



Research article

Globalization, quality and systems thinking: integrating global quality Management and a systems view

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ABSTRACT

A global approach towards quality management highlights the need for constructing a new body of knowledge that views the field of global quality from a systems perspective.

The current article presents the results of an ongoing research based on quantitative and qualitative studies. The qualitative study used Grounded Theory as its theoretical and methodological framework. The subjects of this study were experts in systems thinking, including project managers and engineers who were interviewed in depth about their work in global organisations in a business environment characterized by complex and dynamic challenges. In addition, several qualitative and quantitative tools were applied in a field study of 18 multinational companies.

In view of the requirement for developing new global quality management terminology, this article presents several new key concepts in this field, which have resulted from the ongoing research, with emphasis on a systems-oriented rationale and perspective.

As such, the article is an important stage in building this new body of knowledge, and towards the conceptualization of key variables used in global quality management, from a systems approach that interacts with the fields of international management and strategic management.

1. Introduction

Globalization processes, through which organizations expand their activity beyond local systems into other geographical areas, alter the structures of operational environments. These processes give rise to border-crossing, multinational processes and products, creating complex international operational systems, characterized by multiple operational units located at scattered sites (numerous manufacturing plants, development departments, subsidiaries); the production of varied products; processes that occur at several sites; and diverse dependency relations (degrees of relatedness) among operational units. Different departments or subsidiaries might collaborate when they share customers, and supplier-customer relationships may be contained within the organization itself (i.e., suppliers and customers may be part of the same multinational enterprise).

Globalization provides organizations with many opportunities; however, it also presents management systems with complex challenges (Mehra and Agrawal, 2003). Beyond the classical issues associated with local operations, multinational organizations must also cope with

challenges presented by the decentralization of manufacturing, procurement, marketing, administration, and other market-level activities. The global setting creates particular difficulties for quality assurance and control managers at different levels (Mehra and Agrawal, 2003). These challenges are largely a result of the high degree of complexity inherent in multinational systems. To address these challenges, managers of multinational organizations must adopt a broad, strategic perspective.

Even in organizations that function solely at the local level, operations are often characterized by significant complexity. A local organization must manage its inputs and outputs; identify, acquire and manage resources (capital, raw materials, technology, human resources, knowledge); coordinate operational activities and processes; and identify changes in the competitive environment and respond to them, even in situations of uncertainty.

Multinational organizations face all these challenges, further complicated by the fact that their operations encompass multiple, complex local environments, not only in the regions where the organization currently operates, but also those where it aspires to expand. As a rule, the operational environment in which a multinational organization

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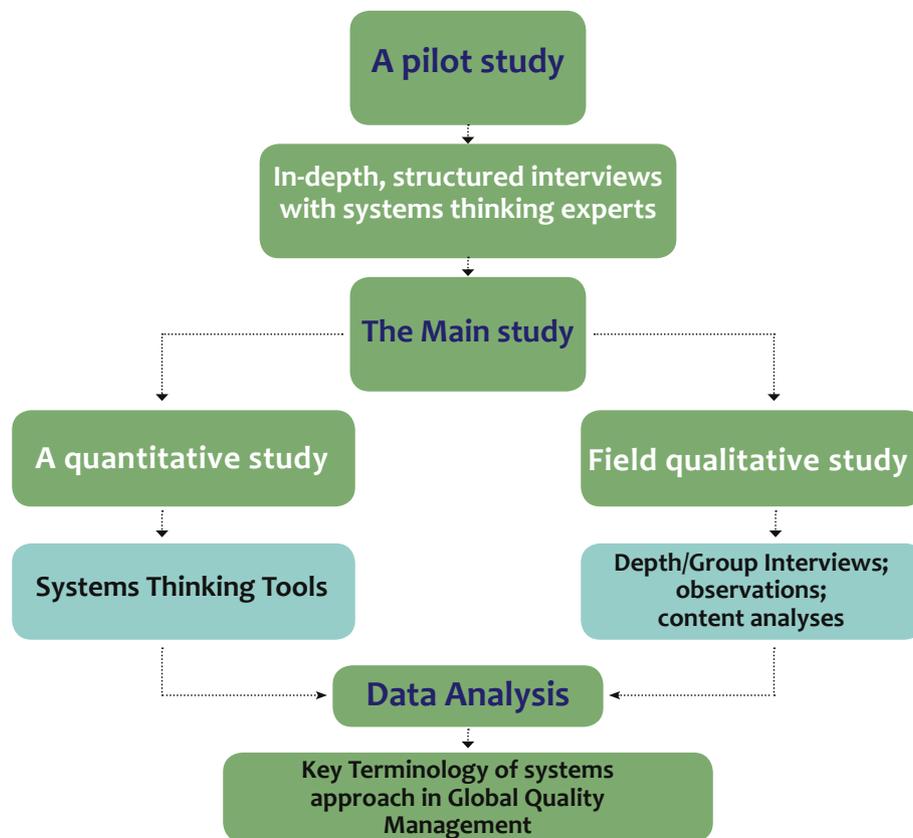


Figure 1. The research design.

functions is much more complex, dynamic and challenging than that of a local organization. The global environment is also characterized by greater managerial uncertainty, which presents managers on all levels with substantial challenges.

Therefore, managing multinational organizations requires a more sophisticated and complex skill set than managing local ones. Managers of global organizations must be flexible and adopt a broad, strategic view of organizational and business functions, and also be able to respond adequately and rapidly to constant, and sometimes simultaneous, changes occurring both within the organization and in the external environment. To cope with these challenges, a multinational organization, its business operations, and particularly its global quality management system needs to create managerial structures which will enable it to work within existing and future settings as a holistic entity, whose separate components are united by a single set of characteristics, values and management principles.

This article presents a new systems approach that can be integrated into quality management processes at the global level, and contribute to a better understanding of their complexities and diverse dimensions. This approach is based on General System Theory (Bertalanffy, 1968) that posits a basic similarity between systems in various disciplines, which facilitates the implementation of this theory for managing varied functional systems in companies and organizations that operate on both local and international levels, including global quality systems. GST incorporates a system of rules and arguments based on a comparison of different disciplines. The current article presents these principles, and uses them to construct new key concepts relevant for global quality management. These concepts will serve as a foundation for developing an updated body of knowledge that integrates two disciplines: quality management and systems thinking, in order to achieve the

multidimensional perspective required for coping with management challenges in a global world.

2. Literature review

2.1. The concept of systems thinking in the global world: theoretical background

Ludwig Bertalanffy (1968) was a biologist who carried out scientific investigations and became a pioneer of systems thinking. A particular focus of his work was the difference between the life processes of mechanism and vitalism: the separation of living and non-living matter. The belief of mechanists was that life is a secondary phenomenon which is the result of chemical and physical processes (Craver, 2007; Darden, 2006). The belief of the vitalists, however, was that a life force animated every living thing (Bedau and Cleland, 2010; Bowler, 2001).

According to Bertalanffy, both of the above schools of thought tried mistakenly to focus on a definition of life only at the molecular level, rather than considering the system. They did not take account of the organization and the interrelationships of the molecules so that we can understand “what separates living matter from non-living matter” it is important to understand microscopic entities and how they impact each other as a whole. Life has to be viewed not at the molecular level but as relationships that intersect among molecules:

A fundamental contrast is found when we consider not single processes, but their totality within an organism or a partial system of it, such as a cell or organ. Then we find that all parts and processes are so ordered that they guarantee the maintenance, construction, restitution, and reproduction of the organic systems (Bertalanffy, 1968).

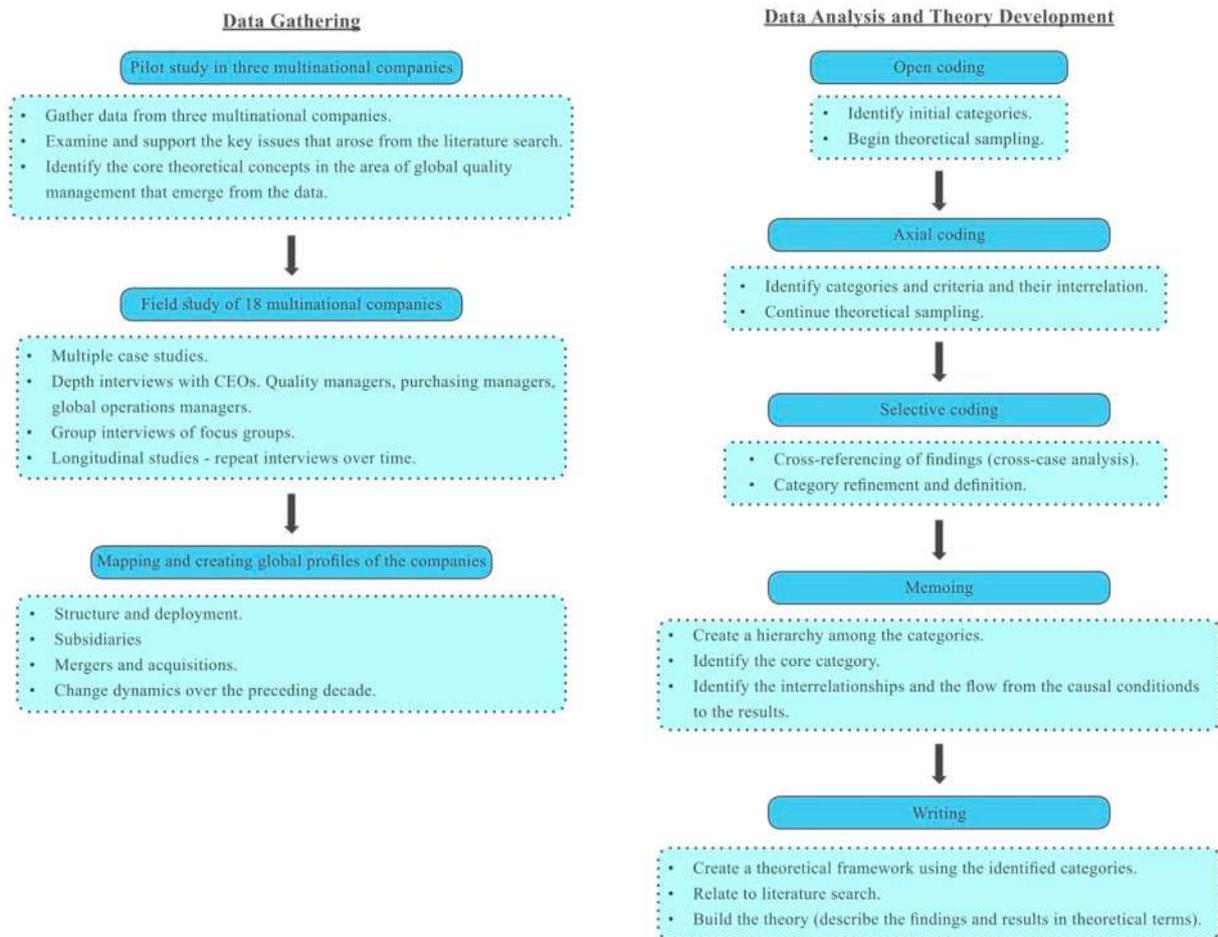


Figure 2. Grounded theory methodology.

According to Bertalanffy, systems thinking emphasises the interrelationships between its components, not merely the components themselves, and encourages us to regard this issue as a whole. This differs from the traditional approach which analyzed the individual parts of a subject in order to understand it. He focused on the formulation of a general systems theory. The aim of this theory was to explain every system in all scientific fields and to find concepts applicable to all systems regardless of temporal scale, type, substance or domain. General system theory, widely known as GST, offers a meta-methodology of holism that aspires to encompass different sciences by discovering concepts, laws and models applicable to systems of all types. GST was an ambitious attempt to establish systems thinking as an independent discipline because it argued that systems were worthy of study in their own right, even though the nature of the elements making them up (mechanical, biological, human) differed.

Systems thinking, built on the foundation laid by Bertalanffy, is a concept that considers an issue in its entirety and, rather than examining individual components, it emphasizes the relationships between components. Founded on a holistic perspective, systems thinking does not attempt to separate systems into components and thus understand them. On the other hand, it puts the emphasis on how the components work together in networks of interaction. The whole emerges from the interactions among the components and consequently gives meaning to the parts. Therefore, the only way to fully understand a system is to understand its components as they relate to the whole. In short, "the whole is greater than the sum of its parts."

During a process of problem-solving many authors make reference to a need to see the "big picture". However, it is rare to arrive at a conclusive, effective solution by breaking problems down into their

individual elements and by finding individual solutions for each element. The opposite, in fact, is the case, where tackling an entire problem can frequently result in a more effective solution.

According to Richmond (1994), "Systems Thinking is the art and science of making reliable inferences about behavior by developing an increasingly deep understanding of the underlying structure." In a later article, Richmond and Richmond (2000) clarifies this concept by introducing the phrase "forest thinking," which he explains means looking at the issue "from 10,000 m rather than focusing on local trees" and "considering how the system influences systems on the other side of the line and how these latter systems influence the former system."

Richmond (1994) underlined how important it is to develop systems thinking within organizations and to focus upon implementing systems thinking. Supporters of systems thinking are usually people who can look at a problem from several angles (Beasley and Partridge, 2011; Evans, 1996; Martin, 2005; McConnell, 2002; Rhodes, 2002; Selby, 2006). On the other hand, non-systems thinkers usually view things from a single perspective, and usually show a 'biased jumper' level of critical thinking' (Wolcott and Gray, 2003).

A pioneer of systems thinking in business organizations, Senge (1990) described the discipline as:

- A practice for perceiving entire systems (wholes),
- A structure for identifying interrelationships and for observing patterns of change as opposed to static 'snapshots',
- A collection of general principles which over the last hundred years, has encompassed areas ranging from the physical and social sciences to management and engineering,
- A set of specialised tools and practices.

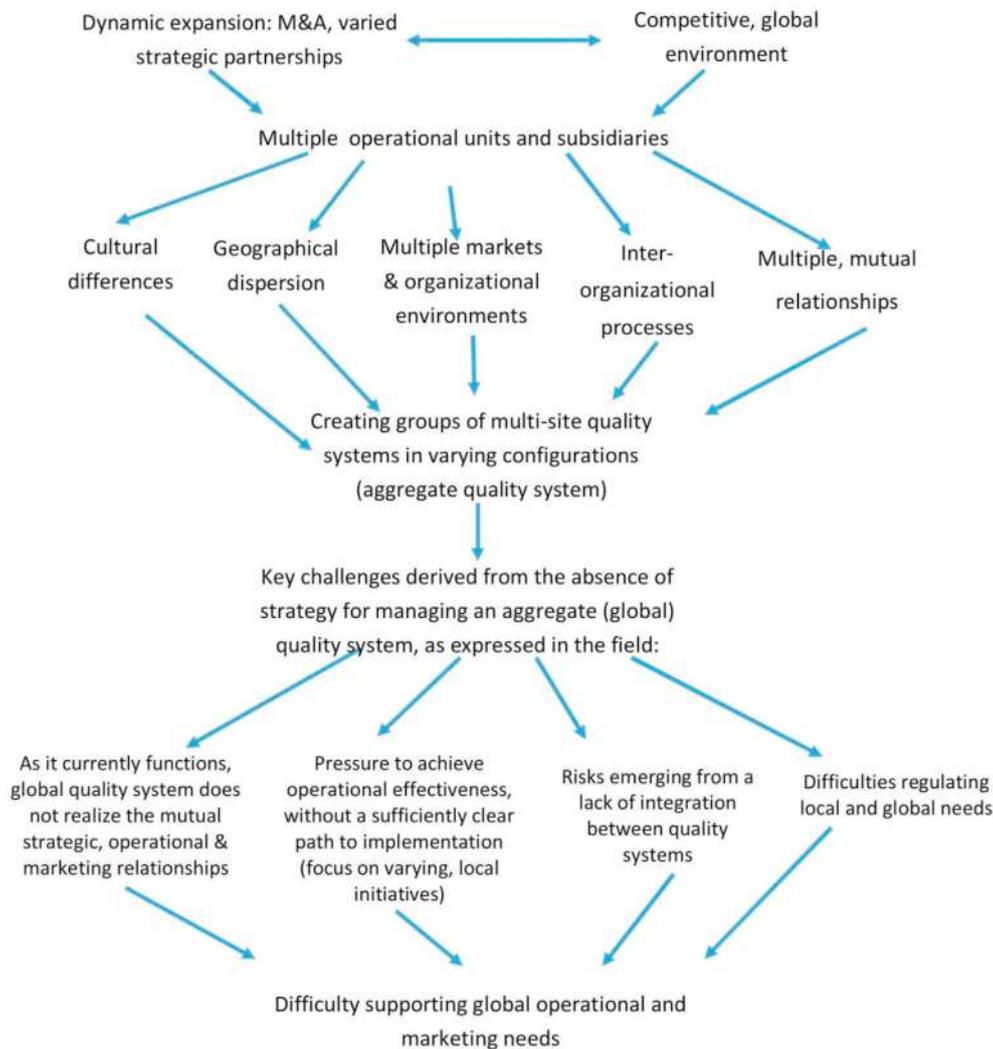


Figure 3. Initial category mapping: open coding stage.

A person who can see four levels that operate simultaneously – behavior patterns, systems, mental models and events – especially in an organizational setting, is a good systems thinker, according to Senge (1990). This unites the fields of mental models, shared vision, personal mastery and team learning. It is commonly thought by researchers that performance improvement can be maximized in organisations by systems thinking. Numerous organisations use this approach regularly in order to improve their planning and decision-making. However, most organizations have not sufficiently developed their systems thinking because there are insufficient tools available to enhance measurement and training of systems thinking.

2.2. Recent findings of systems thinking research in global organizations

Most of the recent research on systems thinking in global organizations discusses definitions, skills, dimensions and perspectives related to this approach. These studies present a multidimensional view on theory and practice, as well as research and applications in a wide variety of fields. We present a sampling of the recent literature below.

Reynolds (2014a,b) deals with the theoretical aspects of systems thinking, and presents systems thinking in practice as a ‘praxis’, or theory-informed practice, demonstrating how its principles might be expressed in a particular systemic inquiry. Sillitto (2104) examines the question of whether systems exist in the real world, claiming that it is

often meaningful and useful to consider the notion that systems do exist in the real world, and that there are objective criteria for identifying them. Koral Kordova (2016) suggests a model for describing factors relevant to systems thinking, presenting them graphically as equations for relationships between open and closed variables, and assigning given numerical values to those relationships.

Other scholars focus on system dynamics, a methodology created decades ago by Forrester (1994). On this basis, Papageorgiou and Hadjis (2008) offered an integrated approach for evaluating business strategies prior to implementation. For this purpose, they suggest an archetypical system dynamics model, in which the web of interdependencies between organizational processes and market characteristics can be managed effectively.

Because systems thinking is an interdisciplinary conceptual framework which is used in a wide range of fields, rather than a discipline, varied studies present how it might be applied to different domains in the global world. These include healthcare, education, systems engineering, psychology and project management (Davidz, 2006; Frank, 2010; Goldstein, 2016; Kenett and Lavi, 2016; Koral Kordova et al., 2018; Leshno and Menachem, 2016; McDermott and Freeman, 2016; Zhang, 2016). These studies enable us to better understand why it is so important to integrate a systems perspective into the working environment of global organizations. Beyond the conceptual foundations of systems thinking, they outline its terminology and tools, as well as the proper ways to use

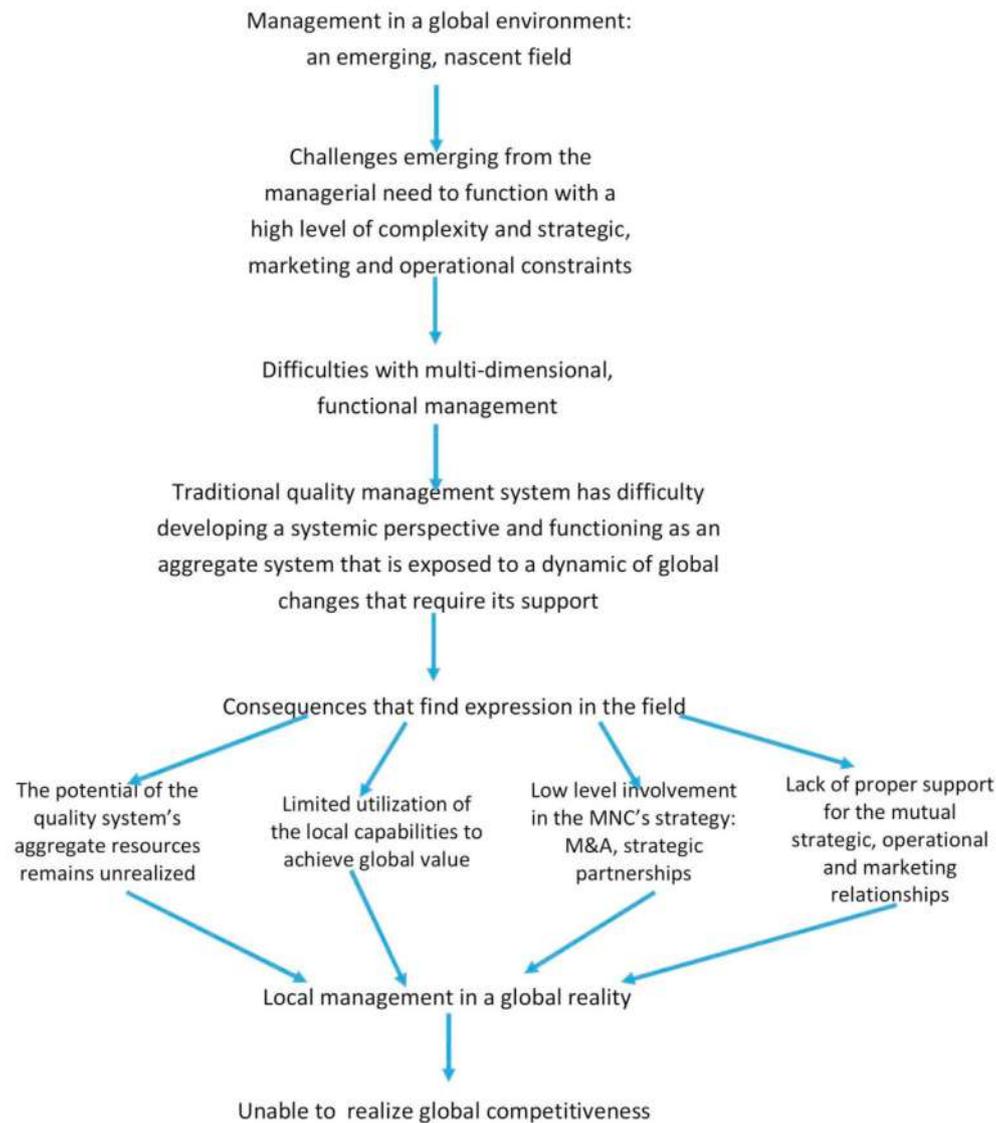


Figure 4. Formulation of the categorical theory: Expanding the mapping process and linking it to the research literature and theory in the field of international and strategic management.

them. Improved understanding of new tools and new terminology will help in the identification of problems and the design of solutions in an environment which is characterized more and more by the complexity and chaos often associated with global organizations.

2.3. The need for a systems approach in global quality management

Today the global business environment has become increasingly complex. This is shown by the need to change the perception and implementation of quality management, given the increasing size and complexity of mutual relationships which link services, products, production and network processes (Srinivasan and Kurey, 2014).

Bashan and Armon (2019) discuss the challenges facing the quality systems of parent companies, and subsidiaries as a result of mergers, acquisitions and a variety of strategic partnerships, which characterize the processes expansion in the global world. These expansions create a multi-reciprocal network structure and raise questions about how to manage the multi-interface aggregation process structure.

Quality professionals should focus on the improvement of performance through better processes. This literature review illustrates the fact

that being able to stay ahead of the competition, both current and future, gives a competitive advantage, and a firm's resources and business strategy will have a major impact on this (Chan et al., 2020).

The definition of 'quality' as 'the percentage of defective products on the production line' is now outdated and inadequate, as changes in technology, the labor force and, indeed, the global economy, have obliged us to take a new approach to the concept of quality worldwide.

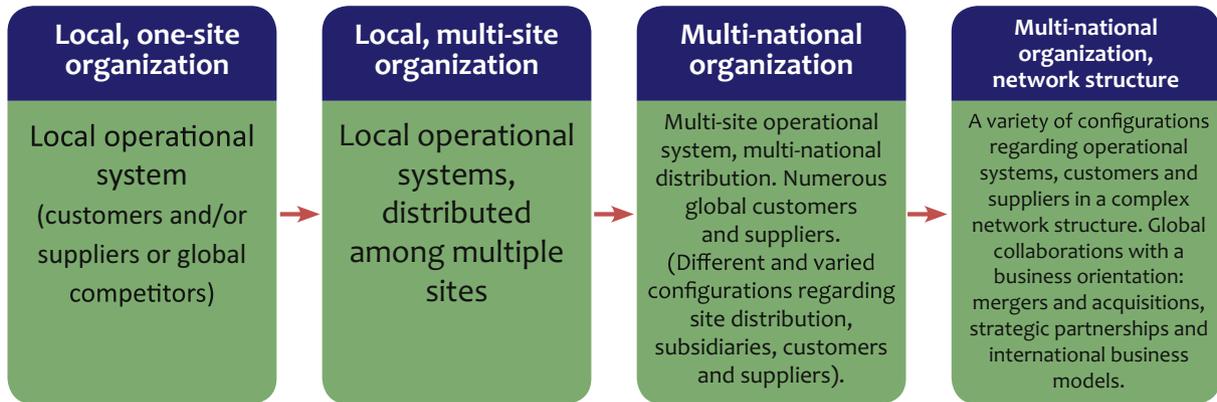
It is important that we develop a practical, strategic approach in order to maintain business excellence and support executives and their companies facing instability and uncertainty in their specific market environments (Wiele et al., 2011).

In spite of the increased use of the term Global Quality Management (GQM), neither a definition of this term nor a universally agreed GQM concept exist.

A review of the literature on GQM shows the need for a robust GQM philosophy which emphasises a requirement for process management and coordination within the organization.

The formation of 'network organizations', a result of a company's expansion processes, creates collaboration and cooperation between different organizations or within a meta-organization. According to

Level of Complexity and Distribution of Global Organizations - Systems Analysis



Dynamic global development: An increase in the level of operational complexity, inputs, and resources, multi-site distribution, business models and strategic partnerships, numerous inter-relationships, and the ever-increasing need for interaction mechanisms in order to achieve operational effectiveness and create global value.



Assessing the required management of the global quality system

An increase in the number of quality systems resulting from multi-site activity, a rise in the number of processes and their level of complexity and variance. Aggregate management is required through a group of quality systems. The need for a coordination and integration mechanism develops among the quality systems, in order to achieve local and global functional value. Effective resource management is necessary, the quality system must be flexible and must be pro-active regarding the company’s global strategy while expanding its involvement in international business models.

Figure 5. Complexity levels of global organizations.

Barabási and Frangos (2014) this expansion enables the company to move from the structure of a tree to that of a multi-dimensional network.

Since the competitive global environment is so complex, it is necessary to adopt a systems perspective in order to analyze the development



Figure 6. Possible geographical distribution of a multinational company.

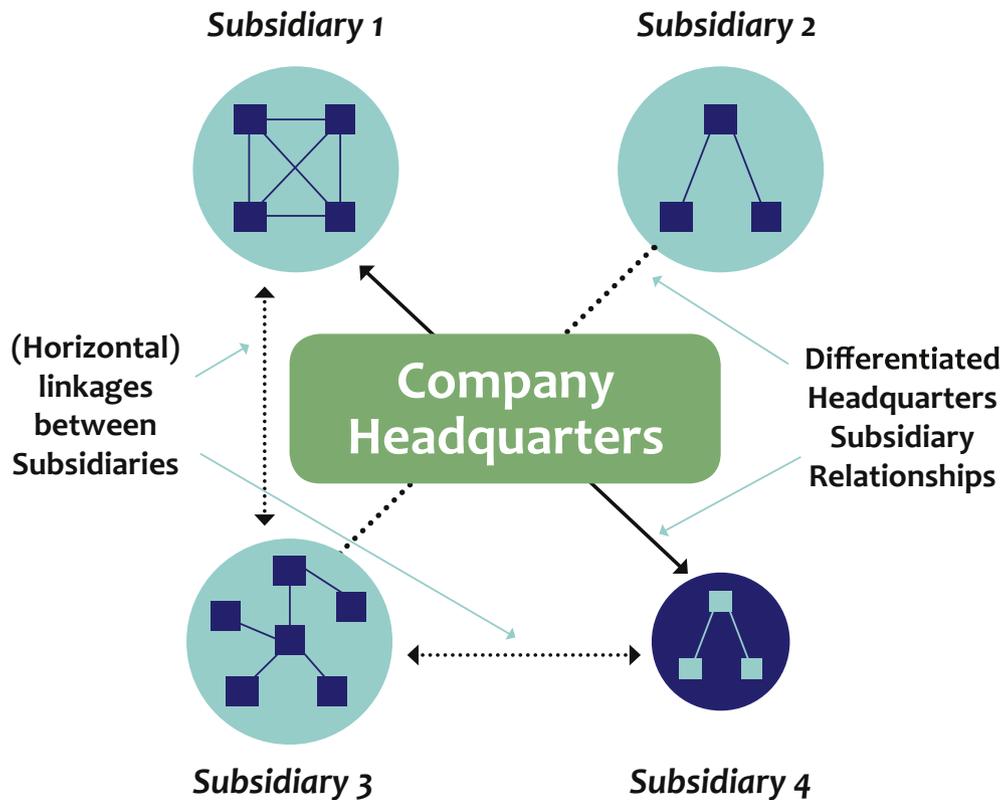


Figure 7. Aggregate structure of subsidiary companies.

of a multinational company and its effect on global quality performance and functioning.

Open and complex systems theories (Mehra and Agrawal, 2003; Bar-Yam and Minai, 2004) and contingency theory (Pugh and Hickson, 1976) form the basis of the systems analysis approach. These theories are used to analyze quality and other systems and management patterns of multinational companies.

Since systems analysis can be seen as the route to planning the functional global integration of the quality system, part of the organization's strategic plan must include the integration of varied systems. The systemic perspective of integrating knowledge from strategic and international management leads to understanding how global organizations constantly expand. This expansion affects how multi-site quality systems spread and perform on local and global levels. According to

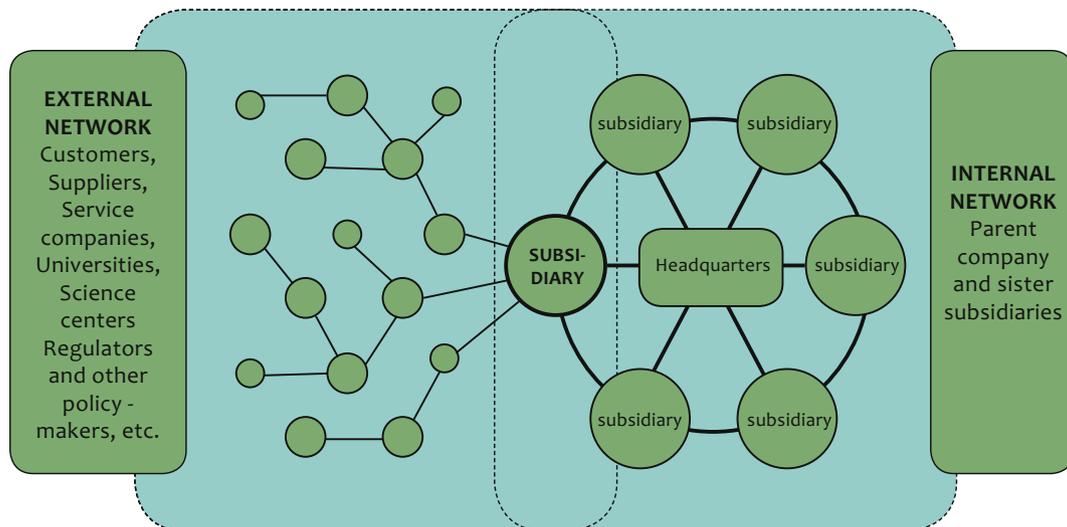


Figure 8. Global distribution of a dynamic and changing network structure.

Table 1. New concepts.

Aggregate Quality System	<p>A group of quality systems belonging to subsidiary companies and their operational units, created by the strategic steps the company takes in order to achieve competitive advantages, such as being closer to customers and/or suppliers, acquiring rival companies, business models, and global, strategic partnerships. In practice, it is a group of local quality systems, each of which operates as a functional unit within a defined environment, and must support the local operational and marketing systems. Each of the local environments has its own environmental characteristics, processes, products, and defined needs that are supported by the quality system. There is also a group of QMS that belong to diverse operational units such as global production, development and geographical distribution.</p> <p>The Aggregate Quality System, represents the QMS on an composite level, is based on the principles of the systems approach; it is a dynamic system whose sub-systems' structure and number change rapidly and frequently, due to diverse strategic steps taken by the multinational company, as part of its expansion process, including mergers, acquisitions and strategic partnerships. The different QMS interact with one another, as discussed in detail below. Moreover, the interrelationships between the parts of the aggregate quality system are of great importance: the whole is greater than the sum of its parts.</p>
Corporate Quality HQ	Behind every multinational company is a corporate quality system operated by the parent company, which is meant to direct the aggregate operations of the QGMS. In most cases, the corporate quality system is also an operational centre in and of itself.
Functional Global Integration	<p>The functional integration of the GQMS depends on creating integration mechanisms, to ensure that the various systems in the aggregate remain connected to one another, and operate as part of a single organizational entity – to reduce failure and encourage quality throughout global markets. The integration process is the outcome of the multi-disciplinary process that characterises GST. A strategic process, it relates to network-based functional management, and its goal is adding global value. In practice, it means finding new ways to integrate the company's operational network branches and operational systems located in different geographical areas, under the general auspices of a single organizational entity.</p> <p>The term <i>functional global integration</i> expresses the notion that every business function requires a special profile of integration mechanisms, in order to achieve efficient global integration between the organization's units. In the current context, we are considering the potential integration of the GQMS, whose aim is to create value by implementing the network's strategic, operational and marketing connections (interrelationships). The integration of global quality functions requires an understanding of international strategies, operations and marketing that provide a rationale for the method and level of integration necessary between systems.</p> <p>According to GST, the term <i>development</i> encompasses the need for combined (integrated) management of the QMS in order to support the system's change dynamic in operations and marketing. The integration process is derived from the global strategy of the organization, and functions using feedback received from the GQMS of operations and marketing units.</p>
Local Management	The management of operational systems and their QMS in the context of local environmental systems, when both customers and suppliers are also local.
Global Development	<p>The development of operational systems and their QMS external to the local system in various ways:</p> <ol style="list-style-type: none"> 1) Customers, suppliers, inputs and resources are external to the local system, 2) Expansion of the company into other geographical areas using varied strategic steps: relocating operational units to low-cost countries (LCC); mergers; acquisitions; and strategic partnerships. <p>Global development reflects a dynamic situation in which closed systems become open systems, whose structures change and cross their own initial, local borders. According to GST, an open system must stop the entropy process and maintain order, which means adapting open systems to changing conditions, new needs, and new demands. In addition, this development must also see the forest and not just the trees, following the Forest Thinking approach.</p>
Global Management	<p>Global management is required as a result of the above-mentioned global expansion and development processes, which are dynamic and create various systems of interrelationships: operational and marketing strategies among the different local units and the subsidiary companies. Operational units and their functional systems – including quality systems.</p> <p>Global management is based on the principles of an open system, according to which mutual relationships exist between and among the system's various parts and components, and other systems that operate in its environment. It operates within a variety of internal and external interrelationships that influence it or which it can influence. Global management requires a systems approach that sees the whole and the interrelationships among the various components, making it necessary to develop cyclical thinking instead of the traditional linear thinking, and recognize the cycles of influence. A problem is not solved by breaking it down into individual parts; it is important to consider all of the implications, as every action of any component in the system influences the other parts and the whole.</p>
Relatedness	<p><i>Relatedness</i> reflects the system of interrelationships among the multinational company's (local) operational units and their functional systems. On a functional level, the aggregate GQMS includes varied branches in a complex tapestry of interrelationships, created during the multinational company's expansion process. Within the system of interrelationships – joined by the strategic, operational and marketing-based rationale that motivates expansion – the system must be an integrated and responsive support system. These strategic relationships dictate the group's operational and marketing dependencies, and it is necessary to determine the correct level of integration that should be adopted to maximise the quality system's functioning.</p> <p><i>Relatedness</i> is based on GST in which interrelationships can act as a constraint, but they can also be perceived as value-adding. According to this approach, taking advantage of relatedness can cause significant improvement, making it possible to reach the leverage point. Moreover, the GST claims that the interrelationships between the company's various units are of utmost importance, because the whole is greater than the sum of its parts (the synergy principle).</p>
Strategic Relatedness	<p><i>Strategic relatedness</i> is an outcome of global development based on diverse strategic steps, such as: mergers and acquisitions, strategic partnerships, vertical integration, and more. The term <i>strategic relatedness</i> expresses the need to evaluate the level of integration and coordination that best suits the various aspects of the different strategic partners' quality systems. The relationships among the systems are formed by strategic perspectives, policy approaches, and future plans. Company decisions made on the strategic level must be supported by functional systems, including the QMS .</p> <p>GST, which is characterised by a strategic perspective, prepares the system for long-term, multi-dimensional strategic consequences, which also affect other systems, and their respective economic and business environments.</p>
Operational Relatedness	<p>A multinational company's expansion process can occur in the branch where it currently operates, in fields related to its existing activities and abilities, or outside of its current branch, by penetrating another, attractive field where it can achieve a competitive advantage. The term <i>operational relatedness</i> expresses the similarity between types of resources, infrastructures, abilities, and acquisition sources that might may be exploited effectively on the level of a group or multinational company. The parent company strives to create integrative activity, exploit a pool of shared resources, and use existing capacities, and central acquisitions, etc., thereby facilitating operational relatedness, and the ability to contribute to achieving cost and competitive advantages.</p> <p>The term <i>operational relatedness</i> expresses the need to evaluate the level of integration required among the different QMS (in an aggregate quality system) to support this relatedness, quality assurance of resources, and the effective management of their derived processes.</p> <p>Similar operational systems, characterised by similar or common resources, can merge their resources and capabilities in order to achieve operational effectiveness at the systems level, which influences the QMS that is responsible for resources and</p>

(continued on next page)

Table 1 (continued)

	management quality. Similarities among these operational systems strengthen the central claim of GST, the similarity of all systems.
Marketing Relatedness	Subsidiary companies or operational units geared towards identical local markets: products that are identical, competitive, complementary and/or dependent on common supply sources (purchasing from the same markets). Marketing relatedness facilitates cooperation when competing for clients in shared markets, in order to gain power by taking advantage of economies of scale. The term <i>marketing relatedness</i> expresses the need to evaluate the level of coordination and integration that should exist between the subsidiary companies' QMS or among the operational units that work with common/shared customers and/or suppliers. Marketing systems can function independently; however, their integrated management and interrelationships – among themselves and with other systems – can serve as leverage on the systems level. Recognizing the mutual relatedness between sub-systems and the mutual influences between parts of the system is a principle of the systems approach. Figure 6 conceptualizes the different types of relatedness, as they are expressed in a single multinational company.
Globalization Levels of the Quality System	Quality systems' level of development results from the varied strategic steps taken by the multinational company in its global expansion process. The various ranks (globalization level) reflect the organization's global development dynamic, on the strategic level, and how it is expressed in the operational and marketing structures, and the quality system. Different globalization levels may be characterized by implementing the principles of the systems approach, which takes into account holistic aspects, such as number of markets, the competitive environment, types of products/services, branches, processes, operational units, and different suppliers and customers. <i>Globalization level</i> reflects the aggregate quality system's complexity level, expressing the interrelations of strategic, operational and marketing aspects, as well as dependent relationships/relatedness between the subsidiary companies, operational units and various branches. An increase in the quality system's globalization level is an outcome of the systems approach, which includes an expansion of the complexity, heterogeneity and interrelationship levels found in a global-network structure. *The systems' globalization level must be defined and mapped, as each level indicates the needs, challenges and strategic assessment responses that are suitable for a particular quality system. The dynamic of global expansion creates similar dynamic changes in the globalization levels of the operational systems and quality systems. This causes changing structural configurations, with differing levels of complexity and relationship arrangements. Each requires a solution at the global quality management level. Systems that operate in a global environment become more complex both structurally and in their network of interrelationships. The systems' changing dynamics and level of complexity pose new constraints and challenges. According to GST, the quality system must therefore adapt itself to these changes, and each quality system must be managed according to the globalization level of the organization within whose framework it operates. The dynamics and possible changes in the organization's globalization level must also be taken into account; the company must prepare itself to deal with any and all possible developments. Using principles of GST facilitates examining cycles of influence, and the network of relationships that which characterise different globalization levels.
Global Quality Value-adding	The advantages/benefits derived from the "meta-system" (the multinational company) strengthens the addition of local quality systems, and/or reinforces their integration (global functional integration). This advantage is embodied by one of the leading principles of the systems approach, that the whole system is greater than the sum of its parts. In other words, the combination of skills, capabilities, and infrastructure of local systems in synergetic activity can provide higher value than the individual or cumulative contribution of each system.
Local Quality Value-adding	The advantages/benefits derived from the local quality system strengthens its sense of belonging or joining the global quality system (to which it can contribute). The local system can provide added value to the aggregate GQMS; to the same degree, integrated systems can offer the local system with added value. The local QMS can both contribute to and benefit from the global entity. This principle supports GST and strengthens the links between the various systems. According to GST, it is necessary to identify reinforcing feedback and balancing feedback processes, when examining the links between the various systems.

The text in bold represents the relevant concept in a systems view.

Morgan and Strong (2003), an understanding of changes that need to be made in an organization, how these changes are to be managed and implemented, and the roadmap for maintaining these improvements in order to achieve better performance, are the guiding principles of a strategic management process. In order to create added value to the company, quality systems, adapted to the appropriate level of international expansion, must be an integral part of these processes.

Quality managers at various levels face new challenges arising from new operational environments (Mehra et al., 2001) whilst the classic issues of local operations remain relevant. Purchasing, marketing, management and distribution around the world are new issues arising from globalization. Whilst these issues can be viewed as opportunities for management, according to Mehra and Agrawal (2003) it is important that managers utilize intricate and extremely complex organizational and administrative strategies.

Quality management system (QMS) operations in multinational companies were analyzed by Bashan and Norea (2018). The framework that they developed classified QMS features which were based on the global structures arising from expansion processes. They also present two models: a derivative one for assessing the maturity level of QMS and a hierarchical model for the global maturity of a multinational organization. The most complex and challenging constellation results from M & A

activities that produce a comprehensive network structure which includes a lack of clarity and conflicts as to the integrative management of the group's various quality systems, thereby highlighting the need to plan appropriate integration mechanisms for quality functions.

Appropriate mechanisms will reduce failures and ensure quality across all processes throughout the multinational organization when they can guarantee the inter-connection of the various quality systems and their functioning as part of a single entity.

2.4. Research objectives

The objective of this research is examining the integration of a systems approach, based on General System Theory, into quality management processes at the global level.

3. Methodology

3.1. Research design

The research paradigm combines quantitative and qualitative methods. In the first, exploratory stage, we conducted in-depth, structured interviews with experts in systems thinking, engineers and project

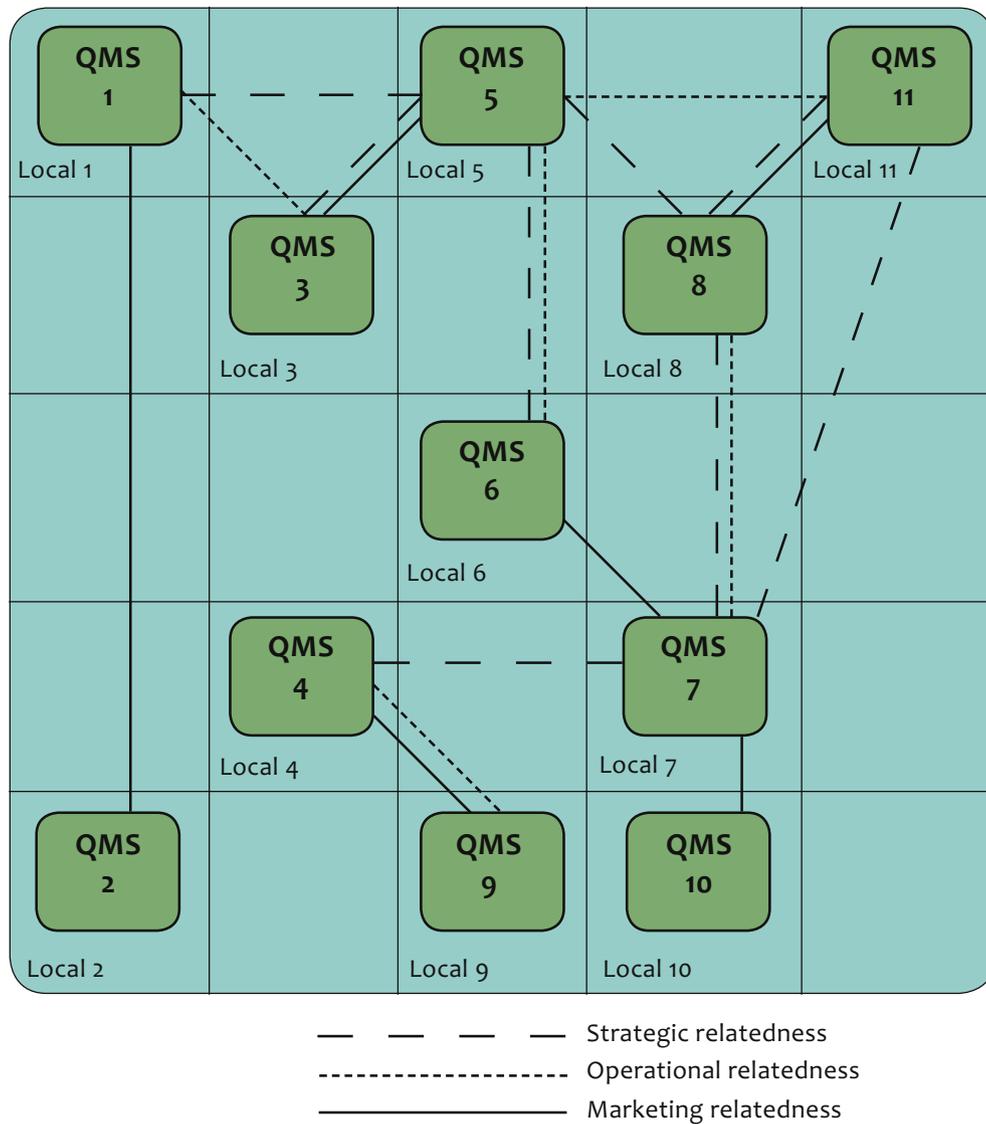


Figure 9. Quality network.

managers who work in global organizations in a business environment characterized by complex and dynamic challenges (Koral Kordova et al., 2018; Koral Kordova and Frank, 2018). The interviewees were about asked applying a systems perspective to managing projects and organizations, and we also collected information about projects, such as the role of the project manager, measures of project success, as well as the relationship between project leaders' systems thinking and the success of the project.

The main stage of the study used both qualitative and quantitative methods, as shown in Figure 1. The quantitative study was based on the tools of systems thinking, primarily on a questionnaire previously developed to examine the systems thinking competency of managers and engineers who lead global organizations. The original questionnaire was validated by experts, and revised in light of their comments (Koral Kordova et al., 2018a; Koral Kordova et al., 2018). The questionnaire was comprised of 40 items on systems thinking and managerial aspects in global organizations. On a scale of 1–5, participants ranked the degree to which they agreed or disagreed with each item. Measuring the reliability using the Cronbach alpha coefficient, the responses to different items in the questionnaire give a uniform result of 0.954.

The qualitative study used Grounded Theory as its theoretical and methodological framework (Glaser and Strauss, 2009; Strauss and Corbin, 1994), in particular the processes and methods which Strauss and Corbin (1994) recommended for the analysis of data and the construction of theory in qualitative research.

Grounded theory is a complex iterative process of asking generative questions to help guide research and generate theories by exposing patterns that emerge from data. With the gathering of data, core concepts can be identified and connections can be developed between this data and the core theoretical concepts. There follows content analysis, verification and summary. Longitudinal studies, observations, content analyses and in-depth interviews with organizational transmitters of knowledge were gathered as field data in this study. The field study included interviews with managers in global organizations using a purposeful sample. The main effort was choosing the interviewees so that they would represent the populations of managers in these organizations and contribute added value concerning the study questions. There were interviews with 39 quality managers, global operation managers and CEOs in 18 multinational companies. They were all selected on the basis

of education, broad experience and their position, and were seen to be experts in their chosen fields.

The companies included global companies that represent the variety of branches.

Consider as example the following company profile:

This company, founded in the 1980s, has a presence on four continents and has an annual revenue in excess of \$20B. A publicly-traded pharmaceutical company, it owns production plants, carries out R&D activities and supports both local and global activities with distribution and marketing mechanisms. With over 40,000 employees this company has a strong growth strategy which has enabled it to carry out mergers and acquisitions into both new global markets and new geographical areas (Europe and North America, Asia and South America) and new market sectors (generics, veterinary pharmacy and medical devices). After solidifying its global presence with R&D, production plants and distribution and supply networks, additional activities in M&A such as competitor buyouts and cooperation agreements served to increase its presence in markets where it was already established.

In order to ensure the reliability of the study, 2–3 repeated interviews of some interviewees were conducted.

The interviewees were asked about the responsibility and competency of the global quality managers, the differences between the global and local activities of quality management in the company, the main challenges faced by global quality management and alternative options for a new approach of managing a quality system in multinational companies.

The principal outcomes of this study, in particular the recurring patterns, were first categorized into groups then analyzed for the intensity and frequency of repetition. Procedures such as cross validation and triangulation were used in order to guarantee the internal validity (trustworthiness) of the findings of the qualitative study.

The history of their Mergers and Acquisitions and other company information was gathered, together with data to enable cross referencing the perspectives of quality managers, company executives and operations managers, in order to distinguish the key variables that represent global quality management.

In order to identify the issues common to quality managers, raw data from interviews was reviewed using grounded theory methodology. Challenges, raised by quality managers in both parent companies and subsidiaries, and supported by interviewees' quotes, were identified during the initial round of reviews. Some companies were included in both groups.

Having created these two lists, we refined the categories whilst reducing each set of challenges to four, in order to gradually identify categories within these challenges. As the organization directs and handles the dynamics of change in a competitive global market, we identified interrelations between categories in the above sets of challenges, and we cross-referenced them in the wider context of the company as a whole. Using the categories identified, a theoretical framework was finally created and, using this framework as a base, a roadmap for managing the quality system in a multinational organisation has finally been created.

The field data was analyzed and representative global profiles were identified. A preliminary theory was developed and relevant key variables were identified using the grounded theory framework. The analysis considered elements of other disciplines, including strategic partnerships, mergers and acquisitions, global strategies and international management, in order to draw attention to the dynamic changes to which the global quality system is exposed.

The principles of open and complex systems theories (Katz and Kahn, 1978; O'Connor and McDermott, 1997) focus on a systems view of mutual relations and interface relations between organizations and their environment, and between organizations and their functional subsystems (Bar-Yam and Minai, 2004; Roli, 2005; Sanders, 2002). This further supports the analytic process.

This study presents features of the management and operations systems which emerge as multinational companies develop, and also

supports insights arising from literature on this subject. It was therefore important to map and analyze the participating companies' global profiles and to link their existing marketing and operational systems' structure to several strategic steps characterizing the recent process of their expansion. As the mapping progresses, categories are combined by determining primary categories, and drawing links between them. The goal is to focus on the relationships between categories in order to understand the full potential inherent in the data gathered. 'Figure 2 presents the steps of grounded theory methodology which are used in this study.

4. Findings

As described in the Methodology section, this article presents results from a study using quantitative tools about systems thinking, and qualitative tools applied in a field study of 18 multinational companies. The study supports the adoption of a systems approach for analyzing the complex processes with which global quality systems must cope.

4.1. Findings of the pilot study

The interview sample included 16 engineers and project managers who work in global organizations and are known to be experts both in systems thinking and in their own fields, based on their position, education and wide experience.

All of the following results are based on a triangulation process as they were found among at least three interviewees.

1. The broad perspective of systems thinking can be seen from different angles and views the system as a whole, with all its operations and complexities.
2. Some managers did not use special tools to encourage systems thinking as they were not familiar with them. All the interviewees felt that the best way to solve problems which occurred during projects was to hold brainstorming or staff meetings with the appropriate technical members of staff.
3. From a professional standpoint, an engineering background is felt to be most important with regard to theoretical and practical knowledge.
4. Systems thinking will assist both managers and engineers when considering the financial and organizational aspects of a project.
5. Systems thinking will encourage creative thinking and will enable people to consider situations from all angles.

4.2. Findings of the main study

4.2.1. Findings of the quantitative study

A questionnaire including items on systems thinking and managerial aspects was used in the quantitative study. The sample included 45 respondents. Most of them were engineers and managers in global organizations.

A one-way ANOVA (analysis of variance) test was used among groups with varied engineering backgrounds in order to examine significant differences in systems thinking capability. With the independent variable being an engineering background, and the dependent variable being average responses to items examining systems thinking capability, the results of the ANOVA test did not find any significant difference in the systems thinking capability of engineers, based on their engineering background (Sig = 0.296).

Having also examined the correlation between systems thinking capability and management skills, it was found that there is a strong, significant, positive correlation ($r(45) = 0.836, p < .000$) between management skills and systems thinking capability. Thus, we can conclude that the better one's systems thinking capability, the higher his/her managerial skills.

4.2.2. Findings of the field qualitative study

The field study identified needs and challenges relating to quality management of both the parent company and the subsidiary. Direct quotes are taken from the interviews to exemplify these perspectives.

4.2.2.1. Quality system challenges faced by subsidiaries

4.2.2.1.1. Functioning at the local level. When a company has been purchased, its quality management system still has to maintain local operations and follow local regulations when working with its customers and suppliers. Although its existing mechanisms may have been developed over many years, its local operations must nevertheless be absorbed into the overall fabric of the purchasing company, which may involve operational changes in the QMS, as it has to work in accordance with instructions for Corporate Quality as well as within the constraints of its local operations. Budget considerations, global operations, business and resource sharing are the driving force behind these instructions, and resource sharing may result in the subsidiary becoming isolated from its original customers and suppliers, due to central purchasing agreements.

4.2.2.1.2. Lateral coordination with other subsidiaries. Several interviews highlighted the issue of acquired subsidiaries facing challenges when working with their peer companies:

- “Where a corporation comprises many companies acquired over time in an uncoordinated, distributed fashion, and hence sister companies are not familiar with each other, there is a heterogeneity.”
- “Plants hardly ever interact concerning quality management”.
- “The fewer common features there are between quality systems and plants, then there is less chance of interaction between the different companies in the whole corporation.”

4.2.2.1.3. Providing global value through local activities. Local quality managers described their relationship with Corporate Quality:

- “in global quality management, people make attempts but achieve very little – simply individual moves and local initiatives.”

4.2.2.2. Quality system challenges faced by the parent company

4.2.2.2.1. Developing a strategy for Corporate Quality.

- “One of the challenges we face when merging supply chains is to work with a variety of quality systems along the supply chain and to keep in sight the individual quality needs of the global organization.”

As the parent company grows into more complex organisational structures and the corporate QMS attempts to coordinate marketing, operational and strategic interrelations, which it may have difficulty in understanding clearly, it becomes increasingly difficult to coordinate and integrate the quality systems of its subsidiaries. The result of this is that Corporate Quality becomes an adaptive entity which mainly deals with ‘harmonizing’ all the quality systems, and these end up being downgraded to local operations which are unable to support the global interests of the parent company.

4.2.2.3. Merging heterogeneous quality management systems. The challenge of merging varied systems after M&A:

- “In the process of Mergers and Acquisitions, which is ever-changing, the organization still has not established a satisfactory concept and *does not appear to see the need for one.*” (Emphasis added)
- “Sometimes a company that has been purchased has no quality management system in place.”

4.2.2.3.1. Coordinating subsidiary quality management systems. The views of interviewees on the need for coordination:

“It isn’t necessarily vital for the quality systems to communicate – the great size of the operation means that it is not a crucial condition to integrate.”

- “To be effective, it is crucial that a global corporate body knows the organization in great detail... since ignorance can lead to the creation of a large, unwieldy, inflexible body with multiple referents.”
- “For a global headquarters to be efficient it is crucial that it understands the entire organization, down to the last detail, or it will be difficult to have strong leadership.”
- The challenges of managing a quality system, including the organizational structure, quality management policy, local operations and global operations, reflect the multiple dimensions, for both parent company and subsidiaries, of operating within the environment of a competitive global market and the dynamics of change. Thus, mergers and acquisitions create a network structure in which a quality management strategy needs to be developed and implemented.

4.3. Mapping the main categories and integrating knowledge from strategic and Operational disciplines

Adopting a qualitative approach led to an intensive process of learning from the field, from within the natural framework where multinational companies (MNC) operate. Collecting and analyzing the data required cross-checking the perspectives of managers working the field: operations managers, quality managers and corporate managers. The multidimensional inquiry was designed to bridge existing knowledge gaps, illuminate the diverse managerial aspects of the subject, and identify its key variables.

This chapter provides a visual overview of the main research findings, and the shaping of the main categories. The findings obtained from the analytical process and their connections to the relevant professional literature represent the key variables in the field being considered, with emphasis on creating thematic relationships, examining interrelationships, and organizing knowledge according an axial coding model arranged according to the identified core categories (Strauss and Corbin, 1994). This mapping provides a comprehensive picture of the main challenges and problems which the quality system faces world-wide, and is an important step towards developing a future body of knowledge.

4.4. Identifying and defining initial categories

Strauss (1987) calls this phase, which aims to identify initial categories, the “open coding” phase. It presents a broad layer of possible data that can shed light on the main issues and challenges affecting the functioning of quality systems in a global reality. The categories evolve as the analytical process progresses.

The diagrams presented on the following pages are the result of the mapping process used to analyze the research findings. They attempt to provide a visual depiction of the systematic process for formulating the key issues that express the principal challenges faced by the quality system in a competitive global environment. They are a visual representation of the mutual interactions and influences between the competitive global environment and the operational functioning of its systems, with emphasis on the quality system. The diagrams reflect the constraints, needs and conduct, as they emerged from our analysis of the research findings, and form the foundation for developing the conceptualization needed by the global quality management field.

The mapping of initial categories as they emerged from findings of the field research in organizations, and mapped during the open coding phase is shown in [Figure 3](#).

Formulation of the categorical theory is accomplished by linking initial categories ([Figure 3](#)) to the research literature and theory in the field of international and strategic management, as shown in [Figure 4](#).

The diagrams reflect the great complexity of the dynamic global environment, which is characterized by having many autonomous

participants who interact with each other while changing dynamically. It is within this complexity that the global quality system must provide support on both the global and local levels.

Management of the global quality system (on which our research focuses) is represented by a group of multi-site quality systems. This aggregate system faces difficulties and challenges arising from the need to address both local and global needs. The latter are largely dictated by Quality Corporate at MNC headquarters, which focuses primarily on the rationale of operational effectiveness and cost savings. The diagram expresses the dilemmas, difficulties and consequences arising therefrom, as they emerged from the analysis of the study findings.

The systemic functional management of the global quality system is most significantly reflected in the analysis of these research findings.

4.5. Systemic aspects derived from analysis of the findings

- (1) The managerial need to function effectively with many elemental constraints – complex systems in a dynamic and changing competitive environment.
- (2) A network structure characterizes the global development level of MNC with all its functional systems, which include this study's quality system.
- (3) The network structure expresses not only the existence of the connections but also their strength and the content that passes through them.
- (4) A multidimensional network of innovative organizational structures (network organizations, split organizations) based on strategic partnerships and international business models, are reflected in various configurations of quality systems.
- (5) Mutual relationships and influences between systems: operating systems, marketing systems and quality systems. The quality system is derived from the operating and marketing systems, and must support achieving the desired quality throughout all processes for which it is responsible.
- (6) Mutual relationships and influences between subsystems (subsidiaries) and the headquarters: the optimization of the subsystem versus the optimization of the super system.
- (7) Strategic, operational and marketing interactions within an MNC (as a network structure) should be reflected in the aggregate management of the global quality system.
- (8) A dynamic system is characterized by a rapid pace of change. Uninterrupted change and continual interaction between the quality, operational and marketing systems (each a network in itself) challenges the functioning of the quality system, which, by its very nature, is less involved in strategic steps at the international level.
- (9) The challenges in developing flexible integration mechanisms, in a highly variable network structure, coordinating its activities and regulating both global and local needs of a quality system.

Creating integration adds value based on the level of directed integration between the subsystems that comprise the global quality system as one of the many functional systems operating within a multinational or global company. A multinational/global company may be defined as either (1) a group of companies controlled by one main managerial body, whose operations are spread out over several countries; or (2) a company that deals with manufacturing or service provision through its various branches (subsidiaries) in several countries. It controls the policies of these companies and must manage them from a global perspective.

The results of a new study show that there are several components that influence the functioning of global quality systems, and – in their current form – pose as yet unanswered challenges. These include:

- Mergers and acquisitions
- Strategic partnerships

- Vertical integration – procurement, suppliers, customers or distributors
- Horizontal integration – acquiring companies that produce competing products or complementary products (buying out the competition)

Because the global expansion of multinational companies is dynamic, their operational and marketing systems also expand in a dynamic manner. As a result, new quality systems of organizations and operations are integrated or acquired through the abovementioned expansion process, and added to the global quality system. From the very definition of a multinational company, it is clear each of the management systems is required to function on both the integrative and local levels.

Findings of the current field study indicate the existence of different levels of complexity in the set-up of the operational and marketing systems, which require suitable responses from the quality system. A quality system must simultaneously support the range of marketing and operational systems that are acquired or dynamically incorporated into a multinational organization, while maintaining interrelationships on a global level. However, our findings show only low levels of involvement by the quality system in the steps towards the organization's global expansion, as well as limited global orientation by management. The concept of quality management in global organizations remains poorly defined. The procedural approach still focuses on the single/individual organization's 'closed system', rather than being characterized by a broad, systems perspective as required by its multiple dimensions and processes.

Based on the study findings, Figure 5 presents a first attempt to portray the complexity levels of global organizations. The left-to-right movement shown in the figure displays several levels of complexity that may or may not develop in a global organization, depending on the strategic steps taken.

The starting point (on the left) is a single-site, local organization that has a relatively low level of global complexity, stemming from its operations with global customers and suppliers. Moving further right in the figure, the level of global complexity rises, and the number and complexity of the processes change and, for the most part, grow. Mutual relationships between operational units, subsidiary companies and strategic partners are added to the company, on the global level. Multinational firms with a network structure present the most complex and challenging structure on the managerial level (on the far right of the figure).

The functional managerial systems in the organization, which include the global quality system, the focus of this research, face complex managerial challenges, following from the increase in the company's general level of complexity and its multiple infrastructures and interrelationships.

Figure 5 describes the analytical components discussed below. It shows the need for assessing the best way to manage a global quality system (presented in the bottom part of the figure), as a result of the organization's diverse global complexity levels. This assessment undoubtedly requires the integration of basic concepts from the systems thinking arena, and the development of suitable terminology, which is described in the Discussion section.

- To conclude, the study findings highlight the need for a new global approach, as follows:
- Support of strategic, marketing and operational objectives as factors that provide quality, and added value,
- Adopt a systems approach for analyzing the activities and developmental stages of global quality functions, as a part of a complex multinational company,
- Integrate a strategic, marketing and operational rationale into the work methods and philosophy of the quality system, although these are not their focus in a traditional company,
- Expand the process approach, by which the system is open and has multiple infrastructures,

- Identify structures and configurations on a network basis, to enable cooperation among different quality systems in the network.

The creation of terminology combining the content worlds of quality management and a systems approach is a basic condition for expanding research about global organizations and the role of their functioning systems. These concepts are derived from the managerial environment presented in Figure 5, and will be described in detail in the Discussion section.

5. Discussion

The pilot study and the quantitative part of the main study demonstrate how systems thinking is seen as a vital tool which enables engineers to examine each system or project from above and to lay out possible difficulties and risks. These findings are in line with previous studies.

In Edson's view (2008), systems thinking can be seen as an overview which considers the system to be more than the sum of its parts, where interactions between interfaces influence operations. In Wigal's view (2004), the aim of systems thinking is to convert the whole system to data. This includes the goals, the environment and how the system components support those goals. Monat and Gannon (2015) claim that systems thinking provides significant value and power. Systems thinking can be utilized for the solution of complex problems that cannot be solved by standard reductionist thinking, since it focuses on the relationships among system components – which often dominate system performance – as well as the components themselves.

Fundamental concepts from the field of systems thinking may be beneficial for global quality systems, facilitating better understanding their organization, how they are managed, and the challenges they face. Based on the findings presented above, and in light of the need for new global quality management terminology, we present innovative key concepts for this field. These concepts can serve as a foundation upon which a novel global quality management theory might be developed, based on a systems approach, and which would facilitate constructing a body of knowledge that supports this theory.

These new concepts expand on concepts already found in the existing literature: system, quality system, and global quality system.

System: A group of parts that operate together to achieve common goals (with emphasis on the relationships between the system's components. Thus, a group of parts that are not connected is not considered to be a system).

QMS – Quality Management System: QMS is the functional system within an organization that is responsible for quality policies and targets, under routine quality assurance processes, using quality assurance regarding resources and products. (QMS is an integrated system combining safety, hygiene, environment, community, etc.)

GQMS – Global Quality Management System: Expands the definition of a QMS to a group of quality systems that are supposed to operate together, under clear quality assurance policies, in decentralized organization, comprised of subsidiaries and operational units that have complex interrelationships.

These systems are inter-dependent and influenced by each other. The relationships are, for the most part, extremely dynamic, but can also be permanent.

5.1. Characterizing the GQMS using general systems theory (GST)

1. In GST-based terminology, a GQMS is an open system that establishes interrelationships with the business environment, and allows for the exchange of information and resources with its environment. Closed systems are stable, static and balanced, and do not allow for the exchange of information and resources with the surrounding environment. Open systems are different, and the following characteristics qualify a GQMS as an open system:

2. A GMS consumes inputs from the business environment, which undergo conversion processes. At the end of the process, it exports outputs to the environment.
3. The processes that occur in the system are of a cyclical nature. The product exported to the environment provides the energy necessary to repeat the operations cycle.
4. *Feedback:* In a GQMS, there are permanent feedback processes. The system changes its behavior in accordance with the information it receives from the business environment.
5. *Differentiation:* A global quality system becomes more complex, interdisciplinary, and multi-disciplinary.
6. *Equifinality:* There are different ways to achieve the goals and desired results of a GQMS.
7. *Synergy:* The interrelationships between the quality system's different parts are very important; the whole is greater than the sum of the system's parts.
8. *Hierarchy:* A GQMS is comprised of sub-systems and is itself a sub-system of the organizational system, which is above it in the hierarchy. Every system within a GQMS may be defined in a hierarchical manner: sub-units (components) are included in larger units (the global quality system), and these units exist within even larger units (the business environment).
9. *Structure:* In order to function correctly, relationships and interrelationships exist among the different parts of the quality system. Proper functioning of the GQMS also depends on mutual appropriate relationships among its parts and components, and between it and the other systems operating within its environment. It is important to understand how the different components of the global quality system function, and their contribution to the system's general functioning. The addition or removal of a single component changes the entire GQMS.
10. *Borders:* It is necessary to create boundaries between the GQMS and units that are external to it. The business environment is outside of the quality system, and the system's influence must be taken into account.

Based on the principles of Bertalanffy's theory (1968) concerning the *similarity of all systems*, all organizational systems have a similar behavioural pathway. A global quality network is an open system with borders that can be opened and closed. By opening the borders, the system can exchange energy and information with the business environment (other systems) in order to develop and change.

Models derived from GST can simplify analysis of complex problems in a GQMS. GST can provide microscopic and holistic perspectives on the system's decision-making process by relating to a large number of aspects. Systems thinking can facilitate evaluation of a current situation by dealing with new inputs, and through the logical examination of the need for change in a global quality system. This theory also enables exploration of the relationships among the various components of the system, and might also be applied to analyses the entire system, its sub-systems, and the interrelationships linking the whole, its parts, and the business environment.

To conceptualize this topic of discussion in a visual manner, we will present the new basic concepts based on GST in Figures 6, 7, and 8, below.

Mergers, acquisitions and strategic partnerships change the operational, marketing and mutual deployments in the network structure. The operational and marketing characteristics of a complex system and its distribution (network structure) include:

- Multiple sites – production, development with global distribution,
- Multiple subsidiaries (in most cases, each subsidiary has its own subsidiary companies),
- Multiple branches,
- Partnerships with a business orientation,
- Multiple operational and marketing systems,

- Multiple customers – global customers,
- Multiple suppliers – global suppliers,
- Multiple processes – change from a closed processes system to an open system,
- Multiple interfaces and resources,
- Multiple interrelationships, operational and marketing strategies,
- High level of change dynamic within the company and business environment,
- High levels of complexity and diversity.

The network structure presented in Figure 5 shows the need for creating an **aggregate quality system**, with global distribution. An **aggregate quality system** is a group of quality systems that becomes necessary because of strategic steps taken by the company in order to achieve competitive advantages: being closer to customers and/or suppliers, acquiring rival companies, and establishing global operational units (for more details see the key concepts, below).

5.2. Innovative key concepts for the healthy management of GQMS

Table 1, below, defines innovative key concepts, whose integration into the professional content and academic worlds of quality management have become a necessity, due to the global reality, which is both complex and dynamic.

These key concepts are based on the principles of GST, which connect the steps taken by multinational companies to achieve expansion with the changing role of the quality system, which becomes a decentralized system, rich in interrelationships. The definitions of key concepts that appear below focus on the role of the quality system on a global level, emphasizing the relevant GST-based systems view.

Figure 9 shows that there may be nodes (quality systems) characterized by broader and more varied mutual relationships with other units. It is likely that there are simultaneous operational, strategic and/or marketing relationships (as between quality systems 8 and 11, or between quality systems 7 and 8).

The management of a (global) aggregate quality system is influenced by its relatedness – strategic, operational, and marketing – and the company must express this in practice, on both the strategic and ongoing, operational levels.

6. Research summary and contributions

The Literature Review showed that the unique change dynamic occurring in the global market does not find a suitable solution in current perceptions of QMS. Moreover, the existing literature does not provide a model for GQMS that are able to cope with the challenges faced by global organizations in a rapidly-changing environment.

Based on a field study carried out among 18 multinational companies, this paper presents a research and practical paradigm, which utilizes the principles of GST to develop a new quality management model for global organizations. This multi-disciplinary combination is suitable for analyzing the activities of multinational companies and their functional systems, because it encompasses the many interrelated components, that engage one another and have mutual influence on the entire system. This type of systems approach strengthens the quality system's global identity, as a complex system; and the strategic, operational and marketing rationale through its work as a global system. According to GST, the QMS cannot be understood based solely by understanding its parts and their individual traits. Rather, GST facilitates understanding the relationships, interactions and processes between the quality system's components, which is why it is very important to adopt these principles for analyzing GQMS.

6.1. Study limitations

The purposeful sampling method was used in this study to examine quality management in global organisations. In order to learn about this phenomenon, researchers selected those individuals who appeared to represent their own population the best. This sampling method is, however, fairly limited since it is not to take a broad view of the qualitative findings to environments and people who are different from those studied here (Firestone, 1993; Merriam, 1985). Whilst constructing the sample, researchers to manage this limitation by increasing the sample's generalizability with respect to the population and, by using target focus groups, conducting longitudinal research and studying multiple cases, by applying selection criteria for interview participants conducting longitudinal research, and by studying multiple cases.

6.2. Directions for future studies

This study provides a foundation for additional research regarding the evaluation and implementation of a systems approach to quality management in global organizations. Directions that should be studied in order to deepen scholarly knowledge about global quality management from a systems point of view include:

1. Mapping additional variables, developing quantitative measurements, and expanding key concepts that could aid the functional management of GQMS. We recommended including variables that represent different organizational structures, which can provide additional insights into the aggregate management of a global quality system.
2. Expanding the professional terminology that deals with the complexity of GQMS is necessary for developing a body of knowledge and models that are relevant to this system in multinational companies.
3. Developing computerized tools to map the different configurations of operational systems in the network that characterizes a multinational company. This mapping is meant to provide a representation of interrelationships (strategic, operational and marketing relatedness), and identify the global key groups (hubs) in the network, which require a response mechanism from quality systems.
4. Expanding the terminology needed to manage multidisciplinary systems, for example: global marketing, global operations, human resources and more, by identifying the challenges and needs in different configurations of global development levels.

Declarations

Author contribution statement

Aviva Bashan & Sigal Kordova: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Wrote the paper.

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