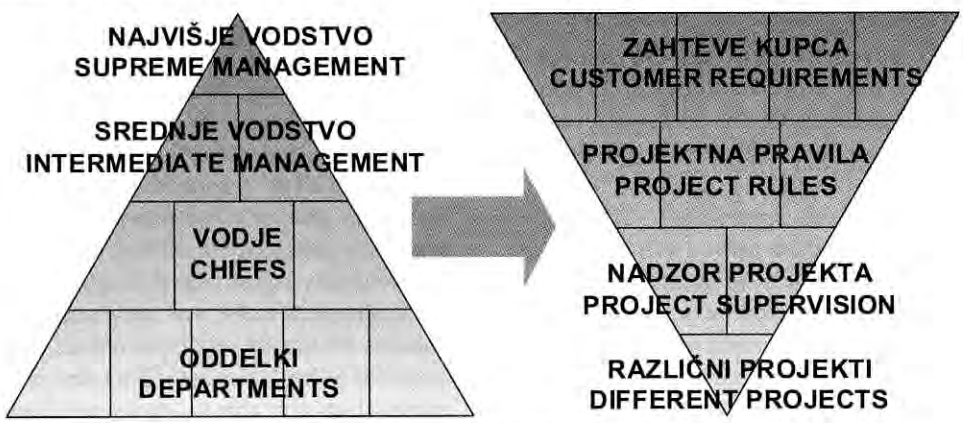
These and other similar trends had an impact on company profile changes, where the market driven companies became the most successful ones. Internally, this demanded organizational changes as well as changes in the methods used.

	PREJ / BEFORE	SEDAJ / NOW
Cilji podjetja Company goals	- boljši izdelki - better products - min. proizvodni stroški - min. product parameters - optimalni parametri - optimum parameters	- boljše podjetje - better company - zadovoljen kupec - satisfied customer - visoka prilagodljivost - high flexibility
Osnovna orientacija Basic orientation	izdelek product	trg market

Sl. 1. *Spremembe v podobi podjetij*
Fig. 1. *The changes in the companies profile*

Zgoraj predstavljene spremembe so povzročile sploščenje organizacijske strukture, skupaj s spremembami v načinu dela.

The above presented changes resulted in the flattening of organizational structures together with changes to the style of working.



Sl. 2. *Organizacijske spremembe [1]*
Fig. 2. *Organizational changes [1]*

Običajna organizacijska struktura je bila hierarhična. Delo v njej je bilo odrejano od zgoraj navzdol. Tako je potekal dober nadzor (stroškov, dela itn.), vendar pa so procesi postali prepočasni za hitre spremembe trga. Podjetja skušajo slediti

The conventional organizational structure was a hierarchical one, where the work was delegated in a top-down direction. In this way, good control (over costs, work etc.) was achieved, however the processes became to slow for fast market changes.

spremembam trga s čim hitrejšimi procesi. Zato je naravna posledica, da se kupčeve zahteve postavijo na vrh tudi v organizacijskem pomenu. V takšni organizaciji pa poslovneži postanejo nadzorniki projektov, vodje projektov pa dobijo zelo široke pristojnosti in odgovornosti za rezultate projekta. Takšen postopek je povzročil hitrejše procese in odzive na zahteve trga.

2 SPREMENJENA VLOGA TEHNOLOGIJE

Zgoraj opisane spremembe so povzročile velike spremembe v procesu razvoja novega izdelka, pri katerem je bila bistveno bolj poudarjena tudi vloga tehnologije.

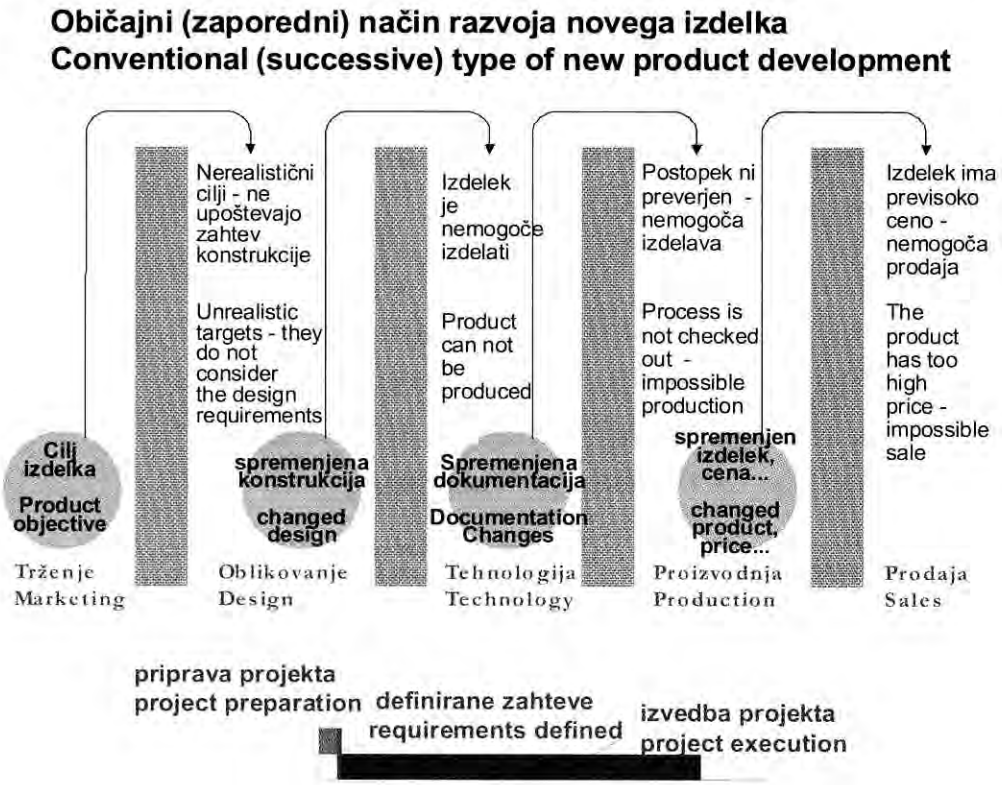
Običajno je postopek razvoja novega izdelka sestavljen iz zaporednih korakov, pri katerih posamezen oddelek v podjetju, ki sodeluje v inovacijski verigi, opravi svoj delež. Seveda pa s tem ni neposredno povezan s celotnim postopkom in zato tudi ni neposredno motiviran za optimalni rezultat postopka. Nasprotno, vsak oddelek si prizadeva za najboljši dosežek svojega dela procesa namesto za najboljši dosežek končnega rezultata: novega izdelka ali storitve - dobimo t.i. stene med oddelki. Zato je sodelovanje med konstrukcijo in tehnologijo vedno obremenjeno z navzkrižnimi interesi in pogledi na rešitve izdelka. Podobno je razmerje med tehnologom in proizvodnjo ali trženjem.

Companies tried to obtain the market advantage with faster processes and the natural change was for the customer requirements to be placed on the top in the organizational sense as well. In this structure the managers became the project supervisors and the project managers obtained broader competencies together with greater responsibilities for the project results. Such an approach was a self generator of process acceleration.

2 THE CHANGED POSITION OF THE TECHNOLOGY

The above presented changes initiated a significant shift in the new product development process, where the role of technology was significantly improved.

The conventional new product development process consisted of successive phases. However, each department is not directly connected with the complete process and as a consequence not immediately motivated for the optimum result of this process. In contrast, each department is focused on optimising its own part of process, instead of improving the final product or service. In other words, walls exist between the departments. Typically, the collaboration between design and technology departments is accompanied by a permanent conflict over product solutions. A similar relationship is established between the technologist and the production engineer.



Sl. 3. *Običajni (zaporedni) način razvoja novega izdelka*
Fig. 3. *Conventional (successive) type of new product development*

Ker ni popolnoma jasno, kdo odgovarja za izid postopka, se projekt zelo zlahka sproži, s sorazmerno malo priprave, pri tem običajno sodelujeta le trženje in razvoj in znotraj njega konstrukcija. Zato bo v fazi izvedbe projekta zelo veliko sprememb, zaradi česar se bodo posamezne podfaze stalno ponavljale. Rezultat je podaljševanje rokov.

Postavlja se vprašanje: Kdo je odgovoren za tehnologijo? Jasno, tehnolog. Vendar pa le-ta mora tesno sodelovati s konstrukterjem in proizvodnjo, če želi pripraviti dobro tehnologijo. Še več, tehnolog mora sodelovati tudi z ljudmi iz trženja in prodaje, financ itn. Kako zagotoviti to sodelovanje?

Odgovor na to je nov postopek, ki temelji na skupinskem delu in načelih projektnega vodenja. Za vsak nov razvoj se ustanovi nov projekt in določi odgovornega za celoten postopek (projektni vodja), projektno skupino in nadzorno skupino ([3] in [4]). Edini namen projektne skupine je uvesti nov izdelek, ki bo zadovoljeval vse zahteve, definirane v daljši fazi priprave (ko se izdela elaborat). Rezultat mora biti uvedba novega izdelka v času, ki je definiran v elaboratu. Takšen postopek je bolj podjetniški, zato je motivacija skupine večja, delo vseh v skupini (iz različnih

Due to the lack of a process holder (project manager) the project is launched very easily, with a very short preparation phase where usually only marketing and design departments are active. Therefore, during the execution phase a number of changes appear and the phases are constantly repeated on account of corrections. The outcome of such relationships is a time consuming development process.

The question arises: Who is responsible for the technology? Certainly, the technologist. However, to achieve good technological solutions the technologist has to cooperate closely with the designer and the production engineer. In fact, the technologist should also collaborate with the marketing and sales people as well as the financial department etc. How to ensure these cooperation?

The answer is a new process, which is based on teamwork and project management principles. For each new product development, a new project is established, where the process holder, project team and supervisory team are appointed ([3] and [4]). The only aim of the project team is to launch a new product which fulfills all the requirements defined in a longer preparation phase. The product has to be launched within time limits that are defined. Such an approach is more entrepreneurial, so the motivation for the team

- 30 - 60% krajši čas
- do 35% nižji stroški
- večji riziko pri veliko večji konkurenčnosti

- 30 - 60% shorter time
- to 35% lower costs
- higher risk with much higher competetiveness

Sl. 4. *Nov (vzporedni) način razvoja novega izdelka*
Fig. 4. *New (simultaneous) type of new product developmet*

oddelkov: trženje, konstrukcija oz. razvoj, tehnologija, proizvodnja, prodaja) je usmerjeno samo v rezultat projekta (postopka) namesto v rezultat oddelka (kakor je bil to primer v prejšnjem postopku - slika 3).

Vzporedni inženiring podpira daljšo fazo priprave projekta z namenom zmanjšati možnosti raznih presenečenj in sprememb začetnega načrta. To ima za posledico skrajševanje izvedbene faze. Vpliv posameznih oddelkov, ki imajo svoje člane v skupini, se tako izenačuje od začetka projekta ([3], [4] in [6]).

Rezultat tega je 30 do 60% krajši čas uvedbe novega izdelka, 35% manjši stroški, skupaj z večjo konkurenčnostjo, pa seveda tudi nekoliko večjim tveganjem [5].

3 HIŠA KAKOVOSTI (HK-QFD)

Dobro zastavljena strategija je pogoj za uspešen projekt. Namen je zadovoljiti kupca in za to si morajo prizadevati vsi vključeni v proces ali projekt (trženje, prodaja, raziskave, razvoj, tehnologija, proizvodnja itn.). To pa je mogoče le, če vsi ti upoštevajo zahteve kupca že od začetka projekta naprej. Takšen postopek tudi zagotavlja, da vsi ti subjekti lahko vplivajo na strateške odločitve projekta kakor tudi na tehnične rešitve. Metoda HK v največji meri podpira takšen skupinski način določitve zahtev (rezultatov) projekta.

Metoda HK se vedno več uporablja v različnih industrijah in storitvah [2]. Vhod v proces HK je "glas kupca", ki pomeni vse kupčeve želje in zahteve (ti naj ne določajo tehnične izvedbe), ki so bile (običajno z tržno analizo) vrednotene kot najpomembnejše. Vsaka zahteva se namreč vrednoti: kako pomembna je za kupca, kako močno je kupec zadovoljen s sedanjim izdelkom in kako s konkurenčnimi izdelki. Ko je "glas kupca" znan (spisek ovrednotenih zahtev kupca), pa mora projektna skupina odgovoriti na te zahteve - rezultat je "tehnični odgovor". Na vsako zahtevo kupca skupina določi vsaj en tehnični odgovor. *Primer: Kupčeva zahteva je bila: močna protikorozivna zaščita. Tehnični odgovor je bil: uporaba nerjavnega jekla.*

Za strateško vrednotenje tehničnega odgovora na zahteve kupca se oceni tudi primerjava s konkurenco. Zato se vsak tehnični odgovor oceni tudi s strateškega pogleda. *Primer: Protikorozijsko zaščito je kupec zelo visoko ocenil, hkrati pa je kupec tudi ocenil, da naš sedanji izdelek zelo slabo izpolnjuje to zahtevo (v primerjavi s konkurenco). Po drugi strani pa je kupec kot dokaj pomembno navedel tudi ceno. Metoda omogoča najti optimalno rešitev.*

is higher and the work of all members (from different departments: Marketing, Design, Technology, Production, Sales) is focused only on the project (process) result instead of the departmental result, as in the former process, Fig. 3.

Simultaneous or concurrent engineering stimulates the preparation phase in order to reduce the surprises and modifications of the initial plan and in this way shortens the execution phase. Therefore, the impact of all departments included in project team is equalized from the beginning of the project ([3], [4] and [6]).

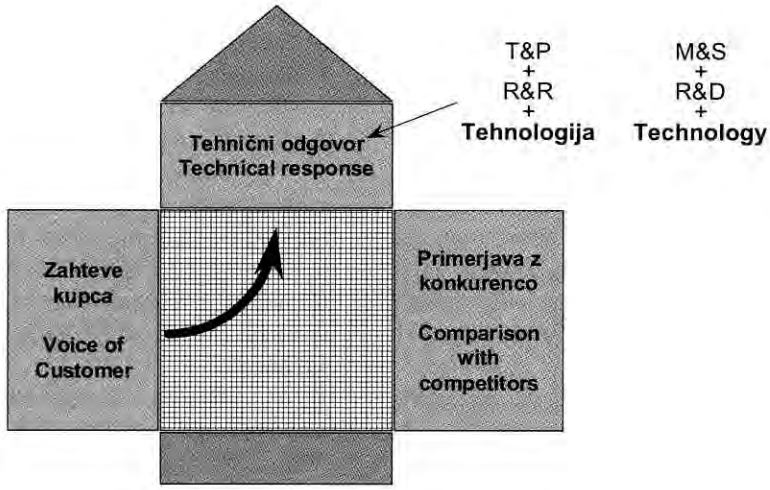
The effect is, on average, a 30 - 60% shorter new product launch time, 35% lower costs, together with increasing competitiveness and also with increasing risk [5].

3 QFD (QUALITY FUNCTION DEPLOYMENT)

A well-settled strategy is the key to a successful project. The aim is to satisfy the customer and this goal has to be followed everybody included in the process or project (marketing, sales, research, development, technology, production etc.). This is only possible if all these departments are dealing with the customer (or market) requirements together from an early phase of the project. Such an approach ensures that all these groups can influence all the strategic decisions as well as all the technical solutions. To stress this team-based process of defining the project requirements, the QFD method can be used.

The QFD method is increasingly used in different industry and service sectors [2]. The input to the QFD process is the Voice of the customer (VoC). The VoC is all of the customer requirements (preferably not determining the technical solution) which were (usually through market analysis) valued as the most important. Each requirement is evaluated: how important it is for customer, how much is the customer satisfied with existing product and how much with the competing products. When the VoC is known (a list of evaluated customer requirements), the project team has to create the answers to these requirements - the result is the Technical Response (TR). For each customer requirement the team determines at least one technical answer. *Example: The customer requirement was: high anti-corrosion resistance. The TR was: use stainless steel.* TR also consists of technological solutions.

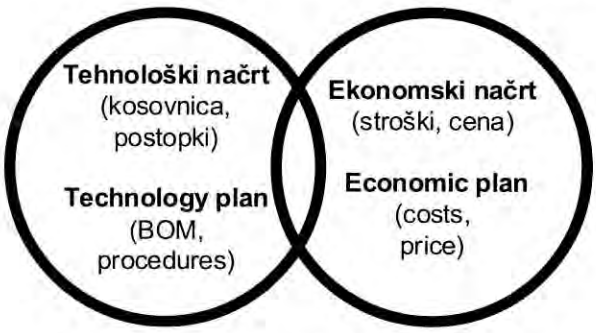
For strategic evaluation of the TR to the VoC, the comparison with competitors is also appraised. Therefore each TR is assessed from the strategic point of view. *Example: Corrosion resistance was assessed to be very high by the customer and at the same time the customer appraised our existing product as poor with respect to this requirement in comparison with the competition. However, the customer also defined the price as quite important. The method enables us to find out which solution is the optimum one.*



Sl. 5. *Metoda HK omogoča strateško načrtovanje*
Fig. 5. *QFD method enables strategic planning*

Metoda HK zahteva precej bolj celovito pripravo tehnologije že v zelo zgodnji fazi, da bi se izognili velikim pritiskom in negotovosti pri uvajanju izdelka v proizvodnjo. Prav tako poudarja pripravo, ne samo tehnološkega načrta (kosovnice in tehnoloških postopkov), ampak tudi pripravo ekonomskega načrta, ki je izjemno pomemben za uspeh projekta (glej spodaj, kjer je bil predstavljen dvom o izbiri materiala in cene). Stari proces (slika 3) se ni tako močno nagibal v to smer.

QFD emphasizes a much more complete preparation of the technology in the very early phases in order to avoid high pressures at the time when the product is being introduced into the production. It also emphasizes the preparation not only of the technological plan (bill of materials and technological procedures) but also the preparation of the economic plan, which is of great importance for the project success (see the example before where the dilemma between the material selection and the price was presented). The former process (Fig. 3) did not provide this tension.



Sl. 6. *Dve področji tehnološkega dela v skupini*
Fig. 6. *Two sides of the technological part in team work*

4 SKLEPI

Spremembe v poslovnem okolju narekujejo spremembe na vseh ravneh, od strateške do operativne, vse z namenom zagotavljati konkurenčnost podjetja. Novi načini organiziranja zamenjujejo običajne prav tako kakor novi procesi zamenjujejo običajne. Vse te spremembe vplivajo tudi na drugačno vlogo tehnologije v podjetju.

Vzporedni načini vodenja procesov zahtevajo projektni način dela, ki temelji na skupinskem delu. Tehnologija postane sestavni del

4 CONCLUSIONS

The changes in the business environment initiated changes on all levels from the strategic to the operational in order to enable the company to retain its competitiveness. New organizations are replacing the traditional ones and new processes are substituting for the conventional ones. These changes affected also the role of technology in the company.

A simultaneous type of process requires a project approach, where team work is of fundamental importance. The technology becomes the constitu-

procesa uvedbe novega izdelka v že zelo zgodnji fazi. Prednost tega je krajši čas uvedbe izdelka ali storitve, manjši stroški (zaradi manjšega števila sprememb v izvedbeni fazi, tehnologija se načrtuje že v fazi snovanja projekta) in izdelki, ki so bliže željam kupca.

Temelj za tak proces sta skupinsko delo in projektna metodologija, ki poudarja pripravljalno fazo. Običajno dobi del tehnološkega oddelka nov status "razvojne tehnologije". Ljudje iz "razvojne tehnologije" imajo prvo nalogo sodelovati pri razvoju novih izdelkov in uvesti te izdelke v proizvodnjo ter so oproščeni dnevnega dela v operativi.

Zaradi dnevnega sodelovanja z ljudmi iz različnih oddelkov (T&P, R&R, itn.) postaja vloga tehnologije bolj kompleksna. Če hoče aktivno sodelovati v skupini mora vsaj delno poznati tudi v finance, trženje itn. Vse to pa bo imelo za posledico bolj učinkovit proces uvajanja novega izdelka.

tive part of the launch process in the very early phase. The advantages are a shorter time for product or service launching and lower costs due to: modifications to and reduction of the execution phase, technology being planned in the project planning phase and products which are close to the customer requirements.

The basis for this process is team work and project methodology (emphasizing the preparation phase). Usually a part of the technology department has to get a new status, e.g. development technology (DT). People working in DT have the obligation to collaborate on new product developments and are usually released from daily operational work. Their only task is to work on new products and to convey them to the production.

Because of daily cooperation with people from other departments (M&S, R&D, etc.) the role of technology becomes more complex. It is desireable that the technologist is also familiar with marketing, finance etc. in order to ensure an active role in the team, which results in a more effective product launching process.

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