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Striving for benefits of sustainability from the interactivity of quality and innovation

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ABSTRACT

In this article, sustainability is considered as a subset of quality and as a challenging target area to innovations for the quality of society. Quality and innovation are conceptually age-old issues and significant business factors today. They represent two distinct professional disciplines, which have a lot of meaningful connections. However, their formal definitions have not been commonly established and neither have their relationships been clearly recognized. Hence in this article, their practical definitions and interactivity are discussed and highlighted regarding individuals, organizations and society. Also, the relatively new concept of sustainability is not understood unambiguously nor practiced consistently. The purpose of the article is to clarify the concepts and to present a comprehensive approach to the theory of sustainability through interactive quality and innovation management for enhancing the quality of society.

Organizations play an important role in striving for sustainable development. Quality and innovation management should be considered in an integrated way in the organizations, and they should cover the area of sustainability. In the whole society, sustainability is realized through diffusion. National and regional initiatives have been launched to promote quality, innovation and sustainability measures. Ultimately, quality and innovation are based on human creativity, activity, and perception.

In this article, discipline-dedicated research and development of quality and innovation, interdisciplinary collaboration and multidisciplinary integrative realization of the specific organizational solutions are highlighted and conceptualized. The ideas presented are based on the long-term practical experience of the authors and our studies from different perspectives and critical inference. When considering practical events, objects and problems, we have combined sound and justified conceptual thinking in creating objective knowledge as the foundation for the efficient doing and effective methodological means.

Keywords: Quality; Innovation; Sustainability; Human individual; Organization; Society; Management; Integration

1. Introduction

Quality and innovation are significant business factors for success in all kinds of organizations and for the sustainable development of the whole societies. They have conceptually and practically developed from the ancient time to the present. Quality and invention were seamlessly merged in skilled crafts. After the

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professional specialization, they developed as distinct specialized disciplines. However, now recently, significant cross-references between these disciplines have been recognized again.

Although quality and innovation are two disciplines, they have a lot of meaningful connections including technological, human, organizational, managerial, societal and standardization aspects. However, often in practical contexts the relationships are not clearly recognized or exploited. Quality and innovation professions have the same goal of quality improvement, i.e. increasing ability to meet the needs and expectations (ISO, 2015a) of the individuals, organizations and societies.

Many quality experts have presented different definitions of quality, which has led to conceptual fragmentation. We have considered this issue in detail in another article (Anttila and Jussila, 2017b). Also, the term innovation is still used without a consistent definition. However, both terms have also got internationally accepted standard definitions.

In this article, quality and innovation are considered from three fundamentally different viewpoints, human individuals, organizations and societies. Societal quality as a composite of individual and organizational quality aspects consists of various characteristic dimensions including sustainability. The development of sustainability development is closely related to quality management and innovation. Quality and innovation are realized society-widely through the diffusion (Rogers, 2003) of the achievements of individual and organizational members of the society.

Management system standardization gives possibilities for realizing quality and innovation management in an integrated way in the organizations. Hence, quality and innovation can together create organizational differentiation for competitive advantage.

National and regional initiatives have been launched to promote quality and innovation activities.

Ultimately quality and innovation are based on the human beings' creativity that relates to the intuitive processes of the human unconsciousness (Hari et al., 2015; Nisbett and Wilson, 1977). Intellectual property (IP) derives from the work of an individual's mind or intellect.

This article is an overview and historical examination of concepts, techniques and phenomena related to quality and innovation. It considers the questions of innovation in quality and quality in innovation. The ideas presented in the article are based on long-term practical experience of the authors and the studies from different perspectives. When considering practical events, objects and problems, our aim has been to combine the sound and justified conceptual and theoretical thinking and efficient doing with effective methodological means. Especially, the Critical Scientific Realism (Niiniluoto, 1999) and Popper's three-worlds theory (Popper, 1978; Niiniluoto, 1990) have been applied to the theoretical foundation for our thinking (Anttila and Jussila, 2017b).

The purpose of this article is to present arguments, means and benefits to promote discipline-dedicated research and development of quality and innovation, interdisciplinary collaboration and multidisciplinary integrative realization of the specific organizational solutions. We have clarified the concepts and presented a comprehensive approach to the theory of sustainability through interactive quality and innovation management for enhancing the quality of society. Especially, collaboration of the experts and organizational integration are emphasized. This article considers sustainability as an acute application area of quality and innovation pursuit, hence participating in the academic discussion on these topical issues.

Aspects of this article have been presented by the authors in several conferences, seminars, etc., for instance in Hail, Saudi Arabia (2013), Tallinn-Helsinki (on board) (2013), St. Petersburg, Russia (2015), Zadar, Croatia (2016), Rome, Italy (2016) and Marrakech, Morocco (2018).

2. Evolution and the relationships of the quality and innovation disciplines

In order to understand better the fragmented, and in many respects contradictory situation in our topic, it is useful to know the historical development of the basic concepts.

Quality and innovation are ancient concepts. Quality (ποιόν, poion, of what kind or quality) was one of Aristotle's (Aristotle, 350 BC a) ten categories to enumerate all the possible kinds of things that can be asked to signify any objects. The quality concept relates to an object and parties involved in that object. Quite originally (Aristotle, 350 BC b), the word quality had two meanings: (a) Differentia, which actualizes the

essence of the object in question and differentiates it from the other objects, and (b) how well or badly the object is perceived by the involved parties. This double meaning is still valid in the everyday language (Oxford Dictionary/ quality, 2015), and it is included in the general standardized professional definition (ISO, 2015a), too. The word *qualitas* first appeared by Cicero (Cicero, 45 BC) as the Latin equivalent to the ancient Greek word ποιότης (poiotes, quality, property; nature, state, condition).

Aristotle has also been referred to in the context of innovation discussion through the ages. He stated that 'technology imitates nature' but also argued that technology can go beyond the nature through authentic human creativity and complete 'what nature cannot bring to a finish' (Schummer, 2001). Innovation is linguistically based on the verb innovate that means to make changes in something established, especially by introducing new methods, ideas, or products. The older related word from the Middle Ages is invent with the meaning of creating or designing something that has not existed before (Oxford Dictionary /invent, 2017). People have however made inventions already before the appearance of these words. 'Every change in human activity, made designedly and systematically, appears to be an invention' (Mason, 1895).

The roots of the modern quality management date back to the time of the beginning of the industrial revolution around 1750. That also was the dawn of modern innovation. At that time quality and invention were seamlessly merged with the craftsmanship. Quality and innovation were evidenced through good products to the needs, process improvement, improved living and working environments of people, and patents (Juran, 1995).

Technology is a common issue in the context of both quality and innovation. Technology includes means by which labor, capital, and information are transformed into products (goods and services) to provide value for the interested parties (Christensen, 1997). This concept of technology extends beyond the engineering and manufacturing to encompass a range of marketing, investment, and managerial processes. Hence, it also includes the quality and innovation management. Technology is an important way of the realization of quality.

Together with specialization, quality and innovation have evolved as distinct specialized disciplines with their own development history, expertise, specialists, research and education traditions, and methodologies. Hence as the result, typically the quality professionals are not very much aware of the innovation phenomena, and neither are innovation experts familiar with the quality principles and procedures. This professionalization of both areas dates back to the early years of the 1900's (Tarde, 1903; Juran, 1995; Godin, 2008).

We can recognize that very recently, significant cross-references between these disciplines have been revealed again in certain national and regional quality and innovation movements and in the international quality management and innovation management standardization. This will later be elaborated in more detail in this article. Their relationships particularly emerge in the improvement of quality of products, processes, and living and working environments of people.

Figure 1 shows some significant milestones in the evolution of the quality and innovation disciplines.

Fig. 1. Milestones and the most important persons in the evolution of the quality and innovation disciplines

We can see that achievements and success of both disciplines were based on the influence of strong and intentional persons and purposeful organizations. More recently also the societal authorities have contributed to promoting quality and innovation within the organizations and societies. The personal creativity of individual inventors has always played a prominent role in the field of innovation.

Professionally quality and innovation come true through organizational implementations. Innovation is an important factor in the product development and process management that also are the most essential areas of quality management. The innovation process, ‘from-invention-to-innovation’ (figure 2), is complicated and involved with many different actors. Quality aspects should be considered in all phases of this process. The diagram visualizes that practically innovation cannot be carried out only by one person, but a great variety of different expertise is needed in the process for realizing the innovation result. Inventors are the key persons to initiate the process, but they are not ‘innovators’ alone. Professional quality practices are beneficial in the innovation process. On the other hand, innovation is a very traditional part of quality management, especially as part of any quality improvement (ISO, 2018).

Fig. 2. From invention to innovation in practice.

3. Conceptual definitions and relationships

Quality and innovation are basic concepts used in the contexts of individuals, organizations and societies. These both concepts have been described in many ways. Sustainability is a set of factors characterizing organizations and societies, although the concept has not been unambiguously defined.

Many quality experts have presented different definitions of the concept of quality (Dahlgaard and Dahlgaard-Park, 2015), which also has led to methodological fragmentation in practical quality implementations. Moreover, the situation is enhanced by the eclectic mix of meanings of the word quality in everyday language. Hence, it is most useful to apply the standardized definition when considering the concept of quality professionally. This definition is used around the world and in millions of organizations and it has been developed by the international experts during more than 30 years. According to this definition, the quality of an object means *the degree to which the object fulfills the needs and expectations of those parties being interested in the object* (ISO, 2015a). In another article we have justified that this definition is valid and advisable also from the scientific point of view (Anttila and Jussila, 2017b).

Organizations compete with the high quality of their products (goods and services). To be successful, the organizations must continuously be responsive to the changing forces of the business environment (Downes and Mui, 2000; Porter, 2001) and strive for distinctively excellent quality through their effective and efficient business processes. This is also the challenge of the quality management, i.e. *management of the organization with regard to quality* (ISO, 2015a), and one of its major activity areas is the quality improvement that takes place through the continual performance improvement of the business processes and products. Quality improvement is defined as *increasing abilities to meet the needs and expectations of the interested parties* (Ibid.). According to the conceptual definition, quality improvement is closely related to learning and innovation, and this same can also be inferred from the practical experiences (Kim et al, 2012).

Both excellent products and competitive processes are based on innovation; the quality improvement tools can also be seen as the creativity and innovation tools (Harrington et al., 1998). Hence, innovation is not any new subject in the quality discipline, but it has inherently been included in the professional quality practices already for decades. However, in general, quality experts cannot be regarded as the experts of innovation, since mostly the quality innovations take place spontaneously.

The word innovation explicitly appeared on the major quality discussions about ten years ago. From then on, this concept has also received increasing importance in the national quality initiatives, especially represented by the performance excellence models (quality award criteria) (NIST, 2010), the future of the quality studies (ASQ, 2011), and in the international quality management standardization, including the standards ISO 9004 (ISO, 2018) and ISO 9001 (ISO, 2015b). Innovations can be applied in the quality improvements at all business areas in the organizations including technology, products, processes, and the business system as a whole (Haner, 2002).

Innovation has also been viewed as a new ‘wave’ for reviving quality management (Osada, 2015; Watson, 2015; Chin, 2015). However, we are convinced that it is more fruitful to understand quality and innovation as two distinct partnership disciplines (Kamaja, 2014) with mutually beneficial relationships producing useful ideas, methodologies, tools, etc. to each other.

Innovation exists everywhere, including the contexts of products and technology and the world of words; innovation is discussed in the scientific and technical literature, but also in social science like history, sociology, management and economics. Innovation is also a central idea in the popular imaginary, in the media and in public policy (Godin, 2015). Innovation has become the emblem of the modern society, and a panacea for resolving many problems (Swaroop, 2016).

We have noticed that when the interest in the traditional quality practices has recently been declined in the business discussion, the popularity of innovation has increased strongly, one even can talk about the innovation ‘hype’ and superficializing the concept. Hence, we also can notice reactions against overemphasizing the innovations. For instance, standardization (DIN, 2000) and imitation (Apunen, 2015) have been seen economically more beneficial than innovation with a good reason. This is justified by the fact that innovation is a slow and uncertain way to business or product regeneration. However, both standardization and innovation are needed in all organizations (Pangaro, 2013). In this regard, these both issues are traditionally included in quality management through the quality control (ISO, 2015a) of the operations as usual, based on standards and innovation for improvement.

Vocabulary of words and terms used in the context of innovation has fluctuated during the decades (Dance, 2012). While innovation experts and many organizations acknowledge that innovation is important for the business growth and success, in the business world the term ‘innovation’ has not been defined consistently with a commonly agreed definition. Sometimes we may get confused about the terms of change, innovation, invention, novelty, originality, creativity and innovativeness (Godin, 2015). Especially important it is to understand the difference between invention and innovation.

The European technical specification CEN/TS 16555-1 defines innovation as *the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations* (CEN, 2013). In this definition, the expressions ‘significantly’ and ‘implementation’ are subject to interpretation. The definition of innovation indicates that the innovation should be a conceptually new and commercially viable solution that is available to markets, governments, and society. This proves that innovation means improved quality according to its definition. Quality improvement cannot take place without innovation. Business innovations are directly related to improving product performance, increasing the effectiveness and efficiency of the business processes, and making the organizations’ structural and operational reforms (figure 3) more effective and efficient. Development of organizational solutions focuses on the products and business structures (‘What’) and processes (‘How’). Opportunities of the innovations are related to the areas of I_1 , I_2 and I_3 . From the organization’s performance point of view, ‘How’ is more important than ‘What’. All of these issues are according to the basic purposes of the quality management, too.

<Figure 1804>

Fig. 3. Innovation is a conceptually new and commercially viable solution.

Also innovations in science can be understood in accordance with the above definition. Science is the pursuit of new socially institutionalized, systematic and critical knowledge of nature, people and society. Scientific knowledge is the result of the scientific research. Knowledge is well justified true belief, and scientific knowledge must meet certain methodological criteria. Science innovations can mean both methodology and results, and primarily require the acceptance of scientific communities, hence differing scientific innovations from scientific inventions.

4. Innovations in technology and quality management

Technology innovations take place according to two major principles (Christensen, 1997) by using:

- Sustaining technology for fostering and enhancing the existing technical features or
- Disruptive technology for simplifying the existing technical solutions and providing very different value proposition.

Technology-based innovations of products (goods and services) provide practically unlimited possibilities for improving the quality of products but also for influencing on the performance of the business processes and operations of individual people and the whole societies. This includes innovations in information technology (IT), biotechnology, nanotechnology, optical technology, energy technology, social technology, wellbeing technology, etc. (Anttila and Jussila, 2013).

New technologies may radically change all business arrangements in the organizations, including practices of quality management. Actually, we are talking about the 4th industrial revolution (Schwab, 2016), which is strongly influenced by digitalization. Opportunities of the new IT based solutions create new ways of working in processes and carry out business activities and products, for instance through networks or ecosystems of organizations. New technologies may have both positive and negative influence on the sustainability development. All these are challenging issues also from the quality management point of view.

The achievements of the information technology include 5G networks, radio frequency identification (RFID), near field communication (NFC), Internet of things (IoT) or industrial internet, social software, intellectual robotics, 3D printing, mobile payment technology and Blockchain, big data analyzing, biohacking, etc. Open source information, cloud services, navigating technology, and Mashup products are currently

important practical examples. The IoT emphasizes sensors that can connect objects to the internet and automatically send their data to IT systems. The objects can be everything from the health care monitors to traffic lights, thermostats, trains or automobiles.

We have recognized serious needs for innovations also in quality practices and methodologies (figure 4) (Anttila, 2011) and ponder whether any real innovations have at all been created for the organizations' quality implementations after Deming, Ichikawa, Juran, and Feigenbaum (Juran, 1995). Do we only follow the old French saying, 'Plus ca change, plus c'est la même chose' (The more it changes, the more it is the same thing) (Karr, 1849)? Quality profession seems to be in crisis (Zairi, 2016 and 2017; Anttila and Jussila, 2018)), and it is not able to adapt to the general development of the organizations' business development and trends of the society at large. The existing prevalent practices have become too formal, complicated, or rigid in many implementations, and they are not necessarily relevant or effective any more to the challenges of today's business environments. Especially disruptive (Christensen, 1997) and 'lean' (Ries, 2011) solutions are needed for quality management and quality assurance, for instance considering the uncertainty of startups and complexity of the networked businesses and ecosystems (Anttila, 2010).

<Figure 3896>

Fig. 4. The crisis in quality management or quality profession in its entirety results from the lack of innovations in the quality management principles, tools, and infrastructures regarding the changes in the organizations' business environments.

5. Innovations in the use of quality management standards for business benefits

The most widely used international quality management standards ISO 9000 have a big impact on the quality implementations in the organizations world over, but they represent stagnation, because they have not been able to follow the general trends of the business development (figure 4) (Anttila and Jussila, 2017a). However, we have no limitations in using innovations also in the traditional and standardized areas of quality management. For instance, although the ISO 9000 do not explicitly promote creativity and innovations in their implementations, their ultimate purpose is to strive for excellence in business performance and to create confidence and satisfaction among the stakeholders of organizations. This should be accomplished with the responsibility of the organizations, which only depends on the organizations' business leaders and experts who should be able to differentiate their business from the others of the crowd. The key issue is that the standards are understood as unlimited opportunities and not as specific restrictive targets or requirements (Anttila and Jussila, 2017a).

In order to wisely and efficiently achieve the benefits of strengths and weaknesses of the general international standardization, implementers should be aware of the general principles of the standardization (Ibid.). When the standardization can be seen as a linking factor between science (theoretical foundations) and practice (organizational implementations, legislation, etc.), the implementers should make use of theoretical knowledge and the best practices when applying the ISO 9000 standards. In fact, the ISO defines (ISO/IEC, 2004) the concept of standard as a *document, established by consensus and approved by a recognized body, that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context*. Standards should be based on the consolidated results of science, technology and experience, and aimed at the promotion of optimum community benefits. Also, the ISO definition of the concept of standardization (Ibid.) is interesting as an *activity of establishing, with regard to actual or potential problems, provisions for common and repeated use, aimed at the achievement of the optimum degree of order in a given context*. In particular, the standardization activity consists of the processes of formulating, issuing and implementing standards.

This means that the implementation of standards in the organizations is a part of the standardization. Hence, it is the responsibility of the organizations' business leaders and experts to take the advantage of science, technology and experience in applying the standards, clarify, correct, and complete general standards and find creative solutions in the organizational implementations in order to achieve business benefits. Thus, the creation and implementation of the standards are two different worlds with their own particular processes, which may and should interact effectively with each other. Standardization process is based on consensus and implementation on innovation.

The biggest obstacles, which hinder or prevent the organization's creative progress (Schein, 1987), are the existing habits, misperceptions and prejudgments of ourselves, and the cultural aspects of the organization, business branch, or country, from which it is difficult to break away. Possibilities for innovations (figure 5) may be found from the model of learning organizations (Senge et al., 1995), which we have used for the 'Quality integration' (Anttila, 2007), i.e. creative business integration of the organizational quality management for aiming at the excellent performance and sustained success. Theoretically this is a teleological approach to the organizational quality (Anttila and Jussila, 2017b)

Fig. 5. The model and the three cornerstones for a creative business integration of quality management, 'Quality Integration'. (Anttila, 2007) base on the ideas of a learning organization (Senge et al., 1995). The 'innovation integration' can be considered in the same way.

The cornerstones of the learning organization model consist of:

- Sound guiding business ideas including organization-dedicated concepts and principles, goals and strategies, and their articulation. These guiding ideas can be aligned with the quality management

principles (QMPs) of the ISO 9000 standards (ISO, 2015a) and the modern professional quality models, and used for the management of the business system and processes.

- Effective tools, methods and theories supporting the quality approach. This can include creative management methodologies and modern means of information technology in order to increase business effectiveness and efficiency, strive for competitiveness and differentiate from the others.
- Innovatory management infrastructure for operation of the organization regarding quality in a broad sense. The infrastructure is to realize the guiding ideas in the whole organization's rapidly changing and emergent business environment in practice.

6. Society-wide movements for organizational quality and innovation

Organizational quality programs of various frameworks, including TQC (Total Quality Control), CWQC (Corporate Wide Quality Control) or TQM (Total Quality Management), have been introduced and widely applied in the various parts of the world since 1950's. Innovation aspects were not explicitly included in these realizations, and now these solutions have lost popularity, most recently TQM (Dahlgaard-Park, 2011). They had not been able to regenerate along with the general development of business environment and society. Moreover, they have not dealt with the questions of quality from the viewpoints of human individuals and societies.

At present, the most practical organizational quality management implementations are based on the ISO 9001 standard, and SixSigma and Lean methodologies. These practices do not contain any creative innovations but only repeat decades-old traditional quality principles, methods and practices.

Globally during the several recent decades, many initiatives have been executed for developing societies from the viewpoints of the quality philosophy and applying the quality practices. All these examples are different and based on different quality foundations. Some of these cases have been successful, having also continuity and sustainability, but some others not. (Anttila and Jussila, 2017b)

National and regional initiatives have been launched or policies defined to promote innovation activities broadly (Barroso, 2009; European Commission, 2013; Council on competitiveness, 2005; TEM, 2009; Miettinen, 2002; Uhlin, 2005). In these cases, the innovation activity is typically seen as a systemic issue, although in practice innovations originate from the ideas of creative individuals or inventors and often are accomplished by several persons in organizations or networks. Typically, in these contexts, also quality aspects have been presented, but only in general terms. Innovation experts have not necessarily been in close contacts with quality experts in these initiatives.

Also methodologies have been developed and researches made (Cornell University et al., 2015; Steinbock, 2006) for evaluating the effectiveness of the innovation policies, including innovation inputs and outputs, at country level. These are used for comparing different economies, countries and regions. However, the country authorities can at their best have only supportive role, because inventions are made by single, grouped or networked individuals and completed into innovations by different organizations. Hence, quality of the innovation process (figure 2) and quality of the innovation results can be considered only in a superficial way in these high-level evaluations.

Organizations have a key role in developing and implementing quality and innovation procedures in practice for business and societal benefits. If quality management and innovation management develop separately as isolated initiatives from each other, the situation is not beneficial to the organizations. The both disciplines need each other, and they even may 'cross-fertilize' each other, for instance there should be quality and innovation in both quality and innovation processes.

The complicated operational environment is particularly challenging for many small and medium size enterprises (SME) and startups, whose business is often totally based on innovative solutions (Ries, 2011), but professional quality and innovation resources are very limited, and adequate quality methodologies have not been developed for these application areas. However, in today's economic environments these organizations have a remarkable importance in the terms of employment and national income. More than 99% of the organizations (for instance more than 22 million organizations in Europe) are SMEs.

7. From sustainability to quality of society through innovations

In this article, quality and innovation are considered from three fundamentally different viewpoints, human individuals, organizations and societies. Table 1 summarizes the fundamental differences of these three entities. Societal quality consists of various characteristic dimensions including sustainability. Societal quality and sustainability are the consequences of understanding and measures of individual people and organizations of the society. Societal improvement requires individual inventions and organizational innovations.

	An individual	An organization	A society
Entity	A rationally, non-rationally and irrationally behaving human being with paradoxical existential freedom and tied to the surrounding environment and other individuals	A systemic group of people with functions, responsibilities, authorities and relationships to be managed for its objectives with its interested parties	A more or less ordered aggregate of independent people and organizations interacting with its own members and external parties as a non-systemic network
Responsibility	The person him/herself (or the guardian)	Top management of the organization	Nobody or everybody
Activity	Be aware, engage, act, invent, imitate, learn, self-control, interact	Organizational processes; Benchmarking; Imitating; Organizational learning	Linking and collaborating (crowdsourcing); Social learning; Knowledge diffusion
Goal	Improved quality of life; Resilience	Improved performance; Sustained success; Resilience	Improved societal quality; Sustainability; Resilience

Table 1. Quality and innovation for and by the intertwined entities of individuals, organizations and societies

In the societal context we are using the expression, ‘Quality society’, that means a society with high quality, or a well-functioning and well-developing society, which is good for all its interested parties. Societal quality consists of many various characteristic dimensions. Sustainability is a set of inherent characteristics of organizations and societies required by the relevant interested parties. Sustainability development consists of significant themes of quality and innovation. These are realized by the diffusion of quality and innovation achievements of the individual and organizational society members (Rogers, 2003).

Conceptually sustainability and sustainability development are not unambiguously established, and hence these concepts are difficult to be understood comprehensively and regarding their composite elements and their relationships (Lozano, 2008). Large scale discussion on sustainability development started with the well-known Brundtland Report (Brundtland, 1987), where the sustainable development was defined as social and economic advance to assure human beings a healthy and productive life, but one that did not compromise the ability of future generations to meet their own needs. In this context the concept of sustainability (Asheim, 1994) is the requirement of our generation to manage the resource base such that the average quality of life we ensure ourselves can potentially be shared by all future generations. Development is sustainable, if it

involves a non-decreasing average quality of life. However, conceptually sustainability is not unambiguously established, and in different contexts it consists of various aspects (ISO, 2016).

The early definitions of sustainability emphasized human aspects. Later the focus has shifted more to the organizational questions, business advantages and challenges (as an example Ford and Despeisse, 2016), and collaboration (Mathur et al. 2008). In general, this trend is strongly highlighted in the widely referenced and used three pillars of the sustainable development (United Nations, 2005) and the related organizational evaluation and reporting (GRI, 2016): (1) Economic development, (2) Social development and (3) Environmental protection. In this context, organizational responsibility and economic growth are emphasized as the prerequisites for achieving society-wide sustainable development.

Recently also many other areas, viewpoints and methodological tools (Lozano, 2012) are linked together with sustainability including corporate social responsibility (ISO, 2010), risks (Faris et al 2013) and resilience (Derissen et al 2009; Berkes and Folke, 2000). Also, the Millennium development goals, MDG (United Nations, 2015a) and Sustainability Development Goals, SDG (United Nations, 2015b) of the UN still further expand the scope of sustainability development to the level of countries and societies. In these contexts, also some quality aspects are incorporated. Sustainability has developed towards a large-scale question of the Planet Earth and humanity (Dunlop et al. 2015; Lazarte, 2016).

We understand that sustainability is a subset of the broader concept of the quality of society that links sustainability with broad quality thinking and particularly focus on human perception in the context of society. According to the general definition of quality, we understand quality in the societal context as the degree to which a set of inherent characteristics of an object (society) fulfils needs and expectations. Sustainability is a set of inherent characteristics of organizations and societies required by the relevant interested parties.

We reason and conceptualize the quality of society, 'Quality society', comprehensively as an antireductionist concept that implies a society with high quality, or a well-functioning and well-developing society, which is good for all its interested parties. However, many widespread practices consider quality of society in a very fragmented way, for instance in various society evaluations and comparisons with many specialized aspects including municipality operations, environment, nature, culture, family issues, feminist issues, migration, employment, education, industry, agriculture, tourism, innovation, welfare, wellbeing, aging, healthcare, sport, communication, food supply, security, religion, etc.

We consider the inherent characteristics of the society from the viewpoint of human individuals including:

- Societal services and their effectiveness and integrity
- Serviceability (i.e. service accessibility and retainability), including capability and availability
- Security regarding property, belongings, societal stability, and local, regional and national defense
- Human identity and intimacy, privacy, self-esteem, self-actualization, and respect
- Human rights and equality
- Morality and ethical performance
- Social performance (*), including education, creativity, connectivity, interactivity and sharing, and incorruptibility
- Nutrition, cleanliness and health
- Esthetics
- Ecology (*)
- Economy (*) and efficiency and cost of poor quality

Sustainable development pillars (*) are here included in the concept of quality as the sub-set.

8. People as the primary source of innovation in creating intellectual property and common knowledge

Creativity relates to the intuitive processes of the human unconsciousness and intuition (imaging) (Raami, 2015). Each human being is naturally creative. A key issue is to release this ability from the internal and external obstacles, and to activate it to practical situations of explicit processes. This is a big challenge for the organizational innovation management. Artists and scientists are considered to be creative persons, and their

approach could also be used for benchmarking for business innovation. As an example (Cameron, 1992) they appreciate the following aspects in journey to higher creativity:

1. The sense of safety: Positive attitude to creativity without fear
2. The sense of identity: Honest self-scrutiny and awareness regarding own needs, interests and mental limits, autonomy and self-protection
3. The sense of power: Mental strength, perseverance to overcome obstacles of spiritual growth, and hope
4. The sense of integrity: Being honest and having strong moral principles, moral uprightness, being whole and undivided
5. The sense of possibility: Release from everyday ties, believe in a new and positive action
6. The sense of abundance: Joy and plentifulness of the good things of life
7. The sense of connection: Social and professional contacts for influence and help
8. The sense of strength: Winning the losses and withstanding criticism, coping with the inadequacy of time
9. The sense of compassion: Sympathetic concern about the sufferings or misfortunes of others
10. The sense of self-protection: Avoiding obsessions, for instance ‘workaholism’, dangers due to the lack of mental stimulation, lust of reputation, and unhealthy competing
11. The sense of autonomy: Feeling freedom, acceptance and success, detaching from self-centeredness, getting contact with the outside world through physical activity
12. The sense of faith: Trusting, knowing own consciousness and creativity, recognizing imagination

Especially Leonardo da Vinci has been considered as the key reference of a creative personality. His innovation principles (Gelb, 2000) were:

- *Curiosità* – An insatiable quest for knowledge and continuous improvement
- *Dimostrazione* – Learning from experience
- *Sensazione* – Sharpening the senses
- *Sfumato* – Managing ambiguity and change
- *Arte/Scienza* – Whole-brain thinking
- *Corporalità* – Body-mind fitness
- *Connessione* – Systems thinking

It is very common that the inventors are going to be quite alone, without the necessary support from the others or even are confronting hostile agents against their achievements.

Intellectual property (IP) derives from the work of an individual's mind or intellect (WTO, 2016; WIPO, 2016) and consists of industrial property (inventions, patents, trademarks, industrial designs, and geographic indications of source) and copyright (novels, poems and plays, films, musical works, artistic works such as drawings, paintings, photographs and sculptures, and architectural designs). Intellectual property rights usually give the creator an exclusive right over the use of his/her creation for a certain period of time.

Many legal principles governing intellectual property rights have evolved over centuries. Creative Commons (Creative Commons, 2016) provides an infrastructure and tools for giving individual creators, companies, and institutions a simple, standardized way to a ‘some rights reserved’ approach to copyright through licenses that are legally solid, globally applicable, and responsive to our users’ needs.

Today, many of the innovations come from the collaboration of many individuals operating in networks (Tapscott and Williams, 2006) for mutual benefits (Rosted et al, 2009; Chesbrough and Vanhaverbeke, 2011). Genuine innovatory networks are unplanned, emergent aggregations (Anttila, 2010). Their growth is sporadic and self-organizing. Network members are independent actors. Nobody manages the network as a whole but each actor has its own characteristic impact on the network. Crowd-sourcing is the practice of obtaining the needed services, ideas, or content by soliciting contributions from a large group of people and especially from the online community rather than from the traditional employees or suppliers.

Knowledge is generally accepted as the primary source of the success of enterprises and societies. In this context, the role of knowledge as a commons and information commons interchangeably are interesting issues (Hess and Ostrom, 2006; Downes and Mui, 2000). A commons is a resource shared by a group of people that is subject to social dilemmas. In particular, an industrial commons is the R & D and manufacturing infrastructure, know-how, process-development skills, and engineering capabilities embedded in the firms,

universities, and other organizations that provide the foundation for growth and innovation in a wide range of industries (Gatarik and Born, 2013). This leads to providing flexible, creative, innovative and sustainable problem solutions and fostering network economics (Barabási, 2002) including the development of quality and sustainability in a broad sense.

9. Business integration and organizational learning for quality and innovation

As well as the evolution of the quality and innovation disciplines (figure 1), also the business management has a similar historical evolutionary development. Many business thinkers and teachers from the creators of the classical school of management theory, for instance F.W Taylor and H. Fayol, to today's influential persons have defined their own management principles and preferences according to their own experiences and insights (Anttila et al., 2012a). These comprise significant general references for the managerial development in any organization.

Early business thinkers emphasized the importance of compliance and control aspects. Although much later quality and innovation appeared as concepts in the reference materials of the business experts, they touched on those aspects at quite a general level and without their mutual linkages. Sustainability appeared in the agenda of the organizational and societal development in the 1980's (Brundtland, 1987).

Quality and innovation are abstractions, they are related to the characteristics of the results or outputs of certain activities or processes; managing quality or innovation is not possible directly but management takes place through the organizations' business system and processes (Anttila and Jussila, 2011). According to the ISO 9000 standard, quality management means coordinated activities to direct and control the organization regarding quality (ISO, 2015a). Quite respectively innovation management means coordinated activities to direct and control an organization regarding innovation. Hence, according to the definitions in practice they are integrated with business management.

Business leaders at the different levels of organizations keep a central position to consider the managerial disciplines on their general management responsibilities (Anttila et al., 2012b). Business leaders often prioritize financial performance and legal aspects when the market and individual interests are being emphasized. Hence it is challenging for highly specialized other disciplines to get a remarkable role in their agendas. Leaders normally recognize the importance of quality and innovation in practice, but they do not consistently act for them as part of their management duties. Naturally top leaders call for creativity, reasoning, and intuition, no less than rational fact-based analysis, because they must wrestle with dilemmas and not only struggle with problems (Low, 1993). With dilemmas, unlike problems, there are no right solutions; one can only choose the most suitable solution. The authentic organizational quality management and innovation management cannot be delegated and cannot be genuinely and effectively implemented without the business leaders' consistent contributions based on their organizational position, authority, and role.

In order to ensure effectiveness, challenging management domains, including quality, innovation, and many other specialized disciplines, should be integrated with the organization's business system and processes (Anttila et al., 2012a), and be consistent with the organization's business targets and culture. Successful development of the business integration is a holistic learning process that leads on to continual refining of the discipline related concepts and principles, tools and methodologies, and management practices (figure 4) in a compatible and consistent way. Organizational learning constitutes the development not just of new capacities, but of fundamental shifts of mind, individually and collectively. That is based on sensibility to new opportunities, changing attitudes, and getting new skills. In this context, the five basic learning factors of figure 6 are the key means by which this learning and business integration are ensured (Senge et al., 1995).

Fig. 6. Five basic learning factors to ensure organizational learning towards the business integration of quality, innovation, and the other specialized business disciplines

Management system standardization gives possibilities for realizing quality and innovation management in an integrated way in the organizations. Quality and innovation can together create organizational differentiation for competitive advantage. Organizations have a key role in implementing quality and innovation procedures in practice. It is not beneficial to the organizations, if quality management and innovation management are developed apart from the organization's business aspirations and as isolated initiatives from each other. Quality and innovation disciplines need each other in organizations, and they even may cross-fertilize each other, e.g. there should be quality and innovation in both quality and innovation processes.

The general quality management standards (ISO 9000 standards series) refer to innovation but in a very immature way. Innovation management is also considered in the European CEN/TS 16555-1 technical specification (CEN, 2013) and the international ISO 50501 (draft) standard (ISO, 2015c). The available documents seem not to refer explicitly to quality issues. However, both standardizations use the same structure to present requirements, which is a positive issue for organizational implementations of both managerial areas in a harmonized way.

ISO/IEC Directives (ISO/IEC, 2012) have defined a high-level structure (table 2) and identical core text, and common terms and core definitions to be used in all international standards for the different discipline specific management. The high-level structure consists of key issues of the established normal business management that are significant for promoting the business integration of the specific management issues. These guidelines can be used in integrating simultaneously quality management and innovation management processes into an organization's processes of business management.

Harmonized titles of the standard clauses
1. - 3. General introductory clauses
4. Context of the organization
4.1 Understanding of the organization and its context
4.2 Understanding the needs and expectations of interested parties
4.3 Determining the scope of the XXX management system
4.4 XXX management system
5. Leadership
5.1 Leadership and commitment
5.2 Policy
5.3 Organizational roles, responsibilities and authorities
6 Planning
6.1 Actions to address risks and opportunities
6.2 XXX objectives and planning to achieve them
7. Support
7.1 Resources
7.2 Competence
7.3 Awareness
7.4 Communication
7.5 Documented information
8. Operation
8.1 Operational planning and control
9. Performance evaluation
9.1 Monitoring, measurement, analysis and evaluation
9.2 Internal Audit
9.3 Management review
10. Improvement
10.1 Nonconformity and corrective action
10.2 Continual improvement

Table 2. The harmonized structure and the chapters and clauses of the text (ISO/IEC, 2012), which present the management aspects required for the different specific disciplines and emphasize their integration within the normal organizational processes. In this structure, XXX means the specific discipline, including quality or innovation.

According to the standardized structure, the organizations can consider required managerial aspects in the harmonized way. The requirement standards ISO 9001:2015 (Quality management) (ISO, 2015b) and ISO 50501 (Draft) (Innovation management) (ISO, 2015c) follow this structure. The same general structure is used in the European technical specification CEN/TS 16555-1 (Innovation management) (CEN, 2013). These standards promote the integrated implementation of quality management and innovation management in organizations.

10. Societal quality and innovation diffusion

Innovations and quality diffuse through the activities of its members into the society (Rogers, 2003). Each society member has its own characteristic networking position and links to influence the development of the society.

International standardization brings about substantial macroeconomic society-wide benefits. Quality and innovation have important relationships in standardization. They are success factors for the individual organizations, but greater economic benefit is gained through the general standardization that distils and

diffuses the results and knowledge of quality and innovation broadly to researchers, experts and organizations. As opposed to patents, the information in standards is accessible to all and its dissemination is not restricted (DIN, 2000; Blind et al. 2011; Miotti, 2009). Hence, international standardization brings about substantial macroeconomic benefits.

11. Conclusions

Reflecting on the development of the quality and innovation activities in general, one can draw a conclusion that originally quality and innovation were seamlessly integrated and then separated and evolved during their professionalization into two different disciplines and continued to develop largely as separate. Still their relationship is not generally clear from the organizations' management point of view. However, the interaction between them is important and fruitful within organizations and among respective expert communities. Both disciplines should be effectively integrated with the business system and processes. In this article, the relationships between quality management and innovation have been considered. Very analogical is the situation also between innovation and many other disciplines, for instance environmental management, information security management, occupational health and safety management, etc. Integration of quality and sustainability can be very natural, because sustainability aspects are included in the scope of quality concept as a subset.

Reinforcement of quality and innovation as partnering disciplines is justified:

- a) From the human perspective for enhancing the quality of life. Personal strive for quality and innovation refine lifelong learning.
- b) From a business perspective for ensuring the sustained competitiveness and success of the organization. Quality and innovation comprise significant conceptual relationships and useful practical possibilities of business benefits. They both are based on people engagement and arise in the organizations' business systems through business processes and their management. They are enhanced by collaboration of the quality and innovation practitioners and professionals, organizational learning and business integration
- c) From a societal and global perspective for reinforcing the sustainable development towards "Quality Society" and saving our planet. Quality and innovation diffuse through decisive operation of people, institutions and organizations

The general evolution of quality and innovation professions take place as the separate disciplines by the experts of the discipline communities, but collaboration is beneficial for the both disciplines. Quality and innovation are based on human abilities and aim at individual and collective human benefits.

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