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## **Automotive Industry Crisis and Fulfillment of ISO/TS 16949 Requirements as a Condition for Car Parts Suppliers**

*Abstract: An automotive industry is one of the most propulsive industrial branches, because it uses a various materials and technologies. Several thousand manufacturers, which have their branches in many countries, participate in the manufacture of parts for the world automotive industry. The best ones among them have achieved the status of reliable OEM suppliers, because they develop independently their parts and components and offer them to vehicle manufacturers throughout the world. It also gives a chance to the manufacturers of parts and components, providing that they manage a quality system in accordance with the requirements of general standards, legislative regulations and especially with the requirements of ISO 9001 Standard and with even more stringent requirements of Technical Specification ISO/TS 16949. For the local manufacturers of automotive parts in Serbia, to find their place on the world market and maintain their position on the local market, it is necessary that they firstly introduce strict world quality standards, revitalize the existing equipment and technology, train their staff and provide conditions for on independent development and testing of their products. A real test for local manufacturers of automotive parts is to be able to master over the production of parts and components following the world standards for the requirements of the materialization of projects related to the assembly of new Fiat models, which is planned for the coming period in our country.*

*Keywords: Quality, suppliers, standard*

### **1. INTRODUCTION**

The automotive industry is among the most significant industrial branches in the world, both from the aspect of the number of employed workers which it engages directly or indirectly and from the aspect of the its impact on the implementation and development of conventional and new materials and about one hundred different technologies. The automotive industry is a

big buyer of modern scientific-technical inventions and the driving force of the development of ferrous and non-ferrous metallurgy, electro-industry, metal processing industry, chemical industry, rubber, plastics, non-metals, textiles industry and in the recent times more and more electronic industry. Also, the automotive industry has a big impact on the development of oil derivatives, coolants and lubricants, transport, tourism,

services and other activities. This industrial branch has a particular impact on the field of modern production of machines and tools. The organization of work and the technological processes in the automotive industry present the utmost achievement in this field and have served as an example to many other industrial branches which have implemented mass production with big volume series. The world automotive industry engages directly several million workers, whereas the number of workers who are indirectly related to the products for the requirements of the automotive industry and the respective services is several times greater than the number of directly engaged workers in this industrial branch. The leading world vehicle manufacturers, such as General Motors–GM, Volkswagen–VW, Chrysler, Toyota and Ford, engage each over 200,000 workers in their factories throughout the world, which is contradictory to the thesis advocated by some local authors about the necessity to break up big systems in our country.

During the initial decades of the automotive industry development, the vehicle manufacturers produced mainly independently in their own plants all the required parts and aggregates. Thus, the famous Ford, with the building of a new big factory, at the beginning of the thirties of the last century, rounded off its production of complete vehicles and completed thereby a total vertical integration of the process, starting from raw material and material production to the manufacture of parts and aggregates for its own vehicle assembly and finally, through the materialization of the placement of vehicles through its own sales facilities, closed the chain to the buyer. Nowadays, globalization and partial horizontal production programs diversifications processes dominate, whereas vertical diversification is less and less present and that segment is left to the leading world part and component

manufacturers. The leading world component and part suppliers have advanced so much, that they are capable of an independent development and advancement of both existing products and of the development of completely new products, materials and adequate technologies. As regards local manufacturers in the field of automotive industry, they were also a significant factor in the industrial production process in our country before the disintegration of former Yugoslavia. This industrial branch had a share of 8.8% in the materialized industrial production of the record year 1989, when some other industrial branches, such as metal processing industry, machine construction, metallurgy etc. also had a similar share and contribution in the total materialized industrial production. In that record year 1989 the industrial production contributed with over 40% in the achieved value of the gross national product – GNP. Following the data from 2009 industry in Serbia has almost half the share as compared to previously mentioned period, and part of the reasons for that are in the big drop in the production of the previously mentioned industrial branches. For example, the automotive industry as a major factor in the production of the total transport means, currently has a share of around 2% of the achievement of the total industrial production in our country, which is less than a quarter of the achieved share in 1989, as the record year of industrial production in our country. The drop in the production has been observed both in the final manufacturers and among the majority of local component and part manufacturers.

## **2. CHARACTERISTICS OF THE LEADING WORLD MANUFACTURERS VEHICLES**

The automotive industry crisis of 2008-2009-2010 is a global financial crisis

in the auto industry that began during the later half of 2008. The crisis is primarily felt in the United States automobile manufacturing industry and, by extension, Canada, but other automobile manufacturers, particularly those in Europe and Japan, are also suffering from the crisis. In 2009 the situation became critical because the global financial crisis and the related credit crunch placed pressure on the prices of raw materials. The economic and financial crisis in 2008 and 2009 put an end to a very long succession of years of growth in new vehicle registration. Total number of new registered motor vehicles amount to 67.9 mn in the world in 2008 (in 2007 year around 71 mn). In 2008 year a total of 70.5 million motor vehicles (73.2 mn in 2007) were produced around the world. Practically all leading world manufacturers to a drop in profits and lay offs of workers in the mother factories. A novelty for the European Union-EU is the extension of its membership with the 12 new member states, of which Poland, the Czech Republic, Hungary, Slovakia, Slovenia and Romania are significant manufacturers of vehicles, not all of which come from the EU. Analyses and research indicate that the trend of outsourcing to the East will decline, as the "old" EU members will have to take more care of their employees in the automotive industry and follow-up industries. This will make further room for investments in Brazil, Russia, China and India because of the prospects in the long run and where the salaries are about ten times lower as compared to the developed countries.

Following the available data, there are over 10,000 manufacturers operating currently in the world, who work for the requirements of the automotive industry on local and international levels. Of this number over 100 have achieved by themselves a total annual sales of over one billion US dollars on programs for the requirements of the automotive industry in

the course of 2007. The average achieved total revenue of 100 of the greatest suppliers of automotive parts amounts to over 5 billion dollars. The greatest sales in 2007 was achieved by the German company Bosch amounting to 36.16 billion dollars with the engagement of 149 thousand employees in the automotive industry program. This is followed by the American company Delphi with sales of 22.28 billion dollars, which is 38% more than in Bosch

The leading component and part manufacturers install their plants throughout the world, thus Bosch has around 240 plants in 39 countries and Delphi 335 plants in 40 countries, this practice is also followed by the other suppliers in the aim of being close to vehicle assembly factories, of which there are over 300 in the world. These numerous plants have to manufacture high quality parts at the lowest possible prices and forward them to the assembly plants, following the "Just in Time" system, if possible. Besides this, it is understood that they must have introduced the quality system following the ISO 9001, ISO/TS 16949, ISO 14001 etc. standards. The compliance with the above mentioned standards is also requested from the subcontractors of the second or third level, which operate under the patronage of the leading first level suppliers. High quality vehicles as complex products, consisting of several thousand separate parts, are thereby provided to a significant extent. Over 1000 different components and parts are installed just on the assembly line.

Despite prevention, mistakes are made even by the most renowned vehicle manufacturers, thus vehicle recalls occur in the aim of eliminating system faults, which have been found on vehicles in the course of exploitation, for example, as following:

- As of March, 2010, Toyota had announced recalls of approximately 9 million vehicles in America, Europe,

China etc,

- As of March 2, 2010, General Motors issued recalls for 1.3 million vehicles in USA, Canada and Mexico,

- As January 30, 2010, The French auto group PSA to recall under 100,000 cars made in Czech plant shared with Toyota,

- Ford is recalling approximately 4.5 million vehicles in USA,

- Volkswagen of America is recalling over 400,000 vehicles in April, 2008,

- As of April, 2010, Mazda recalling nearly 55,000 cars in China, according to China's quality inspection,

- In December, 2009, FIAT Group recall the service for inspection 500,000 Grande Punto in Europe,

- In March, 2010, Nissan recalling over 500,000 vehicles, first all in USA, and Mazda over 400,000 cars,

- Mercedes-Benz is recalling over 50,000 vehicles in June, 2008, etc.

World vehicle manufacturers rarely publish data about the average number of breakdowns for their models in warranty period. Such data are mainly published by various associations which protect the interests of vehicle owners or by independent institutions. For example, the Japanese vehicles have before 2008, the least number of defects, although there are also big differences among the Japanese manufacturers, as well as among the different models of the same manufacturer. Local component and parts manufacturers can project the necessary improvements based on implemented benchmarking and possibly SWOT and other analyses following a planned schedule. Other indicators related to the active and passive safety of vehicles and passengers, particularly children and pedestrians are also used more and more nowadays besides the criterium of quality based on the number of defects causing a breakdown in the operation of vehicles. These new criteria for the complex estimate of the vehicle quality, have more and more impact on the potential buyers in

their choice of vehicle make and model.

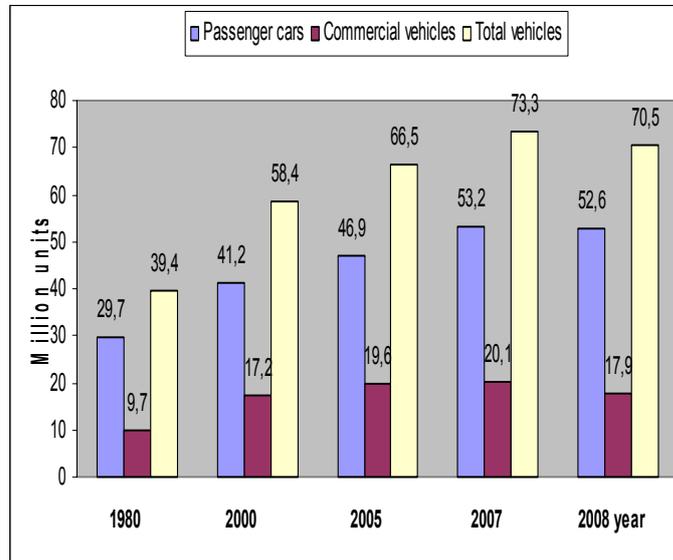
Therefore, world vehicle manufacturers select carefully their suppliers and request them to also bear part of the responsibility for the consequences which may possibly occur in the operation of vehicles in exploitation. The last few years have featured much talk regarding automotive suppliers departing the European Union countries in favour for new locations in central and east Europe. It is generally accepted that on a global level there is around a 30% excess in automotive manufacturing capacity. Yet there is considerable logic in the way the industry has sought to outsource to lower labour costs in terms of component and subassembly building. Merging of main suppliers enables them to dictate the conditions to numerous sub-suppliers to the end of having as low costs as possible. As for this strategy, it is important that such selected suppliers undertake an obligation to design and develop in-house those parts and components that are in their production program. In that way, with assistance and co-ordination with vehicle producers, certain suppliers get the status of Original Equipment Manufacturers-OEMs. The leading world auto-makers have been deciding more and to meet the major part of their needs for parts and components by purchasing them from chosen and qualified original equipment suppliers.

After many years of steady growth(+15 million vehicles between 2000 and 2007), world production of motor vehicles dropped by 4% in 2008, to 70.5 million vehicles (Figure 1).

The economic and financial crisis is to blame for the sudden halt in growth. In developed regions, this has resulted in considerable drops in production rates, in Western Europe( -9%), NAFTA( -16%) and South Korea( -7%). Only Japan, thank to the diversity of its external markets, kept up the pace in 2008 (-0.3%). In Western Europe, production dropped in

2008 in every country, from -1% in Portugal to -34% in Austria. In Germany, the drop was only -3%, benefiting from gains made in the first half of the year, while it reached -20% in Italy. On the contrary, production increased in Central

and Eastern Europe, in particular in Poland (+20%), Hungary (+19%), Russia (+8%) and Serbia (+30% including Fiat Punto-Zastava 10). World registered vehicles fleet exceeds 800 million units.



**Figure 1 Production vehicles in world between 1980 and 2008**

Over 50 millions of new passenger cars are produced every year, which along with the light commercial vehicles, trucks and buses, makes an aggregate volume of about 70 million vehicles. For the past few years, especially in 2009, developed countries have recorded a stagnation in vehicle sales, but it didn't reflect in a decline at the world level, due to a partial grow mostly in India and China. As for the China itself, the vehicle production has grown by incredible 80% in 2003 in comparison with 2002 and 45% in 2009 in comparison with 2008. It is obvious that such trend is not going to persist or repeat over a short time period due to energetic and infrastructural constraints and because of limited steel products manufacture, caused by the market disturbances due to mentioned enormous Chinese consumption. However, a perspective needs for motor vehicles in the Chinese market are enormous, taking into account

the Chinese population of 1,3 billion and the fact that one car accounts for about 20 Chinese, which is 10 times unfavorable than an average in the west developed countries. China's automobile industry is in rapid development since the year 2000. In 2009, over 13 million motor vehicles were manufactured in China. China is the largest automobile market in the world.

Under the conditions of strong market competition and even more frequent globalization in developing and producing vehicles, the price of each single element is significant for total vehicle price, as well as for the items market. Therefore, the world leading producers have decided to reduce the number of various basic platforms used for building their new models, in order to cut the unit costs through the batch increase.

However, only initial results were good, because when all of them have taken the same steps, only those who first had

such vision could make a profit. A present trend is to purchase the vehicle parts from the regions with a lower labour costs, energy and other costs, where employees have a sufficient level of technical education and tradition. This resulted in a mass shifting of factories from the West to the East, both the vehicle final assembly factories and some essential component factories, by transferring necessary know-how and licenses. Normally, it means that a product quality level of the new supplying regions should meet the required standards and norms.

### **3. VEHICLES STANDARDS AND NORMS FOR AUTOMOTIVE INDUSTRY PRODUCTS**

In many countries, an automotive industry, like a food industry, is considered as the most standardized field. High standardization rate in automotive industry is partly a consequence of the fact that the vehicle is not to be designed and developed for a particular customer, but for a presumed target group of customers, and obligations of both parties have not been agreed upon because no contract was made at the beginning of development stage. Therefore, vehicle producer, through vehicle research and development, should meet expected and presumed requirements of future new car customers, as well as the legal requirements and additionally some innovations unexpected by the customers. It has to be offered as much as possible, in order to keep the loyalty of the customer as for retaining the same vehicle trademark. Moreover, many producers are introducing visual, technical, functional or price-related details, thus trying to make a more attractive offer and take over the customers who previously were the fans of some other competitive carmakers. Due to mentioned complexity in the market and because of service and warranty

obligations, the world leading carmakers use their internal standards and norms, thus protecting themselves from unpredicted costs over warranty period and, at the same time, protecting their customers from unexpected expenses during vehicle use after warranty expiration, which also contributes to better company image.

In addition to internal standards and norms, the automotive industry producers are obliged to observe the requirements of other legislative regulations and general standards. It mainly relates to widely accepted international standards associated with quality system certification in accordance with ISO 9001 and with requirements for compulsory homologation of components and vehicles according to ECE Regulations, or as per EU Directives, applicable in signatory countries. It is estimated that currently in the world wide, around one million companies, in 170 countries, have certificates as per ISO 9001:2000 Standard requirements. ISO 9001:2008 only introduces clarification to the existing requirements of ISO 9001:2000 based on eight years of experience of implementing the standard world wide. Many of them relate to automotive industry, being owned by producers of vehicles, parts and materials. However, final vehicle producers are not satisfied with such general standards, but also ask their suppliers to present even higher proofs of specific suitability, which make them being reliable suppliers for final producers. Such idea has partially resulted from an outsourcing trend, meaning an increasing shifting of component production outside a home factory.

#### **3.1 Development of TS 16949**

For the purpose of automotive industry relationship globalization, the world leading producers have recognized the necessity of unifying already

developed national standards into a single generally accepted standard. In July, 1996 the American and European vehicle producers, the “Big Three”, BMW, Fiat, Mercedes Benz, Opel, Peugeot, Citroen, Renault and VW, took an initiative aimed in developing a new international standard for automotive industry, to be based on internal standards EAQF, VDA 6.1, AVSQ and QS 9000. In such way, a foundation was laid for issuing the first ISO/TS 16949 version in 1999. Second edition was prepared by ISO –Technical Committee 176 – Quality Management and Quality Assurance, International Automotive Task Force- IATF and Japan Automobile manufacturers Association Inc.- JAMA, under designation ISO/TS 16949:2002 Technical Specification. Thus, there was no further need for application of previous standards issued by national carmakers and their associations. A global harmonization of quality requirements in manufacture of components, materials, spare parts and in final product service was carried out. A method of certification was also defined by International Automotive Task Force members- IATF, so that the certifications were already conducted by the authorized bodies for several thousands of world producers from automotive industry supply chain.

Technical Specification ISO/TS 16949 is named “Quality Management Systems-Particular requirements for the application of ISO 9001 for automotive production and relevant service part organizations”, meaning that it is based on the requirements of ISO 9001 International Standard.

The main objective of Technical Specification (TS) is development of quality management systems, along with a continuous improvements focused on prevention in order to decrease defects and to reduce deviations and scattering through the whole supply chain in automotive industry field

How important is to have a certificate

as per requirements of ISO 9001 and ISO/TS 16949 is best reflected in the new politics of the world leading carmakers, who ultimately exclude suppliers from the supply chain if are not certified in a specified manner. This particularly relates to the suppliers from other regions, such as the requirements of Japanese producers, Ford, etc, for deliveries from East Europe, China or India. Up to the end of December 2008, at least 39,300 ISO/TS 16949:2002 certificates had been issued in 81 countries. This represents a 12% increase over 2007.

### **3.2 Evaluation of the capabilities of the local manufactures**

If new suppliers have to be involved, one of the first questions from the questionnaire for new supplier suitability estimation is whether they are certified as per above mentioned standards and often per ISO 14000 Standard requirement. In this way, potential suppliers from the supply chain of any world carmaker may accept the imposed rules of the game or immediately withdraw.

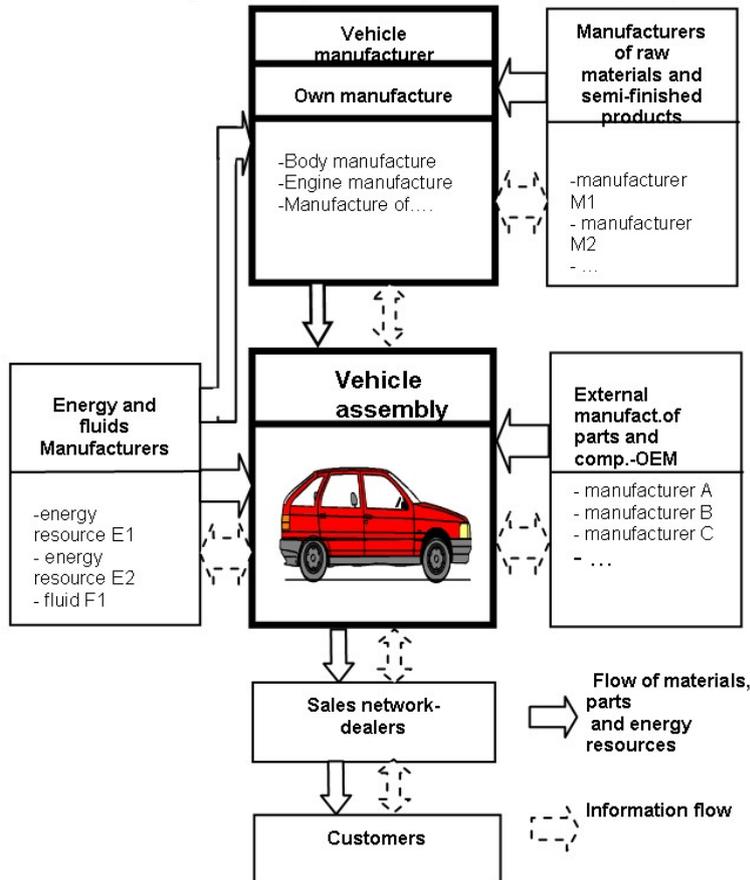
If the first step has been passed as for standard application, the next check up refers to the ability to keep up the continuity of terms, to maintain the offered price level, to provide self-financing conditions and independent development, to enable delayed payment, to take risk in case of customer complaints, etc. Those suppliers who give a positive answers to these and other questions, will get a status of OEM (Original Equipment Manufacturer) supplier, thus being equally involved in the supply chain and vehicle manufacture, as it is schematically shown in Fig.2.

In such a way, the vehicle manufacturers protect themselves from unreliable producers of materials, parts and components and cooperate only with verified and reliable OEM suppliers. In dealing with OEM suppliers, the vehicle producers are trying to assure as less as

possible defected products, i.e., maximum possible quality measured on the basis of defected pieces per million of delivered units (PPM). Based on researches made in one of successful companies in the supply chain of the West European leading carmakers, it appeared that PPM number was going downwards from year to year, as it is shown in form of histogram in Fig.3

and for comparison, one of the world's leading automotive suppliers-OEM, from France, as it is shown in Figure 4.

Fig.3 shows that over 4-year period PPM number has dropped by almost 10 times, thus featuring this producer to be promoted to a status of OEM supplier in the next period, because of his continuous achievements in quality improvement.



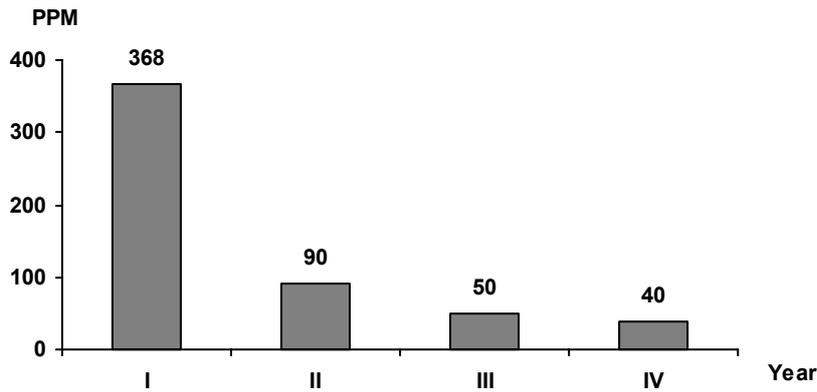
**Fig.2. Scheme of supply chain and vehicle manufacture**

Taking into account that achievement of finished product quality of a business system begins from development and designing, through selection of input raw materials and semi-finished products and furthermore via production process involving a linkage of workers, machines, tools, technical-technological documentation, information, energy, fluids, inter-operation transportation, etc.,

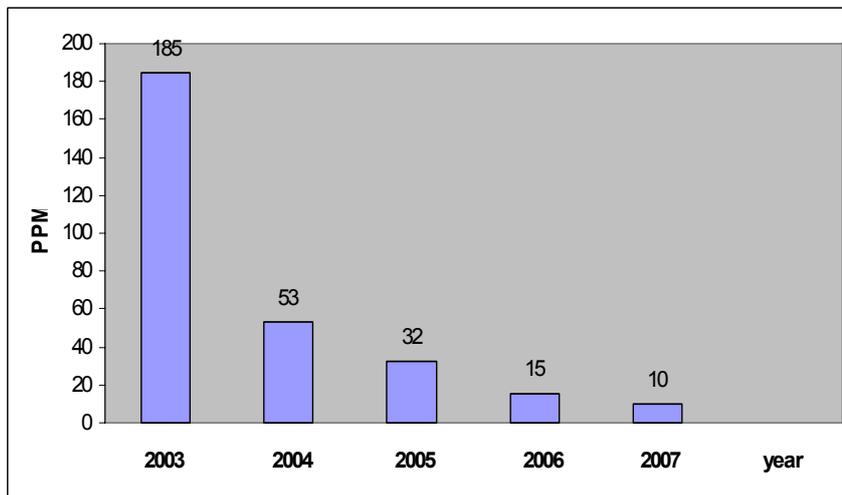
it is necessary to create appropriate methods and techniques for controlling the states and changes of analysed affecting factors. As for the complex products manufacture, which calls for a large number of parameters to be controlled, inspection processes become more complex and more time is required to accomplish these activities. That is why the advanced machine tools are more often

produced with installed adaptive control, which highly increases the price but

provides a great reliability.



*Fig.3. Quality of deliveries as per PPM criterion*



*Figure 4 PPM for one of the world's leading automotive suppliers*

Within a machining system, however, in addition to known input values, there are also actions of surrounding accidental factors, which sometimes may disturb a required system output. For these reasons, those who are well experienced in production process are taking preventive measures, thus trying to eliminate possible defects caused by accidental factors actions. Technical Specification ISO/TS 16949 and its regular application provide a

higher reliability and stability of machining system, that is of the entire business system at the whole factory level. The authors of this paper is of an opinion that the quality of mentioned Technical Specification lies in the fact that it specifies some of very important practical requirements which are not covered by ISO 9001 Standard. Some of additional significant requirements refer to the following:

- introduction of planned and preventive maintenance, identification of key process equipment and development of total preventive maintenance system-TPM,
- production tools management from the stages of designing, manufacture, usage, repair, recovery, storing, quality control, up to wearing out and recycling,
- recording of all activities related to calibration and verification of all control and measuring devices used in production process,
- monitoring and measurement of production process performances, with a special attention paid to the records of significant events related to the machine failures and repairs, damages, tooling replacement, etc.,
- necessity of recording the all modifications, specifying the dates of introduction, parts batch designations and modification validation before batch starting up, with a previous consent of the customer,
- necessity of training the employees at their working places and taking measures to achieve a higher motivation of employees, etc.,
- proper arrangement of equipment and working places, along with minimization of transportation flows and fulfillment of ergonomic requirements,
- verification of processes and output elements of production process, using required internal documentation and production process FMEA,
- necessity of making more effective communications in case of production process deviations and giving the authorization for an immediate interruption of production process in all shifts engaged in running the production process, etc.

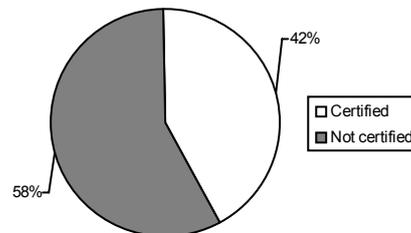
The above selected and specified requirements indicate that a quality assurance calls for their obligatory

fulfillment as per Technical Specification ISO/TS 16949:2009 and ISO 9001 Standard requirements. In such a way, a correlation has been made between the applied quality system and product quality in all production stages, starting from raw material production, through parts production process, assembly process, up to service of products during their usage.

The manufacturers of parts and components are obliged to document the introduction of the quality management system in accordance with the requirements of ISO 9001 and ISO/TS 16949, and for such purpose they have to engage an authorized institution being internationally recognized and accredited at a quality system certification.

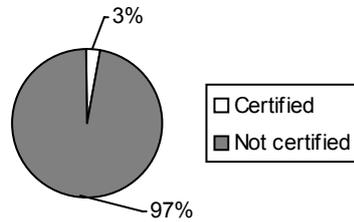
Currently in Serbia there are a few internally authorized institutions, which have issued around 1,000 national certificates as per the requirements of Standard ISO 9001.

Apart from the issued certificates, around 10% account for the producers in the field of automotive industry. Based on researches made for around 100 producers of parts and components for Serbia automotive industry, it appears that 42% of suppliers have certified a quality system as per the requirements of Standard ISO 9001, as illustrated in Figure 5.



**Fig. 5. Certification degree of automotive parts suppliers in Serbia as per requirements of Quality Standard ISO 9001**

The situation is even worse if certification degree is analysed in accordance with stringent requirements of ISO/TS 16949, as shown in Fig. 6.



**Fig. 6. Certification degree of suppliers in Serbia as per requirements ISO/TS 16949**

Figure 6 shows that only 3% of the companies in the field of automotive parts manufacture are certified as per requirements of ISO/TS 16949, meaning that such certification is subject to insufficient significance in Serbia and the Balkans region. Such certification degree will not contribute to export in developed markets. Based on analyses conducted with automotive parts producers in Serbia, it appears that some additional 10% of them initiate the preparations for certification in accordance with the requirements of ISO/TS 16949, thus improving their chances for accessing the world market.

#### 4. CONCLUSION

And in 2010, the situation in automotive industry became critical because the global financial crisis and the related credit crunch. The global economic slowdown has drastically reduced demand for new vehicles in USA and Europe. Vehicle production in Europe in 2010, will fall to levels not seen since the early 1990s, with disastrous effects for suppliers. The worlds suppliers, wants a fundamental change in the way its members do business with

automakers (contract terms, warranty and recall obligations and costs linked to rising raw material costs, ect.). The global trends that influence us and our suppliers. Based on the performed research and analysis, it is possible to maintain that the Serbian automotive industry is facing serious difficulties, which can only be overcome by finding a foreign strategic partner from the same branch and with the adequate support from the government.

It is an undisputable fact that the majority of our companies are not competitive on the open world market and are also losing position on the local market. On the other hand, based on the presented research in the field of local automotive industry, it turns out that there is a downfall in the potential of the local automotive part suppliers. However, one should praise their attitude towards the requirements of the valid standards related to the introduction of the quality systems following the ISO 9001 standard, with the remark that the quality of some automotive parts is often not on the desired level. The compliance with the requirements of the technical specification ISO/TS 16949 has been achieved in a symbolic number of local suppliers, which is a prerequisite for the presence on the foreign market and for supplying the complete vehicle manufacturers, who assemble models by world licences. It is realistic to expect, the recovery and further development of local component and part suppliers within a short time frame, on condition that they too find their strategic partners, besides the complete vehicle manufacturers, who would provide them new licences and new technologies, as has been the case in the past.

Considering that no alternative has been found in Serbia for the available potential of the Serbian automotive industry and other industrial branches, it is necessary to oppose the theses expressed by some "local" officials related to extinguishing the local production. The

government should therefore foresee this year as well as next year the required and adequate subsidies as support to local companies, which have been the carriers of the industrial development in our country

and which can continue to have a significant contribution to the growth of the industrial production and the growth of the GNP.

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