

Design of Quality Management Systems in Vertically Integrated Structures

Effective Management: Quality, Lean, Risks

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For efficient operation of any corporation it needs to create a vertically and horizontally integrated quality management system, consisting of four management levels: corporation, divisions, organizations and suppliers. At each level it is necessary to identify objectives, tasks, systems and set their relations.

Quality management infrastructure at corporate level combines quality policy infrastructure and quality management system information and culture infrastructure.

Divisions set objectives, assess level of their achievement, control accuracy of report information and create motivation systems for organizations.

Organizations manage quality through their quality management systems, fulfilling customer requirements to product quality, deadlines and delivery, as well as division requirements to development of quality management system.

Quality starts with responsibility of the first person of a company. System approach then sets responsibility of all and everyone, differing collective and personal responsibility. Total quality management and total cost management change views on assigning manager responsibilities. Responsibility for quality and cost is treated as a system.

Assignment of responsibility for quality through management levels is done in accordance with applied quality management infrastructure. Executive responsibility means performance of working requirements, standards and initiating improvement proposals.

Process management is characterized by concept of in-built quality and integration of quality management system and Lean. In-built quality enables fulfillment of all customer requirements to quality at the stages of design development, technology development and production preparation.

Design of quality management systems in vertically integrated structures requires new approaches to managerial decisions and differs greatly from designing quality management system for ordinary manufacturing companies.

Key words: system approach, presumption of responsibility, quality management systems, quality management structure, QMS generations.

1. Approaches and specifics

when creating quality management in vertically integrated structures

Quality management in vertically integrated structures requires clarification of some terms and definitions in the sphere of quality management: **QMS** – quality management system of organizations, participating in Life Cycle (LC), **CQMS** – corporate quality management system; **DQMS** – divisional quality management system; **QMSO** – QMS of organizations, included in divisions.

To create a vertically integrated structure it could be used the following **approaches: System approach, System of systems approach, Presumption of responsibility (PoR).**

- **System approach**(alternative to functional approach) –assignment of roles, authorities, responsibilities through corporation. Systems must have the following features: frames, autonomy, links to other systems through controlled input and output, system owners, having authority and responsibilities. It is assumed, that QMS has all these traits. System approach defines responsibility of all and everyone, distinguishing collective and personal responsibility.

- **Presumption of responsibility (PoR)** initially suppose that process or system owner:

- 1) Understands requirements to inputs and outputs;
- 2) Is capable (has authorities, resources, competencies) of controlling process, system;
- 3) Detect errors, nonconformities, process/system problems;
- 4) Evaluates risksofnonconformityandcaninfluencethem;
- 5) Is allowed to stop processes, if nonconformity risk is higher than acceptable;
- 6) Initiate corrective activities in case of nonconformities, problems;
- 7) Recognizes and declares that the stated conditions are sufficient to take the responsibility for process conformance to output requirements, and if risks increase, for notification and/or termination of process.

In all cases process or system owner responsibility includes receiving claims on problem from customer, referred to his area of responsibility, but identified in other processes, systems, as well as take part in finding causes, problems and corrective actions to eliminate them.

Errors, nonconformities are not treated as faults of process/system owner. Whileconcealingordistortion of information, inactivity when problems arise, intentional violation of working standards are viewed as guilt, and in such cases punishment shall considered.

PoRapproachisusedtodistinguish responsibility between control levels in vertically integrated systems, in LC processes between LC stages,and inside organizations between CEOand quality manager, as well as between owners of separate processes.PoRis also the basis for efficient application of feedback loops, includingPDCA.

- **System of systems**– recognition ofautonomy, entirety of organization QMS and personal responsibility of managers for their actions. Quality management from higher level organizations is done through:a) setting objectives for efficiency and maturity indicators;b) setting QMS requirements.(That means systems interacting only through controlled inputs and outputs).

When creating quality management in vertically integrated structures it is need to consider **some specifics** of quality management systems in multilevel organizations (holding companies):

1. **Creating quality management systems** at all levels of vertically integrated structure: corporate, divisional, level of organizations, included in divisions, and participating in LC (Life Circle) (supplier-companies) (Figure 2).
2. **Development of quality management systems**at every level of vertically integrated structure, as the main instrument for solving quality tasks.
3. **Assignment of responsibility and authority**in quality questions at company levels and LC processes.
4. **Integration of QMS, production systems, cost management.**
5. **Setting QMS efficiency indicators**andcreating a system for management of the quality, spreading objectives, tasks, responsibility through all levels: corporate, divisional, level of organizations, included in divisions, and participating in LC.
6. **Deployment of corporate quality management system**through LC processes. System of quality guarantees for interested parties.
7. **Creating CQMS, considering law aspects:** contracts, corporate, administrative law.

Main task is to create a vertically and horizontally integrated quality management system, comprising four management levels: corporation, divisions, organizations and suppliers. At each level it is necessary to identify objectives, tasks, systems and set their relations (Figure 1, Figure 2).

2. Problems and objectives of QMS in multi-level organizations

For the majority of big companies, having specialized divisions and producing various diversified products are typical the multilevel quality management (Figure 1).

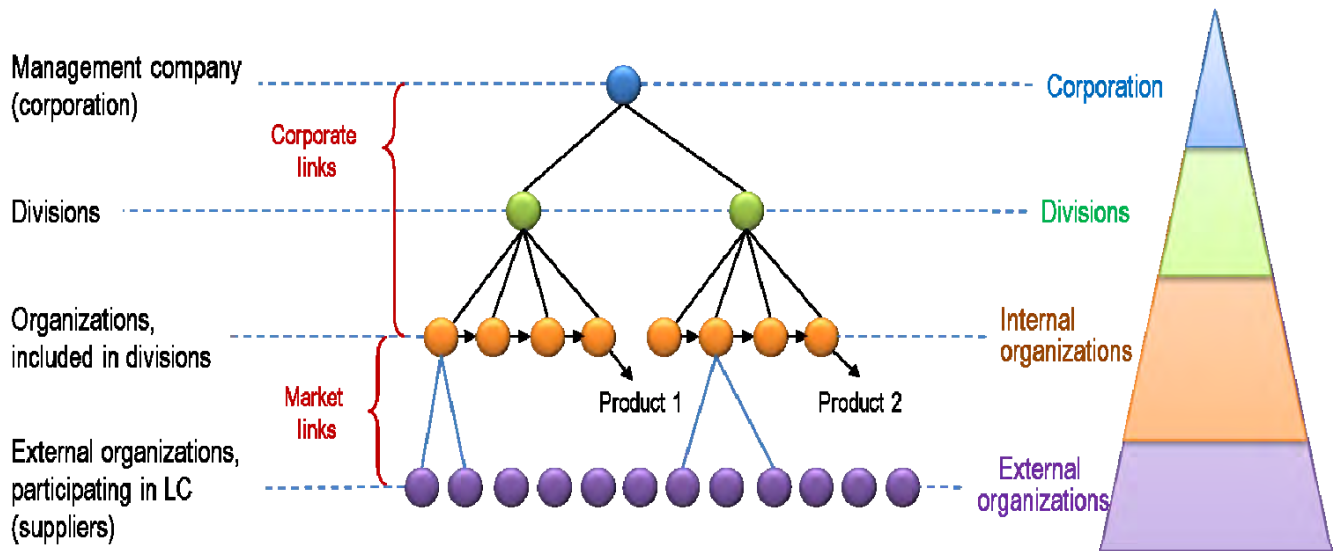


Figure 1. Multi-level quality management model

Although center of quality works is focused in organizations, responsible for manufacturing products, certain tasks appear at higher management levels. Basic is the recognition of impact of quality on corporation brand and high sensitivity of brand to quality failures of any separate products, produced under one brand.

For example, let's name VW Group, whose failure of a separate product led to decrease of cost of company stock. Toyota, Boeing and others have faced similar problems.

Often QMSs in organizations are non-uniform and have different maturity levels. Applied assessment methods, in particular, QMS certification, are non-valid and non-informative.

The main problems of quality management systems in the organization are based on the fact that there are no definitive answers to these questions:

- What is a quality management system of an organization? All quality management systems (QMS) of organization are certified, but all systems are different and no one knows their features.
- Who and how should manage QMS, even if they are certified? Certification is only the beginning of quality works, and not the end.
- Can managers of high integrated structures interfere in its (QMS) work?
- Is quality management system of organization an autonomous system or not?

Distribution of tasks through levels: holding – division – organization – suppliers could give some answers, but is a difficult task. A certain model of quality management system is applied at every level, including application of its available controls (Figure 2).

		Quality management system	Main role in the system	Aim	Object of management
Control levels of quality management system	1 Corporate center Corporate management	CQMS corporate QMS	Creating quality management infrastructure, that combines quality policy infrastructure and quality information infrastructure, as well as resources for their development.	Brand quality	Infrastructure of quality policy, culture, quality information
	2 Divisions	DQMS divisional QMS	Management of QMSO efficiency and maturity: objectives for QMSO, as well as programs of transformation to new generations of quality management systems.	QMSO efficiency	QMSO as an entire autonomous system
	3 Quality works center Organizations, included in divisions	QMSO QMS of organizations, included in divisions	Product quality management through QMS. Achievement of objectives by indicators (KPI) of QMSO efficiency.	Product quality, QMSO objectives	Processes, process systems
	4 External organizations, participating in LC	QMS QMS of external organizations, participating in LC	Delivery quality management. Realization of objectives and requirements of CQMS and DQMS.	Delivery quality	Delivery quality requirements, acceptance, audits, certification

Figure2. Control levels of quality management system

Brand quality and quality management infrastructure are formed at **corporate level**. Quality management infrastructure at corporate level combines quality policy, culture, information infrastructure (Figure 3).

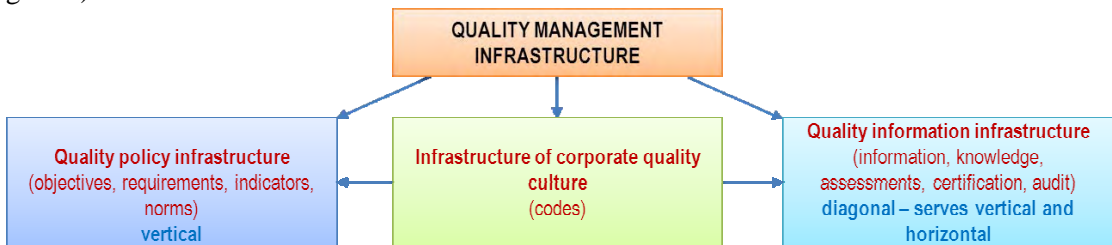


Figure3. Quality management infrastructure

Quality policy infrastructure combines requirements standards, QMS creation manuals, target figures, audits and system assessments, development indicators, as well as development programs and monitoring (Figure 4).

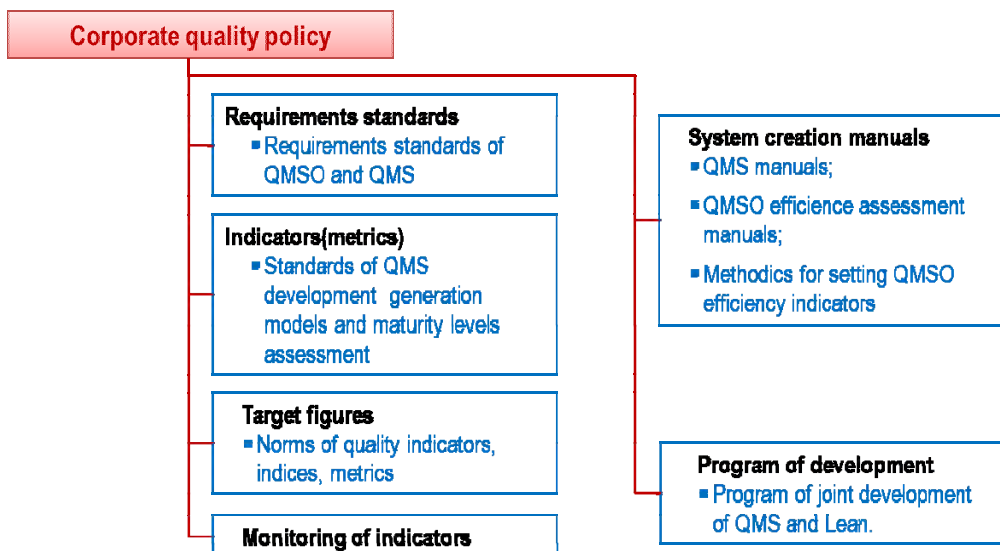


Figure 4. Corporate quality policy

Infrastructure of corporate quality culture forms codes that set principles and values, treating quality as a value (Figure 5).

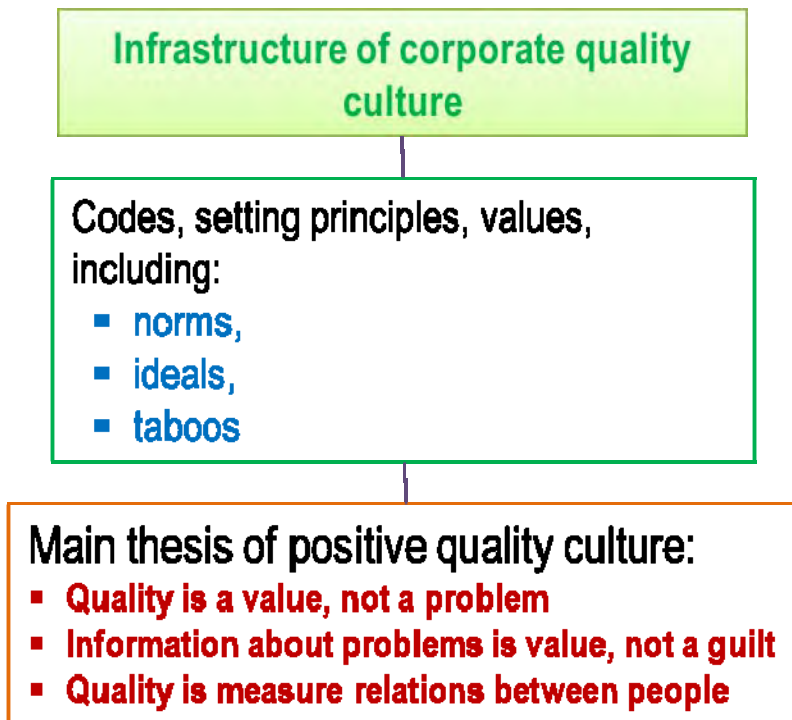


Figure 5. Corporate quality culture infrastructure

Quality information infrastructure combines information about QMS activity assessment at all levels, as well as information about knowledge, acquired by personnel during trainings, seminars and consulting (Figure 6).

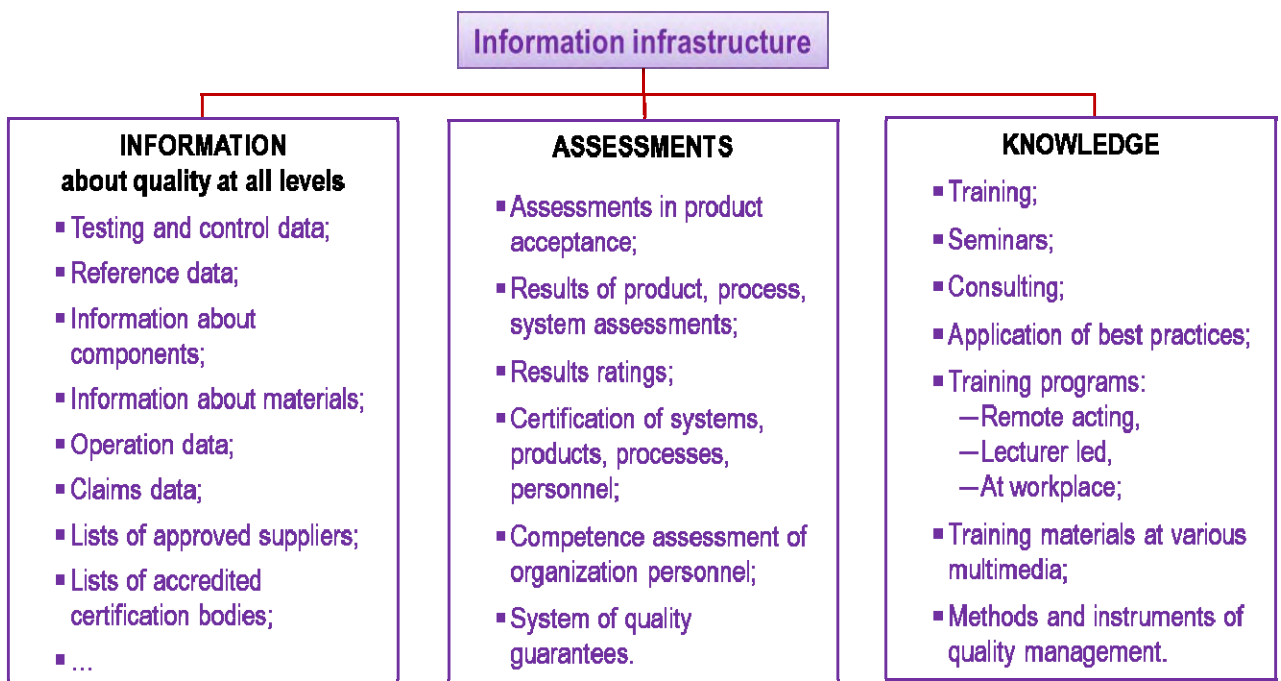


Figure 6. Information infrastructure

Resources, directed to the development of quality policy infrastructure, corporate culture and quality information infrastructure, are emphasized at corporate level (Figure 7).

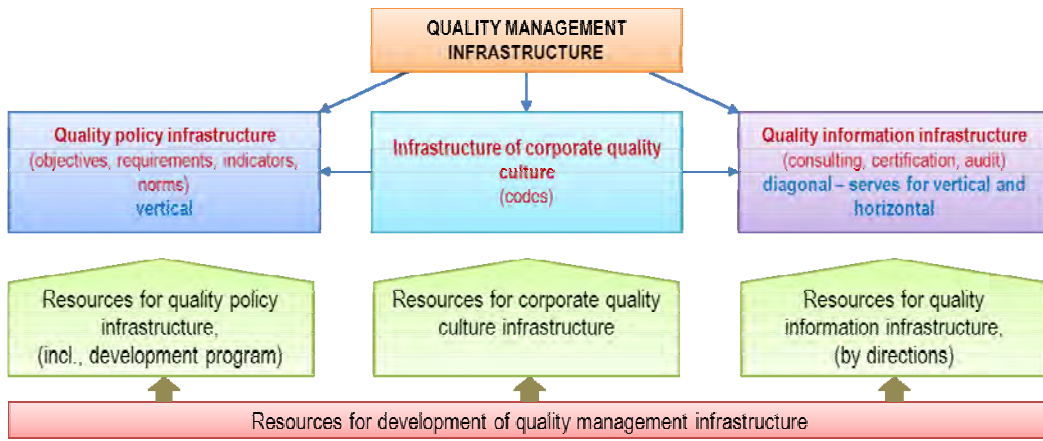


Figure 7. Quality management infrastructure

Efficiency and organization QMSs maturity management, efficiency and maturity objectives management, ascension programs through QMS generations are made at **divisions**'level. As a whole, QM atdivisions'level assumes the following tasks:

- Setting QMS efficiency and maturity objectives of organization, included in division (QMSO).
- Creating program for QMSO development.
- Creating program for personnel training.
- Assessing achievement of objectives by organizations (companies) on the basis of self-assessment.
- Control of reliability of report information about quality and objectives achieved.
- Motivation to fulfillment of quality objectives.
- Indices and Indicators.

3. Quality Indices and Indicators

Effectiveness management of organization quality management systems is done on the basis of complex targeted approach with quality indices and indicators (Figure 8).

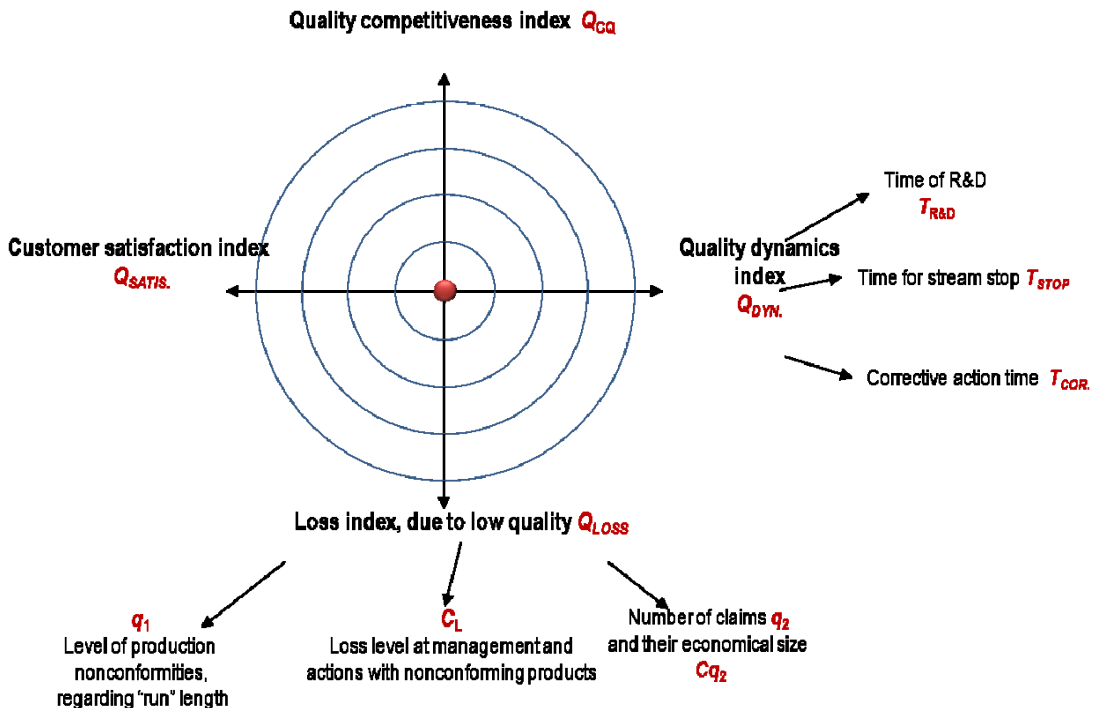


Figure8. Quality competitiveness index

Indices, shown in Figure8, allow evaluating effectiveness and efficiency of QMS and applied System of System approach, when DQMS controls QMSO through setting objectives on indicators and gets reports upon their achievement.

Organizations manage quality through QMSO, fulfilling customer requirements to product quality, deadlines and delivery, as well as division requirements to QMSO development:

- Create, develop and improve their QMSO on the basis of standards and manuals requirements, applied in corporation, level, as well as objectives, set by divisions for QMSO efficiency indicators;
- Conduct process system management according to QMSO;
- Achieve objectives for QMSO efficiency and maturity;
- Report on the level of objectives achievement and corrective actions, implemented when objectives are not fulfilled;
- Are responsible for reliability and accuracy of initial information about achieved indicator data;
- Support quality guarantees for product and QMSO characteristics.

Thereby development of vertically integrated system includes solving the following **objective**:

Distribution of tasks through levels on the base of Presumption of responsibility – initial supposition that personnel at all levels understands and assumes the responsibility for quality (personally and collectively).

To achieve this it is necessary to take into consideration the Classification of QMS by generations of development and maturity levels. 4 maturity generations of QMS are considered here.

4. QMS Generations

Classification of QMS by generations is connected with development of QM, shown in Figure9, and reflects the reality when in one corporation and division QMSs, having certificates of conformance, for example, ISO 9001-2005, can actually belong to different generations. QMSs of different generations can be characterized by evaluation of maturity levels, for example, as it is proposed in IRIS [3], and use these indicators and their evaluations to manage QMS maturity, also through their transformation from 1st, 2nd generations to 3rd, 4th generations.

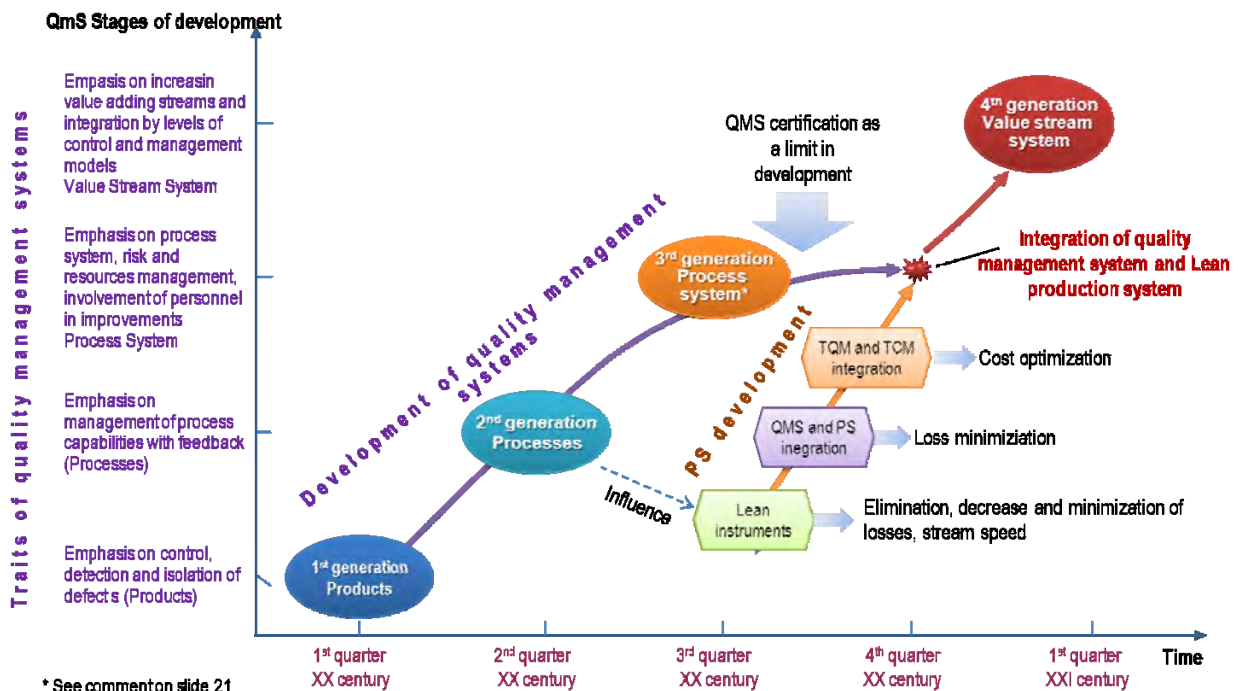


Figure9. QMS Generations

Quality management at the level of suppliers is well detailed, in particular, in such standard approaches as automotive, aerospace, railway industries (ISO/TS 16949 [1], ASEN 9100 [2], IRIS [3]). As a rule, big corporations use standards and manuals and supplement them with their own requirements.

Conclusion

This presentation studies approaches to development of vertically integrated quality management systems of big multi-level organizations. They have shown to be productive in a number of such systems in practice, allowed to clearly distinguish objectives, tasks, roles, responsibilities, authorities among participants of the system, to increase controlling of corporate quality management systems, to eliminate discrepancies and uncertainties, appearing between managers of different management levels.

References

- [1] ISO-TS 16949-2009 Quality management systems - Particular requirements for the application of ISO 9001-2008 for automotive production and relevant service part organizations
- [2] AS/EN 9100 Aerospace Quality Management
- [3] IRIS International Railway Industry Standard