Chapter III

QUALITY MANAGEMENT

1. Quality of Life

We may intuitively sense that quality of life goes beyond our tangible goods and achieved living standard. We can also notice that quality is shaped by a number of factors and circumstances which are effectively verified by time and transcend material issues. Despite the belief that the source of any product's or service's quality and the "creator" of its level is always a human being along with their cultural, physiological and psychological background, the belief that a human being themselves is the final judge who evaluates quality understood as their self-satisfaction, we sometimes do not realize that the level of our satisfaction related to possessing and using a given product or service is determined by our living conditions, our relationships with other people and the intensity of the desire to satisfy our spiritual and material needs.

The abovementioned circumstances should provide sufficient justification for treating quality of life as the initial category in reference to considerations devoted to quality of products and services.

Quality is understood by philosophers as conditions of creating an authentic existence, self-esteem and the sense of uniqueness. Economists approach this issue more objectively as they believe that quality of life reflects basic features of social reality which are autonomous in a way that they are independent of individual perception and evaluation. Consequently, they analyze material, cultural and social living conditions of the society. The following areas of interest related to this approach may also be enumerated: working conditions, wage levels and income, size and structure of consumption, durable goods, free time, natural environment, social environment etc.

This approach may also have a subjective character and then quality of life embraces the evaluation of gradual satisfaction of needs conducted by individuals.

The first approach is thought to enable only the evaluation of living conditions on the basis of a set of objective conditions (quantitative and qualitative), whereas the second one allows us to evaluate quality of life, because the evaluation is then based on subjective measures which indicate the level of a human being's satisfaction related to their various needs.

According to the Commission on the Measurement of Economic Performance and Social Progress[8] the following three conceptual approaches may be useful in thinking about how to measure quality of life [Stiglitz, Sen & Fitoussi 2013, p. 606]

- The first approach is based on the notion of subjective well-being according to which a person can evaluate their situation better than anybody or anything.
- The second approach is rooted in the notion of capabilities. This approach conceives a person's life as a combination of various "doings and beings" (functionings) and of his or her freedom to choose among these functionings (capabilities). The foundations of the capability approach reflect a focus on human ends and on respecting the individual's ability to pursue and realize the goals that he or she values.
- The third approach, developed within the economics tradition, is based on the notion of fair allocations. The basic idea, which is common to welfare economics, is that of weighting the various non-monetary dimensions of quality of life (beyond the goods and services that are traded in markets) in a way that respects people's preferences.

These conceptions aim at searching for new, better than e.g. GDP, measures for socio-economic development and quality of life.

Gross domestic product (GDP) for many years has been treated as the main economic indicator which describes a given country's level of wealth and the strength of its economy. The per capita GDP is one of the main indicators of the living standard. However, in fact it does not describe either the actual wealth distribution, or the poverty level. This indicator also fails to take account of arms expenditure (which does not make human lives better), free time and housework, but is supposed to embrace income related to prostitution, smuggling and drug trafficking.

[8] This commission was appointed in 2008 on the initiative of President of the French Republic of that time, Nicolas Sarkozy, in order to determine the elements which contribute to the improvement of quality of life.

In light of these arguments it is not surprising that Costa Rica leads in the rating created by NEF (New Economics Foundation), so-called the Happy Planet Index[9] comprising 151 countries, ahead of Norway and the USA (whose GDP is much higher) which were classified on the 29th and 105th respectively [The Happy Planet Index 2012].

On the basis of the abovementioned assumptions we may conclude that quality of life consists of two interrelated elements: objective conditions (economic, demographic, environmental, health etc.) and subjective conditions (self-assessment of general and particular living conditions in the following categories: satisfaction, happiness, hope, fear, loneliness etc.) [kns.px.pl 2010]. The hierarchy of individual components of these two elements is diverse in reference to their evaluation conducted by a person, a family or the whole society. It is influenced by, among others: a person's personality, environment, education, tradition, historical and geopolitical background.

Therefore, objective socio-economic conditions may affect self-perceived quality of life in a positive and negative way alike. Consequently, the quality of products and services, which amounts to an integral element of the aforementioned objective and subjective conditions, is equally important. The correspondence between the discussed elements may be characterized as feedback. It means that the evaluation of quality of life is influenced not only by the quality of products and services but also by a person's or a group's life satisfaction in a way that it can stimulate organizations to manufacture products and provide services of high quality.

2. Product and Service Quality

Product and service quality has been controlled in direct and indirect ways for millennia. In ancient Egypt the evidence for the builders' commitment to quality were the pyramids which up until now prove their constructors' great skills. Greeks excelled at arts and craft [Mitra 1993, p.4]. The material evidence for ancient people's consideration for quality may also be found in the Code of Hammurabi (1754 BC) which included the following record /§235/ „if a shipbuilder build a boat for someone, and do not make it tight, if

[9] $Happy\ Planet\ Index = \frac{Experienced\ well-being\ x\ Life\ expectancy}{Ecological\ Footprint}$.

during that same year that boat is sent away and suffers injury, the shipbuilder shall take the boat apart and put it together tight at his own expense. The tight boat he shall give to the boat owner " [Kodeks Hammurabiego 2000, p.127].

In Middle Ages production was more individual and was focused on craftsmen. They set quality standards and made efforts to maintain them. Product quality amounted to an indicator of the master's position within a guild – quality was the reason for pride and prestige in their community. The development of the division of labor, trade and mass production brought about the need to solve systematic problems related to quality of products and services. The term "quality" first appeared in philosophy and was used by Plato who called it *poiotes*. Cicero in his work devoted to the development of Roman philosophical terminology referred to the Greek *poiotes* with the use of Latin *qualitas*. Therefore, this Latin word was reflected in some Romance and Germanic languages, e.g. as *qualita* – in Italian, *qualite* – in French, quality – in English, and *qualität* – in German.

As a philosophical category quality generally denotes a type, a species, a given object's (phenomenon's) value. In more specific terms in means a feature, a set of distinguishing features, or overall characteristics of a given object which are significant due to their internal structure as well as their relationships, impact and surrounding environment. According to Aristotle all qualities may be divided into two types. Quality, in accordance with its first meaning, is the characteristic which makes an object diverse in its essence. The second type of qualities are the characteristics of changeable objects, i.e. characteristics with the use of which we distinguish changes (weight and lightness, warmth and cold, whiteness and blackness). In a sense, advantage and disadvantage also belong to this type [Arystoteles 1998, pp. 268–269].

In the Polish dictionary quality is described as a characteristic, a type, a species, a value, a set of distinguishing features [*Słownik języka polskiego* 1998, p. 769].

In everyday language most often it denotes an evaluation related to the extent to which a given product or service reflects the requirements of the person who formulates the evaluation. It may take account of all or only some features of the evaluated object: weight, color, shape, structure, chemical composition, impact on the surrounding environment, efficiency in fulfilling specific tasks etc. The evaluation may refer to a material, component parts, an instrument, a machine, a room, a service, a phenomenon, a process, a method etc. [Łańcucki 2006, p. 11].

In the literature on the subject individual authors define quality as follows:

- usefulness, customer satisfaction – Joseph M. Juran [Butman 1997, p. 87];

- satisfaction of a customer's present and future needs – W. Edwards Deming [Oakland 2004, p. 5];
- conformance to requirements, not goodness – Philip B. Crosby [Crosby 1999, p. 39];
- a dynamic state associated with products, services, people, processes and environments that meets or exceeds expectations and helps produce a higher value – David L. Goetsch, Stanley B. Davis [Geotsch & Davis 2000, p. 50];
- conformance to customer requirements – John S. Oakland [Oakland 2004, p. 5];
- overall characteristics of a product or a service in the area of marketing, design, manufacturing and servicing thanks to which utilized products and services meet customer expectations – Armand V. Feigenbaum [Beckford 1998, p. 86].

All these definitions, in spite of different ways of expression, include the essential idea of meeting customer expectations.

In the standard developed by the International Organization for Standardization (ISO) quality is defined as a "degree to which a set of inherent characteristics fulfills requirements". Then the following adjectives are given as applicable to the term "quality": poor, good, excellent. ISO opposes the term "inherent" to assigned and defines inherent as "existing in something, especially as a permanent characteristic" [EN ISO 9000:2005]. This definition of quality is the most universal and amounts to the basis for further considerations included in this book within this scope.

We do not always fully realize to what enormous degree quality of our everyday life is determined by service quality. This lack of awareness is probably caused by the fact that we still associate this area with the traditional group of services: transportation, trade, catering, repairs and tourism. Meanwhile, some completely new services have been developed in the last several decades, e.g. services related to tax and investment consulting, advertising, recruitment and sourcing, office services, e-business and cloud computing. The first decade of the 21st century was described as the decade of services due to the fact that their GPD share in many countries reached the level of over 70%, and the dynamics of this sector outstripped the pace of development of industry and agriculture.

In 2012 among all EU member states the biggest share of value added[10] generated by services was observed in Luxembourg – 86,1%. A big share of value

[10] Value added equals a difference between the value of total production and the value of products and services used in the manufacturing process.

added may also be noted in the following countries: Greece (80,2%), France (79,2%), Great Britain (78,7%) and Denmark (77,1%) [GUS 2013, p. 18].

It should be noted here that the data related to the role of services in many of these European economies are surely underestimated due to the fact that they refer only to the activity run in the service sector without taking account of service activity in the whole economy. In the case of industry, for example, functions and activities associated with services include a variety of actions and influence the final production cost and product quality. The activities may be divided into five fundamental categories [Grönroos 2000, p. 47]:

- pre-production (e.g. research and development, project financing),
- performed during the manufacturing process (e.g. quality management, safety assurance, repairs and maintenance, current financing),
- sales-related (e.g. logistics services, actions associated with maintaining and developing a sales network, marketing),
- services provided during the process of consumption and utilization (e.g. informing and instructing customers, information centers, guarantee service, complaint service),
- post-utilization services (e.g. recycling, waste management).

In accordance with the definition included in the Treaty Establishing the European Community (Article 50): "Services shall be considered to be 'services' within the meaning of this Treaty where they are normally provided for remuneration, in so far as they are not governed by the provisions relating to freedom of movement for goods, capital and persons". The directive on services in the internal market [Dyrektywa 2006] defines a service as "any self-employed economic activity, normally provided for remuneration". The relevant ISO standard is included in one of the categories of products along with intellectual property, tangible objects and processed materials. A service is defined by the standard as "the result of at least one activity necessarily performed at the interface between the supplier and the customer, which is generally intangible" [EN ISO 9000: 2005].

In literature on the subject a service is most frequently understood as "all those activities that are intangible and imply an interaction to be realized between service provider and consumer" [Van Looy, Gemmel & Van Dierdonck 2003, p. 10]. Most often among characteristic features of services the following are included [Grönroos 2000, p. 47]:

- intangible character (a service is an activity or a process);
- simultaneousness of the processes of manufacturing, distribution and consumption;
- diversity;

- lack of possibility of unnecessary manufacturing for the stock;
- lack of possibility of acquiring ownership rights.

The importance of individual features is changeable and depends on the type of service, location and time of service provision as well as it is affected by the consumer along with their experience, education, material status, tradition, culture and social background.

It is often difficult to clearly identify these characteristic features. The intangible character of a service entails our inability to touch, taste and test it prior to usage. However, it should be noted that not all services represent the same degree of intangibility. On one hand, we may avail of legal consulting, i.e. a service with a limited share of tangible product. On the other hand, we can have our tires changed, or a TV fixed, or a coat tailored, i.e. make use of services in which tangible elements play a key role [Łańcucki 2006, p. 12].

Simultaneous production and service consumption with the customer's active commitment makes it very difficult to predict the final result of the provided service. It is caused by the fact that not only do qualifications, skills and experience of the service provider affect the final outcome but also the expectations, experience, knowledge and commitment of the consumer are significant in this regard. Diversity is associated with multiple factors which have impact on the result of the provided service. Its ultimate form depends on the service provider and the customer alike. Moreover, it is affected by the material conditions of service provision and the surrounding environment. Due to the fact that direct contact between the service provider and the customer is a characteristic feature of most services, the behavior of any of them may decide about the quality of the provided service. External factors can also significantly influence the perception of a service, e.g. unfavorable weather (storms, rain, strong wind) may affect the evaluation of the service provided by an entity which organizes a rafting camp. A service provider should determine how many of these external factors can be eliminated or limited, which of them may be controlled. The abovementioned characteristic features appear to indicate that it is possible to differentiate the areas of services and manufacturing tangible goods.

Hence, a service is not a product in relation to which a manufacturing specification may be discussed. The process of monitoring and measurement of such "manufacturing" also poses many problems. Very often there is no mock time period which would enable determining if a given service conforms to a given set of requirements. The slogan "let's do it well on the first attempt" in reference to services becomes particularly important, because the client

which buys a service is a witness who frequently co-participates in the process of service provision and immediately spots all mistakes and shortcomings.

Consequently, a tangible product may be withdrawn or fixed, whereas a poor service stays with the customer [Łańcucki 2006, p. 14–15].

Taking account of the complexity and diversity of all elements adding up to service activity, the mechanical transfer of tools and methods from the area of tangible goods production to services should be approached with proper caution.

The complexity of this sphere must prompt the need to specify the fundamental criteria of service evaluation. The definition of the term "service quality" should amount to the basis for further considerations.

Service quality can be plainly defined as the degree to which the essential characteristics of a service conform to the customer expectations. Therefore, the client may decide to what degree the service satisfies their needs. In light of this, the customer is the "judge" in reference to service quality not only at the moment of purchasing it, but also during its provision. Hence, customer evaluation is the final measure of service quality. It certainly does not mean that the provider is excluded from the process of evaluating service quality. On the contrary, active management of quality in a service company calls for sustained monitoring as well as, if it is possible, correcting the process of service provision.

In the literature on the subject the definition of service quality is usually related to the criteria of consumer quality [Szneider & White 2004]. Among these criteria the following are most frequently included [Fitzsimmons & Fitzsimmons 1998, p. 270–271]:

- reliability – ability to realize the declared service in a reliable and thorough way;
- responsiveness (openness and sensitivity) – readiness to serve the client and timeliness of service;
- security which comprises:
  - skills and knowledge necessary for providing the service;
  - politeness, respect and kindness of personnel performing the service;
  - trustworthiness and honesty of the service provider;
  - lack of hazards, risk and doubt;
- empathy understood as:
  - availability of contact with the service provider;
  - transferring information in an understandable way for clients as well as ability to identify with customers;
  - realization of all undertakings related to the identification of clients and needs;

- tangible components of the service process – the type and character of tangible conveniences, equipment, personnel, means of transportation and communication.

The dynamic growth of sales and services on the Internet stimulated researchers in the area of e-services. In researches funded by the Marketing Science Institute, E-S-QUAL was defined as a degree to which an Internet service enables effective and efficient shopping, acquiring products and delivery to customers [Zeithaml, Bitner & Gremler 2009, p. 115]. On the basis of research seven distinguishing features have been identified, including four basic characteristics, related to the evaluation of services as well as three distinguishing features associated with the scope and level of support offered to the customer. The four basic features are:

- effectiveness – simple and fast access to a website,
- satisfaction – the degree to which the declared availibility of items and the possibility of placing an order are satisfying,
- an availability system – proper technical functioning of a website,
- privacy protection – the degree to which a website is secure and protects information about the customer.

The remaining three features are:

- openness (sensitivity) – effective problem-solving and response,
- compensation – the degree to which negative consequences of problems are compensated,
- comfort – accessibility by phone or online.

In some cases in the professional literature service quality is identified with customer satisfaction. However, these two terms should be differentiated as the level of customer satisfaction results from the comparison of the expected service quality with perceived service quality [Johnston & Clark 2001, p. 78].

We should take into consideration the fact that in practice environmental and cultural conditions as well as previous experiences in relation to a person who has had no acquaintance with a given service may decide about this person's positive evaluation. It is also possible that a good service may be perceived by a very demanding person as unsatisfying. Customer satisfaction, therefore, does not maintain the same level of acceptation, because of the dynamic and evolving customer expectations.

Most often the level of these expectations is influenced by the following factors: price, alternatives, marketing, situational factors, opinions communicated by other people, experiences, mood, attitude and emotions [Van Looy, Genmel & Dirdonck 2003, p. 124].

3. Quality Management System[11]

First standards related to quality assurance were introduced by the U.S. Department of Defense in 1959. These standards in 1963 in a modified form amounted to the basis for the development of the first quality assurance program for suppliers of the American army. Consequently, similar programs were implemented also in companies indirectly related to the army, e.g. nuclear power.

First British and Canadian national standards related to quality assurance were published in 1970s. As an example of a spectacular application of quality assurance standards may serve the requirement of the British government in relation to building the tunnel below the English Channel – all companies which participated in the works needed to have the quality assurance system in compliance with the BS5750 standard.

Other countries also developed their standards related to quality assurance which resulted in, due to the dynamic growth of transnational exchange and the diversity of requirements in exporting and importing countries as well as because of the need to organize these standards on the international scale. Hence, in 1985 ISO started working on the development of commonly accepted international standards.

The ISO/TC 176 Technical Committee was appointed. The works of the Committee resulted in publishing the ISO 8402 standard which included terms and definitions related to quality. A year later next standards from the ISO 9000 series associated with quality assurance systems were announced. In the same year states belonging to EEC and EFTA adopted them as European EN 9000 standards.

Next in 1989 the EN 45000 series standards were published. They defined rules for certification bodies and research laboratories. In 1992 the International Organization for Standardization published the ISO 10011 series standards as guidelines for auditing.

The latest edition of the four basic ISO 9000 series standards was published relatively recently and may be presented as follows:

- ISO 9000:2005 – Quality Management Systems. Fundamentals and Vocabulary.
- ISO 9001:2008 – Quality Management Systems. Requirements.

[11] Subchapters 3 and 4 were created on the basis of a previous publication of the author J. Łańcucki [2010, p. 38–50].

- ISO 9004:2009 – Managing for the sustained success of an organization. A quality management approach.
- ISO 19011:2011 – Guidelines for auditing management systems[12].

Nowadays in the whole world quality management systems based on requirements included in the ISO 9001 standard are the most popular management systems applied in practice by production and service organizations in all sectors of the economy, public and private alike.

By the end of 2012 there had been issued over 1.100.000 ISO 9001 certificates in 184 countries [The ISO Survey of Certifications 2012]. Aerospace, arms, electrotechnical and computer companies cooperate with suppliers on condition that they have an ISO certificate. Insurance companies also contributed to popularizing these standards by a system of discounted contribution rates for ISO certificate owners as well as by relevant requirements included in the general insurance conditions.

The motives for introducing quality management systems in compliance with ISO 9001 are [Douglas, Colman & Oddy 2003, p. 321]:

- joining supplier networks of renowned manufacturers,
- increase in the credibility of a manufacturer or a supplier,
- streamlining of management and work organization,
- limiting losses resulted from poor adjustment of a product or a service to the market's requirements,
- lowering internal error cost and costs related to warranty repairs,
- increasing the competitiveness of a product or a service on foreign markets.

It should be stressed that the ISO 9000 series standards are not technical standards, in a way that they do not describe technical parameters to which a product or a service should conform. The standards describe only the rules of managing an enterprise which may support the process of quality assurance in reference to a given product or service. The ISO 9000 family of standards embraces the scope of good practice in management.

The processes of manufacturing and service provision should be organized so as they guarantee good quality in the whole life cycle of a given product or service. Therefore, these standards should support changes in the way an organization is managed. As a result of these changes the organization is able to achieve the best quality possible, all employees feel responsible for it and the customer is satisfied.

[12] More information about audits and this standard can be found in chapter X of the present monograph.

Conformance with these requirements must take account of the close relationship with other management systems, e.g. finances, information, environment. It is crucial for achieving the synergy effect in the process of improving the organization's management system.

Neglecting the abovementioned circumstances may lead to a situation in which the implementation of a quality management system causes more harm than profits[13].

Enormous popularity and universality of ISO standards should not obscure the real role of the International Organization for Standardization in the certification process. The International Organization for Standardization does not conduct certification procedures related to its standards, does not issue certificates and does not control the process of granting certificates performed by other organizations.

3.1. ISO 9000. Quality Management Systems. Fundamentals and Vocabulary

The content of this standard amounts to the basis for understanding the remaining standards. ISO 9000 includes definitions of all basic terms used in the ISO 9000 family of standards. These definitions are crucial to avoiding misunderstanding related to their usage. This standard formulates the eight principles of quality management which, according the authors of the standard[14], can be used by the management of an organization during the realization of activities contributing to the improvement of its functioning[15]:

Customer focus
Organizations depend on their customers and therefore should understand current and future customer needs, should meet customer requirements and strive to exceed customer expectations. The main benefits of using this principle are:

- increased revenue and market share obtained through flexible and fast responses to market opportunities,

[13] The subject of negative consequences related to the implementation of a quality management system is broadly discussed by J. Seddon [Seddon 1997].

[14] The ISO - ISO/TC 176 Technical Committee is responsible for developing standards of the ISO 9000 family. 80 states, 19 international and regional organizations as well as representatives of other technical committees participate in the works of ISO – ISO/TC 176.

[15] On occasion of discussing these rules the content of the following publication was used: Quality management principles [Łańcucki 2006, p. 101–103].

- increased effectiveness in the use of the organization's resources to enhance customer satisfaction,
- improved customer loyalty leading to repeat business.

Leadership
Leaders establish unity of purpose and direction of the organization. They should create and maintain the internal environment in which people can become fully involved in achieving the organization's objectives. Application of this rule enables the management of an organization to achieve the following benefits:
- people will understand and be motivated towards the organization's goals and objectives,
- miscommunication between levels of an organization will be minimized.

Involvement of people
People at all levels are the essence of an organization and their full involvement enables their abilities to be used for the organization's benefit which consists in:
- innovation and creativity in furthering the organization's objectives,
- people being accountable for their own performance,
- people eager to participate in and contribute to continual improvement.

Process approach
A desired result is achieved more efficiently when activities and related resources are managed as a process. It should lead, among others to lowering costs and shorter cycle times through effective use of resources as well as to focused and prioritized improvement opportunities[16].

System approach to management
Identifying, understanding and managing interrelated processes as a system contributes to the organization's effectiveness and efficiency in achieving its objectives. This approach should lead to the integration and alignment of the processes that will best achieve the desired results, ability to focus effort on the key processes as well as to providing confidence to interested parties as to the consistency, effectiveness and efficiency of the organization.

Continual improvement
Continual improvement of the organization's overall performance should be a permanent objective of the organization. The realization of this process should be performed by alignment of improvement activities at all levels to an

[16] Process approach is discussed in detail in point 5 of the present chapter.

organization's strategic intent. Consequently, it should increase an organization's flexibility to react quickly to opportunities.

Factual approach to decision making

Effective decisions are based on the analysis of data and information. Therefore, these decisions are informed. It also leads to an increased ability to demonstrate the effectiveness of past decisions through reference to factual records. Moreover, the ability to review, challenge and change opinions and decisions is increased.

Mutually beneficial supplier relationships

An organization and its suppliers are interdependent and a mutually beneficial relationship enhances the ability of both to create value. The realization of this principle should bring about the flexibility and speed of joint responses to changing market or customer needs and expectations as well as the optimization of costs and resources.

In the ISO 9000 standard it is clearly stated that (2.2) requirements related to quality management systems and products should be differentiated. The former are included in ISO 9001 and can be applied in reference to any organization from any industry or sector, regardless of the proffered product, because of their general character. In the ISO 9001 standard there are no requriements related to the product. They can be indicated by customers, organizations which predict customer requirements or may be included in relevant legislation. Product requirements and sometimes related processes can be included in e.g. technical specifications, product standards, contracts and laws.

The ISO 9000 includes the description of terms and definitions used in the whole ISO 9000 family of standards. The section devoted to vocabulary (3) comprises 84 definitions,[17] classified into 10 thematic groups.

- terms relating to quality: quality, requirement, grade, customer satisfaction, capability, competence;
- terms relating to management: system, quality management system, quality policy, quality objective, management, top management, quality management, quality planning, quality control, quality assurance, quality improvement, continual improvement, effectiveness, efficiency;
- terms relating to organization: organization, organizational structure, infrastructure, work environment, customer, supplier, interested party, contract;

[17] The edition of this standard which was published in 1987 included only 22 definitions, the 1994 edition – 68 definitions. In the present edition 42 definitions have been modified.

- terms relating to process and product: process, product, project, design and development, procedure;
- terms relating to characteristics: characteristic, quality characteristic, dependability, traceability;
- terms relating to conformity: conformity, nonconformity, preventive action, corrective action, correction, rework, regrade, repair, scrap, concession, deviation permit, release;
- terms relating to documentation: information, document, specification, quality manual, quality plan, record;
- terms relating to examination: objective evidence, inspection, test, verification, validation, qualification process, review;
- terms relating to audit: audit, audit program, audit criteria, audit evidence, audit findings, audit conclusion, audit client, auditee, auditor, audit team, technical expert, audit plan, audit scope, competence;
- terms relating to quality management for measurement processes: measurement management system, measurement process, metrological confirmation, metrological function.

3.2. ISO 9001. Quality Management Systems. Requirements

The latest (fourth) edition of this standard of 2008 replaces the 2000 edition. It does not introduce any new requirements, though. The ISO 9001:2008 standard comprises only explanations of the ISO 9001:2000 requirements. The latter resulted from eight years of experience in implementing the standard in the whole world. ISO 9001:2008 also introduces changes aiming at improving its compatibility with the ISO 14001:2004 standard.

All requirements included in the discussed standard are applicable to all organizations, regardless of their type, size and provided product, due to its general character. The standard can be also applied by internal and external parties, including certification bodies, in order to examine the organization's ability to comply with: customer requirements, legal requirements and internal requirements of the organization. Moreover, it should be stated that certification for compliance with ISO 9001 is not required by the standard. The certification is applied in public and private sectors alike, as a way of bolstering customer trust in products and services provided by certified organizations, between business partners, during supplier selection in the supply chain. Moreover, the certification may strengthen the organization's position in the context of public tenders [Frost 2008, p. 56].

According to the authors of the standard, despite the fact that is does not include particular requirements for other management systems, e.g. environmental management systems, occupational health and safety management systems, management systems for financial services and risk management, it enables an organization to adjust its quality management system to relevant requirements of a different management system or the integration of these systems. According to the standard (1.2) "where any requirement(s) of this International Standard cannot be applied due to the nature of an organization or its product, this can be considered for exclusion". However, an organization can exclude only requirements included in clause 7. (Product realization) on condition that the exclusion(s) does not influence an organization's ability to provide its product which complies with customer requirements as well as statutory and regulatory requriements.

The standard determines requirements related to a quality management system which enable an organization to:

- demonstrate its ability to continually provide a product in conformance with customer requirements and requirements included in relevant laws;
- pursue the increase of customer satisfaction by the effective application of its system, including processes related to continual improvement and assuring compliance with customer requirements as well as statutory and regulatory requirements.

The structure of the standard conforms to achieving the abovementioned objectives by an organization. ISO 9001 consists of eight, sometimes very complex, parts (apart from the introduction and foreword). The eight clauses are as follows:

1. Scope.
2. Normative references.
3. Terms and definitions.
4. Quality management system.
5. Management responsibility.
6. Resource management.
7. Product realization.
8. Measurement, analysis and improvement.

The limitations of the present book do not allow us to broadly discuss all of these parts. Therefore, we will focus on the most important, in our opinion, elements of this standard.

Establishing, documenting, implementing and maintaining a quality management system as well as sustained improvement of its effectiveness should take account of the following activities:

- identification of processes necessary for the system along with their application in an organization;
- determining the order and mutual impact of these processes;
- determining criteria and methods for assuring that processes are effectively performed and controlled;
- assuring access to resources and information necessary for the course and monitoring of processes;
- monitoring, measurement and analysis of processes;
- realization of tasks necessary for achieving planned results as well as continual improvement of these processes.

A quality management system should be documented. In the discussed standard (4.2) it is stated that the quality management system documentation shall include:

- documented statements of a quality policy and quality objectives;
- a quality manual;
- documented procedures required by the International Standard;
- documented needed by the organization to ensure the effective planning, operation and control of its processes.

In the standard it is also stated that the extent of the quality management system documentation can differ from one organization to another due to: the size of organization and type of activities, the complexity of processes and their interactions as well as the competence of personnel.

The need for management commitment to the development, implementation and continual improvement of the quality management system effectiveness is strongly emphasized in the standard. This commitment should include: communicating to the organization the importance of meeting customer as well as statutory and regulatory requirements, establishing the quality policy, conducting management reviews and ensuring the availability of resources.

The realization of basic quality objectives essentially depends on proper resource management, including human resource management. Therefore, the role of competence of personnel performing work affecting quality is emphasized in the standard (6.2). In addition, according to the standard, competence is built by proper education, training, skills and experience. Moreover, the importance of infrastructure and work environment in proper resource management is stressed.

Product realization comprise many processes, among others: planning of product realization, customer-related processes, design and development, purchasing, production and service provision, control of monitoring and measuring devices.

Product realization, which consists of the abovementioned processes, needs planning and implementing activities within the scope of monitoring, analysis and improvement.

Among such activities the following can be found (clause 8 of ISO 9001):

- monitoring and measurement:
  - customer perception,
  - internal audit,
  - monitoring and measurement of processes,
  - monitoring and measurement of product;
- control of nonconforming product;
- analysis of data;
- improvement, mainly consisting in:
  - realization of corrective action,
  - realization of preventing action.

3.3. International Standard. ISO 9004. Managing for the Sustained Success of an Organization – A Quality Management Approach[18]

The latest (third) edition of the ISO 9004 standard includes a description of the model which, according to its authors, should help organizations to achieve "sustained success" in the today's complicated, difficult and changing environment. The standard defines sustained success as result of the ability of an organization to achieve and maintain its objectives in the long term (3.1). The term "organization's environment" is described as combination of internal and external factors and conditions that can affect the achievement of an organization's objectives and its behavior towards its interested parties (3.2). In its present form the standard consists of the following parts:

- Management for the Sustained Success of an Organization;
- Strategy and Policy;
- Resource Management;
- Process Management;
- Monitoring, Measurement, Analysis and Review;
- Improvement, Innovation and Learning.

Guidelines included in the standard promote the application of self-assessment as an important tool enabling organizations to:

- review the achieved maturity level, which comprises: leadership, strategy, management system, resources and processes;

[18] International Standard. ISO 9004. Managing for the Sustained Success of an Organization – A Quality Management Approach, 3rd ed., 2009-11-01.

- identify areas of strength and weakness;
- determining opportunities for either improvements, or innovations.

An extended model of a process-based quality management system incorporating the elements of ISO 9001 and ISO 9004 is given in Figure 2.

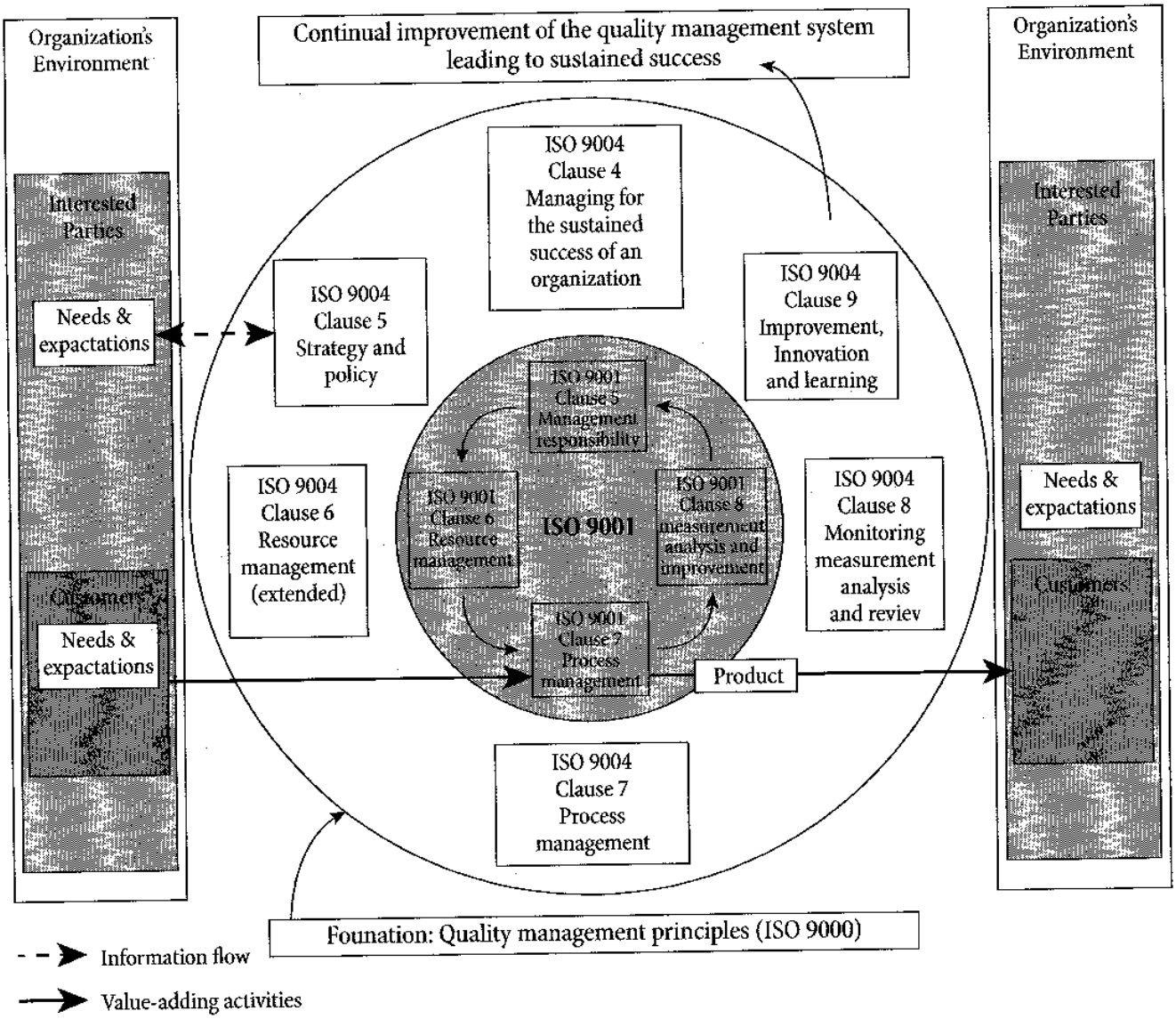


Figure 2. Extended model of a process-based quality management system

Source: ISO 9004:2009 (E) – V

Despite the fact that guidelines included in the ISO 9004:2009 standard supplement the content of ISO 9001:2008, the former may be used independently. It is possible, because ISO 9004:2009 is not intended for certification by a third party, regulatory or contractual actions. Moreover, it has not been designed as a document comprising guidelines for implementing ISO 9001:2008.

4. Correspondence between Quality Management Systems and Excellence Models

The participation of the European Union member states in mutual turnover within the scope of international trade is constantly growing. Therefore, organizations from all of these countries are progressively interested in any initiatives contributing to an increase in the volume of exported products and services on the EU market.

The program of awards and distinctions realized by the European Foundation for Quality Management for many years should be included in the group of such undertakings[19]. This program is executed in conformance with the EFQM Excellence Model and its eight basic principles of excellence.

The three-level award program creates a type of pyramid at the bottom of which we can locate the distinction called "Committed to Excellence", above – "Recognised for Excellence", and at the top – "EFQM Excellence Award".

All of these levels are available for EFQM members and other organizations. The National Partner Organisation[20] on behalf of the EFQM grants awards at the first two levels. Organizations can use any level of requirements applied at successive levels of the pyramid taking account of their maturity level in reference to the EFQM Excellence Model.The basic terms characterizing the Model are[21]:

- achieving sustainable results;
- value added for a customer;
- leading based on vision, inspiration and integrity;
- process management;
- achieving objectives thanks to employees;
- nurturing creativity and innovations;
- building partnership;
- responsibility for sustainable future.

[19] EFQM (European Foundation for Quality Management) was established in 1988 by 14 leading European enterprises. It is a not for profit membership foundation. The mission of the EFQM is to "inspire organizations to achieve sustainable excellence" in Europe (www.efqm.org).

[20] The National Partner Organisation represents the EFQM in Poland. Its main goal is promoting the EFQM Excellence Model. It consists of: PCBC S.A., KiG and Umbrella (Consultant Asssociation).

[21] EFQM Transition Guide. How to upgrade to the EFQM Excellence Model 2010, EFQM 2009.

According to authors, the EFQM Excellence Model can by applied by organizations in many various ways as:

- a self-assessment tool,
- a way of comparing themselves with other organizations,
- the basis for vocabulary and mindset,
- a structure for a management system in an organization.

The EFQM Excellence Model includes nine criteria belonging to two different groups – five are "Enablers" and the following four are "Results".

"Enablers" refer to the way of achieving results ("how"), whereas "Results" indicate an organization's achievements ("what"). The arrows emphasize the dynamic character of the model and show that learning, creativity and innovation help to strengthen "Enablers" and, consequently, lead to the improvement of results. The weights assigned to individual criteria decide about the maximal number of points which represent "Enablers" and "Results" equally.

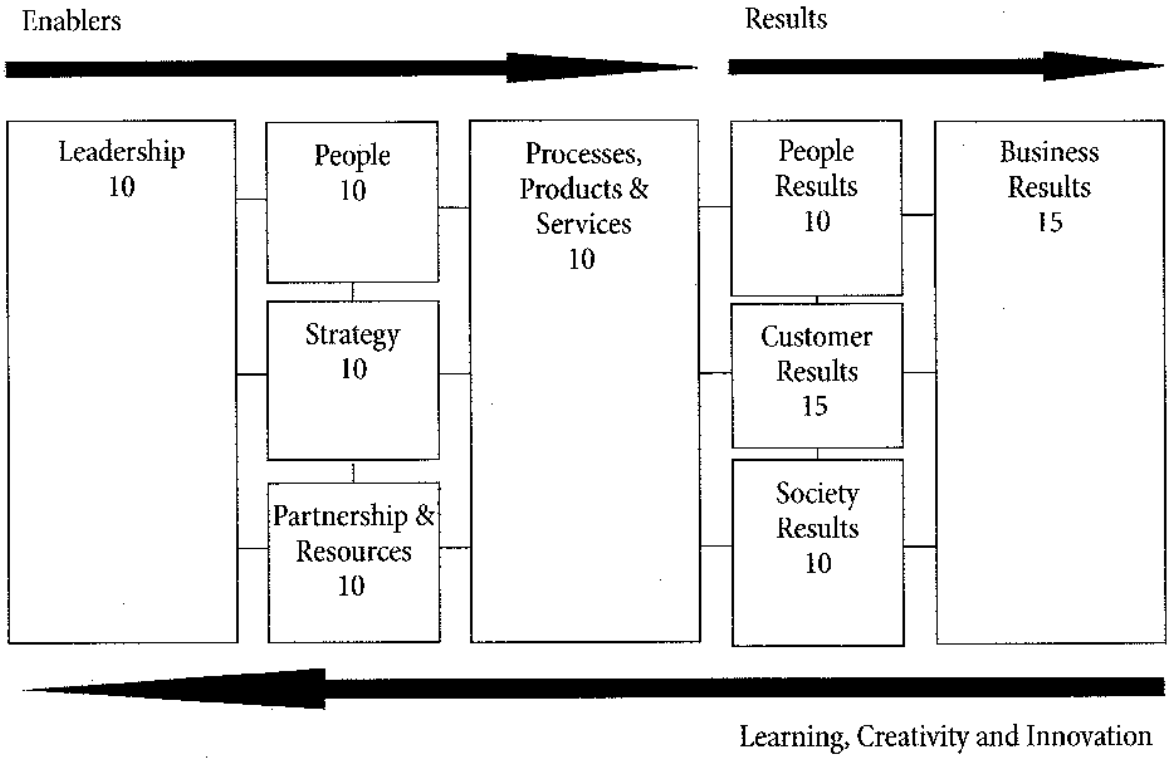


Figure 3. The EFQM Excellence Model (in %)

Source: [Introducing the EFQM]

By comparing quality management principles (0.2, ISO 9000) with the elements of the EFQM Excellence Model described above we can observe that both approaches to quality management systems are based on the same premises. They:

- enable an organization to identify areas of strength and weakness,
- support the evaluation of an organization's activity,
- establish the basis for continual improvement,
- enable external recognition.

The differences between ISO 9001 and the EFQM Excellence may be observed in the area of application.

The ISO 9000 family of standards includes requirements related to quality management systems. The evaluation of the systems is based on meeting these requirements. On the other hand, the EFQM Excellence Model includes criteria enabling comparative evaluation of an organization and all interested parties. These criteria also allow comparing an organization's accomplished results with other organizations' achievements.

5. Process Management

5.1. Process Management

Contemporary organizations search for possibilities allowing the most efficient adjustment to the unstable surrounding conditions. In this regard the discussion about process management, understood as the basis for the key system of managing an organization, or as merely a process approach realized due to the requirements of the ISO 9001 standard during the implementation a quality management system or normalized management systems, appears to play a significant role. Ambitious objectives related to process management are linked with the need to process mapping, modeling and implementing the model. Eventually, it is necessary to measure processes which will allow us to monitor them as well as to follow the effects of improvement. Applying an appropriate, renowned notation in order to map processes and IT support in this regard may be an important question, depending on the intention to use process management.

5.2. Business Process Management

The origins of BPM (business process management) rules reach the emergence of Adam Smith's division of labor in industry ("An Inquiry into the Nature and Causes of the Wealth of Nations", 1776) [Bochenek 2004]. Smith assumed that one employee is able to perform one task from the beginning to the end

in the outwork situation. Once enterprises started employing many workers, it became overly time-consuming and expensive, hence, ineffective.

According to Adam Smith dividing the whole process and developing a specialized division of tasks allowed to simplify and accelerate the process. The author thinks that individual production stages are realized by different workers in the activity chain which makes the work more efficient. In this way business processes were initiated.

More than one hundred years later Frederick Winslow Taylor developed this idea in his considerations by joining "Time Study" with the work of Frank and Lillian Gilbreth "Motion Study"; as a result of which new management methods and the study of "time and motion" were created. The research consisted in analyzing work processes in order to reduce the amount of time and number of actions associated with each of the processes, and, therefore, to increase productivity and efficiency. The actions leading to increasing efficiency and productivity of work were accepted by employers, however, employees welcomed these changes with a dose of skepticism and unwillingness. The term "Taylorism" refers to more scientific and dehumanized approach to efficient activity in business, organizations, economy etc. [Martyniak 1993].

Frank Gilberth in 1921 proposed his work "Process Charts – First Steps in the one Best Way to Do Work" in front of American Society of Mechanical Engineers (ASME) in which he treated about the first way of documenting the course of a process. The ASME standard was commonly applied until 1947 [Jeston & Nelis 2006].

In the first decade of the 20th century "Time and Motion" was a popular conception which suited the modern age of science. In 1936 disappointment was brought by Chaplin's movie "Modern Times". The film in a satirical way presented mass production and assembly lines, repeating the cultural dissatisfaction with industry at the time of the Great Depression. In the face of recession, the theories related to optimization and efficiency as well as the biggest beneficiaries were harshly criticized [Jeston & Nelis 2006].

The time period between 1975 and 1985 witnessed the emergence of workflow technologies. The term "workflow" became commonly acknowledged.

BPM has historically originated from workflow, however, we can point out two fundamental differences between these two terms:

- workflow systems are concentrated on processes based on documents realized by people, whereas BPM is focused on people and systematic processes alike;
- workflow concerns processes within departments, whereas BPM is related to processes within the whole organization.

In 1960s and later Total Quality Management (TQM) became a commonly used management and business process theory. TQM, initially applied to engineering and production, is based on the Japanese philosophy Kaizen and is still being developed [Drummond 1998]. The aim of TQM was: achieving significant improvements of processes and process service, increasing the quality and costs reduction. The key aspects of Total Quality Management became the mainstream of enterprise management. Nowadays the best-known methods of TQM are Six Sigma and Lean Manufacturing.

In early 1990s Business Process Re-engineering (BPR) was initiated and with time became increasingly important. TQM, which began to lose popularity, aimed at gradual improvement of business processes, whereas BPR entailed radical changes of these processes and efficiency.

In 1993 Michael Hammer, an American IT professor, and James Champy developed a conception called "Re-engineering Corporation: Manifesto for Business Revolution". The authors stated that the process is revolutionary, accelerated and expanding. The conception gained enormous popularity accepted by both organizations and consultants. Process re-engineering after its initial success started to become decreasingly popular in late 1990s.

The best rules of Business Process Re-engineering were retained in Business Process Management. In enterprises of high bureaucracy rate, where information is processed, typed and copied between numerous databases, BPM may be a good solution. It allows to focus on the value added for processes related to customer service, contributes to increased efficiency and competitiveness of the company on the market.

5.3. Essence of a Process and Process Management

Process management mainly consists in creating a value for clients [Brilman 2002], the final buyers and internal clients alike. Process management is a systematic evaluation of process functioning, enhancing this functioning and correcting any errors if achieved results are different than the planned ones.

The term of a process refers to a series of actions or steps taken in order to achieve a particular end [The Oxford English Dictionary 1999], a systematic way of acting [Stoner 2001]. In the CMMI (Capability Maturity Model Integration) model a process is defined as actions which may be reorganized during the implementation of solutions. In organizations a process may refer to all actions which add up to the whole company's production and service activity. It is a sequence of all realized actions which aim at transforming the initial stage into the final one in compliance with the customers' expectations.

The initial stage, or a starting point, is information or material which in the course of a process is modified into the final product, in accordance to the rules in a given enterprise. During a process the needed resources are used: human resources, knowledge, skills and experience of employees as well as equipment [Hammer & Stanton 2003]. Process identification allows better understanding of how the company functions. Hence, using proper resources is the crucial element of the realization of all processes According to Krummenacher we may distinguish two main aims of a process:

- it should bring expected results and be realized effectively;
- it should be realized in compliance with the economic calculation in an efficient way, simultaneously minimizing expenditure.

A process should be identified, presented in a graphic, mathematical, number or other way which will allow its further optimization (taking account of given criteria: costs minimization, realization time minimization, value added minimization and others [Łunarski 2008, p. 175].

Process approach defines the usage of all processes in the organization by their identification, defining the relationships between them as well as by maintaining and managing processes. The ISO 9001 quality management standard contributes to process approach [ISO 9001, p. 4.1]. Implementation of process approach in a company according to the ISO 9001 standard [p. 4.1] requires:

- identification of processes realized internally and externally by the company,
- defining the process sequence and interrelations,
- defining the criteria and methods needed in order to assure the effectiveness of processes,
- defining supervision over processes,
- assuring needed resources in order to monitor and realize processes,
- measurements and analysis.

Usefulness of process approach indicated in professional literature is mainly related to constant supervision over the interrelations between individual processes in the whole system of processes, the variety of combinations of processes and reciprocal influence. Introducing monitoring over processes requires launching actions, which improve the efficiency and effectiveness of processes, and accurate identification. In order to indicate mitigation and shortcomings in identified processes, simulations and statistical measurements should be conducted.

Process approach allows us to explore the organization by showing the interrelations, critical points which influence the final product, customer satisfaction as well as the enterprise's financial results. Process approach to

a great extent aims at improving efficiency and effectiveness of a given company, which entails a more accurate satisfying the customers' needs. The results of a process should be beneficial for the client.

Creating a list of processes and an orientation map of interrelations between these processes allows us to implement the ISO 9001 quality management system in a more efficient way. Depending on the aim of the process management, processes may be divided into more detailed elements called subprocesses. They should be divided so as that the sum of all the subprocesses add up to the whole process.

In an organization we may distinguish general, main, support and systematic processes [Wawak 2004].

- Main processes are related to the basic activity of the company. They may stem from the type of activity (e.g. production or service processes) or the law (e.g. state offices). They are assumed to be value added for the client.
- Support processes – realized by employees, do not stem directly from the basic activity of the company (e.g. storage in a production company). These processes may be recommended in the frames of outsourcing.
- General processes, or management processes, are required in order to assure efficient functioning of the company, e.g. accounting or actions of human resources department.
- Systematic processes – processes which stem from the ISO 9001 requirements. We may enlist six systematic processes: document monitoring, records monitoring, non-conformity monitoring, external audits, corrective and preventive actions.

Dendura suggests dividing processes into economic, technical and social [Dendura 2002]. According to Twaróg a universal division would be: strategic planning and support, product development, sales, order realization, maintaining clients. It is popular to analyze processes using the division into basic, support and management processes [Rummler & Brache 2000].

The number of processes on the main map and the terminology used to name them are linked with the selected mapping method, reference model and the specificity of a given organization. In each case of describing processes it is necessary to include:

- process input,
- process outputs,
- structure,
- inputs and outputs for individual stages of a process,
- suppliers,
- clients,

- process owner,
- evaluation criteria,
- influence on the organization,
- measures,
- measurement and evaluation tools,
- management criteria and methods,
- resources,
- process documentation [Dendura 2002].

Process approach amounts to a basis for creating quality management systems in compliance with the requirements of the ISO 9000 series standards and TQM rules. The term *process approach* is frequently treated by enterprises as merely a slogan used as an argument to build a quality management system in a chaotic way [Tabor, Zając & Rączka 2000]. Enterprises should treat process approach as a requirement allowing a reliable analysis of the organization's activity, in particular in the aspect of quality. This requirement enables us to create a quality management system in a given enterprise.

5.4. Identification of Processes and Graphic Modeling

Independent of the process division and composition accepted it is necessary to define and graphically present the processes. In this regard it appears to be appropriate to use renowned graphic notations to illustrate processes, e.g. BPMN – Business Process Management Notation.

Łunarski indicates that the basic tasks during process identification are:

- isolating a given process from a set of processes in an organization according to the selected criterion and labeling the process with a classification code;
- explaining what should be treated as the beginning of the process (it may be e.g. the end of a different process) and the end of it (it should be a defined material or non-material element);
- defining a supplier (or suppliers) at the process input, the clients of the process's product and their potential requirements towards the product;
- defining the internal structure of the process, i.e. describing the elements (operations, actions, stages) of the process and the interrelations between them in time and space;
- defining functions (objectives) of the whole process and its individual structural elements;
- defining the parameters which describe and characterize the course of the process, the measures applied (or potentially applicable) in order to evaluate the effectiveness and efficiency of the process;

- explaining the hitherto way of controlling a given process and analyzing the possibilities of developing more effective ways of controlling the process;
- describing resources used in the course of the process realization and ways of supplementing it;
- describing hitherto ways of monitoring the course of a process and recording, storing and using data;
- describing the stage of documenting a process or its elements as well as evaluating the sufficiency of a given process (if not it needs to be supplemented);
- creating a simplified or precise process model.

A simplified graphic model depicting the course of a process is presented in Figure 1.

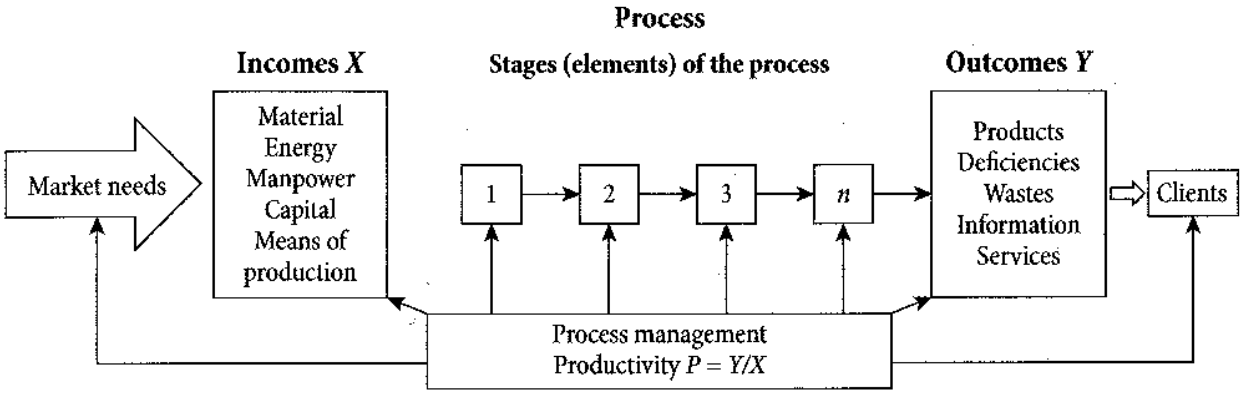
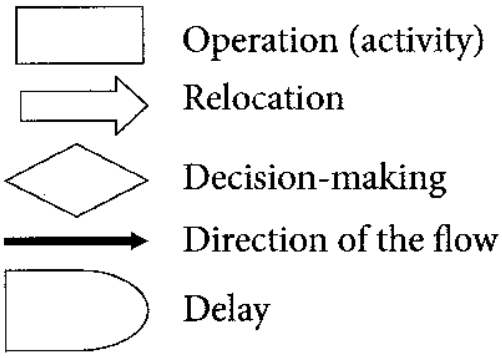


Figure 4. Simplified process model

Source: On the basis of [Łunarski 2008]

A high degree of complexity is characteristic of graphic process modeling. In order to simplify and standardize process maps specific graphic symbols are used. In literature we may find numerous systems in this regard. Below several basic symbols in compliance with ANSI (American National Standards Institute) are presented.



5.5. Business Process Modeling

Business process modeling is a set of activities conducted by business process analytics in a given enterprise. BPM aims at establishing the way a given organization works and its present condition. Furthermore, BPM helps to define the target way of acting and the planned condition [AION Sp. z o.o.,2006]. The aim of business modeling is:

- understanding current problems in a given organization and defining the potential for improvement;
- evaluating the influence of the change in the organization;
- assuring that clients, users, investors and other parties understand the organization in the same way;
- defining requirements of the software system which is necessary to support the target organization and understand the ability to adjust by the software system to be used in the future [Wolski, Stasiak & Dąbrowski 2009].

5.6. Business Process Models

In professional literature we may find numerous definitions of a business process. The definitions are essentially very similar, but there has not been developed a commonly acknowledged general definition yet. Researchers most frequently refer to Davenport's definition which describes a business process as a chain of actions whose final aim is production of specific output value for an individual client or the market [Davenport 1993]. Another popular definition was created by Champy who presented a process as a set of actions which have one or more types of input and create value added for the client. According to Champy these actions have a common aim affected by external events or occurrences in other processes [Hammer & Champy 1993]. Modern term of a business process embraces the flow and usage of information and resources, i.e. it can be defined as a set of business activities which amount to essential measures taken in order to achieve the business objective (BPMN v. 2.0 2011).

Business process models, as a specialized category of models in enterprises, focus on describing the features and characteristics of business processes. For example, these models are used so as to define the function and structure of processes, chains of events and their interrelations, costs and resources related to processes.

A business process model[22] is normally expressed in the form of a diagram which describes the chain of activities along with their relations and chronological order of realization The last element is particularly significant; however, particularly at higher levels of an organization, there are some exceptions when the order of realization does not play an important role. BPM implication concentrates on handling and improving tasks and activities under the circumstances of the process. Business process modeling is a multifunctional tool which combines the tasks and documentation in many departments of the company. In more complicated situations BPM includes activities performed by external organizations in processes.

Process modeling is supported by properly designed and adjusted software and tools. Applications offer standard features which may undergo changes and improvement along with the development of a given organization's processes. There are four basic strategies for process modeling [Fischer 2000, p. 11; Sałaciński 2009]:

- Top-down (from general information to details), specification of a business process begins with recognizing general elements and next it is defined in increasingly detailed manner (and lower level). An advantage of this strategy is the focus on business needs, however, it requires wide knowledge and, in the case of complex processes, even minor mistakes made at the general level may generate significant problems during the detailed description of the process structure.
- Bottom-up (from detailed to general information), it is the opposite of the approach described above, it consists in beginning the specification with elements of the process and subprocesses which are merged and finally create the whole business process. Bottom-up strategy allows us to thoroughly design the system with the emphasis on detailed tasks, subprocesses and products. There is some risk that the specification will be overly detailed and will complicate the business process which will be well-suited for business needs in the approach described above.
- Inside-out (or spreading) – it is a kind of compromise consisting in focusing on main processes, defining their chronology. On the basis of this basic structure support elements, subprocesses and tasks are built up. In this aspect an important problem is to decide which processes or subprocesses are paramount.

[22] Model – a depiction of characteristic features of an item, phenomenon or interrelations in a simplified way [Stoner 2001, p. 28.], a tool with the use of which we may describe a system and its responses to various external circumstances.

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- Mixed – this strategy uses all of the aforementioned approaches so as to achieve the best results and optimize business process modeling [Sałaciński 2009].

The aim of BPM is designing and improving processes in a way that the efficiency and profitability of a given company are increased. Process improvement concentrates on value added for processes related to the client. Hence, the emphasis is put on reducing losses and costs linked with low quality. This type of activity is essential for enterprises which attempt to raise the efficiency of processes associated with better customer service. There are two descriptions of business process models:

- basic (present situation),
- expected (situation to be achieved),

which are applied for analysis, tests, implementation and process improvement. Furthermore, they are aimed at illustrating the present situation in a given company which allows managers, consultants and employees to improve the workflow. Advantages of such processes are:

- value added for clients,
- cost reduction for the company,
- increasing profits.

Contrary to a usual workflow diagram, which focuses on activities within one department, BPM embraces the whole organization; therefore, it provides the possibility to concentrate on clients', both internal and external, needs.

Another model used in order to evaluate process maturity is the prototype of present solutions – CMM. When the term software crisis[23] appeared only an insignificant part of computer systems were fully used, some of them needed to be modified, others were to be created in the frames of paid projects but has never been implemented. Almost a half of undertakings related to computer systems have never been used in practice [Dorsz & Nawrocki 2003].

In early 1980s United States Department of Defense announced a tender offer for creating a list of referential points and criteria enabling the evaluation of service providers of the American government. In 1991the first version of CMM (CMM: Capability Maturity Model) appeared as a result of cooperation between Software Engineering Institute, a research unit financed by United States Department of Defense, and Mitre Corporation. In 2002 at Carnegie Mellon University an integrated CMMI (CMMI: Capability Maturity Model Integration) conception was created. CMM concentrated on software develop-

[23] It appeared in 1960s and was used in order to describe a fast increase in abilities and complexity of problems associated with software. In fact it refers to the difficulty of creating proper and simple software.

ment processes, whereas CMMI provides a broader picture of the organization and process maturity.

A model allows process improvement as stable and constant representations [Introduction to CMMi 2007]. They may be compared with two different approaches to databases which include the same information, but from dissimilar perspectives. In constant representation there was introduced the term of process efficiency levels which may improve individual processes according to a defined scale. Constant representation enables production process improvement in the frames of the development path divided into five maturity levels [Chrapko 2010].

5.7. Standardization in Process Management

The expected result of process identification is general and detailed process maps (diagrams) which create the so-called process architecture. Creating maps which depict the flow and mutual correlation between processes is another significant element of implementing process management. Hence, it is worth considering to use a renowned notation to illustrate processes, for example BPMN (Business Process Mapping Notation). This notation allows comparison of graphic presentations of processes which gains significance in the case of benchmark comparisons, both internal and external. Processes graphically depicted in such a manner allow verification of how undertaken actions are oriented towards internal and external customers, and how they contribute to creating value added for the organization.

Described processes embrace a given sequence of actions which are directly interconnected (realization of one action allows moving forward to another). Thus, the following elements should be considered significant in relation to process description:

- functions separately realized,
- responsibility for realizing individual functions (e.g. position),
- input and output documents.

The documentation prepared within the scope of the quality management system should be process-oriented, which is in favor of a better reception of tasks assigned to employees. For instance, it is easier for an employee to refer to the process "Winning and servicing a client" rather than an element of the standard called „A review of requirements related to the product". The quality management system documentation joins the real activities of the organization and solutions undertaken as a response to the standard's requirements. The basis for document preparation are processes, as opposed to the standard's

requirements. This conception is supported by the liberalization of requirements related to systematic documentation. Hence, each organization decides individually about the need to prepare relevant operational procedures. Modern quality management systems require adequate documentation in relation to understanding and using the process management theory. Thus, new documents are created. For example, process cards or process books which are in the leading role in the area of identification of process realization methods and criteria.

The process card may be the leading document, for the fact that if created for every process it may contain both data characteristic of a given process as well as data related to planning, monitoring and development. An exemplary structure of a process card, based on the assumption that every process will aim at three types of objectives, may include:

- basic – defined according to the definition of a process, understood as an intentional action (e.g. for the process Cards Management: assuring competent personnel for realization of professional tasks in the organization);
- monitoring – defined as indicators whose values should be read as possible early warning signals (e.g. for the process Cards Management: production workers absence higher than 2%);
- improving – defined as objectives whose attaining will be seen as the proper direction of process modeling and development (e.g. for the process Cards Management: decreasing the rotation of executive managers within the first year of recruitment to 0).

The ISO 9001 standard has certain requirements associated with the quality management system documentation, in particular in reference to the need to create documented procedures [ISO 9001]. Furthermore, the intention of the requirements is to individualize the systematic documentation in the aspects of personnel competence, process complexity and the organization's specificity. Finally, the procedure may be defined as the established way of proceeding with the action or process. It should also be stated that procedures may have various forms.

Effectiveness measurement is a significant feature of both process approach and quality management systems in conformity with the ISO 9001 standard. Therefore, there is a need to parameterize processes [Grajewski 2007] . In practice it is linked to the need to define:

- main quality features,
- result and leading measures,
- target values of measures.

Parameterization should be conducted for individual processes in the frames of the process map. Hence, objectives, measures and target values are defined

in the quality management practice, at least for so-called megaprocesses. At the next stage objectives, measures and target values for the basic processes are defined (sectors of lower level). Finally, these parameters are established for the lowest sectors – the operational level. As the result of these actions every employee is aware of objectives and tasks defined in the frames of a given process.

6. Industrial Management Systems

International ISO 9000 series standards have been adjusted to the changing surrounding conditions; succeeding editions of the standards are the sign of the development of standardization within the scope of quality management. A piece of evidence in this regard is also the existence of "industrial" standards dedicated to specific groups of organizations. These specialized standards confirm the ISO 9001 conception as well as the need for profiled requirements and, in some cases, profiled systematic solutions.

In accordance with its assumptions the ISO 9001 standard may be used in any organization and can amount to the basis for certified systematic solutions regardless of the industry, size and legal status of the organization. However, in reference to some industries general requirements, which leave much freedom of selecting solutions, are considered insufficient. Therefore, in some industries it is commoner to apply individualized systems, most of which include all ISO 9001 requirements. The requirements of this standard add up to the core which is extended with additional requirements and comments in the form of remarks. The modifier "industrial" does not completely reflect the essence of these standards as many authors include the ISO/IEC 27001 standard (associated with information security management) in this group [Alberts & Dorofee 2002].

The existence and the popularity of such standards also change the basic understanding of the term "integrated management systems". It does not need to refer to quality management, environmental management, and occupational health and safety management. Frequently organizations implement as well as certify a quality management system and an information security management systems, or a quality management system, but in compliance with both ISO 9001 and ISO/TS 16949. Even if a given organization does not decide to certify the system in reference to a given type of standards, it is

beneficial to know its assumptions as some requirements and solutions may be effective in all or many organizations, regardless of industry. In standards of this type the following areas may be found: configuration management[24], business continuity plans[25], preventive maintenance, risk assessment, asset classification, advanced quality planning, control plans, analysis of measurement systems and many others. The awareness of the existence, essence and objectives of these standards allows a conscious decision about potential application.

The increase in the number of certified systems in reference to all industrial systems is a sign of their growing popularity. It also confirms the validity of the diversification of general requirements included in the ISO 9001 standard.

Table 2. Number of certified industrial management systems by the end of 2012

Industrial standard	Number of certificates	Number of countries	Change in comparison with the previous year
ISO/ TS 16949	50 071	83	+5%
ISO 13485	22 237	97	+12%
ISO 22000	23 231	142	+20%

Source: On the basis of [ISO Survey 2012].

By the end of 2012 in the world there were issued 50,071 ISO/TS 16949 certificates, 22,237 ISO 13485 certificates, 19,577 ISO/IEC 27001 certificates and 23,231 ISO 22000 certificates. The biggest increase in comparison with the previous year was observed within the scope of the ISO 50001 and amounted to 332%.

6.1. ISO 20000 – IT Services Management System

The ISO 20000 standard consist of two standards:

- ISO/IEC 20000–1 – Information Technology – Service Management, part 1: Service Management System Requirements.
- ISO/IEC 20000–2 – Information Technology – Service Management, part 2: Code of Practice.

[24] An important requirement in quality management systems for military industry e.g. in AQAP 110 [AQAP 110].

[25] Inter alia, in information security management systems (ISO/ IEC 27001:2005), in quality management systems for automotive industry [ISO/ TS 16949:2008].

The first part includes requirements on the basis of which companies may obtain certificates and confirmation of compliance with the standard. The second part adds up to an extension of requirements based on the Information Technology Infrastructure Library model, elements of Microsoft Operations Framework and COBIT. Similarly to other standards, which amount to the basis of normalized management systems, it defines processes whose implementation in an organization allows comprehensive regulation of the IT area – from service management, infrastructure, configuration, efficiency management to financial settlements.

ISO/IEC 20000–1 describes requirements associated with processes which create service management seen from four different perspectives:
- requirements related to the management system,
- product life cycle in compliance with the PDCA cycle,
- planning and implementation of a new or modified service,
- specification of IT service processes.

The second part of the standard [ISO/IEC 20000] in greater detail defines the practices which add up to IT service management according to the outline defined in part 1.

Part 3 has also been published [ISO/IEC TR 20000].

Successive parts have also been published:
- ISO/IEC 20000–4 Process Reference Model,
- ISO/IEC 20000–5 Incremental Conformity based on ISO/IEC 20000.

The sixth part of the standard defines maturity levels for ISO/IEC 20000 in compliance with the ISO/IEC 15504 standard. ISO/IEC 20000–1 defines the set of the most important IT processes, among others associated with:
- managing and reporting the levels of services,
- accessibility, capacity and business continuity management,
- budgeting and IT cost calculation,
- business relationship management (customers/suppliers),
- information security management,
- configuration and change management.

As the result of the abovementioned facts the ISO/IEC 20000 standard is a good basis for an IT quality management system or a comprehensive objective audit in the area of IT services. It is also possible to integrate the ISO/IEC 20000 standard with ISO 9001 (quality management) – it may be treated as guidelines for IT companies which implement the ISO 9001 quality management system.

The ISO/IEC 20000 standard is the only official standard within the area of IT service management. It should be treated as a set of objectives for the

IT area, whereas ITIL remains to be a set of answers associated with activities necessary for their realization.

The basic scope of processes defined in ITIL and ISO 20000 is convergent – the most significant difference between these two documents is related to comprehensiveness and purpose. In ITIL each main process is described in a different publication along with exemplary tips associated with its interpretation and implementation. The ISO/IEC 20000 standard, on the other hand, aims at standardizing the IT area, hence, defines requirements for quality management.

6.2. Quality Management Systems in Medical Industry

The lives of patients surely depend on: doctors' efficiency, experience and intuition, but also to increasingly greater extent on efficient medical equipment as well as procedures associated with its use. The legislator, the authors of technical standards related to medical equipment and the authors of organizational standards begin to protect the health and safety of patients, eliminate trade barriers and promote global harmonization.

In 1993 the medical industry for the first time published a European EN 46001/12 standard. This standard supplemented the ISO 9001 requirements with specific requirements associated with medical products. Initially, the EN 460001/2 standard was planned to be a dependent supplement of ISO 9001 and amount to a basis for the certification of medical products.

In 1996 the EN 46001/2 standards were replaced with ISO 13485:1996. The scope of certification was not (and still is not) limited to medical equipment manufacturers. The ISO 13485 is accepted all over Europe as its scope also embraces fulfillment of legal requirements.

In 2000 in the area of health care there was a new edition of the EN ISO 13485:2000 standard entitled Quality Systems – Medical Devices – Particular Requirements for the Application of ISO 9001 (amendment of EN 46001:1996, identical to ISO 13485:1996) prepared by the ISO/TC 210 Liaison Committee. The new edition formulated particular requirements for suppliers of medical devices (the requirements were more specific than the ones included in ISO 9001). This standard is applied when there is a need to evaluate the quality system of a medical devices supplier. Together with the ISO 9001 standard it defines requirements associated with design, development activities, production, installation and servicing of medical devices.

In 2003 the requirements for regulatory purposes and the ISO 13485:2003 standard entitled Medical Devices – Quality Management Systems – Require-

ments for Regulatory Purposes (Polish equivalent: PN-EN 13485:2004(U)) were published. A year later a technical report was created – ISO/TR 14949:2004 Medical Devices – Quality Management Systems – Guidance on the Application of ISO 13485:2003.

In 2003 there was also another standard published in reference to medical laboratories – ISO 15189:2003 Medical Laboratories – Particular Requirements for Quality and Competence (Polish equivalent: PN-EN 15189:2003 (U)).

Another standard published in 2003 by the International Organization for Standardization was ISO 15195:2003 Laboratory Medicine – Requirements for Reference Measurement Laboratories. This standard may amount to the basis of the accreditation of a reference measurement laboratory. This type of laboratories are normally accredited by national measurement institutes or international accreditation organizations.

6.3. Quality Assurance for Supplies in Aerospace Industry on the Basis of the AS9000 Standards

Due to its specificity the aerospace industry in principle must produce devices of maximal safety and reliability as the consequences of improper quality may be fatal for human beings. Therefore, one of the key industrial quality management systems is the standard associated with aerospace – AS9100. This standard was established in January 2004 and his origins date back to 1996 when the SAE (Society of Automotive Engineers) published the ARD 9000 standard.

The following organizations were the main participants in the preparation of this standard [AS9000]:

- AlliedSignal,
- Allison Engine Company,
- Boeing,
- General Electric Engines,
- Loskheed Martin,
- McDonell Douglas,
- Northrop Grumman,
- Pratt & Whitney,
- Rockwell – Collins,
- Sikorsky Aircraft,
- Sundstrand.

Another stage of the standard's development was the publication of the AS9100 standard in November 1999 on the basis of ISO 9001:94, AS9000 and EN

9000–1:94 [Klimczak 2006]. In August 2001 another amendment entitled AS9100 rev. A included references to the IS0 9001:94 and ISO 9001:2000 standards. The present edition of the standard is based on ISO 9001:2008 [PN-EN 9100:2009].

AS9100 Rev. C replaced the previous edition. The reason for the modification was the need to embrace the requirements of the ISO 9001:2008 standard. Industrial requirements, definitions and remarks were also modified. In addition, AS9100 Rev. C includes the rules of quality management defined in ISO 9000 and ISO 9004.

The guidelines included in the AS9100 standard are also applicable for suppliers in the aerospace industry regardless of their specificity or supplied equipment.

Implementation and certification in compliance with the AS9100 series standards is the basis for registration in the IAQG-OASIS (Online Aerospace Supplier Information System) – expectedly only companies from this database will be authorized to supply devices and services for the aerospace industry.

Many efforts have been made to assure that the AS9100 requirements were accepted and adopted not only by American plane producers and first equipment suppliers but also by European, Asian and South American enterprises [Vianna 2006]. In this regard three leading aerospace organizations – the Americas Aerospace Quality Group, the European Aerospace Quality Group and the Asia Pacific Aerospace Quality Group – together created the International Aerospace Quality Group. These organizations are responsible for promotion, supervision and development of the AS9100 standard.

The AS9000 standard is accepted by experts as an extremely significant enhancement of quality systems in the aerospace industry.

New standards amount to an important step towards unification and consolidation of the quality management process in the aerospace industry. Among advantages related to the implementation and the certification of AS9000[26] we may enumerate:

[26] The first company which received the certificate of compliance with the AS9000 was Phoenix Specialty Manufacturing Co., Inc. in South Carolina. The certificate was issued on 12 August 1997 by BVQI. Phoenix Specialty Manufacturing employs 118 people and has a 90-year-old tradition. The enterprise is a supplier on the automotive and aerospace markets and produces, among others headlights and indicators, different types of washers and various metal elements of engines. The company is the key supplier of devices for GE Aircraft Engines and plays an important role on the automotive market. Phoenix Specialty Manufacturing does not produce ready-made devices for installation, but elements used in order to manufacture final subassemblies. The company has received the ISO 9002 and QS-9000 certificates.

- demonstration of compliance with the commonest standards in the nearest past – ISO 9001 and additionally meeting particular requirements for the industry,
- managing the enterprise in a way that proves conformity with even the strictest requirements at all times,
- establishing a certain agreement in order to improve quality on the aerospace market by unifying and limiting many former requirements,
- supporting the conception accepted by the biggest producers.

6.4. Systematic Quality Management for Telecommunications Industry Suppliers on the Basis of TL 9000

TL 9000 Quality System Requirements and TL9000 Quality System Measurements amount to the basis of quality management systems in the telecommunications industry. TL 9000 was created by the members of Quality Excellence for Suppliers of Telecommunications Forum (QuEST Forum) from all over the world. QuEST Forum helps its member organizations in their struggle for quality and perfection in functioning in the area of global communication through implementation of the same quality standard, cooperation in global workgroups, emphasizing the role of applying the best practices for the industry as well as assuring the latest measurement system.

TL 9000 was created in 1996 in the United States of America on the initiative of carriers, producers, manufacturers and telecommunications suppliers. The standard was developed by the QuEST Forum (Quality Excellence for Suppliers of Telecommunications). The QuEST Forum at present consists of:

- 23 carriers (e.g. Bell, British Telecom, Deutsche Telekom, France Telecom),
- 65 hardware suppliers (e.g. Alcatel, Lucent Technologies, Motorola, Nokia, Siemens, Marconi, Intel, Agilent),
- 46 organizations cooperating within the scope of quality management.

The latest edition of the standard was published on 15 November 2009. The TL 9000 standard embraces all requirements of ISO 9001 and is supplemented with 92 industrial requirements. It consists of two parts – Requirements and Measurements – which are divided into particular requirements/measurements for hardware suppliers (Hardware), software suppliers (Software) and services suppliers (Service). TL 9000 defines particular requirements in a way based on the ISO 9001:2008 standard; TL 9000 has a multilayer structure:

- ISO 9001;
- TL 9000 shared requirements;

- requirements associated with a quality management system in reference to specific hardware, software or services;
- shared measurement of TL 9000;
- measurements of a quality management system in reference to specific hardware, software and services.

It is the only standard which includes a uniform set of over 150 measures for evaluating products and services for the whole industry. Companies which implement the TL 9000 system select measures relevant for their scope and use them in order to evaluate the achieved quality level.

The set of measures, shared by all companies, enables comparison of the achieved quality level with other companies from the same sector. Each company which has the TL 9000 certificate every three months delivers its data to the trust center of the QuEST Forum (University of Texas in Dallas). Data are encoded and processed as result of which information about present values of measures is received (maximal, average and minimal values for each measure). In a sense, a certified enterprise automatically gains access to benchmark data from all over the world. Exemplary measures which have to monitored by enterprises with quality management systems based on TL 9000 may be: Number of Problem Reports (NPR), Problem Report Fix Response Time (FRT), Overdue Problem Report Fix Responsiveness (OFR), On-Time Delivery (OTD), Return Rates (RR). TL 9000 certificates are issued in three categories:

- hardware producers (TL 9000-HW),
- software producers (TL 9000-SW),
- services (TL 9000-SC).

Any combination of the certificates enumerated above is possible.

6.5. Normative Basis for Quality Management in Automotive Industry

Industrial standards play increasingly significant role in supplier qualification processes. Similarly, it is the case in the automotive industry. The most important standard associated with the quality management system is the ISO/TS 16949:2009[27] technical specification. It was created by the IATF (International Automotive Task Force) in cooperation with Japan Automobile Manufacturers Association, Inc. (JAMA) and ISO/TC 176 (Quality Management and Quality

[27] In the present chapter the term "technical specification" is used a synonym of ISO/TS 16949.

Assurance Liaison Committee). Among signatories to the technical specification there are Fiat, Ford Motor Company, BMW-Group, DaimlerChrysler, General Motors Corporation, PSA Peugeot – Citroen, Renault, Volkswagen. The aim of ISO/TS 16949 was the unification of requirements indicated by relevant standards of a similar character. It is not the only standard to which OEM refer to. The following norms should be enumerated hereby: American QS-9000, Italian AVSQ, German VDA 6.1, French EAQF. In Figure 1 the evolution of normalized basis of quality management systems in the automotive industry is depicted.

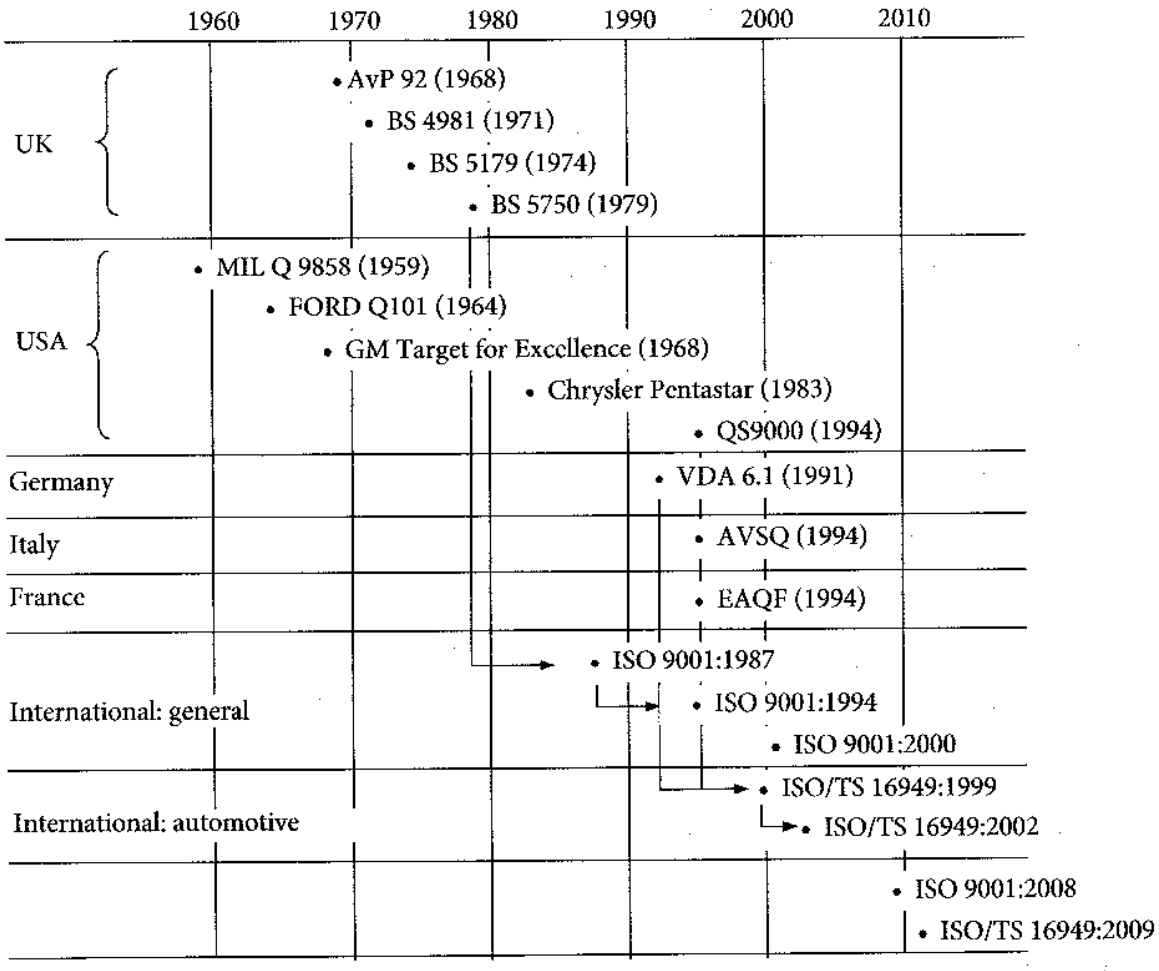

Figure 5. Evolution of standards associated with systematic quality management in the automotive industry

Source: On the basis of [Łuczak 2008]

It appears to be worthwhile to provide a brief overview of the standards enumerated above; however, QS-9000 is not in use any more as well as AVSQ and EAQF are honored only by some OEM. The history of the standards is the

history of modern rules of quality management in the automotive industry. Each of these standards to some extent contributed to the present form of ISO/TS 16949 and the quality management system certification process of compliance with the standard.

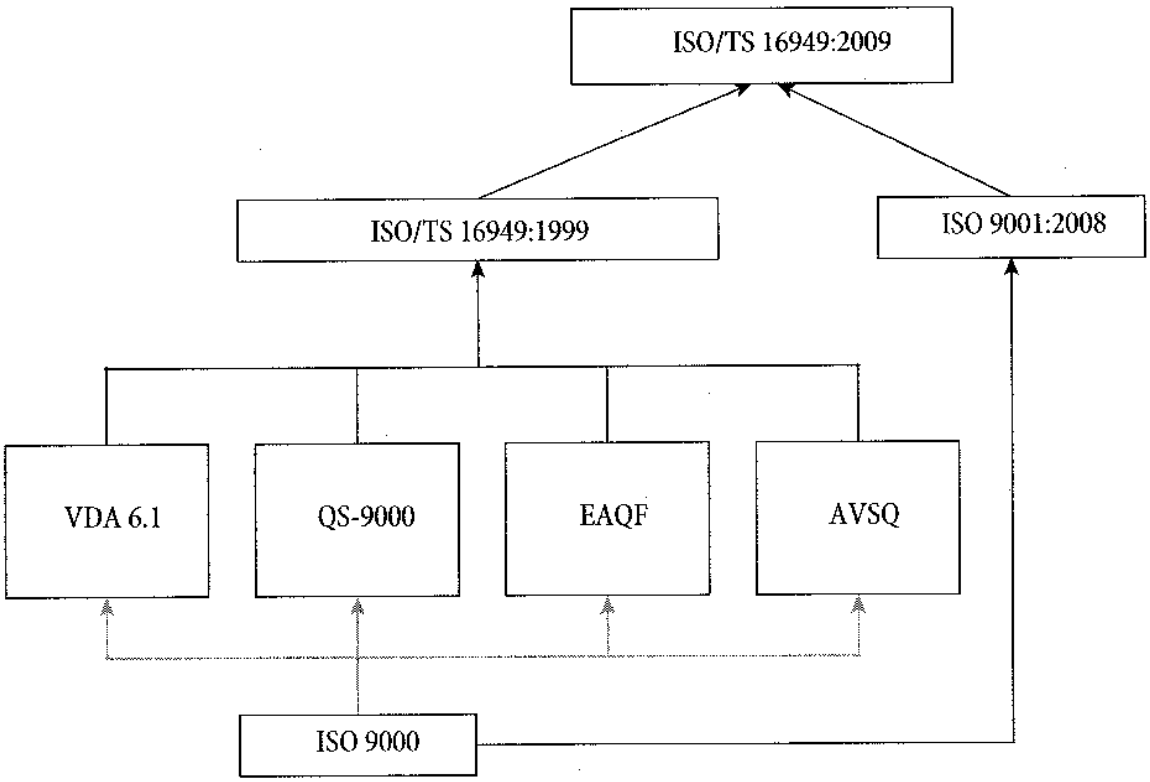

Figure 6. Correspondence between standards associated with quality management in creating ISO/TS 16949:2009

Source: On the basis of [Łuczak 2008]

After the analysis of requirements and commonness of standards within the scope of quality management in the automotive industry, it may be stated that the most insignificant standards are the Italian AVSQ and the French EAQF. They did not become internationally accepted, by contrast with VDA 6.1 and QS-9000 which turned out to be not only more frequently required but also went beyond the group of signatories and began to be used by other OEM. However, a smaller number of certificates and OEM accepting the standards as the basis for their quality management systems does not decrease their role in the supplier qualification processes or shaping the ISO/TS 16949 standard.

The leading standard whose requirements have to be met by suppliers in the automotive industry is ISO/TS 16949. The standard is the ISO technical

specification for the automotive industry created in cooperation with a group of producers. The technical specification unified the American QS-9000, Italian AVSQ, German VDA 6.1 and French EAQF standards related to systematic quality management within the scope of design, production, installation and servicing in the automotive industry.

The requirements defined in the ISO/TS 16949 are associated with production and services realization for OEM and other clients in reference to first-installation products. The following suppliers may apply for certification:

- suppliers of production materials and raw materials (OE);
- suppliers of thermal treatment, welding, painting, coating and other forms of surface treatment;
- installation suppliers;
- OES suppliers (OES).

The technical specification in its structure accords with the content of ISO 9001 and includes all the requirements of the standard. Moreover, particular requirements for the automotive industry amount to an extension of the ISO 9001 particular requirements or add up to completely new ones located at specific parts of the technical specification. They are also significant due to remarks which include commentaries to the requirements and solutions. The most important particular requirements included in ISO/TS 16949:2009, are indicated in Table 3 [ISO/TS 16949 Implementation].

Table 3. Particular requirements for the automotive industry included in ISO/TS 16949:2009

Particular requirements	ISO/TS 16949
Technical specifications	4.2.3.1
Process efficiency	5.1.1
Quality objectives – supplemental	5.4.1.1
Responsibility for quality	5.5.1.1
Customer representative	5.5.2.1
Product design skills	6.2.2.1
Employee motivation and empowerment	6.2.2.4
Plant, facility and equipment planning	6.3.1
Contingency plans	6.3.2
Personnel safety to achieve conformity to product requirements	6.4.1
Cleanliness of premises	6.4.2
Acceptance criteria	7.1.2
Confidentiality	7.1.3

cont. Table 3

Particular requirements	ISO/TS 16949
Change control	7.1.4
Special characteristics (designated by the customer)	7.2.1.1, 7.3.2.3
Review of requirements related to the product – supplemental	7.2.2.1
Customer communication – supplemental	7.2.3.1
Multidisciplinary approach	7.3.1.1
Product design input	7.3.2.1
Manufacturing process design input	7.3.2.2
Product design output – supplemental	7.3.3.1
Manufacturing process design output	7.3.3.2
Design and development validation – supplemental	7.3.6.1
Prototype programme	7.3.6.2
Customer-approved sources	7.4.1.3
Supplier monitoring	7.4.3.2
Control plan	7.5.1.1
Work instructions	7.5.1.2
Verification of job set-ups	7.5.1.3
Validation of processes for production and service provision	7.5.2
Identification and traceability	7.5.3
Customer-owned production tooling	7.5.4.1
Measurement system analysis	7.6.1
Laboratory requirements	7.6.3
Identification of statistical tools; knowledge of basic statistical concepts	8.1.1, 8.1.2
Quality management system audit; product audit	8.2.2.1, 8.2.2.2, 8.2.2.3
Monitoring and measurement of manufacturing processes	8.2.3.1
Layout inspection and functional testing	8.2.4.1
Control of nonconforming product – supplemental; control of reworked product	8.3.1, 8.3.2
Customer waiver	8.3.4
Analysis and use of data	8.4.1
Continual improvement of the organization; manufacturing process improvement	8.5.1.1, 8.5.1.2
Problem solving	8.5.2.1
Corrective action impact	8.5.2.3

Source: On the basis of [ISO/TS 16949:2009].

The number of particular requirements (beyond the ISO 9001 standard) amount to new methods, tools and solutions which must or should be applied in a supplier's quality management system.

6.6. NATO Requirements within the Scope of Quality Management

Since the North Atlantic Treaty Organization was created its member states have monitored the quality of supplied products in the whole supply chain[28]. The monitoring of actions was mainly focused on suppliers who were responsible for meeting particular requirements related to quality management. The basis of their systems were normalizing documents of individual states which were evolving for many years, e.g. American standards MIL-STD (Military Standard), British standards BS (British Standard), as well as NATO publications of AQAP (Allied Quality Assurance Publication) type – a set of quality requirements to be included by the client in their contracts.

The aim of NATO within the scope of quality assurance of supplies is the establishment of a system in which all the elements of the supply chain, regardless of the supplier's location, would be able to manufacture and deliver reliable and material-saving product for the army. In order to meet such assumptions there was created a quality policy which embraces: full responsibility of all involved parties (user, client, supplier and personnel responsible for monitoring in the frames of GQA) for the quality of the product in the whole life cycle, assessment and controlling the risk related to the realization of the contract, on the basis of which the decision about Government Quality Assurance is made. A supplier plays a particular role in this system – they should have an implemented quality management system according to a relevant AQAP contract type. An organization's benefits resulting from its functioning in the quality assurance system in compliance with AQAP may be as follows: bigger competitiveness on the market, meeting clients' requirements, reducing the risk associated with realized undertakings, assuring traceability of realized processes, increase of effectiveness and efficiency of processes (Certification criteria in compliance with requirements of AQAP 2110, AQAP 2120, AQAP 2105, AQAP 2210).

Since 1987, when the ISO standards 9000 series were published, members of the NATO acknowledged and included them in NATO publications related to supplier quality management systems. It began the publications of amended and developed AQAP standards – Allied Quality Assurance Publication.

The amendment of AQAP, which took place in 2003, accepts the ISO 9001:2000 standard as a reference model. As the main aim of publishing documents of AQAP type is to use them within the scope of contracts (the requirements were not replaced with one document). The philosophy of the

[28] On the basis of: [R&S Kompleksowe zarządzanie jakością 2008].

ISO 9000:1994 standard was retained – it divides the scopes of application. The remaining characteristics of the new approach to quality management according to ISO 9001:2000 were fully used. In 2005 there was created the new AQAP 2105 associated with the rules of quality plan development. In 2006 and 2009 new amendments were added, hence, the following contract documents are in force:

- AQAP 2110:2009 – NATO Quality Assurance Requirements for Design, Development and Production,
- AQAP 2120:2009 – NATO Quality Assurance Requirements for Production,
- AQAP 2130:2009 – NATO Quality Assurance Requirements for Inspection and Test,
- AQAP 2210:2006 – NATO Supplementary Software Quality Assurance Requirements to AQAP 2110,
- AQAP 2105:2005 – NATO Requirements for Deliverable Quality Plans.

The most important supplements in reference to the ISO 9001 standard are:

- limiting the risk for all stages of the realization of the contract,
- product configuration management,
- necessity to define contract management in the case of confidential information,
- support of the government quality assurance,
- focus on a customer's needs.

The following publications are also useful at the stages of design, documenting and implementing a quality management system of supplies: AQAP 2009:2006 – NATO Guidance on the Use of AQAP 2000 Series, AQAP 2131:2006 – NATO Quality Assurance Requirements for Final Inspection, AQAP 2105:2005 – NATO Requirements for Deliverable Quality Plans, AQAP 2210:2006 – NATO Supplementary Software Quality Assurance Requirements to AQAP 2110.

In order to assure control and monitoring of the quality management system of supplies in the NATO member states the STANAG 4107 (edition 7) is in force. It defines the rules of monitoring the quality management system of supplies called Government Quality Assurance and introduces the AQUAP (2000) – NATO Policy on an Integrated Systems Approach to Quality through the Life Cycle.

Owning an AQAP certificate is required in enterprises which manufacture products or provide services within the scope of Government Quality Assurance. Moreover, this certificate may be required of suppliers who realize their services or deliver products for the army. The certification body, which

has been indicated by the Ministry of National Defence to cooperate with the Polish National Institution for Quality Assurance, i.e. with the Military Centre for Standardization, Quality and Codification, is the Department of Quality and Management Systems.

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