QUALITY MANAGEMENT IN OPEN INNOVATION PARADIGM CONTEXT

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Abstract

This chapter aims at discussing quality-related issues in the Open Innovation (OI) environment. The chapter is divided into two separate subchapters, where the first addresses the history and culture of quality, quality engineering and management tools and methods, as well as Business Excellence (BE) models and performance measurement. A separate part is dedicated to organisational processes and structures, information flow, quality-related competencies, responsibilities and authorities. The second subchapter focuses on Open Innovation organisations' Quality Management System (QMS) models and the Open Innovation maturity perspective. Practical implications of QMS in different situations in the OI environment are summarised, and a mini-case of Faurecia featuring a real-world example is presented. This chapter is a general contribution to interlinking Quality Assurance (QA) with the OI environment. The chapter is primarily intended for students of master's degree programs and MBA students, but would also be useful for PhD students in forming their research, and for a wide range of professionals interested in quality management in OI organisations.

Prerequisite	General knowledge of strategic management, new product development/quality management issues from an introductory course.
Objectives of the lecture	Lecture targets are MSc students in engineering and management and MBAs in management, and aims to provide them with profound understanding of quality management in the context of open innovation.
Workload	4 teaching hours; 8 h self-study.
Learning outcomes	**LO #5 Creativity:** To know how to plan and manage a creative process. Apply creative thinking methods in innovation and personnel management **LO #60 New Product Development:** To understand product and service innovation. To structure a new product development project. To describe and explain individual phases of stage-gate process. **LO #76 Organizational Culture:** To understand the organizational structure and the influence of culture, politics and leadership on innovation and changes. **LO #XX Quality Management System:** Understanding the QMSs and OI business model, related organisational processes and structures, information flow, maturity level evaluation. **LO #XX Quality Management System:** Quality-related competencies, responsibilities and authorities. Knowledge **LO #41:** To analyse case studies related to innovation critically. **LO #42:** To analyse the innovation needs of a company. Skills Understanding quality engineering and management skills, which are needed and can be developed in the Open Innovation context.

	Competences **LO #1:** To recognise, design and analyse innovative business models. **LO #43:** To emphasise the strategic perspective of innovation management. **LO #46:** To recognise and exploit aspects related to open innovation.
Reading List	**Books:** New Frontiers in Open Innovation (Chesbrough & Bogers, 2014) Open Innovation: A Multifaced Perspective (Mention & Torkkeli, 2016) Open Innovation: New Product Development Essentials from the PDMA (Griffin & Noble, 2014). Open Innovation: Researching a New Paradigm (Chesbrough, et al., 2006). A comprehensive guide to "Efficient Open Innovation" (ACE, 2012). **Brochures:** EFQM Framework. Enterprise 2.0 (EFQM, 2016). ASQ Innovation. Think Tank Executive Summary (ASQ, 2013). Faurecia Supplier Reuirements Manual (Faurecia, 2013). Volvo Supplier Quality Assurance Manual (Volvo, 2014). **Articles:** Toward and inter-organisational perspective on managing quality in virtual organisations (Sitek, Seifert & Thoben, 2010). Ideation Through Online Open Innovation Platform: Dell Ideastorm (Mokter & Islam, 2015). Learning before doing: utilising a co-operative role play for quality management in a virtual organisation (Zgodavova, Kosc & Kekale, 1997).
European Qualifications Framework (EQF) Level	Levels 6, 7, 8.

Lecture Content

Definitions

Innovation – A new or changed object realising or redistributing value (ISO, 2015). Activities resulting in innovation are generally managed. Innovation is generally significant in its effects.

Open innovation (OI) – A distributed innovation process based on purposively managed knowledge flows across organisational boundaries, using pecuniary and non-pecuniary mechanisms in line with the organisation's business model (Chesbrough & Bogers, 2014).

Organisational culture – The values and behaviours that contribute to the unique social and psychological environment of an organisation (businessdictionary.com, 2016).

Networked innovation (related to supply chain) – Occurs "through relationships that are negotiated in an ongoing communicative process, and which relies on neither market nor hierarchical mechanism of control" (Swan & Scarborough, 2005 p.6). It is a hybrid form of an organisation with a specific purpose for collaboration and multiple actors involved in the innovation process. The collaboration covers both knowledge transfer and co-creation activities between the actors (Valkokari, Paasi, Lee & Luoma, 2009).

New product development – The creation of products with new or different characteristics that offer new or additional benefits to the customer (businessdictionary.com, 2016a).

Performance – A measurable result (ISO, 2015). Performance can be related either to quantitative or qualitative findings, as well as to the management of activities, processes, products, services, systems, or organisations.

Process – A set of interrelated or interacting activities that use inputs to deliver an intended result (ISO, 2015a) via certain workflow and decision-making practices, to reach strategic business objectives (Pellikka & Kajanus, 2015).

Product – The output of an organisation, which can be produced without any transaction taking place between the organisation and the customer (ISO, 2015).

Project – A unique process, consisting of a set of coordinated and controlled activities with start and finish dates, undertaken to achieve an objective conforming to specific requirements, including the constraints of time, cost and resources (ISO, 2015).

Project management - Planning, organising, monitoring, controlling and reporting of all aspects of a project, and the motivation of all those involved in it to achieve the project objectives (ISO, 2015)

Quality – The degree to which a set of inherent characteristics of an object fulfils the requirements.

The term "quality" can be used with adjectives such as poor, good or excellent and "inherent", as oposed to "assigned", means existing in the object (ISO, 2015).

Quality innovation – An innovation that: (i) has novelty value and is timely; (ii) is practical and can be utilized; (iii) has been developed in a systematic way; (iv) corresponds to stakeholders' current and future needs; and (v) has improved technical, social or commercial performance (qualityinnovation.org, 2016)

Service – The output of an organisation with at least one activity necessarily performed between the organisation and the customer (ISO, 2015).

Supplier quality assurance – Confidence that a supplier's product or service will fulfil its customers' needs (ASQ, 2016).

Virtual organisation – One that (1) does not have physical (bricks and mortar) presence but exists electronically (virtually) on the internet, (2) is not constrained by the legal definition of a company, or (3) is formed in an informal manner as an alliance of independent legal entities (businessdictionary.com, 2016b).

Theoretical background

History and culture of quality in the perspective of Open Innovation

Quality is a relative term for which each person or sector have a definition of their own. According to (ASQ, 2016), quality can have two meanings in technical usege: (a) the characteristics of a product or service that bear on its ability to satisfy stated or implied needs; and (b) a product or service free of deficiencies. Quality definitions can be more easily understood when we distinguish their meaning from the perspective of an adjective[1] and a noun[2].

The *responsibility* for *product* quality was initially on the creator of a simple product. As products became more complex, responsibility was transferred to the foreman and then later to the controller. With the introduction of the *Quality Management System (QMS)* in the ISO 9000 series of standards in 1987 and the *Total Quality Management*[3] *(TQM)* philosophy during the late 1980s, the

[1] The adjective quality applies to objects and refers to the degree to which a set of inherent characteristics fulfils a set of requirements. An object is any entity that is either conceivable or perceivable, and an inherent characteristic is a feature that exists in an object.

[2] The quality of an object (noun) can be determined by comparing a set of inherent characteristics against a set of requirements. The quality of an object depends on a set of characteristics and a set of requirements, and how well the former complies with the latter.

[3] TQM is an approach to management embracing both social and technical dimensions aimed at achieving excellent results, which needs to be put into practice through a specific framework (Bou-Llusar et al., 2009).

responsibility for quality was further moved to top management and specific departments in the organisation, managers of quality, and the "owners" of *processes*.

As the assortment of products and technical product complexity increase, the customers are ever more demanding, and with the development of technologies, their requirements are also changing. Products are developed to meet a broad range of consumer needs. If some users experience unmet needs, they make the adjustments themselves to satisfy their needs, which was introduced by MIT Professor Eric von Hippel in 1986 as "lead user innovation". This term is often mentioned in relation to Open Innovation. User innovation can be found across a wide range of products and services.

Looking at the evolution of quality thinking over the last half century, *innovation* is in fact a natural outcome of quality thinking, although innovation sometimes involves behaviours and thinking that run counter to some practices in quality (ASQ, 2013). According to John Timmerman, Ph.D. Chairman of the ASQ Board of Directors, the science of innovation defines quality of tomorrow. *Quality Innovation* is a new frontier of quality management for competitive advantage.

The term *Open Innovation* (OI) was introduced on 2003 by the Berkeley Professor Henry Chesbrough in the book "Open Innovation The New Imperative for Creating and Profiting from Technology", and since then it has influenced the mindset of companies around the globe. Having initially evolved in the high-tech sector, especially software firms, the OI paradigm has now spread to most industries around the world, and has become a hot topic in innovation communities (ACE, 2012).

Contemporary products have become more modular (Chesbrough, 2003; Marsh, 2011) and standardised, and are carried out along production chains composed of the contributions of different companies (Sitek, Seifert & Thoben, 2010; ASQ, 2013).

From the functional management viewpoint, organisations have proceeded to process management principles, the systems approach and teamwork towards the management of complex *projects*.

We know that quality is the main distinguishing feature, not only among products and *services* but also among people, corporations, nations, and states. However, quality is perceived, understood and evaluated by each individual in their own way, always a little differently, and it is significantly influenced by the culture (Zgodavova, 2015). Likewise, *quality culture* means different things to different people and organisations, and a variety of factors have made the compliance of quality more challenging. Every organisation has a unique culture, and it is virtually impossible to achieve excellence unless a suitable quality culture has been introduced, because culture is the driving force of quality. The perception of the level of quality varies in different cultures, and this affects customer satisfaction (Reimann, Lünemann& Chase, 2008) and also the maturity of customer requirements significantly. For more details about building a culture of Open Innovation you can read on pages 23 – 25 in the (APS, 2012) brochure.

A survey carried within the OI-NET project (Podmetina et al., 2016) showed that about 70% of organisations in a sample of 500 companies from 35 EU countries (large, SMEs, and micro firms) adopted or planned to adopt open innovation activities, including the competencies needed. The ACE (2012) research showed that organisations collaborated mainly on the basis of clusters and ecosystems (read more in (Vanhaverbeke, 2006), collaborative projects, internet platforms and virtual networks in the context of:

- R&D projects (networks and partnership) – read case studies: Faurecia OI: NPD.
- Sharing human capital (cooperation between companies, labs and universities) – read case studies: Faurecia OI: NPD.
- Technology transfer (prototypes, demonstrations and showrooms) – read case study: Electrolux (OI-NET case repository).
- Open business models, such as spin-off/spin-in, licensing, patent transactions – Case studies: Volvo wireless car; Open innovation helps Whirlpool (Muller & Hutchins, 2012).

Within these OI models, it is then possible to use different existing, modified, and also new tools and methods of quality engineering and management. In the same way, it is possible to employ the principles and tools of Quality Management Systems (ISO, 2015a), Occupational Health and Safety Management Systems (ISO, 2016), and Environmental Management Systems (ISO, 2015b), and explore the level of Business Excellence, as well as the maturity and performance of OI in organisations.

Quality engineering and management tools and methods

From the statistical tools to control product quality in the 1940s, quality engineering and management tools and methods moved to the development of the body of knowledge by the American Association for Quality (ASQ), which includes standards, process improvement, product design, total quality management, and performance excellence.

Managers must find a new approach to quality - one that moves beyond the traditional quality management tools of the last century to the specific actions needed to help an organisation shift from a rules-based quality environment to a true culture of quality (Srinivasan & Kurey, 2014).

The Open innovation approach opens the door for co-innovation and creation of networked co-operation by using:

- Modified or generic management system standards – e.g. ISO 9001:2015; ISO 14001:20015; ISO/DIS 45001:2016 and ISO/TS 16949:2016 with five basic core tools: Advanced Product Quality Planning (APQP)[4], Failure Mode and Effects Analysis (FMEA), Measurement Systems Analysis

[4] APQP is a structured approach to product and process design. This framework is a standardised set of quality requirements that enable suppliers to design a product that satisfies the customer. Read more on Quality-One web page.

(MSA), Statistical Process Control (SPC), and Production Part Approval Process (PPAP). Applications can be derived e.g. based on principles of supply chain quality management, see the (iso.org, 2016) brochure and the Faurecia supplier requirements manual (Faurecia, 2013), Volvo supplier quality assurance manual (Volvo, 2014), and the Electrolux supplier quality assurance system and supplier process audit questionnaire (Electrolux, 2007).

• For understanding quality management in a virtual organisation, read the journal articles (Zgodavova, Kosc & Kekale, 1997) and (Sitek et al., 2008).

• Business Excellence Models: EFQM Excellence Model (e.g. for Enterprise 2.0 can be found in the brochure); Malcolm Baldrige Performance Excellence Model or internal Excellence Systems models of the organisation (e.g. Faurecia Excellence System (FES), Whirlpool's Worldwide Excellence System (WES).

• Six Sigma or Lean Six Sigma philosophy and tools – for more details see Purdue Technology slides. Design for Six Sigma (DFSS) for the new product development using Design of Experiments (DoE)[5], Quality Function Deployment (QFD)[6] and Failure Mode and Effect Analysis (FMEA)[7] for Open Innovation, read the article (Çubukcua & Gümüú, 2015).

• A useful methodology for organisations that struggle with Open Innovation is TRIZ – Theory of Inventive Problem Solving.[8] A six-step process to delivering breakthrough with conceptual solutions by using TRIZ can be found at the CoCatalyst sites.

• Another tool is the Stage Gate®[9] (Cooper, 2016) idea-to-launch model and its application for Open Innovation.

• The principles of project quality management, e.g. according to ISO 10006:2003 (ISO, 2003) and project portfolio management in OI are explained in the book Project-Based Knowledge in Organizing Open Innovation (Boneso, Comacchio & Pizzi, 2014, p. 5, 91).

[5] DoE deals with planning, conducting, analysing and interpreting controlled tests to evaluate the factors that control the value of a parameter or group of parameters (ASQ, 2016a).

[6] QFD is a systematic process for motivating a business to focus on its customers. It is used by cross-functional teams to identify and resolve issues involved in providing products, processes, services and strategies which will more than satisfy their customers. For cooperative development of innovative ideas with the help of QFD see the slides (Schumacher, 2015).

[7] FMEA is a step-by-step approach for identifying all possible failures in the design, manufacturing or assembly process, or a product or service. Read more on the ASQ web page (ASQ, 2016b).

[8] TRIZ is a methodology that can be used to accomplish disruptive innovation in an open way (through the discovery of what you currently do not know). Read more in the innovationmanagement.se web portal (Silverstein, 2016).

[9] The Stage-Gate® model is a value-creating business process and risk model designed to transform an organization's best new ideas quickly and profitably into winning new products, developed by Dr Robert G. Cooper.

Business Excellence models, performance and maturity measurement

Measuring performance is crucial for managers who want to monitor the activities of any organisation. The scoring principle of the EFQM Excellence model and Malcolm Baldrige Performance Excellence model allows assessing how well an organisation is accomplishing what is important to it: the maturity of processes and their deployment, and the breadth and significance of the organisation's results (Enkel, Bell & Hogenkamp, 2011). Self-assessment is used in both models, which helps organisations to improve their performance and results. It can lead to planned improvements and contribute to achieving continuous improvement.

Open business models must allow for a certain degree of organisational permeability to facilitate the in- and outflow of knowledge across organisational boundaries (Chesbrough, 2006; Saebia & Fossa, 2015).

Knowing which elements to manipulate could thus help organisations to improve the quality and effectiveness of Open Innovation. If the instrument is applicable to organisations in general, it could perhaps even be used as a method of benchmarking with which to prioritise activities at a wider scale (Enkel, Bell & Hogenkamp, 2011).

Open innovation activities and processes naturally require some time to mature and work effectively. Measuring the effectiveness and efficiency of open innovation is essential for further improvement. A suitable set of Open Innovation indicators, which can be found e.g. in the work of (Erkens, Wosch, Piller & Lüttgens, 2014), can provide valuable feedback on how open innovation is performing in the organisation. Another approach to Open Innovation measurement is assessment of its maturity. Open Innovation maturity is a multidimensional concept describing the overall capacity of an organisation to engage successfully in and make use of open innovation. As in the field of quality management, where the maturity of the management system can be assessed by various maturity models, there are several frameworks for open innovation maturity assessment, as well. Open Innovation maturity models help to identify where the organisation currently operates and what areas need to be improved.

Many innovation maturity models have been presented in the innovation management literature, and some of them include Open Innovation elements, e.g. the Innovation Capability Maturity Model (ICMM) (Essmann & du Preez, 2009) and the framework for the Service Innovation Capability Maturity Model (SICMM) designed for service organisations (Li, Chen, & Shen, 2010). In recent years, as the topic of Open Innovation has become popular, several Open Innovation maturity models have been developed.

Organisational processes and structures supporting Open Innovation

The relationship between organisational structures and innovation has been the focus of numerous studies, but only a few studies have concentrated on organisational structures for open innovation.

Studies done by Chesbrough (2003) underline how modifications in organisational support allow the process to be opened towards the outside. From Chesbrough's further works, we can conclude that:

• Specific structures and measures are created to promote and evaluate the opening up of an innovation model (Chesbrough & Crowther, 2006);

• Incentive systems are set up, which should include more open-oriented goals and metrics (Chesbrough, 2003);

• Formalised processes for evaluating external knowledge are put in place to complement the existing explorative network. In this evaluation process, an important role is played by the IP Office, which defines the mechanisms for facilitating knowledge transfer and protecting companies from opportunistic behaviour (Chesbrough, 2006). In the same work, Chesbrough points out that coordinating and centralising activities are also a key to operating an open model, and that multiple options exist to coordinate the two extremes of centralised and decentralised approaches.

In Open Innovation processes, organisational boundaries are permeable and firms interact significantly with different actors in their environment (universities, research laboratories, suppliers, customers, exhibitions, venture capital firms, etc.). The Open Innovation Design Thinking™ process model can be found on the Nine Sigma platform.

Depending on the chain of command, a company's structure could be classified as centralised or decentralised, as well as vertical or horizontal. While centralised organisational structures rely on one individual making decisions and providing direction for the company, decentralised organisational structures have often several individuals responsible for making business decisions. In the decentralised organisational structure, organisations rely on a team environment at different levels in the business, and individuals at each level may have some autonomy to make business decisions.

Both the centralised and decentralised ways of organising open innovation have their pros and cons, as presented in the literature. According to (innovationmanagement.se, 2016), companies have in most cases a central organisation of open innovation at the beginning. It becomes a more hybrid structure once the companies understand that they need to involve more people to bring openness into the firm's innovation DNA. The MOOI team members Vanhaverbeke, Chesbrough, & Roijakkers (2014) conclude that a lot of companies have moved towards hybrid models as their organisations have matured in open innovation.

In the case of Electrolux (see the OI-NET case repository), the company has preferred a centralised approach for implementing the OI model by using a cross-functional team rather than a distributed approach with responsibilities spread to several parts of the organisation. The flat hierarchical structure directly connected to the top management (Design, Marketing and Finance, also called the Innovation Triangle) allows saving time for decision-making as well as the time for product

development. The top-down approach has been preferred to communicate the shift from a closed to an open system clearly (Martinelli & Grimaldi, 2016).

Vertical integration is a corporate structure whereby product development through the supply chain is controlled/owned by one organisation (innovationmanagement.se, 2016). This structure allows the company to design and manufacture components, subsystems and final product assembly before selling it to customers. An example of OI application is the one of GM and Ford's with the powertrain systems, which are produced vertically (Ford, 2014).

A successful example of horizontal integration is Dell Computers and IdeaStorm application (Dell, 2016) in the OI process.

On the basis of several cases, we can conclude that Open Innovation is relevant for different types of companies and industries, as long as Open Innovation is structured in an appropriate way to achieve the organisation' innovation strategy and objectives, and as long as they are able to manage quality and performance successfully.

Further discussion about the ways of opening innovation in formal vs. informal and centralised vs. decentralised or hybrid organisations can be found in (innovationmanagement.se, 2016).

KEY TAKE-AWAYS

• Quality is the main distinguishing feature not only among products and services but also among people, corporations, nations and states. Products are carried out along the process chains composed of the contribution of different multinational companies and multicultural teams.

• Different open innovation models bring different approaches to quality and performance assurance of cooperating organisations that mainly collaborate on R&D projects, sharing human capital, technology context, or the open business model.

• Innovation platforms and new or combined tools supporting creativity and processes of new product development are formed.

• Organisations are moving away from hierarchical, internally oriented models to externally oriented (international) networks of (leading) professionals (ACE, 2012) through collaborative leadership.

• Open Innovation maturity models help to identify where the organisation operates currently and what areas need to be improved.

Open Innovation organisations´ Quality Management System models

In designing the QMS model for an OI organisation, which is characterized by a co-innovation goal-oriented strategy, it is important to take account of the size of the organisation, the region of operation, and to recognise whether the innovation mechanism is inbound or outbound, what is the object of innovation (management system, process, product, service or technology) and what is the stage of the product lifecycle:

Research and development ► design and engineering ► prototyping and industrialisation ► component production ► system integration ► sales and service

External organisations are outside the scope of the management system of the Open Innovation organisation (provider), although the co-creation functions or processes are within it.

The problem of quality management in the OI environment appears primarily in the communication interface between OI organisations if one of the participants:

- has significantly different culture of quality and can not adapt to the culture of the OI organisation;
- does not have a compatible quality management system with the OI organisation;
- does not have defined processes and attributes affecting the quality of innovation.

In this chapter, the Virtual Organisation (VO) as a model of the increasingly networked organisation is used for organisational processes and structures, design, quality-related information flow, and the definition of competencies, responsibilities and authorities in OI organisations.

A common case is that co-operation and communication are coordinated by the provider, e.g. the OI organisation, see Figure 1.(OIO), similarly to the supply chain quality management explained in Chapter 4.3 and Electrolux case study in the OI-NET repository.

Collaboration based on technology transfer in the Open Innovation environment

OI activities are provided through integrating the "Open Innovation Council" (OIC), with representatives from different sectors. This integrating element ensures cooperation, knowledge transfer, communication, and assurance of quality.

Responsibilities and authorities: OIC is responsible for the new product development process. An external provider usually have its own certified or at least documented QMS and is responsible for its own innovation and process and product quality.

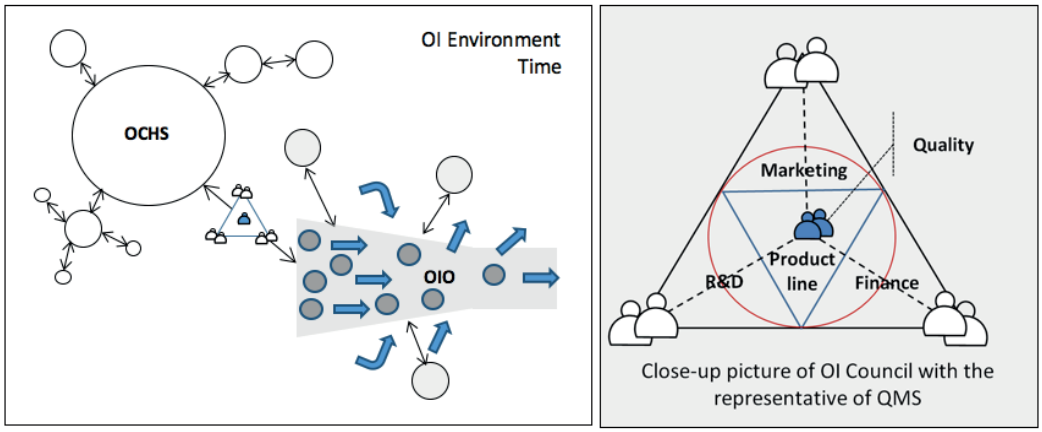

Figure 1. Illustration of the Open Innovation Council (OIC) with quality professionals as representatives of QMS

OIO – Open Innovation Organisation – provider[10]
OCHS – Open Chain Supplier with star topology[11]
◯ – Open Chain Supplier; ● – Closed Chain Supplier (specialist)
⟷ – Information flow

Documented information flow: Information flow between an external provider and the OIC is shown in Figure 1.

Quality management: Management systems of networked organisations should be as compatible as possible, and quality and performance should be audited (if agreed on) according to common principles. For new product quality assurance, it is important to eliminate variance and, if possible, reduce tolerances so that the components and modules can be used with fulfilment of the requirements.

A more complex situation arises when cooperation and communication take place among a multiply interlinked network of organisations. Figure 2 shows the case of a co-creative OI environment for co-operation and communication in a network-based group (e.g. Helix) on R&D projects.

[10] Provider – organisation or individual person that provides a product or a service. It can be a supplier, producer, distributor, retailer or vendor of a product or a service (ISO, 2015a).

[11] Star topology explanation and its relationship with QMS can be found in (Sitek, Seifert & Thoben, 2010).

Networked innovation based on R&D projects

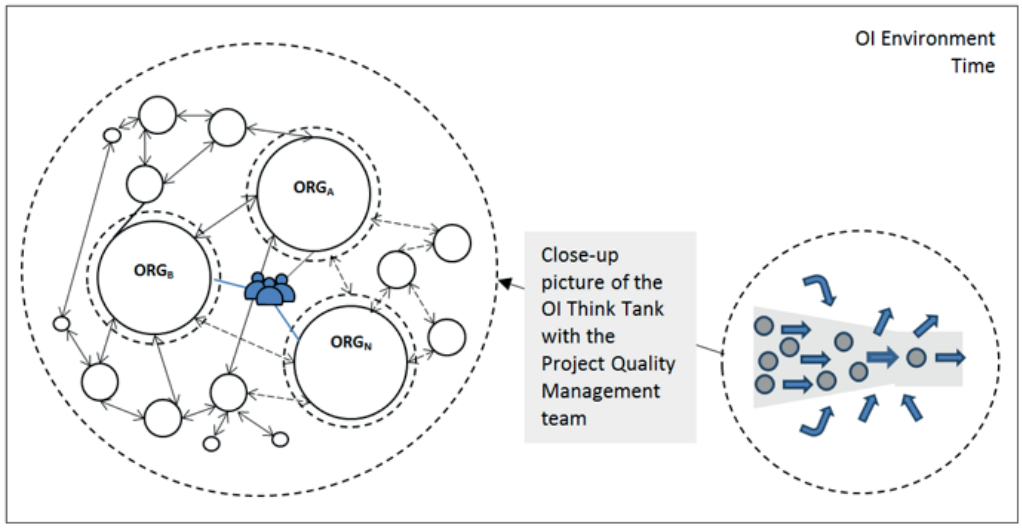

Figure 2. OI environment with network-based group and project topology[12] **(with illustration of open and closed chain providers)**

ORGA, ORGB, … ORGN – members of network-based OI
⟷ - information flow
◯ ● - providers

Responsibilities and authorities: One of the possible solutions is the establishment of the OI Quality Management Office (OI QMO) (Zgodavova, Kosc & Kekale, 1997) and competencies according to (Sitek, Seifert & Thoben, 2010, p. 241), and creating the role of the OI quality manager with responsibility for project success.

Documented information flow: Information flow is outlined in Figure 2.

Quality management: From the intra-organisational perspective, in networked organisations, the quality of all partners' single contributions to the common output should be guaranteed by today's innovation quality (ASQ, 2013) management approaches. From the inter-organisational perspective, the quality of all individual product contributions is not equal to the quality of the common output.

The case study of Faurecia describes the Open Innovation "dWorks" Think Tank process of successful achievement based on networked team cooperation of designers, engineers and marketers, working in a free and independent environment, to help invent automotive seats of the future.

[12] The project topology network is illustrated by a general network topology adapted from (Kumar & van Dissel, 1996; Sitek, Seifert & Thoben, 2010) and a tiered supplier system.

There are various ways in which an organisation can claim that its QMS meets the requirements. For example for the automotive industry (ISO, 2009, revision, 2013) they include: (a) supplier's declaration of conformity; (b) second and third party assessment; and (c) acceptance sampling (ISO, 2005).

KEY TAKE-AWAYS

• Quality management in the OI environment means creating a communication interface between the OI organisations.

• Measuring the effectiveness and efficiency of Open Innovation is essential for further improvement.

• For OI supply chain quality assurance, OI activities are ensured through integrating the Open Innovation Council with representatives of the Quality Management System.

• For networked organisations, one of the possible solutions is establishment of a OI Quality Management Office with responsibility for innovation quality.

Practical implications

The issue of quality assurance in the Open Innovation organisation is essentially applied and practical. Hitherto, in the above sections, we have already referred to several examples of how the discussed concepts can be implemented and what their consequences on business practices are. In this section, we will further exemplify and illustrate some specific impacts, changes and imperatives that are relevant for practitioners eager to understand, implement and develop QMS in OI organisations. We also propose two short case studies as a basis for discussion.

• In every sector where collaboration is based on R&D projects, sharing human capital, technology transfer and open business model, it is necessary to harmonise the culture of quality, to share the vision and negotiate the level of new product quality. The coordination of individual (specific) QMS and common processes and their attributes are also important because it affects the quality of innovation.

OI organisations should identify the current state of the OI maturity level in individual actors (collaborators) and the QMS maturity level based on gap analysis:

• In the case that the OI organisations have a QMS in place, it is sufficient to modify the process interfaces between the participants.

• If the differences are too big, it is necessary to establish a common QMS and to define the responsibilities, authorities and competencies.

New approaches to collaboration are a key to innovation in an open context. Increasingly important is the ability to build virtual communities that also include non-traditional participants. As industries transform towards intelligent products, and eco-friendly and sustainable products and product systems, the role of non-traditional actors increases.

• A central challenge is how open business models and value creation processes will be matched by a changed quality management strategy.

MINI CASE

Faurecia: Open Innovation – new product development

Learning objective

The case fosters discussion about quality management issues related to the Open Innovation process in the highly competitive, price-sensitive market of car seating.

Introduction

Faurecia is an Open Innovation world-leading automotive supplier with four key business groups: automotive seating, emission control technologies, interior systems, and automotive exteriors. The Faurecia Group has 270 industrial plants in 33 countries to provide all customers with a local, on-the-ground service. Faurecia has based its progress-oriented culture on research & development, supported by 5,000 engineers and technicians in 40 centres worldwide.

Faurecia's mission is to create and deliver high-quality and innovative products, technical solutions and services that contribute to the customers' competitiveness and create value for employees and shareholders. One-third of its plants work on a just-in-time basis. The bases of Faurecia's quality culture are the Faurecia Excellence System (FES) and the Supplier Excellence System (SES).

The team has developed such products as SmartFit, a system that enables drivers and occupants to use their smartphones to adjust their vehicle seats automatically to the best position for their body. Another innovation that has been developed by using the Faurecia methodology is the Performance Seat, a unique dynamic comfort system and composite back technology to create a comfortable, attractive, safe seating system that is 30 percent thinner and 20 percent lighter than conventional seats (PR Newswire, 2012).

In 2012 Faurecia was recognised as one of the world's top innovation companies by Product Development and Management Association (PDMA). For more information, visit: www.faurecia.com.

An Open Innovation process

"Faurecia is focused on Open Innovation," said Rob Huber, vice president of innovation for Faurecia North America. "We are constantly looking outside the company and the industry to find the best ideas that can move our industry forward in such areas as light-weighting, passenger wellness and comfort, premium features and other critical trends. We are set up to work actively with people outside the company to translate these concepts into real products" (PR Newswire, 2012). The Open Innovation process is conducted via "xWorks" centres which research the regional market closely, collaborating with various ecosystems that present different opportunities for development of automotive seating in those regions.

The "dWorks" organisation is the latest in a series of Faurecia think tanks, established in Munich. "dWorks" brings together a team of designers, engineers and marketers, working in an open and independent environment, to help invent automotive seats of the future. The "dWorks" office includes a small workshop and space for numerous simulators, mockups and vehicles. "The process tool box also includes multi-day workshops, using a proprietary ideation process, in which multifunctional experts from all disciplines within Faurecia Automotive Seating participate, after weeks of pre-work exploring business, consumer and technology tenets that apply to the topic," said Dr. Olaf Biedermann (Faurecia Press Release, 2013).

The "xWorks" process is founded on very open product-development principles. The "xWorks" sites share 80 percent of their processes, with each area shaping project implementation, collaboration and growth to take the best advantage of its own ecosystem. While "xWorks" think tanks focus on seating, they require that the teams understand the complete vehicle environment and the manner in which seating relates to other systems, so developments from "xWorks" sites may help influence the design of entire vehicles.

Rules for co-operation among networked organisations

Faurecia has set ambitious quality objectives to achieve its mission. These objectives are reaching a 15 parts per million (PPM) average, and commodity dependent and zero red Safety and Regulation alerts. Zero defects and zero tolerance of non-quality is the objective of Faurecia Excellence System (FES). An adaptation of FES has been made for Suppliers as a Supplier Excellence System (SES). The Breakthrough Quality Plan is implemented to bridge the gap between the current quality performance and the demanding objectives. At Faurecia,

purchased parts account for over 60% of overall costs. As such, Faurecia's performance is highly dependent on that of their suppliers (Faurecia, 2013). All suppliers are required to produce Advanced Quality plans to support the development of new products and/or services, in accordance with the guidelines in the Advanced Product Quality Planning and Control Plan (APQP). The principal phases of the new product development at Faurecia are:

Acquisition ► Product and Process Design & Development ► Production Set-up and Pre-Series ► Launch ► Production

During each NPD phase, the suppliers' performance is tracked and monitored to ensure that the suppliers achieve their targets. All suppliers are required to report the status of plan activities. The suppliers' workforce must be specially trained in this procedures.
The APQP process consists of 31 elements deployed within the phases of the program. The responsibility for each element is either by Faurecia or the Supplier, or shared as defined in a kick-off meeting. A detailed description of responsibilities can be found on pages 11-22 of the Faurecia Supplier Requirements Manual (Faurecia, 2013).

Conclusion

Faurecia had incorporated the Open Innovation business model in their strategy. Faurecia recognises the ISO/TS 16949, ISO 14001, and ISO/DIS 45001:2016 management system models and accepts other customer requirements. Faurecia has its own quality management system called FES, which together with SES is the basis of the quality culture in the organisation and the open innovation network.

In order to enhance innovation performance, Faurecia has opened its R&D process and established the "dWorks", a think tank for automotive seat research. This process has made it possible to bring external innovative concepts to the market.

The opening of the R&D process raised the question of quality assurance within the OI network. Suitable support for quality assurance in the planning and development of new proucts or services proved to be the existing Supplier Requirements Manual (Faurecia, 2013). with the APQP tools and Program Management Core System (PMCS) procedures (internal Faurecia documentation).

Content-related materials

Case studies

OI-NET portal case repository: Faurecia – Open Innovation in Supply Chain goo.gl/yNZxGQ.
Electrolux: Supplier enabled innovation along with Open Innovation goo.gl/BpXL8j.

Harvard Business School (HBS) Cases

• Clayton M. Christensen: Molding the Impossible: The NYPRO/Vistakon Disposable Contact Lens Project, http://www.hbs.edu/faculty/Pages/item.aspx?num=22447.
• Henry Chesbrough: The Patent & License Exchange: Enabling a Global IP Marketplace https://hbr.org/product/patent-license-exchange-enabling-a-global-ip-marke/an/601019-PDF-ENG.
• Henry Chesbrough: Managing Research at IBM in Internet Time https://cb.hbsp.harvardedu/resources/marketing/docs/chesbrough_formatted.pdf.

Other cases

• What GM, Ford and Chrysler Learned from Google: http://openinnovation.net/open-innovation/what-gm-ford-and-chrysler-learned-from-google/.
• INVOLVE – we solve challenges together: http://www.volvogroup.com/group/global/en-gb/researchandtechnology/programs_partners/InVolve/Pages/default.aspx.

Video

• Video: Electrolux – Lucia Chierchia, Head of Open Innovation at Electrolux: https://www.ideaconnection.com/blog/2015/12/how-electrolux-does-open-innovation/.

Publications

The list of references contains essential readings that can be selected by instructors depending on the orientation they select for their course. The most recommended readings are listed in the Lecture Overview table at the beginning of the chapter.

Pedagogical guidelines

Interactive activities

Business Games that explain the OI business model
• Open Innovation game, www.open-innovation-game.com.
Business Games that explain QMS in the OI environment
• Open Innovation Management System Role Play Simulation, goo.gl/C8FyxM.

Learning exercises

• The mini-cases in the chapter come with suggested discussion questions. For the cases listed, all HBS cases come with teaching notes.

• Other cases and blogs can be used as basis for classroom discussion on the topics presented in this chapter, as well as other related issues around OI and quality assurance.

• The topics presented can be conveniently expanded by students in the form of an essay identifying, synthesising and analysing additional literature critically. In particular, an essay would be an effective learning exercise for achieving the knowledge learning outcomes (c.f. the Lecture Overview).

• The concepts of collaborative innovation and how the QMS model are implemented in the case of technology transfer in the Open Innovation environment.

• The concepts of collaborative innovation and how QMS model are implemented in networked innovation based on R&D projects.

• Field work involving observations and data collection through interviews with persons responsible for quality or innovation quality can be effective exercises in order to achieve the learning outcomes related to skills and competencies.

Self-study

After having studied the chapter and worked through the mini cases, students are encouraged to access the references in the reference list, and after reading and analysing abstracts and summaries select those for in-depth reading that provide most relevant additional insights, depending on each individual learner's objectives.

Self-evaluation

Students are encouraged to work through the text actively with the help of the self-evaluation questions listed below.

Evaluation questions

History and culture of quality in the perspective of Open Innovation

1. Explain how companies can open up their innovation department to enhance creativity.
2. Give examples of organisational structures and processes supporting Open Innovation.
3. Describe the responsibility of team leaders in the externally oriented organisation structure.
4. How can team members take responsibility for their process, as well as the content of their work?
5. Indicate and briefly describe quality assurance in the new product development process through technology transfer.

6. Give an example of the new competencies required for the Open Business Model.
7. List and briefly describe Business Excellence models suitable for Open Innovation organisations.
8. Which Design for Six Sigma tools can be used for idea generation and new product development?
9. Define the principles of project quality management and main business aspects of an OI project.
10. Based on the recommended case studies and recommended references, propose an OI maturity model.

Open Innovation organisations´ Quality Management System models

1. Based on the recommended case studies describe and compare different models of QMS.
2. Give an example of new competencies required for the OI organisation and compare various stages of OI maturity and QMS maturity.

Individual work examples

The presented topics can be conveniently expanded by students in the form of an essay identifying, synthesising and analysing additional literature critically.

By searching and analysing case studies in academic references, white papers and company websites, concepts of collaborative innovation and how they are implemented can be compared and thus understood better.

Field work involving observations and data collection through interviews with QMS managers and innovation managers can be effective exercises in order to achieve the learning outcomes related to skills and competences.

Group work examples

Students work in groups of 3-6, depending on class size, and each individual selects/is assigned a specific industry where he or she will make an analysis of the QMS and the level of OI maturity and extent and nature of innovation quality assurance. Then, each student presents his/her case, and comparisons are made and discussed in the group. Students can be asked to develop an analysis framework initially in the group for easier and more effective cross-industry comparison. If time is limited, the instructor can provide such a framework depending on the focus envisaged in the course.

Students work by using the role play simulation portal http://web.tuke.sk/simpro-ims/index_en.php and then are asked to present individually a part of homework related to competencies, responsibilities and authorities in a fictive or case OI organisation. If time is limited, the instructor can provide such a framework depending on the focus envisaged in the course.

Teaching tips

Slides

Six sigma and open innovation Purdue Technology slides: http://prec.pr/symposium/2014/pdfs/feb21-pm/Chad-Laux.pdf.
Developing innovative ideas cooperatively via QFD: http://www.eestecns.org/idealab/fajlovi_za_sajt/banjaluka/SCJ%20QFD.pdf.
The CoCatalyst Directed Open Innovation Process using TRIZ: http://www.cocatalyst.com/home/wp-content/uploads/2010/02/CoCatalyst_Directed_Open_Innovation_Process.pdf.

Links to teaching material

Links provided for each source indicated.

Supporting case material

The list of supporting case material contains essential case studies (in the part Content-related material) that can be selected by instructors depending on the orientation they select for their course.

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