The TQM Journal

The international review of organizational improvement
formerly The TQM Magazine

Volume 32 Number 1 2020

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www.emeraldinsight.com/loi/tqm
2020 and beyond

Welcome to the first issue of The TQM Journal of 2020. I would like to begin by sharing good news about the journal CiteScore. Powered by Scopus, CiteScore metrics evaluate serial citation impact over a three-year period. It is a consistent method of tracking journal performance annually. The journal CiteScore for 2018 was 2.51. The 2019 score will be available soon. A method of tracking journal performance on a monthly basis is CiteScore Tracker. While this can fluctuate month to month, I am pleased to inform you that our December CiteScore Tracker score was 3.28. This is the highest score the journal has ever achieved. This is down to the hard work of all the journal’s stakeholders but especially the authors who submit such high quality manuscripts, the reviewers for the thoroughness of their reviews and of course those scholars and researchers who are citing works published in The TQM Journal in their own work. A list of the people who have reviewed papers for the journal in 2019 will soon appear on the journal website.

Next I would like to urge our entire readership to regularly visit the journal homepage and in particular the link “Journal News inc calls for papers”. This link will take you to news of any quality related conferences the journal supports, the list of reviewers mentioned above, as well as calls for papers for any special issues that the journal may be publishing in the future. These special issues are usually managed by a guest editor. There is currently a call for papers for a special issue on “Balancing the ‘hard’ and the ‘soft’ shades of TQM” where the link will take you to more details of submission requirements. This will have a publishing date of 2021. Anyone who has any suggestions for a special issue topic and who would like to guest edit the journal should get in touch with me in the first instance to discuss their ideas.

Finally, thank you all for supporting the journal throughout 2019 and I look forward to your continuing support in 2020.

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A 21st century appreciation for: quality, excellence and complex human adaptive systems

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Abstract

Purpose – The purpose of this paper is to develop a coherent theory and strategy for the achievement of quality outcomes that is meaningful and relevant to people at all levels of society. These should help the quality professional engage with people at all levels of society in the development of a culture that appreciates quality, systems and excellence. The research draws on the work of the community quality councils movement in the USA and sought to build on this experience in a village in northwest Ireland.

Design/methodology/approach – Action research employing an ethnographic type approach to a four year immersion period in a small industrious community. Its inductive nature and naturalist mode of enquiry did not lend itself to either the generation or analysis of quantitative data. Nevertheless it yielded many rich complex pictures or patterns of qualitative information requiring long periods of reflection to decipher the sense and meaning in them.

Findings – The findings can be encapsulated in one sentence “To achieve quality outcomes we must practise excellence and maintain systems that are fit for purpose”. This requires a radical reworking of Deming’s system of profound knowledge (SoPK) to make it relevant to the human complex adaptive systems that permeate the twenty-first century. These operate as autonomous service providers in a rapidly changing environment.

Research limitations/implications – The findings of this research have transferability to all sectors in society pursuing purposeful activity. It is relevant at individual, interest-group, industry, institution and community level. It should make the development of a “quality culture” more attainable at all levels.

Practical implications – Provides quality professionals with new terminology and imagery to engage with, analyse and help autonomous human activity systems in the twenty-first century. It moves Deming’s SoPK to a new level more suited to human systems.

Social implications – By explaining quality, excellence and systems in easily understood and accepted terms the Grange Excellence Model allows every individual, interest-group, industry and institution share the same language and images as they pursue quality outcomes. This unified approach could transform communities and society in general.

Originality/value – The research generates a seismic shift in the appreciation of quality, excellence and systems making them relevant and meaningful to people at all levels of society. This provides quality professionals with a methodology, images and vocabulary that will facilitate productive engagement with purposeful systems at all levels of complexity.

Keywords Service, Quality, Community, Excellence, Complex adaptive systems, Purposeful

Paper type Viewpoint

Introduction

This paper describes a four year action research project which set out to facilitate the practise of quality management principles at all levels of a small industrious community. As a manufacturing engineer who specialised in the application of ISO9000 Quality management systems I was eager to share the benefits that organisations had enjoyed from quality with society at large. It was a rollercoaster journey which challenged everything I accepted as “the quality way”. It revealed fundamental concepts that, if understood and appreciated can embed quality in the culture of any individual, community or organisation. Very early I learned that while communities are not organisations; organisations are rapidly developing all the traits of community and can learn much from them. I hope you will be inspired by this biographical account and can build on the findings to transform how individuals, interest-groups, industries, institutions and society achieve quality outcomes in a harmonious way.
The stimulus was a brief encounter in the mid-1990s with John A. Murphy who was CEO of the Irish Quality Association. He said “In the US there are whole cities applying quality”. As a scholar of quality I was smitten but my background was in manufacturing engineering and I needed to learn more. So began the secondary research and ultimately the four years of primary research which sought to bring quality into all aspects of an industrious village community. It took two more years of reflection to assimilate the learning into a useful format.

The outcome is a deep understanding of what quality is and how it is achieved that has transferability to all human endeavours at all levels in all sectors. This paper will change the way you view complex situations and engage with them. It is not meant to be prescriptive but provides the images, vocabulary and insights to help you develop a shared understanding of: quality, excellence and complex human adaptive systems in easily understood terms. Unfortunately, it also demands from you endless perseverance and patience if you and those you serve are to benefit from it.

How all this came about and some of the underlying “theories” will be explored without getting bogged down in the detail. A link to a comprehensive bibliography is provided. There are no traditional references in the body of the text as it is felt these would break the narrative flow of the argument.

This paper will also, hopefully, give you heart and encouragement as you face obstacles and setbacks in your own pursuits.

USA origins
William Edwards Deming is probably the most enduring of the quality gurus. After his rediscovery in 1980 by NBC he was quickly embraced by US manufacturers seeking to emulate the success of their Japanese rivals. His most quoted legacy is probably his System of Profound Knowledge (SoPK) which he felt was the basis for organisation/management transformation and for realising a quality outcome. SoPK is comprised of four interrelated parts:

1. appreciation for a system;
2. knowledge of variation;
3. theory of knowledge; and
4. psychology.

This aspect of his life would not be explored here but is built on later. What also emerged at that time was a group of dedicated followers who wanted to take Deming’s philosophy way beyond its genesis in manufacturing. Key contributors at this time would include: Tribus, Schwinns, Scholtes, DeCrease and Voehl. These individuals began establishing community quality councils (CQC) to promote Deming’s way in all aspects of community life.

Appendix gives a chronological glimpse into the highlights of the CQC movement. For a brief time a World Centre for Community Excellence existed in Erie Pennsylvania. As more CQCs formed publications began to appear about their successes. Also organisations like ASQ and AQP as well as the Deming Institute became actively involved in their promotion and support.

I was eager to build on their success in a capable and willing community in Ireland. Reviewing the literature available, it was very obvious to all CQC pioneers that the complexity at community level far outstripped anything in organisations. As hard as they tried to view communities as systems they encountered communities comprised of many fiefdoms with their ramparts and divisions. All of these fiefdoms could apply various aspects of quality and SoPK but some were in competition with each other. They could not identify a unifying aim for a community system and as Deming warned “Without an aim
there can be no system”. They also failed to develop any “community viewed as a system model” or coherent theory to help this emerging discipline to grow. Consequently, around the years 1999–2000 the meteoric trail of the CQC movement is extinguished. It is as if it never existed. Later I was told the Americans do not like to write about failures.

Unfortunately nobody told me and at this time we were two years into our primary research with a staffed office in an industrious able and willing community.

The failure of the CQC movement has been a great loss to society. It set back by decades any attempts to bring quality practices into all the non-manufacturing sectors of society. Even today we still see resistance by some sectors and professions who use the defence that “they are different”. Of course they are. Every situation is unique and quality practitioners should accept this and use the techniques and terminology described in this paper to facilitate productive engagement. Furthermore, organisations are developing all the complexities of communities. Individuals are acting with greater autonomy as command and control structures dissipate.

Meanwhile, the person-in-the-street is bewildered if asked to define quality and how it is achieved. As long as this is the case we will never have a culture where quality is endemic throughout society. The challenge for this research and the quality profession is to make it instinctive for anybody engaged in any endeavour to know what quality is and how to achieve it in a harmonious way. Then we must give them the insights, vocabulary and methodologies to practise this in a viable and attractive way.

The primary research
Having selected a vibrant small community and solicited its support we obtained funding for a four year research project.

Our approach was to establish an office as a portal into the community and to engage with the various sectors: industrial, educational, commercial, faith and voluntary and determine what “quality” meant for them and how they practised it. It was based in the village of Grange, Co. Sligo, Ireland. Its title was “Grange CEARN”, CEARN being an acronym for Community Excellence Assistance and Research Network. The office (funded by LEADER) was staffed by a fulltime postgraduate student (funded by FAS) while I acted as lead researcher and project manager (funded by IT, Sligo) in pursuit of a PhD qualification. Over four years two postgraduate students each completed a two year term in the office. We also encouraged and facilitated a number of undergraduate students from the local Institute of Technology, Sligo to base their final year projects in Grange. These provided more opportunities for engagement.

We set about helping the community define excellence.

Excellence was a term in vogue at that time with the government’s healthcare strategy based on the creation of centres of excellence for the treatment of cancer. What exactly a centre of excellence entailed was never fully explained. It was obviously a centre of best practice or a place where “excellence” was practised. The importance of the distinction between excellent and excellence for our research and findings will become obvious later.

Ireland was also experiencing an unprecedented economic boom built, almost entirely, on the very unsound foundation of the construction industry.

At this early stage we made a major error that fortunately was not fatal and probably unnoticed by the community. Rather than helping each sector define excellence (the noun) we embarked on a process of specifying what “excellent” (adjective) meant for them in their activities. This approach translated into helping the ceramic tile manufacturer defining what an excellent tile manufacturer is, the local schools define what an excellent school is and so on.

The benefit of this approach was that it provided a structure for engagement and a huge degree of comfort for us as we struggled to find our way. We could work with the various
sectors to create lists of desirable attributes, do a gap analysis between current and desired situations and develop a strategy for bridging it. Of necessity everything was vague which did not suit many in the community. We were looking for answers and often times could not form a coherent question.

The manufacturing sector was the easiest on the face of it. We engaged with the six owner managed manufacturing units in the community. An obvious starting point here was that an excellent manufacturing facility would implement an ISO9001 based quality management system with or without formal certification. We could help them free of charge.

The education sector was more problematic because the Whole School Evaluation (WSE) programme was being introduced by the Department of Education. WSE was very poorly understood in terms of its content and its purpose. It is safe to say it was treated by teachers and principals with a degree of scepticism and suspicion:

- When it came to the other sectors we literally had a blank canvas.
- What is an excellent grocery store?
- What is an excellent voluntary group?
- What is an excellent religious service?

The challenges
While all sectors of the community welcomed us, it was obvious that it was on the unstated conditions that we did not cost them anything and that we did not get in the way.

This manifested itself during various encounters with the various sectors.

Manufacturing, “We know that quality is important but right now we don’t have time for it”. As stated earlier Ireland was experiencing an unprecedented construction boom and most of the small industries supplied this sector. The emphasis was totally on production and a make it and ship it mentality. A number of arranged meetings with business owners would be cancelled as we walked in the door as “something important” had arisen. As long as we met the conditions mentioned earlier we were tolerated. We audited their systems, made recommendations and had many fruitful, often challenging, encounters with employees at all levels.

The primary school was a relatively new building and its enrolment was increasing. The teachers met us following our invitation to them to engage with us and help us define an excellent primary school. The reception was hostile. One teacher said “Who are we to decide what an excellent school is?” We wondered, silently, if they could not who could. The school principal remained silent at the meeting but later contacted her union and refused to have any dealings with us. Coercion would not work so we were effectively barred from this sector.

The second level school in contrast to the primary one was an old building and obviously in decline. Here the engagement was more constructive and facilitating. While discussing the concept of an excellent second level school the Principal said that “whatever it is you won’t dictate it to us”. What appeared to be a hostile challenge provided the insight that the school itself would begin the process. Again we were welcomed aboard provided we met the conditions of engagement. One of the postgraduate students used her experience with this school in her masters “Quality Management in Education”.

The retail sectors included a restaurant, newsagent, grocery shop, post office and a number of bars. Engagement here could be described as “neutral”.

The voluntary sectors included: drama group, tidy towns group, athletics club, church choir and a women’s group that was at the early stages of setting up a community crèche. These groups saw us as an asset in terms of organising meetings, providing administrative support and so on. What was striking here was the sense of urgency and resoluteness these
groups possessed. They all had a very clear view of the task they wanted to achieve and how they were going to do it; although this was not “documented” anywhere. They did not wish to engage with outsiders until after the task was completed. Customer focus or engagement was not a priority. There was also an unstated suspicion that quality could get in the way of them achieving their goal or at least slow them down with unnecessary discussion. Many had the perception that quality meant paperwork and bureaucracy.

The religion of the community is predominantly Roman Catholic so we approached the priest about defining an excellent religious service, an excellent Mass. The response was unexpected as he enthusiastically welcomed the idea on condition that we define “The” excellent Mass as he jovially said he wanted the “definite” article. With his help we developed a survey questionnaire that was distributed to his parishioners.

All of these activities acted as vehicles for engagement and learning. As time moved on it was becoming increasingly clear that organisational quality had little relevance to people in their “real life” situations.

Over the four year period we developed stronger links with some individuals who would drop into the office for a chat. What was curious was that their behaviour at these social encounters could be radically different when we met them at more “formal” meetings of their group.

As we shared our experiences and approach with colleagues and students we were struck by the following statements/observations:

So you’re telling me that excellent is whatever you think yourself! (Referring to the school principal).

Why is there so much hostility and indifference? Why isn’t there more fun in it?

Are you trying to get the community into neat little engineered boxes?

I don’t get any sense of the aesthetic in this.

At the time we had no answers to these questions and observations. We were too busy immersing ourselves in the various sectors of the community helping them to achieve their various tasks and hoping to gain insights in the process.

**People need specifics**

After some brainstorming meetings with the various groups helping them define an excellent “whatever” they soon began to tire of it. We switched to asking them to put into words what their purpose was. The groups found it very difficult to do this seemingly simple basic task.

Rather than defining an excellent tidy town’s group or its purpose they wanted to organise a fund raising event or get new benches for the park. They were focussed on tasks and eager to get into action. They did not want interference. All we could do was observe, learn and help them in any way we could. We did produce a directory of all the activities in the community showing their structures and after much coaxing and coaching their purpose. We avoided using mission and vision terminology. Everyone knows that a purposeful system must have a purpose.

The main learning from this period was the resistance to any discussion on what “exactly” was being undertaken and how it was to be achieved. Planning or specifying expectations did not exist. Engagement with people outside the group only happened when it was absolutely essential and unavoidable.

An aspiration they all shared was their desire for a quality outcome which they seemed to think was obvious and intuitive. They saw no need to define quality and absolutely no need to evaluate it. This provided a challenge and impetus for us to define a quality outcome in terms that were meaningful and easily understood by everybody in the community.
At the back of my mind was Block’s observation that people must accept commitment and accountability. Later he described these as a “two self inflicted wounds”. We were seeing lots of commitment but nobody wanted feedback or evaluation unless it was the clap on the back for a job well done.

**Defining quality**
The first challenge was to define quality in layman’s terms. The definition of quality we promoted was the one advanced by Labovitz and Rosansky: “A quality outcome is achieved when the right things are done right”. The quality gurus have more elaborate definitions that would leave our community numb.

At this stage of the journey we had a definition of quality that everybody in the community could understand and relate to. Our definition naturally solicits the question “Who decides what is the right thing to do and how it should be done?” The answer for most groups was obvious “they would” if they could be bothered and we were just getting in the way.

Few will disagree with the statement that “A quality outcome is achieved when the right things are done right”. That is what a quality outcome is. How it is achieved is a completely different matter and the source of much frustration, stress and confusion. This duality between the “What” and the “How” of quality has bedevilled professionals, academics and society for decades.

At various stages in the evolution of quality we have been given glimpses of insights that offer workable, plausible solutions for overcoming this duality dilemma in specific circumstances.

Examples include:
(1) Deming’s SoPK.
(2) ISO9001 Quality Management System.
(3) Malcolm Baldrige National Quality Award.
(4) EFQM Excellence Model.
(5) The Shingo Prize.

All of these examples provide us with a visual image/model and a set of principles or theory to help organisations transform themselves into sustaining entities that consistently deliver a quality outcome. None of them specifically define excellence nor are they tailored for individuals to help them and society determine what quality is and how it should be realised.

This research develops a theory and image that have universal applicability in the twenty-first century service economy. These facilitate a deep understanding of the autonomous human activity systems (HAS) that sustain our economy and society and will help you engage productively with them at all levels.

Quality is achieved when the right things are done right. Nobody could argue with this but regarding who decides and how they decide is much more problematic.

**Insights from the crèche group**
As mentioned earlier we worked with an energetic group of mothers intent on setting up a crèche facility. They were in a hurry, a common trait, and we needed to slow them down without curbing their enthusiasm or causing resentment. We gave great attention to creating the right atmosphere for the meetings and provided refreshments. We were determined not to lose them like the primary school teachers.
Having defined quality as doing the right things right; we asked them to help us put into words (define) what a quality crèche entailed. To our delight the room began to buzz with requirements: “As a mother I want to have total trust in the staff”. Secure safe environment, bright and cheerful, affordable, were other suggestions. A woman who worked in an existing childcare facility shared concerns from the providers’ point of view. She explained that there were numerous regulations attached to operating a crèche. It immediately became clear that the definition of a quality crèche would require input from “outsiders”. This was a major breakthrough. After a brief discussion the group agreed that we needed more people in the room. The recognition of these “outsiders” opened up an unexpected grouping including police, funding agencies, local council members and Health Board representatives. We later called this grouping “complementors”. The women we categorised as being either creators of the crèche and/or consumers of its services.

Unknown to ourselves we had identified three categories of people needed to define a quality crèche facility: creators, consumers and complementors (3Cs). These are defined later. These 3Cs are the human part of all systems. They are all clients of the system that serves them all. There are no insiders or outsiders just clients.

Over a series of meetings the 3Cs explored many issues and developed a “working” high-level definition for their quality crèche. The term “working” is used here as the specifics often changed from meeting to meeting and this caused frustration among some group members.

The group wanted to provide a quality crèche. This is one where the right things are done right.

Their initial discussion quickly identified the need for inclusion of 3Cs to decide what is the right thing to do and how it should be done. The process the group used in the development of the specification was most illuminating. It was full of laughter with a great sense of purpose, on-going learning, inclusion and the need to reach consensus on key requirements.

Their “way” of doing things was so impressive that it was decided to research it further.

Who decides and how?
Quality has always recognised the need for a focus on the customer and later this developed into a focus on interested parties. Most groups we worked with were very reluctant even hostile to put this into practise. They knew what they were doing and engaging with outsiders would only create hassle. Curiously, many felt that their efforts were not appreciated by the very people they were helping and this caused even more resentment at any suggestions of inclusion which was seen as intrusion. While the definition of quality was accepted, with many wondering why there was a need to “bother” defining it, we needed to develop an equally acceptable definition of how it was to be achieved.

For general acceptance this definition would have to be seen as a statement of the obvious. It would have to be treated like quality as a given and no fuss attached to it. Whatever this “how” was it was felt that the crèche group were practising it intuitively. What would we call it and how would we describe it?

Around this time our ongoing secondary research was enlightening us about the Malcolm Baldrige and EFQM “Business Excellence” models. The latter describes Business Excellence, as; “Outstanding practices in managing the organisation and achieving results, all based on a set of eight fundamental concepts.” The real enlightenment for this researcher was that excellence, the noun, is a practice for achieving results. It is “the way” and should not be confused with the desired destination which is a quality outcome. This was the mistake we had made earlier in helping groups define the excellent school, etc. To avoid confusion it is better to define a quality school and emphasise excellence as the way, pathway or track to defining and achieving it. This breaks the duality dilemma. Our work with the crèche group reinforced this belief.
This brought us to our second challenge.
To achieve a quality outcome we must practise excellence. What is an acceptable, taken
for-granted, obvious definition of excellence that is relevant at individual level?

Defining excellence
Drawing on the literature on quality and field experience we began to explore in more detail
the various stages of any purposeful human activity. This led us to conclude the following:

- Purposeful human activity involves: definition, realisation, delivery and evaluation.
- This is not Deming’s PDSA/PDCA but is reflected in the ISO9000 process model
  which has unfortunately been linked with the former.
- All these stages need to be done right.
- The interested parties, the clients, decide what this “right” entails. The crèche group
  had help identify these clients as 3Cs.

Another problem is that quality is a moving target; it is an emerging property so people
must accept that it is always changing. Any definition of excellence must allow for this
emergence aspect of quality while providing some core concepts or values that are constant
and sustaining.

Referring to some of the feedback earlier it was essential that the practise of excellence
should not be burdensome and should also address the aesthetic.

After many drafts the following definition of excellence was reluctantly agreed upon.
I say reluctantly because it is of necessity long and requires an open mind that
unfortunately is not always forthcoming:

"Excellence is an evolving methodology for achieving a quality/better outcome".

It is based on voluntary on-going dialogue and agreement between the creators, consumers and
complementors in the activity system, who define, realise, deliver and evaluate dynamic emerging
expectations in an enlightened, effective, efficient, ethical, elegant and enjoyable manner.

Excellence definition explained
It is felt that this definition conveys to people throughout a community at all levels of social
status or education that there is a preferred pathway to achieving a quality outcome. This
pathway is called “excellence” which is an evolving methodology not some rigid frozen
method. It is a methodology that must be entered into voluntarily as coercion will kill
it – remember the primary school teachers. Its basis is inclusion, dialogue and agreement
between those interested parties who are all treated as clients of the system that serves
them. Clients fall into three categories:

1. Creators – those providing or producing the product or service.
2. Consumers – those who are the ultimate users.
3. Complementors – these neither create nor consume but are legitimate clients of the
   system. Obviously complementors would be regulators, financiers, neighbours.

3Cs will exercise varying levels of power and/or influence in the system at any given time.
Take for example a health-care system, complementors here would include admin staff and
regulators. The latter have immense power and influence; the former do not and might
easily be undervalued by the creators (medics). When any client in the system feels
undervalued there will be disharmony and the system will never reach its full potential. In a
harmonious system all clients (3Cs) are of equal value. The system exists to serve all three
categories of client.
These clients must reach agreement as they define, realise, deliver and evaluate (DRDE) dynamic emerging expectations of the task they are undertaking or the service they are providing. They effectively specify a frozen definition of a quality outcome at that instant of agreement. They decide what quality is. They also recognise that quality is dynamic and constantly changing with time. Time erodes the value of any frozen definition of quality, they must act quickly.

How clients achieve agreement is encapsulated in the excellence methodology and is done in an enlightened, effective, efficient, ethical, elegant and enjoyable manner (core values or principles). The enlightened aspect allows clients use whatever tools, techniques or approaches they deem appropriate. This could be the ubiquitous Lean-Six-Sigma approach to realisation or Parasuraman’s SERVQUAL scale, outlined later, to evaluation.

This definition of excellence was deliberately structured to make core elements easy to remember. The clients are categorised as 3Cs. The steps in purposeful activity DRDE the six core principles all begin with the letter “e”. You will notice that elegant and enjoyable are included here. Fit for purpose is not good enough; the “what” and the “how” must also be elegant. The end never justifies the means. Enjoyable refers to the practise of excellence itself and the whole DRDE cycle. Practising excellence cannot be stressful or it will fail to gain acceptance. If it is done in the voluntary, open, learning spirit that is intended it will be enjoyable as well.

We were delighted with our definition of excellence as “the way” a quality outcome is achieved. In academic terms it hit all the right buttons and we were eager to share it with our community and get some reaction.

Community reaction to excellence

The community reaction was polite but non-committal. It could best be described as a big “YAWN”. They were not interested. It was more verbosity getting in the way of them getting on with the job-in-hand. As stated previously they found it difficult to verbalise what the “job-in-hand” was so a long winded definition of excellence left them bewildered.

Even in our own academic circles our view that excellence was the “way” or “pathway” to achieving a quality outcome and not a destination met dissent. We felt despondent.

The statement “To achieve a quality outcome we must practise excellence” helps the quality profession clearly distinguish between the destination “quality outcome” and the way of achieving it “practising excellence”. Quality outcome is the station, excellence is the track, clients are the train and all are dynamic entities. Pirsig used the same imagery. These insights alone are valuable to any quality professional who will otherwise become, sooner or later, disillusioned with constantly moving goalposts.

We pressed some members of the community to determine if they saw any merit in the aspirations expressed in the definition of excellence. Some politely agreed that there was but nobody was willing to practise it.

Obviously it takes more than theories and definitions to achieve a quality outcome. Theories without practice are sterile. We had to discover why these individuals, interest-groups, industries and institutions (4Is) were rejecting us. There can be no learning without a theory. Why was our theory being ignored? This brought us to the third and final part of our discovery.

Systems

Stating that a community is a complex system is a statement of the obvious. But what does such a system look like and why are some more successful than others? Looking at our community we saw that we engaged with 4Is that were complex systems in themselves. We just took them as we found them without any attempt at analysis or putting a framework on them (neat little boxes). Our backgrounds as engineers did not help. Deming produced his “production viewed as a system model” and a theory of SoPK to support it.
His appreciation for a system states that a system must have an aim for without an aim there can be no system. Deming had a model and a theory; we had a theory and no model. It was time to develop a community viewed as a system model. Its universal aim would be to practise excellence as it fulfilled its purpose of achieving a quality outcome. Notice here that the aim which is universal has been separated from the purpose which is specific. This is different to Deming’s approach and provides the universal aim the CQC pioneers failed to identify. It allows all the subsystems of a complex community system share a common aim even if they are in competition with each other. They can all practise excellence.

The third challenge was to develop a complex human adaptive system model that supports the practise of excellence.

Much has been written about systems but the main influencers for this research were. Deming’s SoPK, Checkland’s soft systems methodology, Senge’s fifth discipline, Wheatley’s Leadership and the new science and Gharajedaghi’s systems thinking. The latter emphasised the need for elegant solutions which was incorporated into the definition of excellence. He also developed terminology on socio-cultural systems which he described as groups of like-minded individuals who come together voluntarily to engage in purposeful activity. These systems, he claims, are information-bonded based on a set of shared values and they decide for themselves what to do and how to do it. These concepts of autonomy and shared values had linkages for us with excellence. Based on these insights and input from others we began to develop an image of a human based system that provides a service or a product. We also decided to emphasise four aspects of purposeful HAS:

1. Systems are created by people to serve some purpose.
2. Humans are the driving force of all systems. The technologies and resources they use are secondary.
3. Systems serve their clients not vice versa. Clients fall into three categories: 3Cs.
4. The universal aim for all systems is to practise excellence.

This emphasis on service led us to examine Parasuraman’s work and the SERVQUAL scale of service quality mentioned earlier. This and Wheatley’s work helped us appreciate the various layers of awareness of systems developed later. It also gives enlightened clients some basis for determining how their system and “quality outcome” should be evaluated. Parasuraman’s five service dimensions and their relative importance to clients are:

- Reliability (32 per cent) – ability to perform the promised service dependably and accurately.
- Responsiveness (22 per cent) – willingness to help clients and provide prompt service assurance (19 per cent) – knowledge and courtesy of employees and their ability to convey trust and confidence empathy (16 per cent) – caring, individualised attention the system provides its customers tangibles (11 per cent) – appearance of physical facilities, equipment, personnel and communication materials.

In an attempt to keep it manageable we decided to focus initially on developing a system’s view of an individual. This would appear to be the simplest form of HAS and the building block of all the others.

Image of an individual human activity system (HAS)

At this stage of the research we drew on the work of: Wheatley, Checkland and Gharajedaghi. All had insights into situations and systems that appeared helpful to us. We wanted to develop an image and vocabulary of a HAS that we could employ to profile existing systems in a form of SWOT analysis.

As mentioned previously, we were struck and sometimes taken aback by how some individuals engaged differently with us in different locations. Wheatley and others have
observed this and noted that the context is important and if the context changes everything changes. Context has to be one element of a HAS. The context, in terms of Checkland’s appreciative system, is Weltanschauungen (images of the world) which he argues “can be manifest only as perceptions by human actors who are free to attribute meaning to what they perceive”.

The context, for us is comprised of the circumstances prevailing at a specific point in time and space. It is frighteningly transitory and includes all available resources, prevailing conditions, competitors, assumptions, etc. The context that exists at the time the system is created will be the initial baseline for the clients but they must be mindful of changes and agile to adapt the system and its purpose quickly to the new prevailing context. Failure to do this is like failing to update a computer’s operating system and it will become obsolete or corrupted and fail to provide the quality service it was intended to deliver. Whatever the clients do must always be done by practising excellence.

The next element of a HAS is climate. Climate is tangible and is what we see sense or feel immediately as we engage with a HAS. Is it friendly, hostile, open, closed, etc.?

HAS are comprised of humans whom we termed clients. As described previously these fall into three categories: 3Cs. This grouping is another element of a HAS. Systems serve their clients not vice versa. The climate is created by the clients and reflects the system’s shared culture.

The core element of a HAS is the culture a term that has been defined by many in different ways. For now we will settle for core values and beliefs which are an amalgam of those agreed to and shared by the clients; all the clients not just one of them. The culture is shaped by experience and is intangible but does manifest itself in the climate. An uncaring culture manifests itself in a climate of neglect which we will experience.

Mindful of previous comments of trying to engineer people into neat little boxes and Checkland’s observations we developed the image of a HAS, Figure 1. The shape of each element is random and unimportant. The purpose of the image is to facilitate engagement and debate with system’s clients. It is not a mathematical Venn diagram just a pattern of elements to help us visualise and discuss a HAS.

Even at individual level we have deliberately used the plural of client. The reason for this is Gharajedaghi’s assertion that it is the people in the system, they decide for themselves, what to do and how to do it. These systems have autonomy but this cannot be reckless. It needs to be informed, responsible and adhering to acceptable core principles. This research asserts that the practise of excellence is the desired pathway for all systems to achieve a “quality outcome”. Therefore a system even at individual level must include all three

![Figure 1. Image of an individual complex human adaptive system (HAS)](image-url)
categories of clients: 3Cs. You cannot practise excellence on your own, it would be
dictatorial. When it comes to excellence no one client or category of clients has the monopoly
of wisdom. Nobody is an island!

We felt we now had a comprehensive image of an individual complex human adaptive
system. It is comprised of just four elements which are continually in flux generating the
entity that it is. Any change in any element will result in a changed experience for those
engaging with the system. It is why the person in the meeting behaved differently to when
met on his own.

**Developing images for the other systems in the community**
The community is comprised of systems that exist at individual, interest-group,
industry and institution level. All are purposeful human adaptive systems and as we
analysed them we saw that all could be mapped onto the system image developed in
Figure 1. This image was a fractal that had transferability to systems at all levels even to
the entire community.

All are purposeful human adaptive systems comprised of a fractal of four elements:
context, climate, clients and culture (4Cs). We considered calling this fractal a “Cystem” to
emphasise its relevance to people and community. These elements are its DNA and are in a
constant state of flux generating the experience we have when we engage with them. This
fractal image can be used to understand why a system is behaving as it is and also to
identify how its behaviour or outcome can be improved. For our purposes we would wish
that the desire to practise excellence would be embedded in the culture of all systems we
dealt with. We would like that the universal aim for all systems would be to practise
excellence as it served its clients. This would be the hallmark of a quality HAS.

At this point we felt we should consider the concept of system boundaries for each of the
4Is and for the entire community itself. It seemed to be the expected thing to do. Looking at
the interactions across various systems and geographic borders it was clear that the notion
of a system boundary was ridiculous when dealing with these open systems. We will return
to boundaries later.

At this point in the research we have achieved three things:

(1) a readily understood and accepted definition of a quality outcome;
(2) a definition of excellence as the way to achieve a quality outcome; and
(3) a fractal image of a purposeful HAS that applies to all levels of complexity.

These can be captured in a single sentence or mantra which makes the theory accessible
to everybody:

To achieve quality outcomes we must practise excellence and maintain systems that are fit
for purpose.

We now have the images and vocabulary to flesh out this statement of theory.

The clients of the system must practise excellence and ensure that their system
comprised of four elements: 4Cs, is maintained fit for its purpose. The system must have the
right mix of clients sharing the desired culture, creating the desired climate and optimally
adapting to its context. Ideally the system will maintain itself.

Now we can stand back and let that magic happen – if only!

Unfortunately, systems cannot understand themselves. They need the facilitating and
analytical skills of a quality professional to help them see themselves as others see them.
Then clients must want to practise excellence and be guided on its use as they transform
their system and transform their ideas as they deliver a quality outcome. Again this is not
easy and many obstacles to these transformations present themselves.
Transformation obstacles

Complex human adaptive purposeful systems are in a constant state of flux as they undertake transformations at three levels.

Level one is the embryonic system forming itself to become “fit for purpose”. Level two is the system continually maintaining/transforming itself to remain fit for purpose. Level three transformation(s) are required as it defines, realises, delivers and evaluates the ever-changing quality service it was created to provide in a specific timeframe.

All three transformations face obstacles that must be overcome through the practise of excellence.

Imagine a system coming together to provide some service. This is the situation depicted in the left-hand column, Figure 2. This initial coalescence has no appreciation of itself as a system and absolutely no appreciation of excellence. Our research showed that most embryonic systems will only have a vague idea or uninformed rigid one of what service it intends to provide. This is the state that most groups in our community operated in during our engagement with them.

Ideally, we want this embryonic system to accept the theory that “To achieve quality outcomes we must practise excellence and maintain systems that are fit for purpose”. This must become the universal aim as it undertakes the various transformations. The first challenge is to make sure the system is inclusive and represents 3Cs. These must appreciate and commit to practise excellence as they:

1. Identify the system’s intended outcome or purpose. (This can be general).
2. Transform the system to be fit for purpose as it defines, realises, delivers and evaluates a quality outcome.

Again as our research showed these are not simple tasks. The system will require considerable help from a quality professional to support and guide it.
The desired outcome will be achieved by practising excellence. The desired culture will be achieved by practising excellence. The desired climate will be achieved by practising excellence. The desired D-R-D-E cycle will be achieved by practising excellence and so on.

Even at this initial stage of level one transformation the system committed to practise excellence will face obstacles and must be prepared for them. These obstacles, Figure 2, are not encountered in mechanical systems and confusion and stress will occur if they are not acknowledged and systematically addressed by the system.

Obstacles described
The obstacles to be recognised, accepted and overcome, through the practise of excellence are as follows.

Communication or more accurately “poor communication” is always the greatest obstacle to overcome and shown as the biggest bar in the model. Communication cannot be based on edicts, press releases or e-mails but involve engagement and reflective and generative dialogue. Excellence is predicated on dialogue. Clear, concise, truthful fact based dialogue channels must be established and be effective. A system that fails to communicate fails period!

Challenge as embraced by the Toyota Way should not be viewed as being hostile or adversarial. It is the system’s clients challenging it to deliver the best system outcome within the time frame available. This healthy trait should be embedded in the culture. It is highlighted here to remind systems to encourage, solicit and facilitate ongoing challenge from all clients and outsiders. Failure to accept this will cause internal friction and factions.

Complexity Kahane warns us to be prepared for three forms of complexity: dynamic – depending on the closeness in time and space between cause and effect. Generative – depending on the level of uncertainty. Social – depending on clients shared assumptions, values, rationales and objectives.

All systems will display some level of complexity but it should never cause unnecessary complications or stress within the system. The goal is to remove as much complexity as possible and to manage what remains.

Conflicts may arise or exist between the clients, between the current and desired system or between the systems interactions with other systems. If there is conflict between clients for example a war situation the system breaks down. It is intended to provide harmony not conflict.

Competition includes obvious competitors in the field of activity as well as competition for time and other resources within the system itself. System elements must be in harmony. Climate and culture must keep up with context. Clients must practise mutual respect.

Constraints: much has been written on the theory of constraints. Suffice here to reduce them to a single question “What are the limiting factors on any part of the system?” These can only be overcome by extending the timeframe, reducing the expectations or enhancing the system’s DNA.

Failure to recognise obstacles to system transformation and service realisation, addressed next, will result in confusion putting unnecessary stress on the clients. This may result in disillusionment and sometimes abandonment. None of the excellence models or standards address these obstacles.

Are we there yet?
Imagine now that we have a commitment to practise excellence, an agreed purpose and the desired fit for purpose system in place. Clients will be eager to let the system do what it is designed to do, namely, serve them by delivering a quality outcome. They are keen to rush into action and might see you as getting in the way. If their commitment to practise
excellence is sincere then all will be well but there are more obstacles to overcome. Fortunately these obstacles, Figure 3, are the very same as those described earlier. Again, they need to be recognised and dealt with or the clients will become disillusioned and frustrated and may walk away.

Having put the theory into practice the system is now transformed itself into a new level of maturity. Success has changed it and it is time to “do it all over” as Crosby advised in his Zero Defects approach. With ongoing support and help from a quality professional the system can become a self-sustaining never-ending cycle of transformation as shown in Figure 4.

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**Figure 3.**
Defining, realising, delivering and evaluating a quality outcome

**Figure 4.**
Self-sustaining system transformation continuum

**Note:** The arrows signify the practise of excellence
System boundaries
A mentioned earlier our attempts to identify any physical, geographical or ethnographical boundary for the systems we encountered proved futile. As time progressed there appeared to be one universal boundary that was applicable to all the systems and all their endeavours. That boundary was time, Figure 5.

In terms of HAS time is changing everything at the speed of light. Our “unenlightened” groups were unconsciously aware of this in their almost frenzied tendency to rush into action and get things done. They knew intuitively that delay devalued their plans. They were right but this fact cannot be used as an excuse for not practising excellence and not including consumers and complementors.

All systems operate within a timeframe. This is the universal system boundary. Short define-realise-deliver-evaluate timeframes offer less chance that the outcome will disappoint as a result of time inflated expectations. It is important that timeframes are kept as short as possible while still ensuring that all aspects of the theory are upheld.

To achieve quality outcomes we must practise excellence and maintain systems that are fit for purpose. In a rapidly changing context the system must be agile and skilled at the practise of excellence so that it does not delay things and also keeps the system relevant.

Excellence must be practiced as the system continually transforms itself to maintain its relevance. Excellence must be practiced as the system defines, realises, delivers and evaluates the quality service it was created to provide.

The timeframe boundary is the ultimate limiting factor. Unrealistic or bogus deadlines are to be avoided as they only frustrate clients and force them to abandon the theory. To achieve quality outcomes we must practise excellence and maintain systems that are fit for purpose. These concepts take time and it is only through practise and experience that systems become better and quicker at it. Initially it will appear to be slowing them down but over time they will appreciate that there is no better, faster or more reliable way of achieving a quality outcome in a harmonious way.

Research findings
The building block of society is the individual. If quality is to become embedded in the community it must appeal to the individual in terms that intuitively make sense to him. Organisational approaches such as Quality Management Systems, Excellence Models, LEAN or Six-Sigma are meaningless and sterile. His appreciation of quality is derived from more fundamental concerns that have universal applicability.

Every member of society appreciates implicitly that achievement has two aspects to it. The first is the outcome it is what has been achieved and the second is the process or how it was achieved. Both are intertwined and of equal importance in determining a quality outcome. The notion that the end justifies the means is a fallacy. Machiavelli comes to mind.

People want the outcome to be a quality one and that it is achieved in a harmonious way. Unfortunately, they do not have the vocabulary or images to express these desires and put them into everyday practice.
The findings of this research address this duality or dichotomy that has existed in quality for decades and condenses it into the following statement of theory:

To achieve quality outcomes we must practise excellence and maintain systems that are fit for purpose.

Most people will agree with this statement even if they are unsure what “excellence” means. But like all things the devil is in the detail and we need very clear and concise answers to the inevitable questions and challenges that arise if we are to make this theory a desirable accepted practice at everyday human level.

This paper provides answers when asked:

- What is a quality outcome? Who decides? How do they agree?
- What is excellence?
- What is a “fit for purpose” system?

To make this theory universal practice we must learn to insert every activity into the statement above. It must become “the way” we do things. One can replace “outcomes” with something like “healthcare” and see how it works generically:

“To achieve quality healthcare we must practise excellence and maintain systems that are fit for purpose.”

“To achieve quality customer experience we must practise excellence and maintain systems that are fit for purpose.”

“To achieve zero defects we must practise excellence and maintain systems that are fit for purpose.”

“To achieve harmony we must practise excellence and maintain systems that are fit for purpose.”

The word “maintain” is important as living systems must constantly adapt for survival.

Making this theory a reality is extremely difficult in a century that demands “sound-bite” explanations and instant solutions. This paper provided the answers you will require as you grapple with what appear to be extremely complex systems and, very often, situations that are hostile to quality and your attempts to engage and help them.

**Conclusion**

Society has much to gain from the universal practise of quality management principles. However, this is not quality as we know it in the organised world of systems and models. It is quality at its most fundamental and pure form that is meaningful, relevant and above all appealing to individuals as they undertake various activities.

This research encapsulated this in its mantra: “To achieve quality outcomes we must practise excellence and maintain systems that are fit for purpose”.

This single sentence conveys to everybody in complex human adaptive systems all they need to know for harmony and success. It also facilitates engagement by the quality professional as no part of it could be interpreted as being negative or hostile. It is as relevant to the lollipop person as it is to the multinational.

A quality outcome is achieved when the right things are done right. Excellence is the pathway to achieving a quality outcome and is based on dialogue and agreement between various clients based on a set of core principles.

A fit for purpose system understands and practises excellence as it puts the required clients, culture, climate and context in place to overcome all the obstacles to achieving its purpose.

Systems are inclusive and serve their clients (3Cs) not vice versa and there is no hierarchy of client.

All systems operate within a timeframe and must be mindful that quality is an emerging phenomenon changing with time at the speed of light. Consequently, there is relentless pressure to reduce the timeframe while still providing a quality outcome. Only through practise will system become better and faster at applying the theory.
The transformed harmonious system never rests. Excellence would not let it. Excellence is the alpha and the omega. The challenge for the quality professional is to embed excellence in the systems we encounter so that it becomes the self-sustaining way of choice of doing things. This paper has given you the images, vocabulary and insights to engage with complex systems and help them achieve quality outcomes by practising excellence and maintaining systems that are fit for purpose.

Community is the most complex of systems and we must imagine a time when every individual will embrace the mantra and practise it. As the individual is the building block the mantra will permeate: interest-groups, industries and institutions embracing all activities in society. No longer will people wonder what determines a quality outcome or how it is achieved. They will intuitively respond “To achieve quality outcomes we must practise excellence and maintain systems that are fit for purpose”.

We were led in this adventure by the CQC pioneers and our own studies in quality systems in manufacturing. I am conscious that other disciplines in business and sociology, etc. can bring much to flesh out the triad of the mantra. For us time ran out. This research has added to the body of knowledge by bringing Deming’s SoPK into the twenty-first century:

1. The HAS viewed as a system model reflects the autonomous human systems that predominate;
2. It defines excellence as the pathway to achieving a quality outcome and as being the universal aim of all systems; and
3. The definition of quality, doing the right things right, is easily understood and readily accepted by people.

These three elements comprise the “The Grange Excellence Model” for harmonious outcomes.

Hopefully, you are one of those who can build on these research findings and help excellence become “the way” we do things in harmony in the future. But first you must begin by practising it yourself.

You may be wondering about the community and how it was affected by us in the long-term. It was not. Research affects the researchers and the body of knowledge being explored. We were changed in our appreciation of meaningful quality and how it can be practised by everybody. Our contributions to the body of knowledge on quality are: the mantra “To achieve quality outcomes we must practise excellence and maintain systems that are fit for purpose”; and its explanation in layman’s terminology.

When the research period was over we packed up and moved on. We left them the office with a new sign over the door. So it is with research projects or any projects for that matter.

Appendix. Chronology of community quality councils

Growth of community quality initiatives in USA

1980 Lawrence M.A. Growth Opportunity Alliance of Lawrence (GOAL). This is seen as first CQI. Original focus to improve the quality of life and expand job opportunities in the Merrimack Valley area of Massachusetts and improve competitiveness.

1982 Jackson M.I. (Carole and David Schwinn) Transformation of American Industry Project. (TAI) based at Jackson Community College. It developed basic 14-week course on quality tools and techniques. 1995 it merged with local CQI to form Jackson CommUnity Transformation project. Funded by Kellogg Foundation.


1983 Madison Area Quality Improvement Network (MAQIN) Madison was created by a number of people who had attended a seminar given by Deming at the university of Wisconsin.
1987 Erie Excellence Council (EEC) formed April 1987 Motto “Work together to continuously improve ourselves our organisations and our community” Unclear about direction but adopted Deming’s 14 points and PDCA. Champion was William DeCrease who was encouraged by Myron Tribus and used Schwinn’s TAI materials.

Mid 1980s American Quality and Productivity Institute (AQPI). Was founded by Myron Tribus while at the centre for advanced engineering study (CAES) Massachusetts Institute of Technology (MIT). He had noted the growing number of auto manufacturers working with Deming and Juran. It was felt that an infrastructure was needed to facilitate this transformation. AQPI was a non-profit institute. It was devoted to the promotion of the principles of quality management; through the promotion of more local community-based quality councils.

1987 Greenwood, South Carolina forms a community Quality Council.

Vision “A community that cares about learning; where everyone accepts a responsibility for encouraging and enabling all of our people to reach their full potential and become a positive contributor to our economic well-being and quality of life”.

1989 AQPI and TAI merged to form the Community Quality Coalition (CQC). Mission: “To promote the introduction of quality management principles into every community in the U.S. and make Quality Management a way of life for all aspects of the community”.

AQPI was to foster community councils while TAI would create educational resources.


Vision: To reach out and bring together the broadest possible community representation to shape the Ann Arbor Area’s future. Ann Arbor 2000 encourages the participation of all segments of the community to illuminate, debate and stimulate projects needed for a better and stronger Ann Arbor Area by the year 2000. Ann Arbor Area 2000 is a process of building a preferred future.

1991 World Centre for Community Excellence (WCCE) founded in Erie PA. To serve as an information-clearing house for the many community quality councils formed throughout the USA. WCCE mission: “To promote, encourage, guide and catalyse people in communities throughout the world to work together to continuously improve themselves, their organisations, and their communities using total quality principles”.

1992 American Society for Quality (ASQ) forms the Community Quality Council Committee (CQCC). Its vision: To improve the quality of life in global communities and local regions through the advancement of commonly held principles practised by ASQ and other community quality organisations.

1996 Association for Quality and Participation (AQP) Cincinnati Ohio and WCCE merged to form the AQP centre for community excellence – WCCE is now defunct.

1996 Tacoma-Pierce county Washington State was selected by the Deming Institute in the autumn of 1996. The project was called “Tacoma/Pierce County – W. Edwards Deming Institute Partnership. Tacoma was selected because it was felt that it had the capacity and spirit for collaborative leadership.

1999–2000 AQP, ASQ and Deming Institute are discussing ways to combine their efforts in the area of community quality (Tacoma conference).

2001 AQP becomes affiliated with ASQ.

About the author
Bob Kennedy lectured on Quality Management in the Institute of Technology in Sligo, Ireland for almost 30 years. His primary degree is in manufacturing engineering and he work for some years in medical device manufacturing. In 1993 he completed a Masters on the implementation of ISO9000 Quality Management Systems. He was conferred with a doctorate in community excellence by the University of Limerick in Ireland in 2003. Kennedy is senior ASQ member and former counsellor for members in Ireland. Bob Kennedy can be contacted at: kennedy.bob@itsligo.ie

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Factors for improving performance in ISO 9001 certified small- and medium-sized service enterprises

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Abstract
Purpose – The purpose of this paper is to investigate the factors that are important for improving the performance of ISO 9001 certified small- and medium-sized service enterprises (SMSEs).
Design/methodology/approach – Preliminary research questions were set on the basis of a literature review and then submitted to a Delphi panel of experts. The results from the Delphi panel were transformed into hypotheses in the form of a survey. A sample comprising 115 Italian SMSEs answered the survey, which also included specific fields for qualitative notes. The hypothesis tests used 95% confidence intervals, and notes and suggestions from the respondents were also collected.
Findings – The findings relate to the role and responsibilities of the quality manager, as well the entrepreneur and partners, the quality of the enterprise culture, training, awareness concerning process key performance indicators, visual management and modern digitised documentation and communication. Furthermore, criticisms emerged regarding the ISO 9001 standard in terms of cost of quality measurement, day-to-day improvement and problem-solving.
Research limitations/implications – This research is limited to SMSEs. The limitations of this research open avenues for further research. In particular, many suggestions from the respondents seem generalisable to other industries and also to large manufacturing firms.
Practical implications – The findings of this research could be used as a guideline for implementing ISO 9001 in the SMSE sector. Moreover, some of the criticisms could be taken into account for the next revision of the ISO 9001 standard.
Originality/value – This is one of the first papers to discuss important factors for improving the performance of ISO 9001 in the SMSE sector.
Keywords Service industry, Quality management system, Performance, ISO 9001, Small- and medium-sized enterprises
Paper type Research paper

Introduction
ISO 9001 has been widely investigated since its first issue in 1987. Many papers have discussed ISO 9001s achievable benefits and improvements, the costs related to its implementation, as well as the obstacles and pitfalls in developing this QMS. When ISO 9001 was first issued, many companies benefitted in terms of their external image and marketing (Buttle, 1997). Over the years these benefits have reduced in value due to the increasing number of certified organisations around the world (Staines, 2000); therefore, benefits in terms of improved internal performance have been pursued. However, the literature is contradictory; several authors have argued in favour of improving performance over time through ISO 9001
certification (Staines, 2000; Dick et al., 2008; Psomas et al., 2013; Murmura and Bravi, 2017; Tomic and Spasojevic Brkic, 2018), while other authors have brought into play several drawbacks associated with this QMS (Poksinas et al., 2006; Banuro et al., 2017; Murmura and Bravi, 2017). According to Dick et al. (2008, p. 690): “a certified QMS can achieve an increased emphasis on quality, leading to less waste and duplication of effort, and improvement in product quality. This means there are lower costs and fewer customer defections”.

Moreover, according to some authors (Chiarini, 2011; Fonseca, 2015; Fonseca and Domingues, 2018), when ISO 9001-certified organisations aim to increase their economic and financial process performance, they must integrate their QMS with other more advanced systems, such as lean production and TQM. Therefore, these authors implicitly recognise certain limitations in a certified QMS, at least in improving business performance over time.

In this context, since 2000 the International Organization for Standardization (ISO) has issued three different versions of the ISO 9001 standard, where organisations have been asked to measure the performance of their processes, specifically in terms of effectiveness. These three versions, culminating in the latest 2015 version (ISO, 2015), contain a specific clause dedicated to these improvement principles, where organisations must demonstrate their ability to improve performance over time. Moreover, top management must measure and periodically review process performance, data and trends related to the QMS.

However, while large multinational companies seem better disposed towards new ways of improving their performance and managing their QMSs (Lee and Palmer, 1999; Boulter and Bendell, 2002; Wayhan et al., 2002) several authors (Lewis et al., 2006; Poksinska et al., 2006; Carlos Pinho, 2008; Sicília Ilkay and Aslan, 2012) have highlighted difficulties for small- and medium-sized service enterprises (SMSEs).

Organisations belonging to the service industry have been noted to experience difficulties compared to those in the manufacturing industry in terms of the improvement of performance brought by ISO 9001 certification (Augustyn and Pheby, 2000; Heras et al., 2008; Psomas et al., 2010; Melão and Guia, 2015). For instance, requirement interpretation, documentation management and auditing process seem to be of some concern in the service industry as well as the intangibility and heterogeneity of the outputs of services (Calisir, 2007). In this regard, this study aims to enlarge the debate surrounding the improvement of performance over time in ISO 9001 certified SMSEs. In particular, the study hopes to answer the following questions:

- What are the factors that are important for improving the performance in ISO 9001-certified SMSEs over time?
- Why are these factors important, and what is the context behind them?

To do this, in the next two sections, some preliminary research questions (RQs) are set on the basis of a literature review, and then an online survey is developed by a Delphi panel of experts. A total of 115 Italian SMSEs answered the survey, which was enhanced with specific fields for qualitative notes. The methodology is presented in a specific section, and the results, including the notes and comments left by the respondents, are analysed and discussed. The conclusions are then presented, as well as the limitations of this study and its practical implications, and new avenues for future research are proposed.

**Literature review and preliminary research questions**

ISO 9001 certification has long been debated, and there is ample literature around its application in different kinds of industry, including service organisations. For the purpose of this research, papers concerning difficulties in managing and improving a certified QMS over time were reviewed, in particular those concerning organisations belonging to the service industry and/or classified as SMEs. The main aim of this literature review was to design some preliminary RQs to discuss with the Delphi panel of interviewees, as presented in the next section.
The first relevant studies date back to the 1990s. Brown et al. (1998) were among the first authors who tried to rank the problems encountered in managing ISO 9001 certification SMEs from different sectors over the years. These authors listed a series of difficulties, such as the costs involved, employee commitment, paperwork, interpretation of standards, time commitment, management commitment, training of staff, inflexible standards and auditors.

Other authors began investigating ISO 9001 implementation in SMEs and have advanced some criticisms of the standard, concluding that the real benefits were not important compared to the general costs of implementation (Kean et al., 1995; Brown et al., 1998) and maintenance (Casadesus and Karapetrovic, 2005). ISO 9001 was first introduced in 1987, and over the last three decades costs such as consultancy, certification and staff involvement have reduced (Aba et al., 2016). However, these costs may still represent an obstacle in terms of investment in improving QMS performance, especially for SMEs and the service industries (Mak, 2015). Therefore, the first preliminary RQ is:

RQ1. Are the total costs for managing an ISO 9001-certified QMS an obstacle to improving ISO 9001 performance over time in SMEs?

One of the most studied obstacles to improving a certified QMS is management participation and commitment. Top management’s involvement was found to be an enabling factor, especially important for systematic work and a sustainable improvement process in the system (Poksinska et al., 2006, p. 500). Many authors (Brown et al., 1998; Tang and Kam, 1999; Feng et al., 2007; Magd, 2008; Lee et al., 2009; Ab Wahid, 2012; Ru Chen and Cheng, 2012; Mohammad Mosaieghrad, 2013; Goetsch and Davis, 2014; Chiarini, 2017) have investigated this issue, finding similar results. They conclude that a lack of commitment, leadership and involvement from the top management and management more generally can negatively affect the performance and the improvement of a QMS. These authors concluded that this is true for all sectors and company sizes. As a consequence, a second preliminary RQ has been set:

RQ2. Is a lack of management commitment an obstacle to improving ISO 9001 performance over time in SMEs?

The literature proposes that employee involvement and communication is another important obstacle to improving ISO 9001 performance over time. This claim can be found in several studies from different authors (Brown et al., 1998; Augustyn and Pheby, 2000; Janas and Luczak, 2002; Poksinska et al., 2006; Ab Wahid and Corner, 2009; Chiarini, 2017).

Teehan and Tucker (2014) remarked that, after certification, communication between management and employees may wane and the value and importance of the quality system may seem to be de-emphasised to employees. They pointed out that according to several studies front-line employees are aware of ISO, but uncertain of how to implement it in their day-to-day work with customers. If top management does not show commitment and does not signal the importance of a systematic quality work, employees will put a low priority on the system’s development and consequently nothing will happen (Poksinska et al., 2006).

Ab Wahid and Corner (2009) highlighted the value of teamwork and a reward system as a fundamental aspect of employee involvement. Heras et al. (2008) studied ISO 9001 in the Spanish residential aged care service sector and demonstrated the effect of poor QMS knowledge and training on employee involvement and motivation. A lack of knowledge about the standard requirements and low levels of understanding of the goals and principles of the system could produce different problems (Poksinska et al., 2006, p. 501); thus, other preliminary RQs can be set:

RQ3. Is poor employee involvement an obstacle to improving ISO 9001 performance over time in SMEs?

RQ4. Is poor employee training an obstacle to improving ISO 9001 performance over time in SMEs?
Chapman and Sloan (1999) analysed the continuous improvement in several Australian SMEs that had gained ISO 9001 certification. These authors linked poor continuous improvement performance with a lack of implementation of problem-solving techniques. Similarly, other authors (Kureshi et al., 2010) highlighted how Pakistani SMEs are not fully aware of practices related to quality management techniques; according to these authors this may negatively affect the performance improvement of the QMS over time. Therefore, the fifth preliminary RQ is:

RQ5. Is the lack of quality management techniques an obstacle to improving ISO 9001 performance over time in SMEs?

Paperwork and bureaucracy are also among the obstacles taken into consideration for ISO 9001 improvement in SMEs (Brown et al., 1998). Heras et al. (2008) directly linked bureaucracy with the implementation of the QMS and its sustainability over time; while Lee et al. (2009) highlighted how some Chinese service companies were implementing ISO 9001 to the minimal extent required for obtaining certification. Lee et al. (2009) claimed that this issue may be related to the intention of avoiding paperwork. In any case, this phenomenon seems to be declining with the upgrading of the standard (Psomas et al., 2010); indeed, according to Chiarini (2017), the latest ISO 9001:2015 standard facilitates the writing and control of the documentation. Despite this, the sixth preliminary RQ is:

RQ6. Is paperwork/bureacracy an obstacle to improving ISO 9001 performance over time in SMEs?

In order to set the final hypotheses to be tested, these six preliminary RQs were used to develop a preliminary semi-structured questionnaire for the expert panel.

Methodology

For this research different methodologies have been employed. Specifically, it has been used two rounds of a Delphi method interposed with the thematic content analysis (TCA) and finally a quantitative test of the hypotheses (Figure 1).

The Delphi method can be considered as a method for structuring a group communication so that the process is effective in allowing the group, as a whole, to deal with a complex problem (Linstone, 1978). The most relevant aim of the Delphi method is to gain reliable consensus of a group of experts’ opinion. Typically, the process is structured with a series of interviews through questionnaires, combined with some feedbacks (Robinson, 1991). The Delphi method is particularly employed in management and it has been used in the ISO 9001 field as well (Babatunde and Low, 2015). According to Robinson (1991) and Walker and Selfe (1996), Delphi method consists of two or three rounds of interviews with interviewees who are considered experts in their sector. There is no strict rule for the number of experts; Linstone (1978), who is considered one of the most important scholars in the field of Delphi methodology, suggested that a suitable minimum panel size is seven. For this research, a panel of 12 QMS practitioners with similar characteristics was chosen according to the following criteria:

- at least 10 years of experience in QMS and TQM, and in particular, in ISO 9001 certification;
- proven experience as a consultant and/or auditor in SMEs;
- proven experience as a consultant and/or auditor in a service industry; and
- qualifications as a senior auditor, lead auditor or QMS expert.

In the first round of the Delphi process a semi-structured questionnaire was circulated among the 12 experts in order to collect their opinions and suggestions on the six
open questions. The semi-structured questionnaire is a qualitative approach that typically involves interviews that have some explicit structure, but are not completely structured. Such inquiry usually employs systematic, iterative coding of verbal data written in a memoire (Grbich, 2013). The semi-structured questionnaire developed in this study contains six open questions to cover and discuss each of the preliminary RQs that emerged from the literature review. For instance, preliminary RQ1 was turned into the following open question:

Do you think that the costs of maintaining ISO 9001 certification are an obstacle to improving the QMS over time?

The first round generated a large volume of information, which was analysed, labelled and grouped using TCA. An adequate TCA depicts the thematic content of interview transcriptions by identifying common subjects in the texts (Creswell, 2013). TCA works using the following pattern:

- highlighting in the text notes that are relevant to the topic of the research;
- initially coding each distinct unit of meaning;
- grouping similar codes creating more focussed categories; and
- labelling categories.

Table A1 summarises the process of coding and grouping, showing the initial codes from the text of the 12 interviewees' notes and the consequent focussed categories. Specifically, from this first round nine new categories emerged, which were used for developing a second questionnaire. The same 12 experts were asked to rate the nine categories in terms of their significance according to the following five-point Likert scale: 1 = very unimportant; 2 = somewhat unimportant; 3 = neither important nor unimportant; 4 = important; 5 = very important.
For instance, regarding the first category, in the second round of questionnaire this question was asked:

- Do you consider that consultancy might be important for improving an ISO 9001-certified QMS over time?

In this way, eight RQs out of nine were transformed into hypotheses to be tested. For this reason, a questionnaire (Forza, 2002) with eight questions was developed in order to collect data, and a survey of Italian SMSEs was carried out. For instance, for the first hypothesis, the first question of the questionnaire was:

- Do you consider that having a quality manager belonging to the board (QMANAGER) could be important for improving performance of your ISO 9001-certified QMS over time?

QMANAGER represents the operationalised variable used for the 95% confidence interval (CI) test. Similarly, the other seven questions were set, where the operationalised variables are Cost of Quality (COQ), ENTERPRENEUR, DOCUMENT, TRAINING, COMMUNICATION, KPI_AWARENESS and PROBLEM_SOLV. The eight questions required answers on a Likert scale of one to five, where, as in the second Delphi questionnaire, 1 meant “very unimportant” and 5 “very important”. Each question also had an open answer space so that the respondents could leave notes or comments on the item being addressed. This provided useful information for the discussion and gave more context to the quantitative results.

A large database of around 12,600 quality managers’ e-mails was used in this study. The database was acquired from three consultancy firms specialised in quality management from the official list of Italian ISO 9001-certified organisations held by the national accreditation body, Accredia, and from an Italian trade association. Companies in the databases were selected using a stratified sampling according to the following criteria:

- they belong to service industry and do not have manufacturing processes;
- they have fewer than 250 employees and a turnover of less than €50m;
- they have been managing a certified QMS for at least five years; and
- they have at least one office in Italy.

At the end of the stratification process, 1,473 e-mails were selected and 115 questionnaires were obtained with a 7.81 per cent response rate. In the sample each company record had only one e-mail associated.

Starting from January 2018, the managers included in to the sample had been invited to fill out an online questionnaire for 12 months.

To test the hypotheses, a quantitative inquiry based on a 95% CI was employed for the proportion of the Italian manufacturing SMSE population. According to Pfennig (2010), in this case the population size must be at least ten times the sample. The CI serves as an estimate of the population mean because the test tends to produce intervals that contain the mean. Consequently, the null hypotheses can be stated as:

\[ H_0 : \text{There is no significant difference between the population mean and the means of the proportions of 115 answers to each question.} \]

In order to test the difference from the population mean, the researcher has to select a value within the used Likert scale, from one to five. We started using 2 (slightly interested) for the test. The alternative hypothesis would be that the mean is significantly different from 2 (higher or lower). After having tested the value of 2 we tried the test using 3 (moderately important) and finally 2.5 being in between “slightly important” and “moderately important”.
The CI of the population proportions was calculated using the formula:

$$CI = \hat{p} \pm z \sqrt{\frac{\hat{p}(1-\hat{p})}{n}},$$

where \( \hat{p} \) is the mean of the sample proportion of the \( n = 115 \) answers. It is well known that for a 95% CI the multiplier \( z \) is equal to 1.96 (Dacunha-Castelle and Duflo 2012). For each of the eight answers of the questionnaire, the statistical results give an explanation in terms of inference of the population of Italian SMSEs.

In addition to the quantitative test, qualitative data were taken from the specific fields provided in the online questionnaire for collecting comments and suggestions from the respondents. This information allowed to better understand the phenomena behind the quantitative data, providing context to the quantitative tests.

**Findings**

*Results from the Delphi panel*

In the second Delphi round the 12 experts ruled out consultancy as something important for improving performance in ISO 9001-certified SMSEs. On the other hand, items connected to a lack of problem-solving techniques and the entrepreneur’s commitment and involvement obtained a very high rank. The latter even reached the maximum rank of 5 with a standard deviation (SD) equal to 0, which implies maximum and unanimous consensus among all the experts.

Table I summarises the results in terms of the means and SD of each of the nine categories.

**Sample characteristics**

The sample characteristics are shown in Tables II and III with regard, respectively, to the turnover volume and number of employees and the typology of service industry.

<table>
<thead>
<tr>
<th>Category</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Consultancy can help in improving the QMS</td>
<td>2</td>
<td>0.76</td>
</tr>
<tr>
<td>2. Quality manager must be a member of the board</td>
<td>3.12</td>
<td>1.35</td>
</tr>
<tr>
<td>3. Measuring costs of quality</td>
<td>4</td>
<td>1.19</td>
</tr>
<tr>
<td>4. Entrepreneur’s commitment and involvement</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>5. Lack of improvement through quality documentation</td>
<td>2.87</td>
<td>1.25</td>
</tr>
<tr>
<td>6. Lack of staff training</td>
<td>3.87</td>
<td>0.99</td>
</tr>
<tr>
<td>7. Lack of internal communication</td>
<td>4.5</td>
<td>0.53</td>
</tr>
<tr>
<td>8. Lack of staff awareness concerning process KPIs</td>
<td>4.12</td>
<td>1.13</td>
</tr>
<tr>
<td>9. Lack of problem-solving and TQM techniques</td>
<td>4.25</td>
<td>0.71</td>
</tr>
</tbody>
</table>

**Table I.** Results from the second round of the Delphi panel

<table>
<thead>
<tr>
<th>Turnover (in million euros)</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 2</td>
<td>57</td>
</tr>
<tr>
<td>Between 2 and 10</td>
<td>37</td>
</tr>
<tr>
<td>Between 10 and 30</td>
<td>21</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of employees</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fewer than 10</td>
<td>63</td>
</tr>
<tr>
<td>Between 10 and 50</td>
<td>33</td>
</tr>
<tr>
<td>Between 51 and 250</td>
<td>19</td>
</tr>
</tbody>
</table>

**Table II.** The companies divided by turnover and number of employees
As exposed in Table II, the sample is composed mainly by small company with a turnover lower than €2m and fewer than ten employees.

Considering the typology of service industry, the majority of the interviewed companies offers professional, scientific and technical activities (19.13 per cent), administrative and support services (17.39 per cent), information and communication services (14.78 per cent) and transportation, storage and logistic services (12.17 per cent).

Quantitative results from the hypothesis testing, analysis and discussion

The quantitative results of calculating the mean and the SD within the sample are exposed in Table IV. The standard error of the mean (SEM), which gives useful information on the estimated difference between the mean of the population and the mean of the sample, was also calculated. A smaller SEM indicates better accuracy of the sample.

Table IV shows that the mean of the answers to the first question (QMANAGER) is less than 2 (slightly important), meaning that the majority of the respondents consider that having a quality manager as a member of the board is not important for improving the performance of an ISO 9001-certified QMS. Similarly, the variable DOCUMENT has a mean of 2.36, indicating that quality documentation is not considered as important as the other factors. All the other means are greater than 4 (very important), which shows that six out of eight factors are considered highly relevant to improving performance over time.

To be more certain of the quantitative results from Table IV, Table V provides the results from the t-test procedure setting the test value at 2. The first column of Table V gives the t-values (Student t-statistic). This is the ratio of the difference between the sample mean and the given number to the SEM. The smaller the SEM, the higher the t-value, and consequently the smaller the p-value (Sig. two-tailed).
Given that the \( p \)-value in the third column is greater than 0.05, the null hypothesis of no significant difference between the population mean (2) and the means of the proportion of QMANAGER can be accepted, confirming the results given in Table III. The mean difference is \(-0.017\), which is included in the range \(-0.194\) and \(0.159\).

With respect to DOCUMENT, the mean difference is \(0.365\) and the \( p \)-value is equal to 0.000, which does not allow us to accept the null hypothesis. Thus, we are 95 per cent sure that there is a difference from the population mean that has been set to 2. Therefore, a test with a population mean set at 3 was conducted, which again rejected the null hypothesis \( (p \text{-value} = 0.000) \). Finally, another test was conducted with the population mean set at 2.5. In this case, according to Table VI, the null hypothesis \( (p \text{-value} = 0.112) \) of a no significant difference can be accepted. However, 2.5 is between the “slightly important” and “moderately important” categories, and as a consequence more analysis is necessary to clarify whether or not this factor affects the possibility of improving the performance of the QMS in certified SMSEs.

Qualitative results, analysis and discussion
The qualitative notes collected through the semi-structured questionnaire have been analysed below with reference to each variable considered.

The quality manager as a member of the board
This hypothesis was accepted with a test value equal to 2, confirming that there is no difference from a population mean of 2 (i.e. slightly important). Why do the respondents consider that having the quality manager as a member of the board does not help to improve the performance of the QMS over time? Examination of the comments left by the respondents (29 responses) showed that the dominant word used was “independence”. The respondents considered that the quality manager and the members of the board must be separate people, with independent roles and responsibilities. In this regard, 18 responses

<table>
<thead>
<tr>
<th>Variable</th>
<th>( t )</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
<th>Mean difference</th>
<th>95% CI of the difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>QMANAGER</td>
<td>-0.195</td>
<td>114</td>
<td>0.846</td>
<td>-0.017</td>
<td>-0.194 - 0.159</td>
</tr>
<tr>
<td>COQ</td>
<td>31.568</td>
<td>114</td>
<td>0.000</td>
<td>2.156</td>
<td>2.021 - 2.292</td>
</tr>
<tr>
<td>ENTERPRENEUR</td>
<td>35.422</td>
<td>114</td>
<td>0.000</td>
<td>2.44</td>
<td>2.307 - 2.580</td>
</tr>
<tr>
<td>DOCUMENT</td>
<td>4.344</td>
<td>114</td>
<td>0.000</td>
<td>0.365</td>
<td>0.199 - 0.532</td>
</tr>
<tr>
<td>TRAINING</td>
<td>31.457</td>
<td>114</td>
<td>0.000</td>
<td>2.304</td>
<td>2.159 - 2.449</td>
</tr>
<tr>
<td>COMMUNICATION</td>
<td>43.194</td>
<td>114</td>
<td>0.000</td>
<td>2.687</td>
<td>2.564 - 2.810</td>
</tr>
<tr>
<td>KPI_AWARENESS</td>
<td>29.036</td>
<td>114</td>
<td>0.000</td>
<td>2.296</td>
<td>2.139 - 2.452</td>
</tr>
<tr>
<td>PROBLEM_SOLV</td>
<td>39.340</td>
<td>114</td>
<td>0.000</td>
<td>2.574</td>
<td>2.444 - 2.703</td>
</tr>
</tbody>
</table>

Table V. One-sample test results; Test Value 2

<table>
<thead>
<tr>
<th>Variable</th>
<th>( T )</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
<th>Mean difference</th>
<th>95% CI of the difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>QMANAGER</td>
<td>-5.810</td>
<td>114</td>
<td>0.000</td>
<td>-0.517</td>
<td>-0.694 - -0.341</td>
</tr>
<tr>
<td>COQ</td>
<td>24.248</td>
<td>114</td>
<td>0.000</td>
<td>1.656</td>
<td>1.521 - 1.792</td>
</tr>
<tr>
<td>ENTERPRENEUR</td>
<td>28.174</td>
<td>114</td>
<td>0.000</td>
<td>1.943</td>
<td>1.807 - 2.080</td>
</tr>
<tr>
<td>DOCUMENT</td>
<td>-1.603</td>
<td>114</td>
<td>0.112</td>
<td>-0.135</td>
<td>-0.301 - 0.032</td>
</tr>
<tr>
<td>TRAINING</td>
<td>24.632</td>
<td>114</td>
<td>0.000</td>
<td>1.804</td>
<td>1.659 - 1.949</td>
</tr>
<tr>
<td>COMMUNICATION</td>
<td>35.157</td>
<td>114</td>
<td>0.000</td>
<td>2.187</td>
<td>2.064 - 2.310</td>
</tr>
<tr>
<td>KPI_AWARENESS</td>
<td>22.712</td>
<td>114</td>
<td>0.000</td>
<td>1.796</td>
<td>1.639 - 1.952</td>
</tr>
<tr>
<td>PROBLEM_SOLV</td>
<td>31.698</td>
<td>114</td>
<td>0.000</td>
<td>2.074</td>
<td>1.944 - 2.203</td>
</tr>
</tbody>
</table>

Table VI. One-sample test results; Test Value 2.5

Factors for improving performance
were identified where the respondents had highlighted how the members of the board set strategic goals, objectives and key performance indicators (KPIs), while the quality manager is a more technical figure in charge of deploying and implementing these objectives. This is in accordance with the content of the ISO 9001:2015 clauses dedicated to leadership, organisational roles, responsibilities and authorities (ISO, 2015).

Interestingly, 12 respondents suggested that if the quality manager were also a member of board, he/she would mainly pursue economic and financial performance to the detriment of others factors, such as customer satisfaction. This is fundamentally the reason why they considered that the quality manager should be completely independent from the board. For instance, eight respondents suggested that the ISO 9001 standard should be more explicit regarding the separation of responsibilities between the quality manager and the partners. However, certain respondents noted that in micro-organisations with few employees the quality manager is often the entrepreneur or a partner.

Measuring the cost of quality
From the notes, the respondents highlighted that they are trying to calculate both COQ and costs of poor quality (COPQ). From the TQM literature (Harrington, 1999) it is well known how COQ are the total costs related to a QMS, including investments in prevention and controls. While the COPQ are only connected with failures and not necessary controls and checks.

According to the quantitative results (see Table IV), the respondents believed that the measurement of COQ and COPQ is very important for improving performance, and the comments and suggestions left definitely confirmed this. For example, 32 respondents commented that it important to measure the COQ in order to understand if the benefits achieved are greater than the costs related to the QMS. However, even if the respondents were familiar with COQ and COPQ, they recognised certain difficulties regarding how to accurately measure COQ. In fact, 21 respondents stated that their traditional accounting systems were not able to calculate the total costs, especially in terms of the overhead costs related to non-conformity. Some of these respondents referred to the possibility of using a different cost accounting system, such as activity-based costing. Elements of this aspect can be found in Ittner (1999) and Dale and Plunkett (2017). However, according to the respondents, in the service sector this phenomenon seems to be more important than in the manufacturing sector, due to the lesser degree of standardisation of services and processes. Indeed, some respondents argued that their accounting software did not take this possibility into consideration. Furthermore, 11 respondents also commented that the quality culture is less developed in the SME sector.

Finally, on interesting note, 13 respondents considered that the ISO 9001 standard should impose the measurement of COQ on senior management, in order to evaluate the real costs and benefits of a certified QMS.

Entrepreneur’s commitment and involvement
As expected, the entrepreneur’s commitment and involvement was something that was taken for granted. The literature review clearly showed this, as well as our panel of experts and, naturally, ISO 9001 itself in the clause dedicated to leadership (ISO, 2015). The comments and suggestions from the respondents confirmed this, as well highlighting that the entrepreneur and their partners in the board must set strategic quality goals, process indicators, measure the COQ and show their commitment to, and involvement in, the organisation as a whole. However, in eight comments the respondents noted how the ISO 9001 could encourage more day-to-day involvement of the entrepreneur in the QMS. They considered that the current ISO 9001 might allow the entrepreneur to only manage the system sporadically, such as during management reviews or for the management of relevant claims. Nevertheless, when the organisation is an SME, it is important to have the
entrepreneur and his/her partners involved regularly. This could be seen to be contradiction with the results from the first question, where the respondents believed that the quality manager should have a separate role from that of the entrepreneur. Despite this, according to the respondents, the entrepreneur should be more involved in the QMS, particularly in strategic and problem-solving activities, rather than in activities such as writing and managing the documentation.

**Quality documentation**

The quantitative results showed that the mean of documentation is not greatly different from the tested value of 2.5. Therefore, the respondents were undecided between whether it was slightly or moderately important to use documentation to improve QMS performance. The comments gave more context to this result, and there were no less than 34 negative suggestions regarding quality documentation; precisely 23 respondents believed that procedures and work instructions are only one way of standardising processes and that this could introduce “red tape”. The risk of increasing bureaucracy with the introduction of quality documentation has been also highlighted in the literature review. In any event, the respondents believed that is important to standardise a process through quality documentation, but only after having improved the process. In total, 22 responses highlighted how quality documentation can help to improve performance when it is simple, digitised within the enterprise resources planning (ERP) software, or even integrated in advanced cyber-systems such as augmented reality and artificial intelligence. Some respondents believe that modern cyber-technologies should automatically update quality documentation, replicating state-of-the-art of processes. Indeed, 12 respondents believe that quality documentation is often not aligned with all the improvements introduced, thus losing some of its potential for making the best practices available.

**Training and communication**

Training and communication were seen by the respondents as strongly connected, and both received high mean values according to Table IV, with COMMUNICATION scoring the highest mean of all eight questions, at 4.6870. The comments and suggestions left concerning training were all taken for granted, and the participants referred to training and education as a vehicle for increasing people’s skills and a tool for improving performance in a company’s processes and services. Several interesting comments were made regarding communication, where 14 respondents stated that often communication is not as fast as it should be, especially in terms of answers for service non-conformities and organisational problems. Again, the respondents stated that they would like to see the entrepreneur more involved in solving problems and communicating their solutions. The respondents also suggested the use of advanced technologies and visual systems for communication. For instance, ten respondents highlighted the use of software, apps and social media for improving communication concerning non-conformities, problems in general and their solutions, as well as best practices and KPIs.

**KPI awareness**

Connected with the issue of communication, the respondents believed that the use of KPIs and raising employee awareness of them could be a relevant factor in improving QMS performance over time; communication was seen as key to raising employee awareness. According to 21 respondents, KPIs should be identified, managed and reviewed by the entrepreneur and the members of the board. The respondents considered that it is fundamental that KPIs be communicated to all employees using visual systems such as noticeboards and electronic screens, following the kaizen principle of visual management. Moreover, they
believed that employees should be involved in KPI management and be aware of every negative deviation from targets. With respect to the issue of KPI targets, it is interesting to note that 12 respondents declared that sometimes the targets set by managers could be too strict. According to these respondents, targets that are too difficult to be met tend to discourage and demotivate people instead of raising their awareness. This issue was often discussed by the “father” of the TQM movement, Deming (1986), in his conferences and papers.

Problem-solving
Problem-solving was considered to be the second most important factor for improving performance over time. According to Table IV, the quantitative results showed a mean of 4.5739, with a relatively low SD. However, going over the qualitative notes left by the respondents several issues worthy of a deeper discussion were noted.

First and foremost, no less than 37 respondents commented that a problem-solving process is important for improving performance; however, 21 state that they did not know how to manage problem-solving. Some respondents admitted that no-one within their organisation was trained to use problem-solving tools such as Pareto analysis, cause and effect diagrams, 5WHYs or the plan-do-check-act approach. Other respondents stated that they did not know that problem-solving could be based on specific tools and methodologies.

However, probably the most important suggestion came from the 14 respondents who state that the ISO 9001 clause dedicated to QMS improvement did not encourage problem-solving. In fact, Clause 10, named improvement (ISO, 2015, p. 29), does not directly require a problem-solving process, and according to the respondents, this clause does not align with the TQM principle of continual improvement (Deming, 1986). Furthermore, 12 respondents stated that they found this ISO 9001 clause more focussed on the improvements that arise from the management review processes put in place by the entrepreneur and the board rather than day-to-day improvements. They also highlighted how certification body auditors did not require problem-solving and TQM tools for the day-to-day improvements carried out by the staff.

Conclusions
This study aimed to identify factors that are important for improving the performance of the ISO 9001 QMS in SMSEs. As a first step, a number of the factors identified in a literature review were submitted to a panel of experts for their approval. One of these potential factors – using consultancy in an effort to improve QMS performance over time – was ruled out by the experts. The other eight potential factors identified were transformed into hypotheses to be tested via an online questionnaire. A total of 115 Italian SMSEs answered the questionnaire. Hypothesis testing by means of a 95% CI approach ruled out another potential factor: that the quality manager should be a member of the firm’s board in order to improve the performance of an ISO 9001-certified QMS. Comments and suggestions from the respondents were collected and gave context to the phenomena behind the data.

Some of the findings of this study are not new, and have already been discussed in the literature, while others represent new findings. For example, this study confirmed that SMSEs also face the issue of separating the quality manager’s role and responsibilities from those of the entrepreneur and their partners. The entrepreneur and the partners should focus on the company’s strategic objectives, management review, problem-solving activities and solutions, communication and COQ measurement. Regarding the latter, the respondents considered that ISO9001 should require the measurement of COQ in order to clarify whether or not the QMS performance overcomes the costs associated with it. However, it seems that in SMSEs it is more difficult to measure COQ and COPQ than in other sectors. This is due to the use of traditional accounting systems and software, as well as a lower level of implementation of a quality culture.
Other well-known findings pertain to the use of quality documentation for standardising the improvements that have been achieved and maintaining and updating this documentation. Training and communication inside these organisations are other issues already discussed in the literature. Furthermore, the respondents emphasised the importance of raising employee awareness of process KPIs and any deviations from their targets. However, KPI targets should not be too strict, to avoid the risk of demotivating employees.

A new factor identified in this study relates to the use of modernised quality documentation, which should be completely digitised and integrated into the ERP software. The respondents highlighted how documentation should automatically replicate a state-of-the-art process without manual intervention in writing procedures and instructions. New cyber-technologies such as augmented reality and artificial intelligence should be used for this. QMS communications should also be based on new systems, such as social media and apps.

Although these new technologies are rapidly advancing, requests related to more traditional visual ways for communicating and managing were also noted. In this light, KPIs and problem-solving processes should be made visible to all the employees via noticeboards and screens. This is in accordance with the visual management principles of lean thinking.

Finally, this research brings to light some interesting criticisms of the ISO 9001 clause dedicated to improvement. The respondents from SMSEs highlighted how this clause neither fosters problem-solving processes based on TQM tools and principles nor by day-to-day continual improvement managed by company staff. External auditors have also been criticised for not pushing organisations in this direction.

This research has important practical implications for quality management practitioners. First, the comments and suggestions left by respondents could be used as a guideline for implementing an ISO 9001 QMS in the SMSE sector. Second, the suggestions could be used for revising and improving the current processes in existing ISO 9001-certified SMSEs.

**Agenda for further research**

The limitations of this research open certain avenues for further research. This study was based on a sample of 115 Italian SMSEs, which means further research from other countries and using different methodologies is needed.

Many suggestions from the respondents seem generalisable to other industries and also to large manufacturing. These suggestions could be tested as hypotheses, as well as investigated in practical case studies. In particular, the role of the quality manager and the board, depending on the size and kind of industry, should be further studied. Moreover, the issue of calculating the COQ and COPQ in a service organisation deserves further investigation. Why is this so difficult? Is it a matter of tools and technology or a lack of culture? Referring to tools and technologies, more research is also needed on how tools from other systems, especially Lean and Six Sigma, could improve the ISO 9001 QMS; not to mention advanced cyber-technologies from Industry 4.0.

As a final note, reflections and research on how to improve the next version of ISO 9001 should be welcome. Our sample has provided some criticisms of the day-to-day improvements introduced in ISO 9001, the measurement of COQ and the use of QMS documentation, to mention but a few.

**References**


Further reading


Appendix

Interview focus: discussion of the research questions connected to the difficulties of improving the ISO 9001 QMS in SMSEs

Responses Initial coding  Focussed coding (items)

Data from 8 experts

A good consultant could introduce relevant improvements
Influential and skilled quality manager
Quality manager must belong to the board
Quality manager may be the entrepreneur him/herself
Measuring savings in terms of costs of poor quality
Benefits must be higher than costs for maintaining the QMS
Lack of management commitment only depends on the entrepreneur
Entrepreneur involvement is everything
Top management must be identified clearly as one person
Quality documentation useless for improving processes
Employees are often not involved in drafting documents
Quality documents are not updated
Quality records not systematically analysed
Staff are not well trained in the QMS
Staff do not receive adequate communication about the QMS
Lack of staff awareness concerning process KPIs
Lack of problem-solving
Non-conformities are not quickly analysed and solved
No use of TQC techniques

1. Consultancy can help in improving the QMS
2. Quality manager must belong to the board
3. Measuring costs of quality
4. Entrepreneur commitment and involvement
5. Lack of improvement through quality documentation
6. Lack of staff training
7. Lack of internal communication
8. Lack of staff awareness concerning process KPIs
9. Lack of problem-solving and TQC techniques

Table AI. Coding qualitative data from the interviews with the 12 experts

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Fuzzy assessment analysis and key improvements to a production system

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Abstract

Purpose – The framework of Six Sigma Define-Measure-Analyze-Improve-Control was applied in this study, and various tools and techniques were used at different stages to implement lean measures to ensure quality. The purpose of this paper is to develop a decision-making framework that assesses key quality performance to ensure that practitioners improve quality and control by modeling and optimizing production processes.

Design/methodology/approach – A model of a quality performance index system was established. The weights of factors and sub-factors, which were estimated using an FAHP, were used as a reference for the decision maker under fuzzy uncertainty to make a decision, and thus, results present the bottlenecks in processes. Furthermore, any other factors that may affect the key process bottlenecks must be considered. The critical to quality characteristics were determined, and factor levels were set. The interaction between the factors was analyzed, their significance was studied using the Design of experiments and the parameters were predicted. Finally, quality improvement decisions were made through failure mode and effects analysis.

Findings – The implementation results of this research prove that the proposed model could successfully determine the key processes and focus on the improvement of critical quality factors under limited resources.

Originality/value – This study establishes a set of performance appraisal methods for production systems, which can be used for improving productivity and quality.

Keywords Quality control, DMAIC, Design of experiment, Fuzzy analytic hierarchy process

1. Introduction

To enhance competitiveness, companies should continuously improve their production processes and product quality. In the quality control of manufacturing process, critical to quality (CTQ) is the key measurable characteristic that affects the output of the process and product quality. These CTQ are ultimately determined by a few vital variables (factors) that contribute most to process variation. These critical quality problems should be further investigated to gain insight into potential areas of improvement. Abdullah et al. (2008) indicated that when many products are composed of a large number of components, it is difficult to evaluate in advance the degree of influence of certain variables on quality performance. Thus, for a practical analysis of critical quality components, decomposing product structures from product systems to components and identifying critical quality characteristics based on the process analysis are essential. Thus, the selection and prioritization of quality improvement goals are particularly crucial. However, corporate reform cannot blindly adopt a trial-and-error approach and requires a systematic mechanism to improve production efficiency. Costa and Pires (2006) proposed that guidelines with statistical and non-statistical approaches are required to identify a few crucial quality components. Therefore, according to Define-Measure-Analyze-Improve-Control (DMAIC), this study proposes an evaluation model based on fuzzy multi-attribute decision making (FMADM) with the Design of experiments (DoE) and failure mode and effects analysis (FMEA) for critical quality performance evaluation to create a mechanism for effectively reducing variation.

Six Sigma is a rigorous and disciplined methodology that uses data and statistical analysis, such as FMEA, DoE, ANOVA, etc. Some of these tools have been adopted from TQM; the aim is to reduce variations in any process; reduce manufacturing and service
costs, more profitable by increasing customer satisfaction (Antony, 2008; Manville et al., 2012; Bhuiyan et al., 2006; Chiarini, 2013b; Chakravorty and Shah, 2012; Drohomerskii et al., 2013). There are many successful cases in the literature that are used for defect diagnosis and quality improvement through the Six Sigma management system model (Ghosh and Maiti, 2014; Prashar, 2014); the enhancement of sigma level (Srinivasan et al., 2016) and its application in the process of grinding in the manufacture of automotive products have been proved to improve the yield (Gijo et al., 2014) and improve and control process in an Indian automotive gear manufacturing unit (Prashar, 2016). Montgomery (2005) proposed Six Sigma emphasizing the use of DoE as a methodology for systematically applying statistics to experimentation. Giulio et al. developed a synergy between metrological concepts and Six Sigma methodology, and it consists of a series of tests in which purposeful changes are made to the input variables of a product or process so that one may observe and identify the reasons for these changes in the output response. Kumaravadivel and Natarajan (2013) reported, FMEA, the cause-and-effect matrix and the failure modes and effects analysis are both together employed for flywheel casting process, to map key process input and output variables and to find out the potential causes for low output of the process, remedial actions are taken against variations in the process. Sharma and Rao (2013, 2014) utilized that FMEA is carried out for the failure modes of the observed CTQ characteristics in the area of engine manufacturing, based on prioritizing the risk priority numbers (RPNs) and making quality improvement decisions.

The aforementioned studies have focused on Six Sigma and on the evaluation and improvement of quality performance to improve each process. However, the design and related quantitative analysis of the evaluation index system must be conducted systematically. The rankings completed by AHP are not accurate because there is no fuzzy phenomenon in the concept of human choice, semantic expression and sensory judgment. This ambiguity will affect the subjective judgment of the selection. The advantage of fuzzy analytic hierarchy process (FAHP) is that it can convert the unambiguous semantic variables used by AHP into membership functions with fuzzy properties. Zadeh (1965) proposed “Fuzzy Sets,” compared with the non-zero or one inference method of traditional logic, and the fuzzy inference is used as the membership function to obtain the appropriate degree of each rule and to get the appropriate inference. The quality is not easy to quantify, as assessing production quality performance involves human decision making, which is imprecise, vague and uncertain. Sreedharan et al. (2019) employed fuzzy approach to assess an organization’s readiness for LSS deployment. Fuzzy logic was used to create favorable weights for the fuzzy linguistic variable. Yali et al. (2019) proposed an accurate fuzzy predictive model through complexity reduction based on the decision of needed fuzzy rules. They, in their work, added the decision of fuzzy rules needed for prediction based on membership values to predictive modeling before the extraction of fuzzy rules. Fuzzy AHP have the capability to measure the level of consistency in the judgments provided by a decision maker (DM) and can capture subjectivity (or fuzziness) of human judgments as the verbal assessments are converted into crisp values. Therefore, this study establishes a quality performance evaluation index system with reasonable and objective factor weights. Determining the weight of a factor is related to the multiple-criteria decision-making problem, and the DMs usually feel more confident giving linguistic variables rather than expressing their judgments in the form of numeric values.

Fuzzy set theory is a useful tool to deal with imprecise and uncertain data and determining the weight of a factor related to the multiple-criteria decision-making problem. AHP, proposed by Saaty (1980), is a practical decision-making method. Being an extension of AHP, fuzzy AHP is able to solve the hierarchical fuzzy decision-making problems. The FAHP method has widely been used to solve different decision-making problems. Kerk et al. (2019) proposed a new interval method, i.e., MIFIS, to handle uncertainties in fuzzy rules. MIFIS is useful for tackling real-world FMEA problems that require the fulfillment of the
monotonicity property in order to provide rational prioritization outcomes. Teh et al. (2018) use of a classical system identification-based framework for generating monotone fuzzy If-Then rules for monotone TSK FIS modeling is investigated. The learning phenomenon is explained in paper, where monotone data do not always produce monotone fuzzy rules. Gunjan and Desai (2017) employed fuzzy AHP to finalize LSS elite barriers that are prioritized and stratified. Yadav et al. (2018) aimed to propose a hybrid framework for handling the challenges of wastes reduction and quality improvement and utilized feedback from industry experts. For framework, incorporating fuzzy sets in AHP ensures the optimality of barrier weights. Vickery et al. (2016) utilized hierarchical regression model to test hypotheses concerning the main effects of product and process modularity and the effects of their interactions with complexity on new product introduction performance, and the results are statistically verified. Rathia et al. (2015) represented an approach for selection of capacity waste factors at an automotive industry using fuzzy logic based on the AHP method. The key customary parameters in the model are mined from the brainstorming session with DMs and reports from the literature. Final ranking is calculated through priority vector thus obtained. Because the aforementioned studies have shown the high applicability of the FAHP for solving practical problems, determining weights in the performance evaluation index system is essential. Therefore, in this study, a process-based quality management model was used to develop an FMADM evaluation model for key quality performance evaluation. Using the proposed model, DMs can predetermine the primary process bottlenecks that may significantly affect quality performance.

1.1 Background and motivation

Our case study is a company producing carbon fiber tennis rackets. It is oriented by market demand and has multiple specifications, multiple small lots and short delivery times. According to the production data collected, the product defect rate is high and behind schedule. Systematic bottlenecks in the manufacturing processes reduce the throughput of the whole production system. There are many operation activities and conditions including material handling and quality, worker operations, process parameters, operational conditions and so on that can lead to quality problems. When a quality event occurs, quality engineers use various methods (including statistical and non-statistical methods, depending on experience) to analyze it and find out the cause of variations. In general, these methods are problem-solving tools that can be used effectively to produce improvements. However, if there were a prevention mechanism to predict quality problems in advance, this would reduce failure costs in quality and would also reduce the costs of improvements. This is a difficult task and it requires effective tools.

Quality control is crucial in identifying the quality characteristics of products by comparing specifications or requirements and appropriately compensating for the differences between the actual performance and the standard performance (Djunaidi and Suryadarmawan, 2014). To evaluate the quality bottlenecks systematically for a racket product, the present study proposes the use of FAHP as a decision-making tool, and identifying critical quality components and variations caused by the developed evaluation model is essential prioritizing improvements with limited organizational resources. This model provides the effective utilization of the available resources without excess investments on resources for optimal performance. Six Sigma DMAIC cannot be treated as an alone activity. It necessitates attachment to the whole thinking rather than just the usage of few tool and techniques of process improvement. It must be very clear how Six Sigma projects and other activities link to core processes. Therefore, the objectives of this study are as follows:

1. establish a decision-making framework for key quality performance evaluation; and
help practitioners in modeling and optimizing experimental data for improving the quality control of industrial processes.

The contribution of this paper establishes a set of quality performance appraisal methods for production systems. The proposed model could successfully determine the key processes bottlenecks and focus on the improvement of critical quality factors under limited resources for improving their productivity. The remainder of this research is organized as follows: Section 2 framework proposed for controlled quality. Section 3 illustrates research methodology. Then, Six Sigma DMAIC phases were applied in a case study to implement lean measures to ensure quality. The conclusions are then given in Section 4.

2. Framework proposed for controlled quality
Six Sigma DMAIC phases were applied in a case study. Initially, work breakdown was implemented from the workflow. In particular, factors and sub-factors were determined and the evaluation index system of quality performance was established. In the index system, the fuzzy AHP method was employed to obtain factor and sub-factor weights by comparing the opinions of DMs. To ensure the satisfactory quality of the decision, the consistency of evaluation must be analyzed, and thus, results present the bottlenecks in processes. Furthermore, any other factors that may affect the key process bottlenecks must be considered. The CTQ characteristics were determined, and factor levels were set. The interaction between the factors was analyzed, their significance was studied using the DoE, and the optimization process parameters were predicted. Finally, quality improvement decisions were made using the FMEA and were listed as regulatory priorities to ensure the effective operation of the production system. Figure 1 shows research methodology flowchart.

3. Implementation of Six Sigma in terms of DMAIC
3.1 Stage of define
The company in the case study produces carbon fiber tennis rackets. The quality requirements of the customer were integrated into the production process, which not only describes the current processes but also provides strategies to improve the production process and can

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**Diagram:**

```
Define   Identifying CTQ characteristics

Measure Establishing quality evaluation index system and weights were estimated (FAHP)

Analyze Parameters optimization to improve critical quality (DoE)

Improve Identifying potential failures and related effects on processes (FMEA)

Control Standard operating procedure is established
```

Figure 1. Research methodology flowchart
indicate the direction of data collection during the measurement phase. Figure 2 shows the flowchart for the production of carbon fiber racquets.

The four main characteristics of customer satisfaction with quality in the production process are as follows:

1. The raw frame of a tennis racket after it is fabricated and has passed a strict inspection can continue to the next process. The inspection includes ensuring that the appearance is nondefective that the structure is normal, that the weight and balance conform to the specifications and that the strength is appropriately pressure tested.

2. After removing from the mold, in the puttying process, the surface of the frame has to be sanded to remove excessive resin and to produce a smooth surface and drilling string holes into the raw frame. The inspection includes ensuring that the surface of the raw frame is smooth and without cracks, that good adhesion is present between the layers, and that oversanding has not damaged the structure.

3. The frames are then painted with the base colors. How the frame is suspended during the painting process has a critical influence on quality. The inspection process includes issues caused by result in painting damage: dirt, grime, cracks and tears.

4. Next, decals are transferred onto the racket and coating. The inspection process includes ensuring that the decal has covered the frame elegantly.

In production practice, identifying CTQ is one of the most important and difficult tasks. This study designed a framework to effectively determine product characteristics or process parameters that have an important causal relationship with product quality in complex processes.

3.2 Stage of measure

3.2.1 Fuzzy analytic hierarchy process (FAHP). Fuzzy set theory was first introduced to address real-world problems in which DMs need to analyze and process information that is imprecise or vagueness. The triangular fuzzy numbers (TFNs) are the most widely used membership function for many applications. TFNs are usually employed to capture the vagueness of the parameters related to the decision-making process. In order to reflect the fuzziness that surrounds the DMs when they conduct a pairwise comparison matrix, a TFN, denoted as \( \tilde{A} = (l, m, u) \), can be used to describe a fuzzy event with calculation purposes to obtain a crisp priority vector. The parameter “\( m \)” is the most promising value. The parameters “\( l \)” and “\( u \)” respectively, are the smallest possible value with the largest possible value. A fuzzy set \( \tilde{A} = \{ (x, m_A(x)), x \in R \} \), where \( m_A(x) \) is called the membership function that assigns to each object \( x \) a grade of membership ranging from 0 to 1.

There are several fuzzy AHP methods reported that gave a comparison of different fuzzy AHP methods (Buyukozkan et al., 2004). Among different AHP methods, Chang’s (1992, 1996) method has widely been used in different application areas, such as supplier selection problems (Lima Junior et al., 2014). This method uses linguistic variables to express the comparative judgments made by different makers. It requires lower computation complexity than the other methods. In this study, we employed this method to get the factor and
sub-factor weights from expert’s opinion as making pairwise comparisons. Let 
\( \tilde{A} = (\tilde{a}_{ij})_{n \times m} \) be a fuzzy pairwise comparison matrix, where 
\( \tilde{a}_{ij} = (l_{ij}, m_{ij}, u_{ij}) \). The steps of Chang’s (1992, 1996)
method can be described as follows:

- Step 1: the value of the fuzzy synthetic extent with respect to the \( i \)th object is
defined as:
\[
S_i = \sum_{j=1}^{m} M_{ij} \odot \left[ \sum_{j=1}^{n} \sum_{j=1}^{m} M_{ij} \right]^{-1},
\]
with:
\[
\sum_{j=1}^{m} M_{ij} = \left( \sum_{j=1}^{m} l_{ij}, \sum_{j=1}^{m} m_{ij}, \sum_{j=1}^{m} u_{ij} \right), \quad i = 1, 2, \ldots, n,
\]
\[
\sum_{i=1}^{n} \sum_{j=1}^{m} M_{ij} = \left( \sum_{i=1}^{n} \sum_{j=1}^{m} l_{ij}, \sum_{i=1}^{n} \sum_{j=1}^{m} m_{ij}, \sum_{i=1}^{n} \sum_{j=1}^{m} u_{ij} \right),
\]
\[
\left[ \sum_{i=1}^{n} \sum_{j=1}^{m} M_{ij} \right]^{-1} = \left( \frac{1}{\sum_{i=1}^{n} m_{ij}}, \frac{1}{\sum_{i=1}^{n} m_{ij}}, \frac{1}{\sum_{i=1}^{n} m_{ij}} \right).
\]

- Step 2: the values of \( S_i \) are compared and the degree of possibility of
\( S_j = (l_j, m_j, u_j) \geq S_i = (l_i, m_i, u_i) \) is calculated. This can be equivalently expressed as follows:
\[
V(S_j \geq S_i) = \text{height}(S_i \cap S_j) = \begin{cases} 1 & \text{if } m_j \geq m_i \\ 0 & \text{if } l_j \geq \mu_j \\ \frac{m_j - m_i}{(m_j - u_j)} & \text{otherwise} \end{cases}
\]

- Step 3: both the values \( V(S_j \geq S_i) \) and \( V(S_j \geq S_k) \) to compare \( S_i \) and \( S_j \). The minimum
degree of possibility \( d(i) \) of \( V(S_j \geq S_i) \) for \( i, j = 1, 2, 3, \ldots, k \) is calculated as follows:
\[
V(S \geq S_1, S_2, S_3, \ldots, S_k), \quad \text{for } i = 1, 2, 3, \ldots, k
\]
\[
= \min V(S \geq S_i) \quad \text{and } (S \geq S_j) \quad \text{and} \ldots \quad (S \geq S_k)
\]
\[
= \min \left\{ V(S \geq S_i) \right\} \quad \text{for } i = 1, 2, 3, \ldots, k.
\]

- Step 4: assume that \( d'(A_i) = \min V(S \geq S_i) \) for \( i = 1, 2, 3, \ldots, k \),
where \( A_i, (i = 1, 2, 3, \ldots, n) \) comprises \( n \) elements. Then, the weight vector is defined as:
\[
W' = (d'(A_1), d'(A_2), \ldots, d'(A_n))^T.
\]

- Step 5: the weight vectors are normalized and are non-fuzzy numbers as follows:
\[
W = (W_1, W_2, \ldots, W_n)^T.
\]

3.2.2 The proposed framework for designing performance evaluation index system. This
study combined the workflow control to divide each activity of the work breakdown
structure into different work breakdown structure packages. The proposed framework for
designing performance evaluation index system, in order to search for a consensus, it is
necessary to establish a representative and democratic decision-making process. The hierarchical structure is constructed by combining all the factors and sub-factors specific to the research problem. Based on the identified factors and sub-factors, the hierarchical structure for evaluation is obtained (see Figure 3). In order to obtain an objective decision, DMs are experts who have experience with in the field. Each member in the committee is required to provide judgments on the basis of personal knowledge and expertise. The DMs have to determine the relative weights of factors and sub-factors. The proposed framework is composed of the following steps:

• Step 1: developing the hierarchical structure of the evaluation index system.
• Step 2: determining the linguistic variables and fuzzy conversion scale.

The DMs make pairwise comparisons of the importance or preference between each pair of factors. Each set of pairwise comparisons for a level requires \( n(n-1)/2 \) judgments, which are further used to construct a positive fuzzy reciprocal comparison matrix. The comparison of one factor over another can be done with the help of interviews, which are in the form of linguistic variables. In this paper, TFNs are used to represent subjective pairwise comparisons of DMs, namely, “just equal,” “equally important,” “weakly more important,” “strongly more important,” “very strongly more important” and “absolutely more important.” The triangular fuzzy conversion scales and linguistic scales, which are proposed by Kahraman et al. (2006) are used to convert such linguistic values into fuzzy scales, as is demonstrated in Table I.

• Step 3: establishing comparison matrices.

Consider a problem at one level with \( n \) factors, where the relative importance of factor \( i \) to \( j \) is represented by TFNs \( \tilde{a}_{ij} = (l_{ij}, m_{ij}, u_{ij}) \). As in the traditional AHP, the comparison matrix \( A = \{\tilde{a}_{ij}\} \) can be constructed as Equation (9).
Consider a group of K DMs involved in the research: they make pairwise comparisons of \( n \) elements. As a result of the pairwise comparisons, we get a set of K matrices, \( \hat{A}_k = \{ \hat{a}_{ijk} \} \), where \( \hat{a}_{ijk} = (l_{ijk}, m_{ijk}, u_{ijk}) \) represents a relative importance of element \( i \) to \( j \), as assessed by the expert \( k \):

\[
\hat{A} = \begin{bmatrix}
1 & \hat{a}_{12} & \cdots & \hat{a}_{1n} \\
\hat{a}_{21} & 1 & \cdots & \hat{a}_{2n} \\
\vdots & \vdots & \ddots & \vdots \\
\hat{a}_{n1} & \hat{a}_{n2} & \cdots & 1
\end{bmatrix} = \begin{bmatrix}
1 & \hat{a}_{12} & \cdots & \hat{a}_{1n} \\
1/\hat{a}_{21} & 1 & \cdots & \hat{a}_{2n} \\
\vdots & \vdots & \ddots & \vdots \\
1/\hat{a}_{n1} & 1/\hat{a}_{n2} & \cdots & 1
\end{bmatrix}.
\]  

(9)

- Step 4: calculating the consistency index and consistency ratio (CR) of comparison matrix.

The DMs can understand the uncertainties they face under different circumstances. To assure a certain quality level of a decision, the consistency of an evaluation has to be analyzed (Saaty, 1980).

The consistence index (CI) for a comparison matrix can be computed with the use of the following equation:

\[
CI = \frac{\lambda_{\text{max}} - n}{n-1},
\]

(10)

where \( \lambda_{\text{max}} \) is the largest eigenvalue of the comparison matrix, and \( n \) is the dimension of the matrix.

The CR is defined as a ratio between the consistency of a given evaluation matrix and consistency of a random matrix (Saaty, 1980):

\[
CR = \frac{CI}{RI(n)}.
\]

(11)

If the CR of a comparison matrix is equal or less than 0.1, it can be acceptable. When the CR is unacceptable, the DM is encouraged to repeat the pairwise comparisons:

- Step 5: calculating the factor and sub-factor weights.

Through the use of the extent analysis fuzzy AHP method, factor and sub-factor weights can be calculated from group decision matrices.

3.2.3 Establishing the quality performance evaluation index system. In order to have the correct and objective evaluation results, the sources of data used to evaluate quality performance are experts who have experience with in the field. The selected factors and sub-factors were discussed by them. The final hierarchical structure was then achieved, as shown in Figure 3. It consists of four factors, each of which is divided into two or more sub-factors. To acquire the factor and sub-factor weights, interviews were provided to get their viewpoints. Pairwise comparisons, which were derived from their assessments on the relative importance of one factor over another, were used to form the comparison matrices of

<table>
<thead>
<tr>
<th>Linguistic scale for importance</th>
<th>Triangular fuzzy scale</th>
<th>Triangular fuzzy reciprocal scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Just equal</td>
<td>(1, 1, 1)</td>
<td>(1, 1, 1)</td>
</tr>
<tr>
<td>Equally important</td>
<td>(1/2, 1, 3/2)</td>
<td>(2/3, 1, 2)</td>
</tr>
<tr>
<td>Weakly more important</td>
<td>(1, 3/2, 2)</td>
<td>(1/2, 2, 3)</td>
</tr>
<tr>
<td>Strongly more important</td>
<td>(3/2, 2, 5/2)</td>
<td>(2/5, 1/2, 2/3)</td>
</tr>
<tr>
<td>Very strongly more important</td>
<td>(2, 5/2, 3)</td>
<td>(1/3, 2/5, 1/2)</td>
</tr>
<tr>
<td>Absolutely more important</td>
<td>(3/2, 3, 7/2)</td>
<td>(2/7, 1/3, 2/5)</td>
</tr>
</tbody>
</table>

Table I. Linguistic scales and fuzzy scales for importance
each DM. The representative comparison matrix of the group acquired when making pairwise comparisons of the factor is shown in Table II.

Defuzzification was performed get all the elements in the crisp comparison matrix. By employing Equations (10) and (11), the CR value of the crisp comparison matrix is 0.049 < 0.1. Hence, it is acceptable.

When making comparisons all sub-factors at the corresponding level with respect to the upper level factors, the comparison matrices of DMs at the corresponding level were derived. There presentative matrices were then obtained and they are shown in Table III. From the results of the consistency test of the comparison matrices by each DM and the representative matrices, it was found that they are all less than 10 percent. Therefore, the consistency in each matrix is acceptable.

The sub-factors weight vector was determined as $W_1$–$W_4$.

By taking pairwise comparison matrix of the factors in Table II, as an example, the factor weights were calculated as follows. Using Equations (1)–(4), we determined TFN values of the four output indicators as follows:

$$S_1 = (2.9, 4.439, 7.5) \odot (1/27, 1/16.269, 1/10.867) = (0.107, 0.273, 0.690),$$

$$S_2 = (2.3, 3.563, 5.5) \odot (1/27, 1/16.269, 1/10.867) = (0.085, 0.219, 0.506),$$

$$S_2 = (2.5, 4.607, 8) \odot (1/27, 1/16.269, 1/10.867) = (0.093, 0.283, 0.736),$$

$$S_2 = (2.667, 3.66, 6) \odot (1/27, 1/16.269, 1/10.867) = (0.099, 0.2258, 0.552).$$

<table>
<thead>
<tr>
<th>$U_1$</th>
<th>$U_2$</th>
<th>$U_3$</th>
<th>$U_4$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$U_{11}$</td>
<td>(1, 1, 1)</td>
<td>(1, 1, 1)</td>
<td>(0.4, 0.791, 2)</td>
</tr>
<tr>
<td>$U_{12}$</td>
<td>(0.4, 0.759, 1)</td>
<td>(1, 1, 1)</td>
<td>(0.4, 0.804, 2)</td>
</tr>
<tr>
<td>$U_{13}$</td>
<td>(0.5, 1.264, 2.5)</td>
<td>(0.5, 1.243, 2.5)</td>
<td>(1, 1, 1)</td>
</tr>
<tr>
<td>$U_{14}$</td>
<td>(0.5, 0.751, 1)</td>
<td>(0.667, 1, 2)</td>
<td>(0.5, 0.909, 2)</td>
</tr>
<tr>
<td>$U_{21}$</td>
<td>(1, 1, 1)</td>
<td>(1, 1.317, 2.5)</td>
<td>(1, 1.331, 2)</td>
</tr>
<tr>
<td>$U_{22}$</td>
<td>(0.4, 0.722, 2)</td>
<td>(1, 1, 1)</td>
<td>(0.5, 1, 1.5)</td>
</tr>
<tr>
<td>$U_{23}$</td>
<td>(0.5, 1, 1.5)</td>
<td>(1, 1, 1)</td>
<td>(0.5, 1.1, 2)</td>
</tr>
<tr>
<td>$U_{24}$</td>
<td>(0.5, 0.685, 1)</td>
<td>(0.667, 1, 2)</td>
<td>(0.5, 0.909, 2)</td>
</tr>
<tr>
<td>$U_{31}$</td>
<td>(1, 1, 1)</td>
<td>(1, 1.317, 2.5)</td>
<td>(1, 1.331, 2)</td>
</tr>
<tr>
<td>$U_{32}$</td>
<td>(0.4, 0.722, 2)</td>
<td>(1, 1, 1)</td>
<td>(0.5, 1, 1.5)</td>
</tr>
<tr>
<td>$U_{33}$</td>
<td>(0.5, 0.751, 1)</td>
<td>(0.667, 1, 2)</td>
<td>(0.5, 0.909, 2)</td>
</tr>
<tr>
<td>$U_{34}$</td>
<td>(0.5, 0.685, 1)</td>
<td>(0.667, 1, 2)</td>
<td>(0.5, 0.909, 2)</td>
</tr>
<tr>
<td>$U_{41}$</td>
<td>(1, 1, 1)</td>
<td>(1, 1.317, 2.5)</td>
<td>(1, 1.331, 2)</td>
</tr>
<tr>
<td>$U_{42}$</td>
<td>(0.4, 0.722, 2)</td>
<td>(1, 1, 1)</td>
<td>(0.5, 1, 1.5)</td>
</tr>
<tr>
<td>$U_{43}$</td>
<td>(0.5, 0.751, 1)</td>
<td>(0.667, 1, 2)</td>
<td>(0.5, 0.909, 2)</td>
</tr>
<tr>
<td>$U_{44}$</td>
<td>(0.5, 0.685, 1)</td>
<td>(0.667, 1, 2)</td>
<td>(0.5, 0.909, 2)</td>
</tr>
</tbody>
</table>

Table II. Comparison matrix of the factors

$U_1 (1, 1, 1)$ $U_2 (1.137, 2.5)$ $U_3 (0.4, 0.791, 2)$ $U_4 (1, 1.331, 2)$

Table III. Comparison matrix of the sub-factors within $(U_1 – U_4)$

Notes: The weight vector was calculated as $W_1 = (W_{U_{11}}, W_{U_{12}}) = (0.454, 0.546)$; The weight vector was calculated as $W_2 = (W_{U_{21}}, W_{U_{22}}) = (0.551, 0.449)$; The weight vector was calculated as $W_3 = (W_{U_{31}}, W_{U_{32}}, W_{U_{33}}) = (0.367, 0.331, 0.302)$; The weight vector was calculated as $W_4 = (W_{U_{41}}, W_{U_{42}}) = (0.663, 0.337)$.
The values of $S_i$ were individually compared and the degree of possibility of $S_j = (l_j, m_j, u_j)$ $\geq S_i = (l_i, m_i, u_i)$ was then identified by the use of Equation (5). Thereafter, we determined the minimum degree of possibility $d(i)$ of $V(S_i \geq S_j)$ for $i, j = 1, 2, \ldots, 4$ by using Equation (6).

Table IV shows the values of $V(S_i \geq S_j)$, and minimum degree of possibility $d(i)$ of $V(S_i \geq S_j)$. Therefore, the weight vector was obtained by the use of Equation (7):

$$W^* = (0.984, 0.866, 1, 0.888)^T.$$  

We then normalized the weight vectors using Equation (8) and obtained the relative weights of the four factors, where $W$ is a non-fuzzy number:

$$W = (W_{U_1}, W_{U_2}, W_{U_3}, W_{U_4})^T = (0.263, 0.232, 0.268, 0.238)^T.$$  

The data show that the most important process is painting to a weight of 0.268. In addition, another implication from the distribution of vector weights is that the outcomes of the puttying process are not good as those for other process. Through on-site study and related production reports (e.g. cause and effect analysis), we found that the raw frame made of the composite and the adhesive result as well as the operating degree of the surface finishing indirectly affects production performance and quality stability of the subsequent process. Therefore, in the analysis stage, the effect of the degree of adhesion on the surface of the raw frame on the productivity is discussed, and the parameters are optimized to solve the purpose of maximizing the production capacity.

### 3.3 Analysis stage

After the raw frame is formed, it will be then treated and covered by the finish. The advantages and disadvantages of adhesion can be recognized from the grinding surface. DoE is a strategy of planning, conducting, analyzing and interpreting experiments so that valid conclusions can be drawn efficiently and economically. It is highly effective for improving the process output, performance and variability. Thus, the DoE was performed using MINITAB 17 statistical software in this study. The experimental layout was an unreplicated $2^{(5-1)}$ fractional factorial experimental. In total, 16 randomized experimental runs were generated. The objectives were to determine the control factors that affect the adhesion results of the raw frame surface working and optimize the process parameters to increase productivity.

#### 3.3.1 Step 1: the experiment and data collection

A brainstorming meeting was held by the management team. The participants raised the quality characteristics factors based on their engineering knowledge, experience and historical data, and sorted the problems on the basis of their severity and the degree of influence and control over important factors. All the causes do not have equal importance or impact on the CTQ, so prioritizing is essential. The voting results yielded five control factors: adhesion ratio, drying time, drying temperature, shift and sandpaper number. Table V lists five main effects and three interactions. Each control factor has two levels.

<table>
<thead>
<tr>
<th>$V(S_i \geq S_j)$</th>
<th>Value</th>
<th>$V(S_2 \geq S_j)$</th>
<th>Value</th>
<th>$V(S_3 \geq S_j)$</th>
<th>Value</th>
<th>$V(S_4 \geq S_j)$</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V(S_1 \geq S_j)$</td>
<td>1</td>
<td>$V(S_2 \geq S_j)$</td>
<td>0.881</td>
<td>$V(S_3 \geq S_j)$</td>
<td>1</td>
<td>$V(S_4 \geq S_j)$</td>
<td>0.903</td>
</tr>
<tr>
<td>0.984</td>
<td></td>
<td>0.866</td>
<td></td>
<td>0.886</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>0.986</td>
<td></td>
<td>0.888</td>
<td></td>
<td>0.888</td>
<td></td>
</tr>
<tr>
<td>0.984</td>
<td></td>
<td>0.866</td>
<td></td>
<td>1</td>
<td></td>
<td>0.888</td>
<td></td>
</tr>
</tbody>
</table>

Table IV. Values of $V(S_i \geq S_j)$
3.3.2 Step 2: experimental statistical analysis and interpretation. As evident from the ANOVA results in Table VI, the $p$-values of main effects of A (adhesion ratio), C (drying time) and D (drying temperature) are less than 0.05, this implies the significant effect. The AC and AD interactions are also statistically significant. Figure 4 presents the normality plot of the effects. Therefore, the effects of the B (sandpaper number) and E (shift) on the

<table>
<thead>
<tr>
<th>Label</th>
<th>Control factors</th>
<th>Levels</th>
<th>Interactions</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Adhesion ratio</td>
<td>5%</td>
<td>10%</td>
</tr>
<tr>
<td>B</td>
<td>Sandpaper no.</td>
<td>No. 150</td>
<td>No. 180</td>
</tr>
<tr>
<td>C</td>
<td>Drying time</td>
<td>30 min</td>
<td>60 min</td>
</tr>
<tr>
<td>D</td>
<td>Drying temperature</td>
<td>60°C</td>
<td>80°C</td>
</tr>
<tr>
<td>E</td>
<td>Shift</td>
<td>Day</td>
<td>Night</td>
</tr>
</tbody>
</table>

Table V. List of control factors

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>Adj. SS</th>
<th>Adj. MS</th>
<th>$F$-value</th>
<th>$p$-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main effects</td>
<td>3</td>
<td>3,116.2</td>
<td>1,038.73</td>
<td>53.23</td>
<td>0.000</td>
</tr>
<tr>
<td>Adhesion ratio</td>
<td>1</td>
<td>1,870.6</td>
<td>1,870.56</td>
<td>95.86</td>
<td>0.000</td>
</tr>
<tr>
<td>Drying time</td>
<td>1</td>
<td>390.1</td>
<td>390.06</td>
<td>19.99</td>
<td>0.001</td>
</tr>
<tr>
<td>Drying temperature</td>
<td>1</td>
<td>855.6</td>
<td>855.56</td>
<td>43.85</td>
<td>0.000</td>
</tr>
<tr>
<td>Two-way interactions</td>
<td>2</td>
<td>2,419.6</td>
<td>1,209.81</td>
<td>62.00</td>
<td>0.000</td>
</tr>
<tr>
<td>Adhesion ratio x dry time</td>
<td>1</td>
<td>1,314.1</td>
<td>1,314.06</td>
<td>67.34</td>
<td>0.000</td>
</tr>
<tr>
<td>Adhesion ratio x dry temperature</td>
<td>1</td>
<td>1,105.6</td>
<td>1,105.56</td>
<td>56.66</td>
<td>0.000</td>
</tr>
<tr>
<td>Error</td>
<td>10</td>
<td>195.1</td>
<td>19.51</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>15</td>
<td>5,730.9</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: $R^2$(adj.) 94.89 percent

Figure 4. Normal plot of the effects

Lenth's PSE = 2.625
adhesion results of the raw frame can be ignored, and the limited resources can be focused on improving important factors.

The percentage contribution is the proportion of the total SS for each variable and interaction that effectively indicates the relative importance of each factor. As Table VII shows that the main effect “adhesion ratio” could explain approximately 33 percent of the variation, “drying time” approximately 7 percent and their interaction approximately 23 percent. Thus, the most important factor in this process is “adhesion ratio.”

3.3.3 Step 3: confirmation runs with the recommended settings. The main effects of the A, C and D are plotted in Figure 5. All three effects are positive, and if we considered only these main effects, we would run all three factors at a high level that can give the best adhesion results of the raw frame surface working. However, it is always necessary to examine any interactions that are important. The main effects do not have much meaning when they are involved in significant interactions. The AC and CD interactions are plotted in Figure 6. These interactions are the key to solving the problem. Note from the AC interaction indicates, when the Factor A (adhesion ratio) high level, the Factor C (drying time) effect is small, and when Factor A low level, the Factor C effect is large. The optimal setting for the AC is Factor A kept at the low level and Factor C kept at the high level. The AD interaction

<table>
<thead>
<tr>
<th>Source</th>
<th>Adj. SS</th>
<th>% contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adhesion ratio</td>
<td>1,870.6</td>
<td>32.64*</td>
</tr>
<tr>
<td>Drying time</td>
<td>390.1</td>
<td>6.81</td>
</tr>
<tr>
<td>Drying temperature</td>
<td>855.6</td>
<td>14.93</td>
</tr>
<tr>
<td>Adhesion ratio × drying time</td>
<td>1,314.1</td>
<td>22.93*</td>
</tr>
<tr>
<td>Adhesion ratio × drying temp.</td>
<td>1,105.6</td>
<td>19.29</td>
</tr>
<tr>
<td>Error</td>
<td>195.1</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>5,731.1</td>
<td></td>
</tr>
</tbody>
</table>

Table VII. General linear model: ANOVA

![Main Effects Plot for Yield](chart.png)

Figure 5. Main effects plot
indicates that A (adhesion ratio) has little effect at low D (drying temperature) but has a large positive effect at high D (dry temperature). Therefore, the best adhesion results of raw frame surface working would appear to be obtained when A and D are at the high level and C is at the low level.

The optimal settings for the significant factors need to be determined to optimize the capacity and reduce the variability in the adhesion results. The optimized data based on the experimental results are presented in Figure 7 and Table VIII.

### 3.4 Improvement stage

FMEA is a useful tool to identify any potential design- and process-related failure modes and to determine the effects of the failure modes. FMEA is performed to eliminate or reduce failures, starting with the highest priority failures. In this stage, to prioritize actions by calculating the

<table>
<thead>
<tr>
<th>No.</th>
<th>Parameters</th>
<th>Optimal level</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Adhesion ratio (%)</td>
<td>5</td>
</tr>
<tr>
<td>C</td>
<td>Drying time (min)</td>
<td>60</td>
</tr>
<tr>
<td>D</td>
<td>Drying temperature (°C)</td>
<td>60</td>
</tr>
</tbody>
</table>

**Table VIII.**

Figure 6. Interaction plot

Figure 7. Response optimal
RPN, each failure mode is assigned a numeric value that quantifies the likelihood of occurrence, detection and severity of impact during manufacturing in order to identify, implement and document corrective actions to address failure modes until a satisfactory quality level is achieved. In order to attain more precise results in FMEA that correspond to the data of real production, the occurrence rating is based on production data from production floor. As for Severity and Detection ratings, they are based on the knowledge and experience of the team members. Table IX shows the FMEA worksheet of the case studies.

3.4.1 FMEA summary. FMEA was used to minimize the failure of the production process, to significantly improve the quality and to maximize productivity, thus improving the profitability of the company:

Adhesion ratio RPN reduction rate: \( \frac{150}{320} = 53.1\% \),

Dry time RPN reduction rate: \( \frac{90}{216} = 58.3\% \),

Dry temperature RPN reduction rate: \( \frac{80}{245} = 67.3\% \).

3.5 Control stage

The case company conducted the following long-term monitoring of control factors to maintain the improvement in the results:

1. standardize the optimal level of the three critical control factors, namely, the adhesive ratio, dry time and dry temperature; include key stakeholders in the development of the control plan; maintain accountability;

<table>
<thead>
<tr>
<th>Case No.</th>
<th>Failure mode</th>
<th>Effects of failure</th>
<th>Severity ((S))</th>
<th>Potential cause ((S))</th>
<th>Occurrence ((O))</th>
<th>Detection ((D))</th>
<th>RPN</th>
<th>Current process control</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Adhesion ratio</td>
<td>EP coating affects wall thickness</td>
<td>8</td>
<td>Proportion error of EP coating</td>
<td>8</td>
<td>5</td>
<td>320</td>
<td>Formulating according to standard ratio</td>
</tr>
<tr>
<td>2</td>
<td>Drying time</td>
<td>Time affects adhesion and hardness</td>
<td>9</td>
<td>Instrument diagnosis error</td>
<td>6</td>
<td>4</td>
<td>216</td>
<td>Timer</td>
</tr>
<tr>
<td>3</td>
<td>Drying temperature</td>
<td>Difference in temperature, resulting in high abnormal value</td>
<td>7</td>
<td>The air near the oven was not convective</td>
<td>7</td>
<td>5</td>
<td>245</td>
<td>A thermostat was added outside each oven machine</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Case No.</th>
<th>Failure mode</th>
<th>Action taken</th>
<th>S</th>
<th>Action results</th>
<th>O</th>
<th>D</th>
<th>RPN</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Adhesion ratio</td>
<td>Use multiple suppliers</td>
<td>6</td>
<td>5</td>
<td>5</td>
<td>150</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Drying time</td>
<td>Fool-proofing device</td>
<td>6</td>
<td>5</td>
<td>3</td>
<td>90</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Drying temperature</td>
<td>Do not place large number items near the stove</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>80</td>
<td></td>
</tr>
</tbody>
</table>

Notes: \( O \), occurrence; \( S \), severity; \( D \), detection; RPN, Risk priority number = \( O \times S \times D \)

Table IX. Failure mode and effects analysis (FMEA)
2. continuously collect and record key quality data; use statistical program tools to
monitor and control process variability to maintain improved stability; and

3. establish a standard operating procedure (SOP) to facilitate the smooth running of
the overall production system.

4. Conclusions
Quality performance evaluation is vital because product quality decides the market share of
a firm and, therefore, has been getting a lot of attention from managers. The practical
implication of this study outlines the measures that can help policy makers to successfully
implement the suggested methodology to improve the quality of placements. The developed
approach can be extended to other various manufacturing processes for improving
productivity. Management of critical components in manufacturing systems aims at
managing components with the highest risk that can cause disruptions in manufacturing.
As discussed, each evaluation model has its own characteristics related to response and
factors, and misspecification of the component can yield inappropriate inferences and
erroneous experimental results. Therefore, a proper framework of selection and diagnostic
criteria contribute to the final decision about the best model for application on real problems
in industrial setting.

The framework of Six Sigma DMAIC was cited to this study, and the model of a quality
performance index system was established based on the production processes of the case
company. Determining the weight of a factor is related to the multiple-criteria
decision-making problem. The application of fuzzy AHP to conduct quality performance
evaluations can reflect their achievements regarding each evaluation factor. We employed
this method to get the factor and sub-factor weights from expert’s opinion as making
pairwise comparisons matrix, and the consistency has to be analyzed to assure a certain
quality level of a decision. The DMs usually feel more confident giving linguistic variables
rather than expressing their judgments in the form of numeric values. The proposed
framework can assist management to systematically and precisely identify the production
areas requiring improvement. Unlike the traditional AHP, one contribution of this
approach is the introduction of fuzzy AHP to determine the factor and sub-factor weights
in the evaluation index system. As fuzzy AHP has the capability to capture the vagueness
of human judgments and makes the derived weights in the index system more objective
and reasonable. This approach can reduce subjectivity in the evaluation process. In the
group decision-making environment, applying this framework of the fuzzy AHP can get
an accurate solution with a high degree of consensus. Hence, it may also be used as a
reference for management practitioners when solving decision-making problems. The
case establishes a systematic assessment model that successfully identifies key process
dependencies and shows the applicability of this framework in providing a valuable tool in
the quality performance evaluation process.

Furthermore, any other factors that may affect the key process bottlenecks must be
considered. The interaction between the factors was analyzed, their significance was
studied using the DoE and the best combination of levels of process parameters was
determined. First of all brainstorming session was carried to identify the probable causes
of the problem. As a result of brainstorming, session five parameters were identified. In
this study, two-level factorial experiment was used to identify the influential factors that
impact the adhesion results of the raw frame surface working process. The confirmation
runs showed as evident, from the ANOVA results in Table VI, that the $p$-value of main the
effects of A (adhesion ratio), C (drying time) and D (drying temperature) are less than 0.05;
this implies that the significant effect. The AC and AD interactions are also statistically
significant. Therefore, the non-significant effects of the B (sandpaper number) and E
(shift) on the adhesion results of the raw frame can be ignored, and the limited resources can be focused on for improving important factors. After analyzing interaction plot, following optimal levels were decided for three factors shown in Table VIII. It is our belief that the statistical tool and processes knowledge provided engineers a solid problem-solving foundation and effectively solve quality control problems.

One of the purposes of the FMEA is to assess the risks of the production processes that influence on product quality. It deals with the errors arising in the elements of the process, as well as errors in the input and output of the process and their mutual ties. The team decided the improvement steps based on final validated root causes in the analysis stage. All the improvement steps are approved by the top management so that ease of availability of resources can be there at the time of implementation of improvements. Based on that root causes, various improvements were carried out one by one. The results of the case implementation showed the RPN was significantly decreased. Finally, for sustaining the improvements and setting standard way of work for operators, SOP was prepared for the operators and training was also provided to them on SOP. The main aim of SOP was to guide operators regarding way of carried out process as well as to make them aware about the importance of each step in the process and also maintaining the critical three parameters to their specified level for sustaining the benefits.

This paper presents a case study from a company producing carbon fiber tennis rackets demonstrating how the implementation of Six Sigma DMAIC can bring breakthrough improvement in the performance of the process as well as business. A decision-making framework was developed for the effective utilization of existing resources, without any additional investment to achieve best-in-class performance. This approach integrates various tools and methods into a single framework. The conventional method of determining CTQ is dependent on the experience of quality engineers. However, this research can effectively identify the CTQ by using the fuzzy AHP method. This proposed framework could be aid the managers to get decision making in quality improvement and performance, which can be accounted by the identified factors in the study. The contribution to practitioners, the framework approach is a tool that enables easy modeling and data analysis, and hence, helps guide the improving and optimization process. Second, the right classification of variables may assist increasing the knowledge about the relation among variables, positively influencing the further improvement of them. It can then serve as a guide for the organizations to take the necessary steps to improve the current management practices by concentrating more on the factors, which will facilitate and enhance quality improvement and firm performance. The contribution of this paper establishes a set of quality performance appraisal methods for production systems. The proposed model could successfully determine the key processes bottlenecks and focus on the improvement of critical quality factors under limited resources for improving their productivity. In future studies, other multi-criteria methods such as the fuzzy PROMETHEE and ELECTRE method can be used to address key quality performance evaluation problems. In addition, mathematical models can be combined with the model proposed here. This will improve our proposed model and is one direction of future research.

References


Further reading


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The heterogeneous implementation of ISO 9001 in service-oriented organizations

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General Department, University of Athens, Athens, Greece, and

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Hellenic Open University, Patra, Greece

Abstract

Purpose – The purpose of this paper is to investigate the heterogeneity in the implementation of the ISO 9001 quality management system in service-oriented organizations, and to identify patterns (i.e. relationships, dependencies and exceptions) among critical implementation factors, possible implementation determinants and desired post-implementation outcomes.

Design/methodology/approach – The paper adopts a qualitative approach, in the form of a multiple case study of five ISO 9001 certified, service-oriented organizations, located in Greece. Using multiple data collection methods including interviews with upper management and employees, desk research and on-site observation allowed for data triangulation.

Findings – The analysis reveals that ISO 9001 implementation can range across different levels of fidelity, from merely superficial to genuinely substantive. Several determinants (i.e. implementation experience, motivation for certification, perception of quality, commitment to change) affect the level of fidelity and, in turn, the post-implementation outcomes. Interestingly, even a superficial ISO 9001 implementation can initiate, at least to a moderate degree, beneficial changes throughout the organizations. The organizations that strictly abide by ISO 9001 requirements still have to address some challenges, most notably to instill a culture of prevention in their management system and to efficiently balance standardization and flexibility.

Originality/value – This study contributes to the ISO 9001 internalization literature, providing an in-depth analysis of possible patterns among ISO 9001 implementation factors, determinants and outcomes. Related findings are also discussed under the prism of the revised ISO 9001:2015.

Keywords Service industry, Heterogeneity, Quality management system, Multiple case study, Internalization, ISO 9001 implementation

Paper type Case study

1. Introduction

The international standard ISO 9001 specifies the fundamental requirements of a quality management system (QMS). The widespread adoption of ISO 9001 worldwide is truly impressive. According to data obtained from the International Organization for Standardization (ISO, 2018), the number of certificates awarded in recent years has surpassed one million with a tendency to stabilize at this level. Although all certified organizations receive a standard-form certificate without gradations, it is an open secret that they do not all implement the standard’s requirements with the same fidelity. Implementation fidelity refers to the degree to which an intervention or program is delivered as intended (Carroll et al., 2007). We consider as “intervention,” in this study, the action taken to integrate the ISO 9001 requirements into an organization’s management system.

However, most studies in the field do not address this discrepancy, assuming homogeneous implementation of ISO 9001 across all certified organizations (Heras-Saizarbitoria, 2011). One possible explanation for this phenomenon is that a methodological study of the heterogeneity in the implementation of ISO 9001 is objectively difficult. It is convenient to consider the implementation of ISO 9001 as a “black box” and to deal instead with peripheral
issues, such as certification motivation, benefits, and obstacles. Opening the “black box”, however, is rather demanding, as it requires an in-depth study of the daily activity of the certified organizations, in order to reliably and objectively document the degree of fidelity of the critical implementation factors of ISO 9001. Furthermore, access to this level of information is difficult for anyone outside of the organization.

Therefore, there have been rather few attempts in the relevant literature to investigate the differences in implementation levels – also known as the “internalization” of ISO 9001 – and thus to highlight the true dimension of the issue of “ceremonial conformity” to the ISO 9001 requirements, which some organizations consciously elect to do (Boiral, 2003; Naveh and Marcus, 2004; Briscoe et al., 2005; Christmann and Taylor, 2006; Poksinska et al., 2006; Jang and Lin, 2008; Nair and Prajogo, 2009). The aforementioned studies may serve as a good starting point for delving deeper into the critical ISO 9001 implementation factors, so as to fully extract such complex information from the organizations. Only recently have attempts been made to approach this issue in greater depth and from a more holistic perspective (Heras-Saizarbitoria, 2011; Ivanova et al., 2014). Heras-Saizarbitoria and Boiral (2013) eventually raised this issue for further exploration.

The purpose of this paper, in line with Heras-Saizarbitoria and Boiral’s (2013) suggestion, is to enrich research on the heterogeneity of ISO 9001 implementation, with emphasis on service settings. In this context, we make an in-depth comparative study of five ISO 9001 certified service-oriented organizations situated in Greece. The internalization of ISO 9001 is ascertained by several critical implementation factors, while possible implementation determinants and post-implementation outcomes are also examined, in order to identify distinct patterns among them. The triangulation of data – vitally important to guarantee the validity and accuracy of the results – was met by interviewing upper-level managers and front-line employees, along with conducting desk research and on-site observation.

This study was guided by the following exploratory open-ended research questions:

**RQ1.** Which factors affect ISO 9001 implementation fidelity, and to what extent?

**RQ2.** How do post-implementation outcomes (i.e. management system attributes acquired by an organization following ISO 9001 implementation) vary in relation to the implementation fidelity of ISO 9001?

**RQ3.** Is there a minimum level of ISO 9001 implementation achieved by all organizations, regardless of the degree of fidelity to the standard?

**RQ4.** What challenges are faced by even those organizations that implement ISO 9001 with high fidelity?

This paper is structured as follows. Section 2 presents the background of the study by reviewing the relevant literature. Section 3 describes the methodology employed in the study. Section 4 presents the most important results and related discussion based on the cross-case comparative analysis. Finally, Section 5 presents the conclusions of the study and provides directions for further research. In order to facilitate readability, the critical outputs of this case study analysis are presented in the form of cross-case comparisons in Tables AI–AIII.

### 2. ISO 9001 implementation factors, determinants and outcomes

Literature shows an extensive list of factors directly or indirectly related to the ISO 9001 implementation. For the purposes of this study, we focus on a limited number of these factors, which were chosen mainly based on the frequency of their appearance in the literature or in ISO 9001 requirements. Among these factors, we selectively recognized the ones that constitute a sine qua non condition for ISO 9001 implementation and classified them under the category of “implementation factors” (described throughout Section 2.1).
These factors were separated from possible “implementation determinants” and “post-implementation outcomes” (described throughout Sections 2.2 and 2.3, respectively). Consider, for instance, the following three factors met in the literature: “internal audits and management reviews,” “motivation for ISO 9001 certification” and “flexibility and adaptability.” We cannot imagine an ISO 9001 certified organization without satisfying some core requirements, such as conducting internal audits and management reviews. On the other hand, any organization may be ISO 9001 certified, regardless of its motivation, even though the different types of motivation may constrain or enable the substantive implementation of ISO 9001. In the same vein, any organization may be ISO 9001 certified, regardless of the attributes their management system acquires after ISO 9001 implementation, such as flexibility and adaptability; we can assume though that the substantive implementation of some core ISO 9001 requirements may provide flexibility and adaptability to their management system. On the basis of the reasoning above, “internal audits and management reviews” can be considered as an “implementation factor”; “motivation for ISO 9001 certification” can be viewed as a possible “implementation determinant”; and “flexibility and adaptability” as a desired “post-implementation outcome.”

2.1 Implementation factors

A wide range of critical factors that indicate the level of ISO 9001 implementation fidelity has emerged throughout both the related literature (e.g. Heras-Saizarbitoria, 2011; Ivanova et al., 2014) and the standard’s requirements (ISO, 2015). These factors can be summarized as follows: quality policy; leadership and organizational roles; objectives; processes; documented procedures; internal audits and management reviews; problems identification and handling; and people. In the remainder of this section, we present the specific critical parameters included in each factor.

First, the quality policy, stating broadly the overall principles of a quality system, should be clearly and formally defined and documented (Nair and Prajogo, 2009). Subsequently, it should be communicated in an understandable manner (Biazzo, 2005) to appropriate levels in the organization, internally and externally (Aldowaisan and Youssef, 2006; Nair and Prajogo, 2009). Finally, the quality policy should be connected with strategy (Biazzo, 2005; Alić and Rusjan, 2010) and applied in practice for all relevant functions of the organization (Tsim et al., 2002).

Top-management leadership and commitment during the ISO 9001 implementation process is also associated with the level of implementation fidelity (Pokinska et al., 2006; Jang and Lin, 2008; Ivanova et al., 2014). Being committed to fully support the ISO 9001 implementation efforts is a prerequisite for top management to ensure the control and improvement of quality performance (Douglas et al., 1999; Marques et al., 2013). In parallel, there should be a very clear definition and communication of tasks and job descriptions to the employees so as to enhance their engagement (Biazzo and Bernardi, 2003; Broomfield, 2004; Jørgensen et al., 2006).

Aligning long-term quality objectives with short-term targets is also a factor that characterizes the substantive implementation of ISO 9001 (Vouzas, 2004). This ensures that the achievement of the individual targets leads to the achievement of the overall quality objectives (Chountalas and Lagodimos, 2019).

Another major factor, indicating the level of ISO 9001 implementation fidelity, is process management (Chountalas and Lagodimos, 2019). According to this factor, the entire management system should be organized based on horizontal, cross-departmental processes (Yeung et al., 2003). These processes should be initially identified (Ivanova et al., 2014) and delineated on a process map, so as to elucidate their interactions (Heras-Saizarbitoria, 2011). Subsequently, they should be planned, executed as planned, monitored, controlled and improved on a systematic basis (Kanji, 1998; Gotzamani and Tsiotras, 2001; Biazzo and
Bernardi, 2003). Note that improving non-primary service processes is most often neglected within the quality system of service organizations (Dahlgaard-Park, 2011).

Documented procedures should be designed so as to be used as a point of reference for the operational tasks to be consistently performed on a day-to-day basis (Douglas et al., 1999; Psomas et al., 2011; Marques et al., 2013). The documented procedures should be implemented without deviations in practice, otherwise, they are deemed useless if not a threat to the desired outcome of the organizations’ efforts. Documentation could be effectively applied through a hierarchical system of interdependent documents (Broomfield, 2004; Carmignani, 2008) and should be periodically modified (Heras-Saizarbitoria, 2011). Nevertheless, extensive documentation can trigger bureaucracy to the expense of flexibility (Escanciano et al., 2001).

Internal audits and management reviews are part of the hierarchical monitoring system of ISO 9001 and focus on the operational procedures and the management system, respectively (Broomfield, 2004; Psomas et al., 2011). Internal audits can be highly beneficial toward quality improvement through their proper integration in the business operation (Alić and Rusjan, 2010) and the active participation of employees (Heras-Saizarbitoria, 2011). Management reviews are based on the analysis of several sources of information and may trigger improvement initiatives, ranging from minor readjustments of the management system to organization-wide reengineering (Tsim et al., 2002).

Problem identification requires preventive action in order to avoid defects (as much as possible) in the first place (Biazzo, 2005). When defects do arise, they must be promptly located and effectively corrected (Yeung et al., 2003), focusing on both mitigation measures and definitive resolution. Defects due to poor implementation of the requirements of ISO 9001 are treated as non-conformances, while defects due to existing deficiencies are treated as inherent problems (Dervitsiotis and Lagodimos, 2007).

Focus on people is another characteristic of the substantive implementation of ISO 9001 in such a way that continual quality improvement is attained (Tari et al., 2007; Zografaki et al., 2017). In this regard, constant and appropriate training is a crucial parameter that helps employees to furthering their skills (Singh, 2008; Heras-Saizarbitoria, 2011). Providing employees with two-way communication channels is also important (Casadesús and Karapetrovic, 2005; Singh, 2008), since it raises employees awareness regarding quality issues (Jørgensen et al., 2006).

2.2 Implementation determinants

This section presents some determinants that possibly constrain or enable the substantive implementation of ISO 9001, as drawn from the pertinent literature. These are related to ISO 9001 implementation and certification either directly (i.e. experience with ISO 9001 implementation; motivation for ISO 9001 certification) or indirectly (i.e. perception of quality; commitment to change).

The substantive implementation of ISO 9001 is a dynamic process that goes alongside with the evolvement of the organization (Gotzamani and Tsiotras, 2001). In this respect, it is reasonable to assume that more experienced organizations, in terms of ISO 9001 implementation, exhibit a higher degree of implementation fidelity. Furthermore, according to Conca et al. (2004) and Benner and Veloso (2008), not only experienced organizations are able to yield more valuable results, but also to address problems related to ISO 9001 implementation more effectively.

Another determinant is the motivation to obtain an ISO 9001 certification, which can be divided according to the literature into two categories: intrinsic and extrinsic (also referred to as internal and external). Intrinsic motivation is associated with the genuine need of an organization to improve either its overall management system effectiveness or its specific quality performance (Dervitsiotis and Lagodimos, 2007). Extrinsic, on the other hand, is
associated with external pressures imposed on an organization in order to get certified, such as marketing pressures to attract customers (Llopis and Tari, 2003), governmental or legal enforcement (Marshall, 2002), import-export facilitation and international markets penetration (Huarng et al., 1999), and competitors’ pressure (Feng et al., 2008). Intrinsic motivation is considered as a key enabler for substantive ISO 9001 implementation, whilst extrinsic motivation could hinder the improvement of a QMS, since any related efforts are kept usually at a superficial level (Dale et al., 1997; Lee and Palmer, 1999; Gotzamani and Tsiotras, 2001).

The way quality is perceived by an organization is also indicative of how the organization chooses to implement the requirements of ISO 9001. A broad perception of what quality is (i.e. an on-going process, orientated toward continual improvement), intrigues a substantive implementation of ISO 9001, which, in turn, can yield more valuable results (Lee and Palmer, 1999). In contrast, a narrower perception of quality leads to a more “compliance focused” certification, hence a less substantive implementation of ISO 9001 (Vouzas, 2004).

Commitment to change is also recognized as a very important factor that contributes to the success of practically any improvement initiative and therefore, to the successful and substantive implementation of ISO 9001 (Gotzamani et al., 2007). This commitment encompasses well-defined processes of change management so that changes are being systematically implemented and controlled (Carlsson and Carlsson, 1996).

2.3 Post-implementation outcomes

There are two ways to go about examining the post-implementation outcomes of ISO 9001. The first and most widely used one is to consider the broader outcomes an organization may obtain, such as economic benefits (Corbett et al., 2005; Sharma, 2005; Manders, 2014; Psomas and Pantouvakis, 2015), customer satisfaction (Casadesús and Karapetrovic, 2005; Singh et al., 2006; Foksinska et al., 2006), competitiveness (Naveh and Marcus, 2005), image and reputation (Escanciano et al., 2001); yet, these outcomes have been particularly well studied in a variety of settings. The second one, which is favored in this study, is to follow the paradigm of Dervitisiotis and Lagodimos (2007) and examine some desired attributes that are directly related to the morphology of a management system, such as flexibility and adaptability, standardization, preventive approach, fact-based decision making and continual improvement orientation.

Flexibility and adaptability are gaining importance, considering the constantly changing conditions of the environment within which an organization operates (Briscoe et al., 2005). A management system may obtain these attributes through the substantive implementation of ISO 9001 requirements (Tsim et al., 2002; Singh et al., 2006). Otherwise, incapability to efficiently interpret the “spirit” of ISO 9001 requirements may lead to bureaucratic systems that hinder any kind of flexibility and adaptability efforts (Escanciano et al., 2001; Boiral and Roy, 2007; Murmura and Bravi, 2017).

ISO 9001 – despite the bureaucratic constraints that it may bear – provides standardization which is a highly desirable attribute for any management system (Biazzo and Bernardi, 2003; Singh et al., 2006). When processes are repeatedly and systematically implemented following a specific pattern designed beforehand, consistency is achieved (Zairi, 1997), which helps to maintain quality in constantly high, desirable levels (İlkyay and Aslan, 2012). In contrast, uncontrolled variance in processes is the primary cause of quality problems (Hackman and Wageman, 1995).

ISO 9001 implementation effectively allows for proactive actions to prevent problem occurrence (Biazzo, 2005). Thus, prevention (as opposed to ex post correction) is an equally desirable attribute of a management system (Sila and Ebrahimpour, 2003; Sadıkoglu and Zehir, 2010). Not only is it indicative of quality features, but prevention is also cost-effective in comparison to ex post correction (Priede, 2012). Preventive measures are often overlooked
when implementing management systems from a compliance perspective, superficially meeting minimum requirements (Alič and Rusjan, 2010).

Effective decisions are based on the analysis of data and information (Biazzo, 2005). Following this approach, the establishment of fact-based decision-making systems prevails which means systematically making decisions on objective evidence of what was actually happening (Kanji and Yui, 1997). This is another desirable attribute of a management system that can be obtained from substantive ISO 9001 implementation (Fotopoulos and Psomas, 2009; Yu et al., 2012).

Continual improvement with regards to effectiveness, cost efficiency, responsiveness in a timely manner and overall quality is deemed necessary for any organization (Hackman and Wageman, 1995). A management system rigorously based on ISO 9001 requirements is effectively characterized by a philosophy of continual improvement (Dale et al., 1997). The plan-do-check-act methodology, popularized by Deming, has become the prevailing mechanism for continual improvement in most ISO standards (Magd and Curry, 2003). Under this approach, the changes needed to improve processes are usually incremental (Kanji, 1998).

3. Research method
In this section, we present the research design selected for this study, including the procedures for case selection and data collection, coding and analysis.

3.1 Research design
This study, exploratory in nature, seeks to investigate the heterogeneity in the implementation of ISO 9001 in service-oriented organizations. The need to better understand such a complex phenomenon (i.e. the internalization of ISO 9001) led to the choice of a multiple case study as the preferred research method (Eisenhardt, 1989; Yin, 2014). The overarching open-ended research questions used in this study (see Section 1) are also supported by this very approach, providing information-rich data. To address the research questions, a simple classification scheme was developed, as a result of a thorough examination of extant literature (see Figure 1). Along with the factors that indicate the level of ISO 9001 implementation, implementation determinants and post-implementation outcomes were also examined.

3.2 Case selection
The selection process in multiple case studies strategy traditionally pertains to non-random sampling (Saunders et al., 2011). In this study, our aim was to sample for heterogeneity in ISO

![Figure 1. The classification scheme](image-url)
9001 implementation fidelity, so we used maximum variation sampling to ensure diversity of the selected organizations (Palinkas et al., 2015). Drawing from a pool of 22 service-oriented organizations whose management systems were familiar to us from prior consultancy experience, we took a stratified purposeful sample of five organizations that agreed to provide us with access to multiple sources of data: a call center, a training institute, an IT/software company, a bank and a school. Note that the primary data were collected by two researchers not previously involved in providing consultancy services to the selected organizations, in an effort to refrain from predetermined judgments. We limited our study to service settings, in order to enrich the literature in this rather under-explored field, in contrast to the thorough research conducted in the industry sector. It has also been recognized that service-oriented organizations require specialized consideration when examined within the context of quality management frameworks or standards implementation (Singh et al., 2006; Dahlgaard-Park et al., 2013). All of the organizations we examined in this study are medium- to large-sized, operating in Greece and their common base is that they are all certified to ISO 9001. The names of the organizations are withheld so as to maintain anonymity.

3.3 Data collection procedures

Using multiple data collection methods, including interviews, consequent desk research and on-site observation, allowed for data triangulation. The purpose of triangulation, as employed here, is the confirmation of data (Jick, 1979); when data gathered through different collection methods are found to be consistent, confidence in the credibility of findings can be enhanced (Knafl and Breitmayer, 1991). The interviews were based on a semi-structured form that allows new issues to emerge for exploration (Saunders et al., 2011) and their duration ranged from 1 up to 2 h. They were conducted with a senior officer whether in charge of the Quality Department or of upper-level management, directly involved with designing and organizing each organization’s management system. All five interviews were audio-recorded and were all subsequently transcribed for further data analysis, using specialized software (i.e. QDA Miner). Consequent desk research exploring the documentation, the online presence and the intranet of each organization, as well as on-site observations of several procedures implementation (wherever possible), were also conducted as a confirmatory source of the data acquired through the interviews. At a later stage, interviews with five lower-level employees (one for each organization), who were in charge of the ISO 9001 implementation were also conducted, which gave further insight into the study’s objectives. Senior managers were interviewed through on-site visits (four organizations) and a teleconference (the training institute, for location reasons), while the employees were all interviewed by telephone. Evidently, confidentiality issues were mentioned prior to each interview to enable a less detained description of case sensitive issues, such as the actual level of ISO 9001 implementation.

Table I presents an overview of the data sources used, per factor across organizations. It also incorporates a bubble chart where relative frequencies (i.e. word count per issue for each interview respondent) are represented by circles of different diameters. Additionally, it indicates where the interviews were confirmed by the review of documents and records, the on-site observation or both.

Some examples of on-site observations include: observing a training session (including software applications and simulated calls), hosted by the call center, in line with their documented procedures; observing an internal management review process conducted by the school regarding the students’ registration procedures; observing how the IT/software company handles technical problems, as a routine; observing the daily operation of a special “transformation office” that allows the bank to effectively manage change; observing the daily operation of the call center so as to record bureaucracy issues (e.g. in reporting); and observing the daily operation of a particular department in the bank that coordinates and facilitates process improvements.
3.4 Data coding and analysis

Data coding was primarily based on Miles and Huberman (1994) “start list” of codes, derived mainly from the study’s classification scheme and research questions. As such, the most important factors have emerged early on, as a result of the literature review; of course, keeping up-to-date factors was a necessary venture in an attempt to maintain consistency. Examples of data coding are presented throughout Table II.

3.5 Case analysis method

The data coding was mainly used to examine the patterns (Campbell, 1975), especially during the cross-case analysis part of the research. Yin (2014) suggests individual case report prior to drawing cross-case conclusions, thus forming the basis for the framework outlined in Figure 2.

<table>
<thead>
<tr>
<th>Items coding</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motivation for ISO 9001 certification</td>
<td>ISO 9001 was imposed; we had to be certified; it was a prerequisite to be competitive</td>
</tr>
<tr>
<td>Commitment to change</td>
<td>Changing and improving needs much work to be done; it is not just theory, it is walking the talk; and when we notice failure to change, even after workshops, we immediately intervene</td>
</tr>
<tr>
<td>Documented procedures</td>
<td>Our procedures cannot be overridden. I mean never! I sometimes prefer to buy something on my own, instead of waiting for approval, even if it is just a small piece of cord</td>
</tr>
<tr>
<td>Standardization</td>
<td>There is too much unnecessary standardization and bureaucracy in many instances; on the contrary, for other important things, standardization is virtually inexistent</td>
</tr>
</tbody>
</table>

Table I. Overview of the data sources per factor across different organizations

Table II. Data coding examples
Evidently, analyzing the data encompassed both a within-case and cross-case analysis approach. For lack of space and to improve readability we omit here the individual case reports and present only the encoded data collected in each individual case (derived from within-case analysis) in the form of cross-case comparisons. The data, summarized in Tables AI–AIII, are presented by thematic area (i.e. implementation factors, determinants and outcomes respectively), allowing for easier comparisons between the results and the literature, as suggested by Eisenhardt (1989) and Baxter and Jack (2008).

4. Results and discussion

From the cross-case comparisons performed, it is apparent that only two of the five organizations reviewed (i.e. the bank and the school) implement the ISO 9001 standard in a way that substantively meets its requirements. They have thus managed to strengthen their management system, effectively controlling and improving quality. On the other hand, the IT/software company appears content with the partial satisfaction of the ISO 9001 requirements, focusing only on the ones it considers useful for its operation. The two remaining organizations have made little or superficial effort to meet the ISO 9001 requirements, either due to unawareness of the actual scope of the standard’s implementation (call center) or by choice, having the sole purpose of publicly demonstrating certification (training institute). Naturally, ISO 9001 implementation fidelity yields corresponding outcomes, since a substantive implementation imparts fundamentally different attributes to a management system compared with partial or superficial implementation. It is also clear that certain determinants affect the fidelity of implementation. Some selected patterns in the case study data are highlighted next, among the determinants, the implementation factors and the post-implementation outcomes of ISO 9001.

First, it is worth discussing some interesting insights this study provides on the fundamental relationship between ISO 9001 certification motivation and implementation fidelity. Our analysis largely confirms the findings of previous studies (Boiral and Roy, 2007; Terziovski and Power, 2007; Martinez-Costa et al., 2008; Valmohammadi and Kalantari, 2015), which point out that intrinsic motivation leads to high fidelity implementation and yields valuable results, while extrinsic motivation leads to low-fidelity implementation and yields limited results. Typical examples of the former case are the bank and the school, whose internal need to improve their management system through certification has led to the substantive implementation of nearly all ISO 9001 requirements. A typical example of the latter case is the training institute, which clearly uses certification
as a marketing tool, while neglecting to substantively implement even important ISO 9001 requirements, such as documentation, management by objectives, process management, internal audits and employee training.

More interesting than the abovementioned extreme cases are those of the other two organizations: the call center and IT/software company. Certification for the call center was both intrinsically (for internal improvement) and extrinsically motivated (for marketing reasons). Driven by its partly intrinsic motivation, this organization makes sincere efforts to implement certain ISO 9001 requirements. However, it does not appear to understand how to fully implement ISO 9001 and internalize the benefits it could derive from such an approach. Many requirements of the standard are thus implemented superficially, but without the organization’s awareness that it is falling short of substantive implementation of these requirements. In other words, due to its limited understanding of the ISO 9001 requirements, the organization incorrectly believes that it implements ISO 9001 substantively. This case shows that along with good intentions, ISO 9001 implementation requires specialized knowledge. The service of business consultants could be helpful in this regard (see also Douglas et al., 1999). Turning to the IT/software company, although it was initially certified purely to satisfy the requirements of its customers (i.e. extrinsic motivation), it appears along the way to have recognized the opportunity for improvement through the substantive implementation of at least some of the ISO 9001 requirements. In this context, the organization has progressively identified its processes, fully documented its critical procedures, conducted internal audits and trained its employees. On the other hand, it is lagging with regard to management by objectives, process control and management reviews. Considering the relative recentness of the organization’s certification and its gradual recognition of the benefits of ISO 9001 implementation, it appears to have significant potential for further substantive implementation of the ISO 9001 requirements. This case highlights an interesting aspect of this subject: even if an organization is initially extrinsically motivated to attain certification, it might, in the process, recognize the value of the ISO 9001 standard and gradually improve its internal operation through substantive implementation of the standard’s requirements.

Irrespective of the motives for certification and other determinants, it appears that all organizations reviewed, without exception, have achieved a minimum level of both ISO 9001 implementation fidelity and post-implementation outcomes. For example, they have set clear policies, defined employee tasks and job descriptions, identified and mapped – whether fully or partially – the processes of their management system, established problem identification mechanisms and based at least their important decisions on objective data. It is therefore obvious that certification in and of itself effectively leads to some management system changes, which may prove particularly beneficial for their operation. Naturally, this is still far from the complete and substantive implementation of the ISO 9001 requirements and thus the maximum benefits that organizations could derive from it (for further discussion on this point, see also Poksinska et al., 2006).

Perhaps the most important benefit of ISO 9001 implementation is the introduction of the principle of continual improvement. This is, of course, not something that can be done superficially. It requires an organization-wide culture change, which takes time and experience working on the standard’s requirements (see also Gotzamani, 2010). The bank and the school appear to have achieved this. For these organizations, it all begins with the adoption of the notion that quality is a complex process that will never attain perfection – hence, there is always room for improvement. They also demonstrate a strong and lasting commitment to change. With the above as a starting point, the bank and the school substantively implement certain critical ISO 9001 requirements that contribute to the fulfillment of the principle of continual improvement: alignment of long-term objectives and short-term targets, integrated process management including process monitoring and control, documentation of critical
procedures – which ensures implementation consistency – and large-scale audits and management reviews. The remaining three organizations implement these requirements superficially or not at all. It is, therefore, no surprise that they have failed to incorporate the principle of continual improvement into their management system.

Another important issue underscored by the case studies is the balance between standardization and flexibility of the management system. The key to this relationship is the extent of bureaucracy that ISO 9001 implementation introduces. The bank is a typical example of strict standardization. Detailed documentation of even trivial procedures has led to an intensely bureaucratic, and thus less flexible, management system. At the other end, the training institute eschews documentation of procedures, avoiding the problem of bureaucracy in favor of flexibility. However, without fixed reference points (i.e. standardized procedures) and without the implementation of a standardized change management process, the training institute’s management system is exposed to ad hoc changes with questionable results. Drawing on its extensive ISO 9001 implementation experience, the school appears to strike the ideal balance between standardization and flexibility. By selectively documenting only operationally critical procedures, it manages to keep the level of bureaucracy low, achieve a satisfactory level of flexibility and retain the benefits of standardization. This approach is strongly encouraged by the recent revision of ISO 9001:2015 (see also Fonseca, 2015; Wilson and Campbell, 2018). It should be noted, however, that this is not so easy to accomplish in practice. The call center (less systematically) and IT/software company (more systematically) have also embraced selective documentation of their procedures, but they have not avoided the heavy bureaucracy. A possible explanation for this phenomenon could be their lack of ISO 9001 implementation experience.

Finally, it should be mentioned that the management systems of the organizations reviewed have not particularly incorporated the principle of preventive action. Thus, they are often forced to correct serious problems after their emergence, which creates additional costs. This is especially true for the three organizations with low-fidelity implementation of the ISO 9001 requirements. But even the school, which possesses various mechanisms for identifying potential problems and conducts substantive management reviews to evaluate them, has failed to operate preventively. Only the bank appears to have seriously assumed preventive action, mainly because it has adopted the basic principles of risk management. Note that the recent ISO 9001:2015 revision incorporates specific risk management requirements, which, in the coming years, is expected to significantly help organizations recognize the importance of prevention and implement large-scale preventive measures (see also Chiarini, 2017; Hoyle, 2017; Tepaskoualos and Chountalas, 2017).

5. Conclusion and future directions

This paper has examined, in the form of multiple case studies, the implementation of ISO 9001 in service-oriented organizations. The data presented show that although all certified organizations receive a standardized certificate of compliance with the standard’s requirements, the implementation fidelity of these requirements may differ substantially from organization to organization. Some organizations can implement the requirements more superficially and others more substantively. This observation could give rise to an interesting debate on the degree of rigor applied in the certification process and whether this varies across certification bodies or countries. That would be a challenging field to explore in future research, possibly in line with the assumptions of Transaction Cost Theory (following the paradigm introduced by Christmann and Taylor, 2006).

In this study, we concentrated on various factors that determine the level of ISO 9001 implementation fidelity. By adopting a holistic approach, we also examined certain determinants of the standard’s implementation, as well as some critical implementation outcomes, in the form of specific management system attributes acquired by an
organization following ISO 9001 implementation. We have tried, thus, to address a critical area that preoccupies academics and business executives alike.

The findings of this study confirmed the role of certification motivation on ISO 9001 implementation (i.e. intrinsic motivation usually leads to substantive implementation and extrinsic motivation leads to superficial implementation). It also highlighted two factors (i.e. specialized implementation knowledge and implementation experience of ISO 9001) as possible moderators of the relationship between certification motivation and ISO 9001 implementation fidelity (see Section 4 for details). These hypotheses are open to future empirical research, possibly drawing on the underpinnings of the organizational learning theory.

A particularly noteworthy finding is that certification, regardless of motivation or other determinants, can provide a minimum level of implementation of the ISO 9001 requirements across all organizations. This finding is broadly aligned with the underpinnings of the institutional theory. Nair and Prajogo (2009) concluded that low performing firms are guided by institutional pressures to get ISO 9001 certified. In this respect, they proposed organizations to move away from pursuing ISO 9001 as an institutional legitimacy and head toward properly internalizing ISO 9001 practices in their internal processes. Drawing on the work of Nair and Prajogo (2009), we further argue that even an organization that was initially compelled by external factors to be certified (or “institutional” factors as Nair and Prajogo put it), without a particular interest in the substantive implementation of the standard, can eventually reap some benefits; and, more interestingly, if it also appreciates these benefits and gradually becomes convinced of the value of the ISO 9001 standard, then it can start implementing the standard’s requirements more substantively, gradually reaping more benefits. It would be useful if future research took into account this possibility of organizations coming around to the value of substantively implementing ISO 9001, and not just center on the “initial certification motivation,” as is usually the case. To illustrate this point, consider that a large number of organizations worldwide were first certified over a decade ago. Thus, their “initial motivation for certification” might not be representative of their present situation. In this respect, a measure of their “current motivation for implementing ISO 9001” could be used instead or in addition.

An attribute that an organization can definitely not adopt easily without substantively implementing ISO 9001 is incorporating the principle of continual improvement into its management system. This is particularly crucial for service organizations that struggle to satisfy the ever-increasing customer requirements. Addressing this challenge in practice, requires a great deal of effort by the organization at various levels, whether reshaping the culture (a broad understanding of quality, commitment to change), or substantive implementation of certain critical ISO 9001 requirements (management by objectives, process management, documentation, internal audits, management reviews). Theoretical models – possibly referring to the resource-based view – that correlate the above factors with continual improvement could be created and tested in future research.

Even organizations that implement ISO 9001 substantively face challenges. Notable examples that emerged in this study are those of striking a balance between standardization and flexibility and incorporating the principle of preventive action into their management system. It is particularly encouraging that the latest revision of ISO 9001:2015 attempted to address both these issues. In the former case, it provided specific guidance for organizations to avoid excessive bureaucracy, and furthermore removed certain requirements regarding mandatory documentation of procedures and record keeping. In the second case, it introduced some basic risk management principles, thus enhancing the preventive mechanisms of the management systems. It would, therefore, be interesting in future research to see an evaluation of the contribution of the revised edition of ISO 9001:2015 to address the above challenges, which many certified organizations currently face.
In this last part of the paper, we identify some limitations of this study and propose additional future research guidance to overcome them. First of all, the data in the study were drawn from Greek organizations, which are nowadays experiencing significant difficulties due to the country’s severe financial crisis. Possible cuts in critical ISO 9001 implementation factors (e.g. employee training, conducting internal audits) may have influenced the results of the study. Therefore, any generalization of its findings must be drawn with caution. Although the organizations in the sample are typical examples of the service-oriented industry population, the sample’s small size, due to the nature of the study, may not ensure that all possible patterns among the factors examined have been identified. In future research, the patterns among determinants, implementation factors and outcomes should be further tested with a larger number of organizations and in other industries (e.g. manufacturing or commerce).

References


Magd, H. and Curry, A. (2003), “ISO 9000 and TQM: are they complementary or contradictory to each other?”, The TQM Magazine, Vol. 15 No. 4, pp. 244-256.


Corresponding author
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<table>
<thead>
<tr>
<th>Implementation factors</th>
<th>Call center</th>
<th>Training institute</th>
<th>IT/software company</th>
<th>Bank</th>
<th>School</th>
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</thead>
<tbody>
<tr>
<td>Quality policy</td>
<td>Specific, structured, very detailed policy; they follow a certain structure to ensure uniformity</td>
<td>Specific, structured, very detailed policy; they follow a certain structure to ensure uniformity</td>
<td>Specific, structured, very detailed policy</td>
<td>Specific, structured, very detailed policy</td>
<td>Specific, structured, very detailed policy</td>
</tr>
<tr>
<td></td>
<td>Not particularly communicated internally; brief reference to policy and certification on their website</td>
<td>Ample reference to policy and certification on their website; clearly for marketing purposes; not applied; mostly used as a facade</td>
<td>Typically available through the intranet; no particular actions are taken to actively communicate policy to employees</td>
<td>Brief reference to policy and certification on their website</td>
<td>Brief reference to policy and certification on their website</td>
</tr>
<tr>
<td>Leadership and organizational roles</td>
<td>Limited top-management commitment, mainly focusing on the purely administrative/managerial tasks; limited top-management commitment, not seen by all employees as a way to improve profitability</td>
<td>Limited top-management commitment, mainly focusing on the value-added aspects of the organization; the job descriptions are not fully documented; the job descriptions are clearly communicated to employees, but they are not documented at all</td>
<td>Limited top-management commitment; they seem quite detached from what is performed on lower levels; the job descriptions are clearly communicated initially, but they are often not updated when additional tasks are introduced thereafter</td>
<td>Limited top-management commitment; they seem quite detached from what is performed on lower levels; the job descriptions are clearly communicated initially, but they are often not updated when additional tasks are introduced thereafter</td>
<td>Extend top-management commitment, characterized by supportive and helpful behavior</td>
</tr>
<tr>
<td>Objectives</td>
<td>Short-term targets are not fully aligned with long-term objectives; they are often discontinued; quantity-related KPIs; feedbacks; turnover rate; self-efficacy</td>
<td>Short-term profit maximization is the key driver for targets' setting; no long-term objectives are set; product quality KPIs (grades)</td>
<td>Short-term profit maximization is the key driver for targets' setting; no long-term objectives are set; product quality KPIs (grades)</td>
<td>Short-term profit maximization is the key driver for targets' setting; no long-term objectives are set; product quality KPIs (grades)</td>
<td>Several short-term targets are aligned with a variety of long-term objectives, depending on the particular department involved</td>
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Table AI. ISO 9001 implementation factors across different organizations
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<tr>
<td>processes</td>
<td>A specific team identifies horizontal cross-functional processes and interactions amongst them, across the whole organization.</td>
<td>Organized mostly around vertical hierarchical structures.</td>
<td>A limited number of critical processes are identified. Individual process maps exist, not particularly communicated to employees and partly implemented. Processes are not systematically monitored and controlled.</td>
<td>A specific team identifies horizontal cross-functional processes and interactions amongst them, across the whole organization.</td>
<td>All the critical procedures are very detailed documented in a specific and structured way; they are clearly communicated to employees. The existing procedures are devotedly applied; there is no possibility for employees to override any step of the procedures, even for minor things; only for urgent operational needs that may arise, there is a predefined procedure.</td>
</tr>
<tr>
<td>process mapping</td>
<td>Process mapping exists, but it is not particularly communicated to employees nor is it implemented. Processes are not systematically monitored and controlled.</td>
<td>Process mapping exists; it is communicated to employees and largely implemented. A limited number of processes (i.e. the most critical) are continuously monitored and controlled.</td>
<td>Process mapping exists, but it is poorly communicated to employees; the latter narrowly focus on their specific tasks, regardless of processes involved. Processes are not systematically monitored and controlled.</td>
<td>Process mapping exists; it is poorly communicated to employees; the latter narrowly focus on their specific tasks, regardless of processes involved. Processes are not systematically monitored and controlled.</td>
<td>Process mapping exists; it is poorly communicated to employees; the latter narrowly focus on their specific tasks, regardless of processes involved. Processes are not systematically monitored and controlled.</td>
</tr>
<tr>
<td>documented procedures</td>
<td>Some procedures are documented, mostly those that are mandatory for certification, though they seem to create bureaucracy; some procedures are not documented, despite being critical for organization’s operation. The existing procedures are generally applied; though it is not unusual for employees to override certain procedures.</td>
<td>All the critical procedures are very detailed documented in a specific and structured way though they seem to create bureaucracy. The existing procedures are generally applied; though it is not unusual for employees to override nearly all procedures.</td>
<td>All the critical procedures are very detailed documented in a specific and structured way though they seem to create bureaucracy. The existing procedures are generally applied; though it is not unusual for employees to override nearly all procedures.</td>
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<tbody>
<tr>
<td>Internal audits and management reviews</td>
<td>Internal audits are conducted just before the external re-certification audits or annual surveillance audits; no follow-up is undertaken. Elementary internal management reviews are conducted, mostly based on employees' feedbacks; they are mainly extrinsically driven, just to meet the certification requirements.</td>
<td>Internal audits are not conducted regularly and systematically; the organization focuses directly on results (KPIs) ignoring the audit of the procedures that produce these results. Elementary internal management reviews are conducted mostly based on limited employees' feedbacks; they are mainly extrinsically driven, just to meet the certification requirements.</td>
<td>Full-scale internal audits are conducted every 2 years; small-scale internal audits are also performed as a preparation to annual external surveillance audits. Their short-term orientation has resulted in degradation of management reviews; only small-scale internal management reviews are occasionally conducted.</td>
<td>Minor bypassing procedures option. Standardized internal audits are conducted, ranging from weekly (for critical procedures) to yearly (for trivial procedures); random audits are also performed to cross-check that things function as they should. Large-scale internal management reviews are conducted, based on several sources of information (surveys, performance metrics, audits results, etc.); they are broadly communicated amongst all employees.</td>
<td>Some audits are conducted only for critical procedures; the organization mostly focuses on results rather than the audit of the procedures that produce those results. Constant multiple-level internal management reviews are conducted, based on several sources of information (feedbacks, surveys, etc.); the results of management reviews are used as a guideline for the following year's planning.</td>
</tr>
<tr>
<td>Problems identification and handling</td>
<td>Standard mechanism to identify and handle problems, merely conforming to ISO 9001 requirements.</td>
<td>Standard criteria are used to identify problems; then, the problems are handled on ad hoc basis.</td>
<td>Standard mechanism to identify and handle especially technical problems, as a routine.</td>
<td>Standard, large-scale mechanism to identify and handle especially administrative and legal problems; sometimes it seems quite sluggish because of the maze of bureaucracy.</td>
<td>Standard mechanism to identify and handle especially administrative and legal problems; a certain amount of initiative is also given for trivial problems. Extensive focus on people. Extensive training for employees.</td>
</tr>
<tr>
<td>People</td>
<td>Limited focus on people. Standard procedures for employees' training. Top-bottom communication via intranet.</td>
<td>Very limited focus on people. No care for employees' training. Top-bottom communication via meetings.</td>
<td>Limited focus on people. Standard procedures for employees' training on both technical and non-technical skills. Top-bottom communication via portal site.</td>
<td>Extensive focus on people. Training has a specific learning plan preposition for all employees. Interactive communication via intranet, meetings, groups, teams, help desk, workshops.</td>
<td>Extensive focus on people. Interactive communication via intranet, meetings, groups, teams, conferences.</td>
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</table>

Table AI. Implementation of ISO 9001
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<tr>
<th>Implementation determinants</th>
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</thead>
<tbody>
<tr>
<td>Experience with ISO 9001 implementation</td>
<td>Not experienced; their QMS was systematically managed only after certification; they were first certified 4 years ago</td>
<td>Moderately experienced; their QMS was systematically managed only after certification; they were first certified 6 years ago</td>
<td>Not experienced; their QMS was systematically managed only after certification; they were first certified 4 years ago</td>
<td>Very experienced; their QMS was systematically managed even before certification; they were first certified 20 years ago</td>
<td>Experienced; their QMS was systematically managed even before certification; they were first certified 12 years ago</td>
</tr>
<tr>
<td>Motivation for ISO 9001 certification</td>
<td>Mixed motivation: need for improving their documentation processes; marketing focus</td>
<td>Highly extrinsic motivation: certification is widely commercialized and used as a pure marketing tool</td>
<td>Extrinsic motivation: customer requirement (sales-driven motivation); marketing focus</td>
<td>Highly intrinsic motivation: critical need for improving their QMS</td>
<td>Intrinsic motivation: Basic need for improving their QMS</td>
</tr>
<tr>
<td>Perception of quality</td>
<td>Quality is perceived as beneficial mostly for documentation; they have a limited awareness of how quality and certification can contribute to the benefit of the organization</td>
<td>Quality is perceived as a synonym of customers' satisfaction; certification is of secondary importance and totally disconnected from what constitutes quality</td>
<td>Quality is perceived as a synonym of certification; they believe that certification alone is a bearer of quality</td>
<td>Quality is perceived as a multi-dimensional, on-going process, before during and after certification</td>
<td>Quality is perceived as a multi-dimensional, on-going process, before during and after certification</td>
</tr>
<tr>
<td>Commitment to change</td>
<td>Not particularly committed to change; they only occasionally focus on large-scale cross-functional changes, with a limited application of formal change management processes</td>
<td>Not particularly committed to change; whatever occasional change realized is driven and monitored by the General Director alone; no specific change management processes exist</td>
<td>Not committed to change; they do not really care about managing any changes due to the technical nature of the business itself; change management processes are totally disregarded</td>
<td>Commitment to change is instilled in their culture; change is systematically managed by a special transformation office, actively supported by top management; rather than just talking about changing culture, they are actually working hands-on toward this direction</td>
<td>Commitment to change is instilled in their culture; change is systematically managed by the project team in charge for quality; the importance of change is communicated to the employees and, as such, it is welcomed by them; they try to make the employees part of the change</td>
</tr>
<tr>
<td>Organizations</td>
<td>Call center</td>
<td>Training institute</td>
<td>IT/software company</td>
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<td>-------------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Flexibility and adaptability</td>
<td>There is a lack of flexibility and adaptability, due to the burdensome bureaucracy</td>
<td>There is high flexibility and adaptability; they do not stick to the norms of certification, so they have no bureaucracy constraints</td>
<td>There is a lack of flexibility and adaptability, mainly because of too many procedures and layers of bureaucracy; change is a time consuming process</td>
<td>There is a lack of flexibility and adaptability, mainly because of too many procedures and layers of bureaucracy; change is a time consuming process</td>
<td>There is a certain amount of flexibility and adaptability, since bureaucracy is controlled at relatively low levels</td>
</tr>
<tr>
<td>Standardization</td>
<td>There is some standardization in their management system; they fail to standardize all critical processes</td>
<td>There is very limited standardization in their management system; they mostly operate ad hoc</td>
<td>There is broad standardization in their management system; all critical processes are fully standardized</td>
<td>There is excessive standardization in their management system; all processes are fully standardized</td>
<td>There is broad standardization in their management system; all critical processes are fully standardized</td>
</tr>
<tr>
<td>Preventive approach</td>
<td>No particular preventive action is taken, except from very basic practices</td>
<td>No preventive action is taken</td>
<td>Very few preventive actions are taken especially as regards the quality delivered to the customers</td>
<td>Many preventive actions are taken across all the organization’s operations; operational risk is a major part of its governance</td>
<td>Few preventive actions are taken; weekly meetings act as an incentive for developing proposals for problems prevention</td>
</tr>
<tr>
<td>Fact-based decision making</td>
<td>Important decisions are made according to metrics, so they are mostly based on objective criteria; elementary decisions are based on perceptions</td>
<td>Most decisions are made according to specific KPIs, so they are fully based on objective criteria</td>
<td>Important decisions are made according to metrics, so they are mostly based on objective criteria; elementary decisions are based on perceptions</td>
<td>At an administrative level, even the elementary decisions are based on objective criteria; at operational level, some urgent issues are quickly addressed, based on less objective decisions</td>
<td>All important decisions are based on objective criteria; constant multiple-level reviews, feedbacks, questionnaires etc. are used as a guideline for decision making</td>
</tr>
<tr>
<td>Continual improvement orientation</td>
<td>There is a tendency toward improvement but it seems to be grounded more in theory rather than in practice</td>
<td>They are not really oriented toward improvement; they are more short-term result-driven rather than long-term quality-driven</td>
<td>They are not really oriented toward improvement; they are more short-term result-driven rather than long-term quality-driven</td>
<td>There are particular departments in charge of managing process improvements in continuous basis</td>
<td>Continual improvement is effectively enabled by quantitative and qualitative feedback from multiple sources (e.g. processes, customers, employees)</td>
</tr>
</tbody>
</table>
Revising the Kano model for designing an employee compensation system

Developing one-dimensional attributes

Hossein Vaez Shahrestani, Arash Shahin, Hadi Teimouri and Ali Shaemi Barzoki
Department of Management, University of Isfahan, Isfahan, Iran

Abstract

Purpose – The purpose of this paper is twofold: first, to revise the Kano model with a focus on one-dimensional attributes; and second, to use the revised model for categorizing and prioritizing various employee compensation strategies.

Design/methodology/approach – The Kano evaluation table has been revised and the one-dimensional attribute has been further extended to three categories of $O_M$, $O_A$ and $O_A$. In the next step, the literature review-based identified strategies have been categorized and prioritized according to the developed Kano model. Consequently, an employee compensation system has been proposed to a process-based manufacturing company as a case study.

Findings – Findings indicated that out of the 44 employee compensation strategies, typically 6 were must-be, 13 were one-dimensional, 18 were attractive and 7 were indifferent. Also, the results of the revised Kano model indicated that typically out of the 13 one-dimensional strategies, 7 were one-dimensional tending toward must-be ($O_M$); and 6 were one-dimensional tending toward attractive ($O_A$).

Research limitations/implications – The case study was limited to one company. The validity of the proposed model can be further studied in a larger population. This study provides managers with a more accurate instrument of decision making in selecting more differentiated employee compensation strategies, which, in turn, might lead to more employee satisfaction.

Originality/value – Theoretically, this study is different from existing studies, since almost none of the previous studies extended the Kano evaluation table for one-dimensional attributes. Practically, this study is another evidence of the application of the Kano model in the field of human resource management and in particular contributes to the design of employee compensation systems.

Keywords Kano evaluation table, One-dimensional attributes, Revised Kano model

Paper type Research paper

1. Introduction

In the new era, organizations have found that human resources are considered as the most important asset. This is due to the fact that financial assets and advanced technologies will not create competitive advantage for the organization unless they are managed effectively by human resources. This, in turn, illustrates the high importance of human resource management (HRM) for organizations to grow and gain competitive advantage. One of the main tasks of human resource managers is to design and implement an employee compensation system for employees. Nevertheless, performed studies on employee compensation compared with other human resource studies (employee selection, performance appraisal and turnover) are scarce and dispersed (Gupta and Shaw, 2014). The consequences of employee compensation decisions among the most important factors in the survival of organization are to achieve a competitive advantage and to continue the competitive advantage of the organization. From the point of view of HRM, the success of major human resource activities is related to and depends on the strategies and activities of employee compensation. The ability to create an incentive among employees and maintaining desirable employees is largely influenced by employee compensation proposals (Dulebohn and Werling, 2007). Also, employee compensation systems can support and protect the organization’s strategy and increase its effectiveness (Festing et al., 2007).
Employee compensation is a generic term that includes wage and salary system, pay and reward system, and intends to compensate employees' services in the organization. Anyone joining the organization brings capabilities, abilities, skill and in some cases, his/her credit to the organization and expects these inputs to be compensated by the outputs the organization gives him/her (Gholipour, 2014). The theory of motivation shows that both the internal and external modes of employee compensation are important for the employees. Individuals, in addition to money, work for inner rewards such as attractive and challenging work, growth opportunities and personal progress (Balkin and Swift, 2006). It should be mentioned that not all of the strategies of employee compensation are possible and necessary for organizations. In fact, organizations should select different strategies for their employees in accordance with their objectives and conditions. To identify the prioritized strategies of employee compensation, various tools and techniques can be used. One of such techniques is the Kano model.

In the past, researchers traditionally believed that satisfaction is proportional with the level of performance, meaning that higher performance will cause higher customer satisfaction and lower performance will result in less customer satisfaction. This concept is called the one-dimensional model of the relationship between quality and customer satisfaction. Kano et al. (1984) revealed an asymmetric and nonlinear relationship between satisfaction and performance and presented a two-dimensional model (Chen, 2012). The Kano model is a useful technique for classifying and prioritizing customer requirements based on how they affect customer satisfaction (Xu et al., 2009). This model is used to distinguish three types of a product/service attributes that affect the customer satisfaction in a variety of ways. They are must-be, one-dimensional and attractive attributes.

In the two-factor theory of Herzberg, the only factor that somehow results in satisfaction and dissatisfaction of employees is wage (money). In fact, this factor is very close to one-dimensional attributes in the Kano model (Robbins and Judge, 2010). It should be mentioned that since the nature of many of employee compensation strategies is monetary (e.g. unemployment insurance, housing allowance, tuition allowance, entertainment facilities, sport facilities and years of service right), it is possible that many of these features fall into the category of one-dimensional requirements. Actually, the basic Kano model does not provide a criterion for separating these features, and puts all of these features in one category. With regard to the high competition of organizations in the present time, the basic type of classification is no longer effective and encourages researches to develop it further for special applications such as selecting employee compensation strategies.

In this study, an attempt has been made to revise the basic Kano model by eliminating its weakness regarding the single category of one-dimensional attributes. The literature review indicates that while one of the prevailing features of products/services is the one-dimensional attribute (Witell and Lofgren, 2007; Lee et al., 2008, 2011; Wang and Ji, 2010; Bilgili et al. 2011; Yang, 2011; Chen, 2012), there is no criterion for differentiating such attributes by the Kano model and all are located in a single category. It should be noted that organizations in some cases cannot meet two or more of the requirements of customers (employees in this paper) at the same time for technical/financial reasons. Therefore, attempting to identify the prioritized features can be useful and create competitive advantage for the organization (Shahin and Nekuie, 2011). Another weakness of the basic Kano model is that one-dimensional attributes, if met or not, can have different effects on customer satisfaction and actually appear in the Kano model as two half-lines with different slopes instead of a straight line (Lin et al., 2010). However, the Kano model does not have a criterion for distinguishing and differentiating such attributes.

In the following, after the literature review, the employee compensation system and the Kano model are briefly described. Then, the research methodology is explained and the proposed approach is examined in a case study. Findings are then discussed followed by study conclusions.
2. Literature review

The literature review shows that no research has ever been done on the integration of the Kano model and the employee compensation. However, the Kano model has been frequently used in combination with other approaches and some of the cases are addressed in the following.

Shahin and Mohammadi Shahiverdi (2015) estimated the customer lifetime value (CLV) for new product development based on the Kano model. They stated that in the prior performed studies, the previous information obtained from customers was used to determine the CLV. The purpose of their study was to modify the estimation of CLV prior to produce a new product. For this purpose, they used the Kano satisfaction index (SI). This index was used as a basis for developing related equations to allocate Kano requirements to different stages of the product life cycle.

Salehzadeh et al. (2015) proposed a new approach for evaluating the situational leadership theory (SLT) based on the Kano model. They proposed a new method for evaluating the SLT. Initially, questions for each of the SLT styles were developed and then various styles were analyzed by the Kano evaluation table. Based on the classification of the Kano model, their findings indicated that the appropriate leadership style for undergraduate, postgraduate and PhD students were directing, coaching and supporting styles, respectively.

Shahin et al. (2013) conducted a study on the subject of typology of Kano models. They developed and suggested a revised reference Kano model. In their study, the existing Kano models were classified into three types and for each type, the curves were studied along with the corresponding evaluation tables, and eventually a new type of Kano model was developed. The findings of their investigation indicated that the existing Kano model types have weaknesses. For example, the starting points of the curves are not in a proper position; the sequence and slope of the curves have not been shown accurately; and the cells of the Kano evaluation table have not been correctly encoded. They resolved such problems in their proposed Kano model.

Shahin and Nekuei (2011) proposed a new method for calculating the $K$ (adjustment parameter) values for the differentiation of dimensions (requirements) by assuming equality of distance between the curves of must-be/attractive requirements and by using the linear logarithmic transformation. For example, they suggested 2, 3 and 4.5 values for $K$ considering less must-be, somewhat must-be and highly must-be requirements; and the values of 0.5, 0.7 and 0.98 for less attractive, somewhat attractive and highly attractive requirements. The results of their case study indicated that this new method significantly influenced the differentiation of the Kano dimensions and provided a more precise prioritization of the dimensions than the basic method.

Hartono and Chuan (2011) proposed an integrated model of Kano and Kansei engineering for service applications. They used the Kano model and regression analysis for determining the relationship between the performance of service attributes and the emotional response of customers. As a case study, 100 tourists in 4 and 5 star hotels were studied. Findings indicated that among the 39 studied service dimensions, there were 9 must-be, 9 one-dimensional, 13 attractive and 8 indifferent attributes.

Lin et al. (2010) developed an adjusted regression approach for removing the limitations of dummy variable regression and providing a more accurate classification of attributes. Regarding the classification of attributes based on the Kano model, their findings indicated a difference between the two approaches of basic and adjusted regression analysis.

Li and Roloff (2007) tried to find how various employee compensation systems may reflect organizational cultures and affect the organizational attractiveness and the perception of job applicants in the organization. Their results indicated that the organizational culture of organizations with competency-based employee compensation systems was more aggressive, reward oriented and less decisive than those with seniority-based employee compensation.
compensation systems. Generally, individuals were less attracted to those organizations wherein wage and salary distribution was based on seniority than those organizations that used mixed employee compensation distribution systems or organizations wherein wage and salary distribution systems were wholly based on competency factors.

Werner and Ward (2004) investigated employee compensation literature. After reviewing 6,867 articles in 20 prestigious journals in 7 years, they found 396 articles related to the field of employee compensation. They classified these articles into 12 categories. Based on the combination of these articles, the relationship between various categories was analyzed and areas for future researches were suggested.

While the literature review indicates that one of the most frequently studied attributes of the Kano model is the one-dimensional attribute (e.g. Shahin, 2004; Hartono and Chuan, 2011; Lin et al., 2010), there is no criterion for differentiating such attribute in the classic Kano evaluation table. In this study, an attempt has been made to fill this important research gap.

In this paper, the studies performed on employee compensation, some of which were mentioned above, are used to identify different employee compensation strategies. Also, considering the fact that an important part of this study is about the development of the Kano model, the methodologies of studies such as Shahin et al. (2013) and Shahin and Nekuie (2011) are used to learn how the Kano model can be further revised. Finally, similar to the study of Salehzadeh et al. (2015), the Kano model is used to measure the employee satisfaction, contrary to most of studies in this field that used the Kano model to measure customer satisfaction.

3. Employee compensation system

HRM is one of the topics in organizational science that deals with employment issues and also with strategies, decision making and activities related to such issues. The focus and center of relationship between employers and employees is the exchange of employee compensation. One main reason for most people to work is that they depend on the wage and salary of work for survival. Although internal factors play a significant and prominent role in the survival of individuals in employment relationships, employee compensation plays a central and key role (Dulebohn and Werling, 2007). Effective employee compensation programs have numerous advantages. Companies that pay good wage and salary attract employees more. After employment, employees who have been satisfied with the payment most likely remain in the organization. A proper employee payment system enhances employee motivation, and as a result, increases organizational productivity (Stewart and Brown, 2014). It should be noted that when we look at studies conducted in the field of HRM, thousands of studies are available inter alia in the field of employee selection, performance appraisal and turnover. In contrary, studies performed in the field of employee service compensation are scarce and scattered (Gupta and Shaw, 2014).

The employee compensation systems, which are also referred to as “the reward and payment systems,” provide a plan for rewarding employees. A regular compensation package includes two major elements of direct and indirect payments (Li and Roloff, 2007). In general, employee compensation indicates the financial and non-financial rewards that employees receive from an organization. However, in most cases, employee compensation includes the financial rewards by the organization to employees (Stewart and Brown, 2014).

The literature review indicates that financial reward has a strong positive effect on motivation and performance of employees. For example, in a study, it was found that employee productivity will increase with an average rate of 30 percent after financial motivation of people. This is due to the fact that such rewards fulfill the basic needs of people such as food, residence and respect by others (Aguinis et al., 2013).
4. Kano model

The basic Kano model was developed on the basis of motivation–health theory suggested by Herzberg et al. (1959), which is also known as attractive quality theory (Lee et al., 2011). This model is able to differentiate the types of product/service attributes that influence customer satisfaction in different ways (Kano et al., 1984). In the next section, each of the attributes of the Kano model, i.e. must-be, one-dimensional, attractive, indifferent, reverse and questionable attributes is explained briefly.

Must-be attributes are referred to those parts of the primary characteristics and features of a product/service that, if provided, will not lead to customer satisfaction, while their absence severely leads to customer dissatisfaction (Shahin and Nekuie, 2011). Meeting must-be attributes ultimately leads to the expression of “I’m not dissatisfied” by the customer (Sauerwein et al., 1996).

One-dimensional attributes cause customer satisfaction as much as if they are met, and in the opposite sense, they cause customer dissatisfaction as much as if they are not met; that is, a higher level of meeting these requirements leads to a higher level of customer satisfaction, and vice versa. Therefore, for one-dimensional requirements, customer satisfaction or dissatisfaction requires a linear relationship with the level of meeting requirements (Shahin and Nekuie, 2011). It should be mentioned that these requirements are also known as functional, normal or obvious requirements (Shahin and Zairi, 2009).

Attractive requirements are referred to those parts of a product/service features that, if not provided, do not lead to customer dissatisfaction, while their presence highly results in customer satisfaction and even delight. In fact, since customer may not be aware of or does not explicitly express or expect such attributes, meeting them leads to more satisfaction than proportionate satisfaction, while if these requirements are not met, customer will not be dissatisfied (Shahin and Nekuie, 2011). In other words, these attributes are beyond the expectations of customers (Shahin and Zairi, 2009).

In addition to the three main types of the Kano attributes (must-be, one-dimensional and attractive) explained in the previous section, Kano et al. (1984) also proposed three more types of attributes, which are described in the following. Indifferent attributes are referred to those parts of a product/service features that customers are indifferent to, and meeting or not meeting them does not result in any increase or decrease in customer satisfaction.

Reverse requirements are referred to those attributes that customers do not like their presence of (Wang and Ji, 2010). In fact, unlike the one-dimensional requirements, the lack of these requirements results in customer satisfaction and their existence leads to customer dissatisfaction (Chen et al., 2011). An example for reverse requirements could be retaining related transaction data by a company for customer to inquire after delivering goods (Chen et al., 2011).

The questionable requirements indicate a case that there is a contradiction between customer’s response to questions (Wang and Ji, 2010). For example, the customer provides positive response to both presence and absence of an attribute. Such responses are not worth analysis and should be ignored in investigations.

As it was explained, the Kano model is an appropriate technique for industries to analyze their key features in order to make better decision about their strategies. Customers only judge the quality of products/services. They evaluate quality by using numerous features that are important from their point of view. Therefore, the degree of importance is a key and important element that is considered by customers when evaluating qualitative performance. Accordingly, Pouliot (1993) merged the concept of importance degree into the Kano model and thus developed a new modified Kano model. Then, after 20 years, Shahin et al. (2013) re-examined the Pouliot’s model to remove the existed problem in the model and proposed a revised version. Based on the revised model (Figure 1), the features were categorized into more precise categories and the three groups...
of attractive features and three groups of must-be features were distinguished more accurately (Shahin et al., 2013).

It should be noted that in this model, the curves \( A_1, A_2 \) and \( A_3 \) represent less attractive, attractive and highly attractive attributes, and similarly, \( M_a, M_b \) and \( M_c \) represent less must-be, must-be and highly must-be attributes. Consequently, the Kano evaluation table was also modified (Table I).

5. Research methodology
The research methodology of this study includes two steps. In the first step, the Kano model is revised by developing the categorization of one-dimensional attributes and in the second step, it is explained that how the revised model can be applied in selecting employee compensation strategies. These two steps are described in the following.

**Step 1: developing the Kano model for one-dimensional requirements**

In the previous section, the modified Kano model that was initially proposed by Pouliot (1993) and then reviewed by Shahin et al. (2013) was explained. The focus of those studies was on the

![Figure 1. The revised Kano model](image)

**Source:** Shahin et al. (2013)

### Table I. The modified Kano evaluation table

<table>
<thead>
<tr>
<th>Customer needs</th>
<th>Functional form of the question</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I like this feature omitted</td>
<td>Dysfunctional form of the question</td>
</tr>
<tr>
<td>2. I need this feature omitted</td>
<td>1. I like this feature included</td>
</tr>
<tr>
<td>3. I am neutral about this feature</td>
<td>2. I need this feature included</td>
</tr>
<tr>
<td>4. I can live with including this feature</td>
<td>3. I am neutral about this feature</td>
</tr>
<tr>
<td>5. I dislike including this feature</td>
<td>4. I can live with omitting this feature</td>
</tr>
<tr>
<td>6. I dislike omitting this feature</td>
<td>5. I dislike omitting this feature</td>
</tr>
</tbody>
</table>

**Notes:** A, attractive need; O, one-dimensional need; M, must-be need; I, indifferent; R, reverse; Q, questionable

**Source:** Shahin et al. (2013)
must-be requirements and attractive requirements, regardless of the one-dimensional requirements. As it was also mentioned in the Introduction section, one of the predominant and highly repeated requirements in studies and case studies performed in this area is the one-dimensional requirement, but there is no criterion for distinguishing such requirements in the basic Kano model, and all of them are in one group (a number of these performed case studies were addressed in the Introduction section). Also, as it was mentioned, one-dimensional requirements can have different effects on customer satisfaction if met, and in fact, they appear in a two half-line with different slopes in the Kano model (Lin et al., 2010). However, the Kano model does not have a criterion to distinguish these features. In the revised Kano model of this study, the two above limitations in the Kano model have been removed with the aim of proposing a more precise approach.

In order to achieve the above-mentioned objective and inspiring from the key point that one-dimensional requirements can appear in two half-lines with different slopes in the functional and dysfunctional areas or as a straight line with identical slopes in the functional and dysfunctional areas in the Kano model, formulating and analyzing such requirements have been performed. For this purpose, the SI and the dissatisfaction index (DI), which indicate the slope of lines of the Kano model in the functional and dysfunctional area, have been used for determining the three types of one-dimensional attributes (Table II).

In order to use Table II for categorizing one-dimensional attributes, the two indicators of SI and DI should be computed. It should be mentioned that $O_D$ indicates one-dimensional attributes as a straight line, $O_M$ indicates one-dimensional attributes tending toward must-be attributes and $O_A$ indicates one-dimensional attributes tending toward attractive attributes.

As it is clear from Table II, when the two indicators of SI and DI are equal, it actually means that the slope lines of the one-dimensional attribute in the functional and dysfunctional areas are equal, and the one-dimensional attribute appears as a straight line. When the absolute value of DI indicator is greater than the absolute value of SI indicator, it actually means that the slope of the one-dimensional attribute in the dysfunctional area is greater than the slope of the one-dimensional attribute in the functional area; and when the absolute value of SI indicator is greater than the absolute value of the DI indicator, it actually means that the slope of the one-dimensional attribute in the functional area is greater than the slope of the one-dimensional attribute in the dysfunctional area. The associated examples are also illustrated in the table. According to the examples, the $O_M$ lines, apparently and particularly in respect of their fragmentation, are similar and are closer to the must-be attributes lines. $O_A$ lines are closer to the attractive attributes lines, which, in turn, imply the accuracy and validity of the new categorization of one-dimensional attributes.

<table>
<thead>
<tr>
<th>Comparison of SI and DI</th>
<th>Category</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>$SI =</td>
<td>DI</td>
<td>$</td>
</tr>
<tr>
<td>$SI &lt;</td>
<td>DI</td>
<td>$</td>
</tr>
<tr>
<td>$SI &gt;</td>
<td>DI</td>
<td>$</td>
</tr>
</tbody>
</table>

$SI = \frac{A + O}{A + O + M + I}$  
$DI = \frac{O + M}{A + O + M + I}$

**Table II.**
Developing the one-dimensional attributes in the Kano evaluation table.
Step 2: applying the revised Kano model in selecting employee compensation strategies

At this stage, all options of the employee compensation have been identified by reviewing books (e.g. Arthur, 2001; Phillips and Connell, 2003; Gerhart and Rynes, 2003) and journal articles (e.g. Werner et al., 2005; Rahman and Mustafa, 2018; Lin et al., 2019) in the field of HRM, as well as interview with the experts in this field. The interviewees included eight university professors in the field of HRM and organizational behavior (five professors from the Department of Management, University of Isfahan and three professors from the Faculty of Entrepreneurship, University of Tehran). In the next step, the identified features have been screened by the mentioned university experts and professionals of the industry under study using Delphi method. Then, the Kano questionnaire has been developed based on the screened features and has been distributed to the statistical population. Ultimately, the types of features and the priorities of employee compensation strategies have been identified based on both the basic and the revised Kano evaluation tables.

6. Case study and findings

A process-based production company was selected as the case study to examine the proposed model. This company was selected regarding its variety and range of employee compensation options compared to other companies in Iran. The company allocated considerable budget to such policy and if the options became more aligned with the needs of employees, the effectiveness of the employee compensation system would increase. For this purpose, first literature was reviewed and all employee compensation strategies were identified. At this stage, about 80 various employee compensation strategies were extracted, which reduced to 44 strategies in the next step using the experts’ opinion and by Delphi method. Then, the Kano questionnaire was designed regarding the 44 identified employee compensation strategies and distributed to the respondents.

Morgan’s sampling table was used to estimate the sample size and accordingly, since the population size of the company was 360, the sample size was obtained as 186. To increase the validity of data and also because of the possibility of returning less completed questionnaires, the needed sample size was supposed to be 210. After distributing questionnaires and collecting the completed copies, questionnaires containing incomplete and ambiguous information were omitted, and ultimately 196 questionnaires were used for data analysis. The Kano evaluation table of Shahin et al. (2013) was used for categorizing the Kano attributes. The obtained results are summarized in Table III.

As it is clear from Table III, out of the 44 strategies, 6 were must-be, 13 were one-dimensional, 18 were attractive and 7 were indifferent attributes, which indicates that the majority of strategies were attractive to employees. In addition, the most frequent strategy was fixed monthly salary with a less must-be Kano attribute. Moreover, all of the must-be attributes were typically less must-be ($M_3$) and all of the attractive attributes were also typically less attractive ($A_1$). In the next step, 13 one-dimensional attributes were extracted for investigating the applicability of the revised Kano model. The results are presented in Table IV. According to the results, the 13 one-dimensional attributes were further categorized into 7 $O_M$ and 6 $O_A$ attributes indicating that the revised Kano model provides more distinguished categories of one-dimensional attributes. Based on the results, “Favorite work tasks” with SI coefficient of 0.81 and “retirement plan” with DI coefficient of −1.00 were determined as the most important strategies of $O_A$ and $O_M$ categories, respectively.

7. Discussion

Findings indicated that out of the 44 studied employee compensation strategies, 6 were must-be, 13 were one-dimensional, 18 were attractive and 7 were indifferent attributes. Also, according to the obtained results of the developed Kano model, out of the 13 one-dimensional attributes, 7 strategies were categorized as one-dimensional tending toward
Table III.
Categorizing employee compensation strategies based on the Kano evaluation table of Shahin et al. (2013)

<table>
<thead>
<tr>
<th>Employee compensation strategies</th>
<th>$M_a$</th>
<th>$M_b$</th>
<th>$M_c$</th>
<th>$O$</th>
<th>$A_1$</th>
<th>$A_2$</th>
<th>$A_3$</th>
<th>$I$</th>
<th>$Q$</th>
<th>$R$</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed monthly salary</td>
<td>92</td>
<td>-</td>
<td>-</td>
<td>15</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>5</td>
<td>4</td>
<td>1</td>
<td>$M_a$</td>
</tr>
<tr>
<td>Life insurance</td>
<td>20</td>
<td>4</td>
<td>40</td>
<td>60</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>52</td>
<td>-</td>
<td>-</td>
<td>$A_1$</td>
</tr>
<tr>
<td>Complementary insurance services</td>
<td>20</td>
<td>-</td>
<td>4</td>
<td>51</td>
<td>68</td>
<td>24</td>
<td>3</td>
<td>23</td>
<td>-</td>
<td>-</td>
<td>$A_1$</td>
</tr>
<tr>
<td>Retirement plan</td>
<td>93</td>
<td>-</td>
<td>-</td>
<td>99</td>
<td>98</td>
<td>6</td>
<td>2</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>$O$</td>
</tr>
<tr>
<td>Unemployment insurance</td>
<td>68</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>84</td>
<td>-</td>
<td>-</td>
<td>12</td>
<td>31</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Payment of vacation time and turnover</td>
<td>23</td>
<td>-</td>
<td>-</td>
<td>79</td>
<td>20</td>
<td>15</td>
<td>8</td>
<td>51</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Sickness leave</td>
<td>50</td>
<td>-</td>
<td>-</td>
<td>70</td>
<td>12</td>
<td>-</td>
<td>-</td>
<td>59</td>
<td>2</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Training allowance</td>
<td>18</td>
<td>-</td>
<td>-</td>
<td>47</td>
<td>66</td>
<td>32</td>
<td>-</td>
<td>-</td>
<td>29</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td>Housing allowance</td>
<td>60</td>
<td>-</td>
<td>-</td>
<td>64</td>
<td>32</td>
<td>16</td>
<td>-</td>
<td>23</td>
<td>-</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Feasts gift (calendar vacations)</td>
<td>19</td>
<td>-</td>
<td>-</td>
<td>72</td>
<td>60</td>
<td>-</td>
<td>-</td>
<td>44</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Loan</td>
<td>37</td>
<td>-</td>
<td>-</td>
<td>60</td>
<td>61</td>
<td>-</td>
<td>-</td>
<td>36</td>
<td>2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Token (to buy clothes and foods)</td>
<td>15</td>
<td>-</td>
<td>-</td>
<td>43</td>
<td>63</td>
<td>24</td>
<td>-</td>
<td>-</td>
<td>51</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Kindergarten and elders residencies</td>
<td>8</td>
<td>-</td>
<td>-</td>
<td>47</td>
<td>64</td>
<td>20</td>
<td>-</td>
<td>-</td>
<td>56</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Sport facilities</td>
<td>55</td>
<td>-</td>
<td>-</td>
<td>39</td>
<td>43</td>
<td>12</td>
<td>12</td>
<td>35</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Pilgrimage-tourism trip facilities</td>
<td>29</td>
<td>-</td>
<td>-</td>
<td>49</td>
<td>61</td>
<td>4</td>
<td>-</td>
<td>52</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Health-salutary facilities (health check-up, dental services, free counseling, etc.)</td>
<td>86</td>
<td>-</td>
<td>-</td>
<td>89</td>
<td>17</td>
<td>-</td>
<td>-</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Transportation service</td>
<td>77</td>
<td>-</td>
<td>-</td>
<td>57</td>
<td>24</td>
<td>-</td>
<td>8</td>
<td>26</td>
<td>4</td>
<td>-</td>
<td>$M_a$</td>
</tr>
<tr>
<td>Years of service right</td>
<td>87</td>
<td>-</td>
<td>-</td>
<td>78</td>
<td>-</td>
<td>21</td>
<td>6</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>$M_a$</td>
</tr>
<tr>
<td>Sharing in profit</td>
<td>7</td>
<td>4</td>
<td>-</td>
<td>71</td>
<td>67</td>
<td>20</td>
<td>-</td>
<td>27</td>
<td>-</td>
<td>-</td>
<td>$A_1$</td>
</tr>
<tr>
<td>Payment to ideas and innovations</td>
<td>23</td>
<td>-</td>
<td>-</td>
<td>47</td>
<td>38</td>
<td>26</td>
<td>-</td>
<td>57</td>
<td>1</td>
<td>4</td>
<td>$O$</td>
</tr>
<tr>
<td>Payment based on competency and capability</td>
<td>10</td>
<td>-</td>
<td>-</td>
<td>22</td>
<td>33</td>
<td>21</td>
<td>4</td>
<td>98</td>
<td>1</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Awards</td>
<td>20</td>
<td>4</td>
<td>-</td>
<td>60</td>
<td>72</td>
<td>8</td>
<td>4</td>
<td>27</td>
<td>1</td>
<td>-</td>
<td>$A_1$</td>
</tr>
<tr>
<td>Priority to buy stocks</td>
<td>25</td>
<td>-</td>
<td>-</td>
<td>85</td>
<td>36</td>
<td>37</td>
<td>12</td>
<td>1</td>
<td>-</td>
<td>$A_1$</td>
<td></td>
</tr>
<tr>
<td>Challenging work</td>
<td>80</td>
<td>-</td>
<td>-</td>
<td>72</td>
<td>11</td>
<td>8</td>
<td>-</td>
<td>24</td>
<td>1</td>
<td>-</td>
<td>$I$</td>
</tr>
<tr>
<td>Variety of working activities</td>
<td>47</td>
<td>-</td>
<td>-</td>
<td>92</td>
<td>32</td>
<td>-</td>
<td>-</td>
<td>24</td>
<td>1</td>
<td>-</td>
<td>$A_1$</td>
</tr>
<tr>
<td>Favorite working duties</td>
<td>44</td>
<td>-</td>
<td>-</td>
<td>64</td>
<td>31</td>
<td>24</td>
<td>-</td>
<td>32</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>The sense of having identity and being important due to the job</td>
<td>80</td>
<td>-</td>
<td>-</td>
<td>72</td>
<td>11</td>
<td>8</td>
<td>-</td>
<td>24</td>
<td>1</td>
<td>-</td>
<td>$M_a$</td>
</tr>
<tr>
<td>The opportunity to grow and promote</td>
<td>47</td>
<td>-</td>
<td>-</td>
<td>92</td>
<td>32</td>
<td>-</td>
<td>-</td>
<td>24</td>
<td>1</td>
<td>-</td>
<td>$O$</td>
</tr>
<tr>
<td>Participation in decision making</td>
<td>44</td>
<td>-</td>
<td>-</td>
<td>64</td>
<td>31</td>
<td>24</td>
<td>-</td>
<td>32</td>
<td>1</td>
<td>-</td>
<td>$O$</td>
</tr>
<tr>
<td>Freedom of action and authority</td>
<td>40</td>
<td>-</td>
<td>-</td>
<td>64</td>
<td>52</td>
<td>-</td>
<td>-</td>
<td>39</td>
<td>1</td>
<td>-</td>
<td>$O$</td>
</tr>
<tr>
<td>Working feedback</td>
<td>28</td>
<td>-</td>
<td>-</td>
<td>60</td>
<td>60</td>
<td>-</td>
<td>12</td>
<td>35</td>
<td>1</td>
<td>-</td>
<td>$A_1$</td>
</tr>
<tr>
<td>Acquiring reputation (introducing on the website, selecting as a sample employee, etc.)</td>
<td>5</td>
<td>-</td>
<td>41</td>
<td>74</td>
<td>28</td>
<td>-</td>
<td>45</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>$A_1$</td>
</tr>
<tr>
<td>Acknowledgments (verbal thanks, thanks in written form and officially, recording appreciation in the profile)</td>
<td>19</td>
<td>-</td>
<td>59</td>
<td>62</td>
<td>9</td>
<td>-</td>
<td>43</td>
<td>4</td>
<td>-</td>
<td>$A_1$</td>
<td></td>
</tr>
<tr>
<td>Favorable working conditions (suitable temperature, adequate light, appropriate heating and cooling systems, sufficient space, etc.)</td>
<td>85</td>
<td>-</td>
<td>77</td>
<td>-</td>
<td>14</td>
<td>17</td>
<td>3</td>
<td>-</td>
<td>$M_a$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Floating working hours</td>
<td>11</td>
<td>-</td>
<td>-</td>
<td>31</td>
<td>86</td>
<td>9</td>
<td>5</td>
<td>48</td>
<td>2</td>
<td>3</td>
<td>$A_1$</td>
</tr>
<tr>
<td>Work at home (distance working)</td>
<td>-</td>
<td>-</td>
<td>22</td>
<td>37</td>
<td>37</td>
<td>-</td>
<td>94</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>$I$</td>
</tr>
<tr>
<td>Possibility of choosing rewards (cafeteria)</td>
<td>-</td>
<td>-</td>
<td>29</td>
<td>52</td>
<td>12</td>
<td>-</td>
<td>101</td>
<td>1</td>
<td>1</td>
<td>$I$</td>
<td></td>
</tr>
<tr>
<td>Special work room</td>
<td>9</td>
<td>-</td>
<td>-</td>
<td>17</td>
<td>30</td>
<td>48</td>
<td>-</td>
<td>89</td>
<td>3</td>
<td>-</td>
<td>$I$</td>
</tr>
<tr>
<td>Dedicated secretary</td>
<td>6</td>
<td>5</td>
<td>-</td>
<td>14</td>
<td>37</td>
<td>12</td>
<td>-</td>
<td>119</td>
<td>2</td>
<td>1</td>
<td>$I$</td>
</tr>
<tr>
<td>Personal driver and special parking</td>
<td>8</td>
<td>5</td>
<td>-</td>
<td>12</td>
<td>44</td>
<td>24</td>
<td>-</td>
<td>101</td>
<td>2</td>
<td>-</td>
<td>$I$</td>
</tr>
<tr>
<td>Furnished office with equipment</td>
<td>9</td>
<td>5</td>
<td>-</td>
<td>14</td>
<td>53</td>
<td>44</td>
<td>-</td>
<td>69</td>
<td>2</td>
<td>-</td>
<td>$A_1$</td>
</tr>
<tr>
<td>Appreciation of the family (sending a flower basket to the home, inviting the family for a meal, etc.)</td>
<td>8</td>
<td>-</td>
<td>59</td>
<td>56</td>
<td>40</td>
<td>-</td>
<td>32</td>
<td>1</td>
<td>-</td>
<td>$A_1$</td>
<td></td>
</tr>
<tr>
<td>Private meeting with senior managers</td>
<td>37</td>
<td>-</td>
<td>48</td>
<td>28</td>
<td>20</td>
<td>-</td>
<td>61</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>$I$</td>
</tr>
<tr>
<td>Work and family balance</td>
<td>97</td>
<td>-</td>
<td>59</td>
<td>23</td>
<td>-</td>
<td>-</td>
<td>14</td>
<td>2</td>
<td>1</td>
<td>$M_a$</td>
<td></td>
</tr>
</tbody>
</table>

must-be attributes ($O_M$) and 6 strategies were categorized as one-dimensional tending toward attractive attributes ($O_A$). As an example, strategies such as retirement plan and payment based on competency and capability were among the one-dimensional tending toward must-be attributes ($O_M$), which means that the line slope of these strategies in the
functional area was less than their line slope in the dysfunctional area; or in other words, if these strategies were selected and performed, their influence of their absence on employee dissatisfaction was more than the influence of their presence on employee satisfaction. Strategies such as entertainment facilities and favorite work tasks were among one-dimensional tending toward attractive attributes ($O_A$), which means that the line slope of these one-dimensional strategies in the functional area was greater than their line slope in the dysfunctional area; or in other words, if these strategies are selected and performed, the influence of their presence on employee satisfaction was more than the influence of their absence on employee dissatisfaction. Also, according to Table IV, the absolute value difference between SI and DI in terms of participation in decision making, as well as the freedom of action and authority strategies was less than the other strategies. Compared to other strategies, the line of these two was closer to the 45° line of absolute one-dimensional attributes ($O_A$), and if the 0.03 ratio of the SI value of these strategies was reduced and added to their DI value, these strategies could be also transformed into absolute one-dimensional requirements.

As the literature review indicated, various studies have been carried out on developing the Kano model, among which Pouliot (1993), Shahin et al. (2013) and Shahin and Nekuie (2011) can be referred to. It is noteworthy that the focus of none of these papers was on one-dimensional attributes as one of the prevailing and overwhelming attributes of the Kano model. In other words, none of the developed forms of the Kano model, which were presented earlier, provides an indicator for distinguishing one-dimensional attributes and they all considered all one-dimensional attributes in one single category. It should be mentioned that in some cases, for technical or financial reasons, organizations cannot simultaneously meet two or more employees’ requirements. Therefore, prioritized and selecting compensation strategies seem useful and create competitive advantage for the organization. Also, as it was mentioned, one-dimensional attributes if met or not can have different effects on customer satisfaction/dissatisfaction and actually appear in the Kano model as two half-lines with different slopes. However, the basic Kano model does not have a criterion to distinguish these features. In this study, by developing the Kano model and focusing on one-dimensional requirements, an attempt was made to make this technique more effective. It should be mentioned that another distinguished point of the present study compared to other studies on the development of the Kano model is its innovative approach in using two indicators of SI and DI to classify one-dimensional attributes. The use of the Kano model in prioritizing and selecting employee compensation strategies also seems an innovative idea, which is unique in the literature of HRM.

<table>
<thead>
<tr>
<th>One-dimensional attributes</th>
<th>SI</th>
<th>DI</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retirement plan</td>
<td>0.52</td>
<td>−1.00</td>
<td>$O_M$</td>
</tr>
<tr>
<td>Unemployment insurance</td>
<td>0.49</td>
<td>−0.78</td>
<td>$O_M$</td>
</tr>
<tr>
<td>Sickness leave</td>
<td>0.43</td>
<td>−0.63</td>
<td>$O_M$</td>
</tr>
<tr>
<td>Housing allowance</td>
<td>0.57</td>
<td>−0.64</td>
<td>$O_M$</td>
</tr>
<tr>
<td>Health-sanitary facilities</td>
<td>0.55</td>
<td>−0.91</td>
<td>$O_M$</td>
</tr>
<tr>
<td>Payment based on competency and capability</td>
<td>0.55</td>
<td>−0.82</td>
<td>$O_M$</td>
</tr>
<tr>
<td>The opportunity to grow and promote</td>
<td>0.64</td>
<td>−0.71</td>
<td>$O_A$</td>
</tr>
<tr>
<td>Paying vacation time and turnover</td>
<td>0.62</td>
<td>−0.52</td>
<td>$O_A$</td>
</tr>
<tr>
<td>Feasts gift</td>
<td>0.68</td>
<td>−0.47</td>
<td>$O_A$</td>
</tr>
<tr>
<td>Payment to ideas and innovations</td>
<td>0.73</td>
<td>−0.56</td>
<td>$O_A$</td>
</tr>
<tr>
<td>Favorite work tasks</td>
<td>0.81</td>
<td>−0.56</td>
<td>$O_A$</td>
</tr>
<tr>
<td>Participation in decision making</td>
<td>0.61</td>
<td>−0.55</td>
<td>$O_A$</td>
</tr>
<tr>
<td>Freedom of action and authority</td>
<td>0.59</td>
<td>−0.53</td>
<td>$O_A$</td>
</tr>
</tbody>
</table>

Table IV. Categorizing one-dimensional employee compensation strategies based on the developed Kano evaluation table
In a comparison of this study with other studies performed in the field of employee compensation, it seems that most of investigations (e.g. Johnson et al., 2016; Werner and Ward, 2004) are limited merely to a specific subject in the field of quality management such as service quality, while interdisciplinary studies such as the subject of this paper on employee compensation strategies are very rare and scarce. It should be mentioned that by using or developing the existing tools and methods of quality management in other disciplines such as HRM, the effectiveness of employee compensation systems can be improved. This, in turn, can meet organizational requirements better and can create competitive advantage for organizations, just as the current study did.

With respect to the general order rule of the importance of attributes for fulfillment ($M \rightarrow O \rightarrow A \rightarrow I$), an organization must, as far as possible, meet employee compensation options that are in the category of must-be strategies (such as fixed monthly salary and transportation service); increase one-dimensional strategies (such as a retirement plan and payment based on competency and capability); and perform attractive strategies (such as awards and work feedback) as much as possible. Organizations can also eliminate strategies that are in the category of indifferent attributes (such as working at home and special work room) from the employee compensation system in order to control organizational costs. This is because their existence or absence does not have that much impact on employees’ satisfaction. Also, regarding the results of the revised Kano evaluation table, if the organization for financial or technical reasons cannot simultaneously consider two or more one-dimensional strategies for its employees, it should place the prioritized strategies and select the most important strategy in order to obtain higher employee satisfaction and to create competitive advantage over its competitors. For example, if the studied organization is not able to consider payment based on competency and capability and payment to ideas and innovations for its employees, simultaneously, according to the findings, since payment based on competency and capability is one-dimensional tending toward must-be attribute ($O_M$) and payment to ideas and innovations is one-dimensional tending toward attractive attribute ($O_A$), the organization should first select the payment based on competency and capability strategy based on the general order rule of the Kano model.

8. Conclusions

As it was explained, in the studied company there were diverse employee compensation strategies. If such strategies are aligned with the requirements of the employees, they will add to the effectiveness of the employee compensation system of the company. In this study, an attempt was made to take an effective step in this regard by designing an effective employee compensation system for the organization as a case study. For this purpose, first, the Kano model was revised based on an innovative approach and by developing the Kano evaluation table for one-dimensional attributes. Then, employee compensation strategies were identified based on the literature review and were screened by experts. In the next step, the identified strategies were categorized by the revised Kano model proposed by Shahin et al. (2013) and finally, the one-dimensional strategies were re-categorized by the developed Kano model.

Findings indicated that out of the 44 employee compensation strategies, 6 were must-be, 13 were one-dimensional, 18 were attractive and 7 were indifferent attributes. Also, according to the results of the developed Kano model, out of the 13 one-dimensional attributes, 7 strategies were one-dimensional tending toward must-be attributes ($O_M$) and 6 strategies were one-dimensional tending toward attractive attributes ($O_A$).

In summary, the literature review indicated that most of the studies carried out on the Kano model were related to customers and less attention was paid to the application of this model within the organization and particularly in HRM and employee compensation. Therefore, one of the aims of this study was to fill this research gap. Another aspect of the
innovation of this study that can be referred to is the use of a new and innovative approach, which is the use of two SI and DI indicators in classifying one-dimensional attributes. Also, among the advantages of the revised model over the basic Kano models is the more accurate distinguished categorization of the one-dimensional attributes.

The revised model of this study helps organizations in controlling their costs regarding employee compensation system. It also results in increased employee satisfaction. For example, an organization can eliminate employee compensation strategies that are located in the indifferent requirements category for which, their implementation can be costly (such as special work room and dedicated secretary); and on the other hand, in order to increase employee satisfaction, attractive requirements (such as floating work hours and work feedback) can be considered in the employee compensation system. Organizations can also benefit from the proposed approach by further prioritization of strategies which, in turn, might lead to increased employee satisfaction.

It is important to note that the case study was limited to a process-based production company. To achieve more accurate results and to assess the effectiveness of the proposed approach, a larger statistical population should be considered and the revised model should be further examined in different fields and in various organizations. This study was limited to a specific time period and since the requirements of employees can change over time, continuous studies on the same organization under study seem necessary. Another limitation of this study similar to most of the studies on the Kano model is that the types of attributes were determined according to the frequency ratio (e.g. Table III) and in some cases, a slight change in the participants’ responses can transfer an attribute from one category to another.

While the subject focus of this study was on the application of the Kano model in employee compensation as one of the HRM topics, researchers can examine the application of the revised model in other subjects of HRM. More studies can be performed to increase the accuracy of determining the type of attributes by incorporating the concept of fuzzy approaches in the Kano model with the aim of removing the limitation of using the frequency ratio.

References


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Exploring patient empowerment

The link between satisfying physician relationship and patient involvement

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Abstract

Purpose – The purpose of this paper is to develop a research framework for exploring and improving patient empowerment through the analysis of the effects produced by a satisfying physician relationship on patient involvement in the healthcare process.

Design/methodology/approach – The authors begin with a literature review of patient empowerment in healthcare, useful to highlight the importance of relational aspects. Then, the authors tested the hypotheses of the research through the analysis of 450 questionnaires. The results are analyzed through covariance-based structural equation modeling.

Findings – This paper highlights how empowerment is a more complex phenomenon, needing many dimensions to be investigated. The hypotheses were tested, and correlations computed, highlighting a medium-strong positive correlation between physician relationship and patient involvement determining satisfying patient empowerment.

Research limitations/implications – The considerations conducted in the paper are restricted to physician relationship and needs further research aimed to analyze and evaluate the changes in patient behaviors influenced by empowerment.

Practical implications – The research points offer new insight into patient empowerment and allow the healthcare provider to create new opportunities for promoting patient empowerment through the development of quality relationship for effective patient involvement.

Originality/value – The study developed contributes new insight about patient empowerment in the healthcare management literature, proving the key role of satisfying physician relationship useful for future researches.

Keywords Patient satisfaction, Participation, Empowerment, Patient involvement, Physician relationship, Self-management

Paper type Research paper

1. Introduction

The issue of customer participation is critical in fields such as health (McColl-Kennedy et al., 2017), where patients are often unwilling to participate (Berry and Bendapudi, 2007; Zaimuddin et al., 2013), and healthcare organizations have always considered the patient as a passive subject (Protheroe et al., 2008; McColl-Kennedy et al., 2012; Elg et al., 2012; Gustavsson et al., 2016).

In recent years, the need to identify the way in which patients become more aware and involved in the service delivery system has become even more critical. Furthermore, the increased patient participation is closely tied to the need to promote more conscious access to health services which achieves, at the same time, the containment of health spending, the self-determination of patients and greater well-being. Nowadays, the health policy of West countries are increasingly promoting the active participation of the patients in health services, both for the effects that it has on health outcomes (especially for chronic disease), and for the impact of health spending on the gross domestic product of countries (Martin et al., 2005; Bate and Robert, 2006; Elg et al., 2012). The policymakers’ interest in developing the active participation of patients in health services has been supported by studies focusing on changing the role of patients in health services, how to promote these new behaviors and the benefits they generate for the patient and for health expenditure (Davis et al., 2007; McColl-Kennedy et al., 2012, 2017; Smith et al., 2009; Carman et al., 2013).
It can, therefore, identify two different priorities (closely related) that health organizations should promote patient participation, especially for those suffering from chronic diseases:

- the recognition of an active and aware role of the patient in all phases of the health process such as prevention, diagnosis, care and rehabilitation; and

- the ascription to the patient of greater participation and responsibility in accessing to healthcare services, to promote more careful and aware consumption processes and achieving efficiency conditions for healthcare providers and, in general, for the economy of the country.

As stated, it leads to the empowerment of patients, namely, a patient management that, through health education and the promotion of health-friendly behaviors, provides the person with the critical tools to make better decisions for their well-being, reducing cultural and social inequalities; although scholars (Essén et al., 2016), have shown how patient participation in healthcare can also be seen as a tool for patient exploiting.

Thus, the purpose of this paper is to develop a research framework for exploring and improving knowledge about patient empowerment starting from the consideration of the relationship developed between physician and patient. That is, if and to what extent a satisfying relationship between physician and patient influences patient involvement, where for patient involvement it refers to the patient’s ability to self-manage care and to his/her active and conscious participation in the healthcare process. Particularly the research questions analyzed are:

**RQ1.** Does a satisfying physician-patient relationship affect patient self-management?

**RQ2.** Does a satisfying physician-patient relationship affect patient participation?

**RQ3.** Does patient self-management affect patient empowerment?

**RQ4.** Does patient participation affect patient empowerment?

The paper begins with a literature overview of patient empowerment in healthcare highlighting the tools considered by scholars as patient empowerment enabling. Then, the study analyses the factors that affect patient empowerment with emphasis on the involvement of the patient, afterward we assess our research hypotheses. Finally, the study concludes with a discussion of theoretical and managerial implications as well as limitations and what further analysis can be developed in the future.

The study contributes a novel framework for patient empowerment in the quality management literature, demonstrating new insights for future research, especially because it overcomes the purely theoretical analysis developed in the literature, allowing to identify as the quality of the relationship between physician and patient promotes the active and responsible involvement of the patient, namely, the patient empowerment.

### 2. Background and literature overview

#### 2.1 Beyond patient participation in health services: empowerment

In the healthcare sector, the promotion of more conscious and active participation is achieved through processes of empowerment, a word used for the first time in the healthcare sector by Rappaport (1981), in reference to the social policy adopted for people affected by mental handicaps. Rappaport, in particular, considers empowerment as the only policy that may increase the chance that people affected by mental handicaps have to control their own life, avoiding the adoption of centralized solutions, but promoting those that, on a case to case basis, render themselves appropriate to different contexts.
In the healthcare context, the empowerment is understood mostly as a process through which people and communities acquire greater control, awareness and self-determination concerning decisions and actions that affect their own health (Braithwaite and Lythcott, 1989; Breslow, 1992; Bodenheimer et al., 2002; Coulter and Ellins, 2007). Freire (1993), particularly, proves the role of empowerment both as an outcome and a process. In the first case, empowerment allows for the measurement of the increase of the patient's ability to take autonomous and informed decisions about his/her own health, while, in the second case, it permits the development of actions aimed at promoting the adoption of modes of behavior by the patient that are more critical, autonomous and informed, which culminate in empowerment as an outcome (Anderson and Funnell, 2010). Schulz and Nakamoto (2005, 2013), instead, proposed a model which shows as the combined effect of empowerment and knowledge generate variance in the patient's behavior. In this regard, they identify four distinct dimensions of empowerment: meaning, competence, self-determination and impact (see also Camerini et al., 2012).

The complexity of empowerment for health allows for the development of reflections on the effects that it has on the patient. First, two aspects appear that mirror each other and impact on the processes connected to the active participation of the patient. Indeed, giving to the patient an active role in the healthcare process, if on one side it attributes to him/her greater rights and range of discretion, on the other side, it requires they assume a more informed and responsible behavior in the process itself (Hirschman, 1970; Ippolito et al., 2013).

What is told constitutes a major challenge for the healthcare provider, because for the specificities of the health sector, e.g. information asymmetries and so on. Indeed, the patients have little awareness of the consequences in terms of costs that have their purchases or behaviors (Berry and Bendapudi, 2007; Sofaer and Firminger, 2005), or, in any case, they may have little interest in the economic impact of the care needed to solve their own health problems, which is often added, with a multiplier effect, the unwillingness to participation for reasons that may be psychological, of age, economic, etc. In this regard, Berry and Bendapudi (2007) highlight how in the healthcare sector customers are often reluctant to take part, especially considering the latter an obligation.

Second, the ultimate end of health empowerment is well-being; this highlights the change from a focus on illness to a focus on the physical and psychological health of the patient, aspects that are intimately connected and which influence each other reciprocally. You consider, in the paper is used the term “well-being” rather than the expression “quality of life” used by some scholars (Cohen et al., 1996; McColl-Kennedy et al., 2012; Sweeney et al., 2015). In this study, quality of life is viewed as a wider concept that goes beyond the sphere of the physical and psychological health of the patient (well-being), including in addition to well-being itself the welfare policy of the country in which the patient lives, the quality of services and organization of the person's own local community, their political freedom and security and so on (Sen, 1999). Moreover, according to our meaning of well-being, Engström and Elg (2015) analyzed the effects of patients participation on personal well-being, articulating the latter in its dimensions: physical, psychological, existential and support.

Empowerment, moreover, assumes a critical role in government, indeed, health policy of western countries is increasingly promoting the active participation of the patients in health services, especially in developing policies that aim at changing the organizational culture of the providers, facilitate access to care and promote communication. As stated, allow to create conditions for the development of patient-centered care systems focused on the individual needs of patients and their experiences, creating the conditions for the effective involvement of the patient in the care management (Sofaer and Firminger, 2005; Crawford et al., 2002), but also a positive impact on the outcomes (Chen et al., 2013).

Empowerment is thus a complex construct that goes beyond the aspects of proactive participation and customer satisfaction considered in the context of service management,
which involves social, psychological and economic aspects as underlined by the relevant literature highlighting its multidimensional character (Rappaport, 1981, 1984; Zimmerman and Rappaport, 1988), and it is, therefore, consistent with the complexity and multidimensionality of the active participation of citizens in health services.

In the theoretical approaches to empowerment, until now, there is a lack of understanding in how the healthcare actors should approach resource integration for the benefit of the patient, and most of all, there is very little attention to the system’s view of the complex phenomena occurring within the service network. In this regard (January 2019) it is developed a literature review dealt with patient empowerment aimed at verifying the extension of the scholars’ analysis of the tools that enable the patient to empowerment. The literature review has been developed through the database of Web of Science, it is used as a keyword patient empowerment, in particular, the research considered only the articles in English published in the last 11 years (from 2008 to 2019) in the categories nursing, management, business, public administration e-communication. Web of Science highlighted 362 articles, of which 332 nursing, 13 management, 12 business, 5 public administration and 2 communication. This first information allows to highlight how most of the literature on patient empowerment is developed by nursing journals, little is the consideration of journals that have a disciplinary field of management or business. The review involved a first analysis of the abstracts in order to eliminate articles about work empowerment (nurses and other health workers), which made it possible to reduce articles to 99.

Then, the 99 articles were read rapidly to eliminate the papers that analyzed the patient empowerment in general terms without deepening the study of the tools that enable empowerment. This last phase allowed to reduce to 40 articles that were then analyzed in depth to highlight the tools empowering the patient empowerment considered by scholars.

The analysis of the 40 articles allowed to identify five macro types of tools enabling patient empowerment (Table I).

The macro types pointed out through the literature review are very interesting, also because they allow us an analysis of tools that healthcare providers adopt to promote the patient empowerment, especially in chronic disease. Most of the articles highlight the importance assumed for the patient empowerment by the relational aspects, underlining how the quality of the latter positively influences the active and responsible patient involvement in the healthcare process.

However, there are few articles that consider the relational aspects in the relationship between patients and physicians and how they affect empowerment in a managerial context.

<table>
<thead>
<tr>
<th>Tools patient empowerment enabler</th>
<th>Articles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient-centered care models</td>
<td>Jerofke et al. (2014)</td>
</tr>
</tbody>
</table>

Table I. A literature review of patient empowerment (2008–2019)
analysis perspective, this is also explained by the fact that most of the papers of the literature review (35/40) are of nursing journals.

2.2 Factors influencing patient empowerment and conceptual model

According to our literature review, a patient empowerment model is proposed that highlights the quality driver factors for the development of empowerment in the healthcare processes (Figure 1).

A first critical aspect for the development of patient empowerment is the physician relationship, definable as “the communication that provides useful or needed information, receiving advice about treatments and ask questions about their own condition” (Smailhodzic et al., 2016).

A further critical aspect of the physician relationship for patient empowerment is the quality of this relationship developed with the healthcare professionals (Tan and Goonawardene, 2017), consisting also in the quality of the information received (Ouschan et al., 2006; Zineldin et al., 2014). Many scholars consider the quality of the information through physician and patient as part of the therapy (Tveiten and Meyer, 2009), mostly, for the effects, it creates on the patient’s sense of control (Tveiten and Knutsen, 2011).

Since it represents an important factor for the effective implementation of a healthcare management focused on patient satisfaction, expression of a good-quality service (Moretta Tartaglione et al., 2018), the quality of the relationship developed between the patient and the healthcare professionals also plays an important role for the empowerment (Ouschan et al., 2006; Halldorsdottir, 2008; Desborough et al., 2017). According to Garrett (2019), we can state that only a little of which much is written is then applied in practice.

However, it should be noted that the quality of the relationship plays a critical role for patient empowerment even when it refers to other actors in the healthcare network; an example is the case of online support communities or self-help groups (Chen et al., 2008) or tools for creating and sharing knowledge (Coulter and Ellins, 2007; Schulz and Nakamoto, 2013). Shared knowledge could also be meant in a negative way as, e.g. online fake news (Frost et al., 2014).

The patient empowerment model analyzes two additional factors whose quality is important for the purpose of patient empowerment; the self-management and the participation. The effectiveness of these factors depends on the quality of the physician relationship that, in turn, influences patient empowerment (Ouschan et al., 2006). The choice to investigate the relationship between the patient and the doctor was a contextual choice, since within the Italian Health System the figure of the nurse specialized in chronic diseases is not envisaged, but only the two figures of nurses and pediatric nurse, while the management of chronic patients is still entrusted to the general physician (general practices). Contrary to what happens abroad, and especially in Angolophones countries, where the figure of the nurse specialist for the management of chronic patients is envisaged;

Figure 1.
Quality driver factors of patient empowerment (our model)
experience that also gives rise to high satisfaction in chronic patients, improving their quality of life (Turner et al., 2001; Vrijhoef et al., 2001; Neylon, 2015).

Self-management is the patient’s ability to manage independently his/her own health, it implies the development of very important skills, especially in patients with chronic disease, where self-care or self-management plays a critical role both to avoid worsening health conditions and to reduce the associated health costs. In this regard, studies on self-management in chronic patients have shown improvements in outcomes (Rochfort et al., 2018; Lee, 2018), even if the development of skills and abilities in the management of one’s own health requires adequate educational interventions (O’Brien et al., 2015).

Patient participation is the way in which the patient carries out treatments in the healthcare process; it involves the need to adhere to the therapy, to comply with the recommendations and warnings of health professionals (Tapp et al., 2018). As patient self-management, participation affects patient satisfaction and patient behavior outcomes (Mahapatra, 2017).

2.3 The link between patient empowerment and a satisfying physician relationship

The research framework adopted in the paper, with the related research questions, considers the effects produced by a satisfying patient-physician relationship for the development of patient involvement, which in turn generates the patient empowerment (Figure 1), according to Kay (2016). The choice of a satisfying patient-physician relationship it derives from the consideration of how the relationship between the physician and the patient was achieved in the past. The physician has always carried out his/her activity with considerable autonomy and discretion toward not only the management of the healthcare facility in which it is inserted but also of the patients (Walsh et al., 2019).

Furthermore, the physician has a position of power toward the patients based on the information asymmetry that characterizes the type of service offered and the strong specialization of the activity carried out (Sharma, 1997). This characteristic, combined with the coordination and control of the medical activity that takes place outside the organization (in the context of professional orders or colleges), causes inadequate attention to the needs of the patients.

At this point, it is necessary to clarify why the research uses the term involvement to synthesize both the patient self-management and patient participation in the healthcare process. The modalities with which the patient’s participation is realized do not consist solely in a series of actions and interactions, but impact on the cognitive and empathetic effects of participation in the healthcare process. This leads to the development of behaviors (physical and emotional) by the patient capable of promoting harmonious relationships with the other actors in the healthcare process characterized by a constant and long-lasting tuning aimed at loyalty (Hirschman, 1970).

These highlights, the sense of responsibility of the subject, constituting a model in which the intensity of the participation of the customer is more challenging in terms of dynamism, and this determines the development of positive and harmonious interactions with the service provider. An example of which said is the case of citizens who attend training courses on techniques of resuscitation and the use of defibrillators. Prahalad and Ramaswamy (2000), use the concept of involvement, with reference to the co-opting customer in the value-creating process, implicitly underlining the active role of the provider in the promotion of the participation of the customer.

Vargo and Lusch (2004) give to the term involvement the same connotation by analyzing the service-centered view of exchange and later using the term involvement (Vargo and Lusch, 2008) to write down the participation in co-production. Lusch et al. (2007), Kumar et al. (2010), Kohler et al. (2011), McColl-Kennedy et al. (2012) and Sweeney et al. (2015) use the term involvement, attributing to it a meaning very close to that which stresses the pro-active role of the provider in facilitating the active participation of the customer.
Bettencourt (1997), Auh et al. (2007) and Guo et al. (2013) use the term “involvement” with a significance that attributes a greater effort to the role of the client in the process of co-creation, on the same level as the provider, highlighting a reciprocal involvement at the same level.

3. Research design and methods

Given the complexity of patient empowerment, the aim of this paper is to analyze if and to what extent a satisfying physician-patient relationship affects patient involvement in the healthcare process creating fertile conditions for the development of patient empowerment. Therefore, a questionnaire were developed, in order to investigate the hypotheses reported in Table II, to verify which of these variables has more impact on patient empowerment.

The questionnaire consisted of five sections plus the personal data section. The first section was dedicated to the collection of personal data, analyzed in order to understand the main demographic characteristics of the sample in order to contextualize the interviewees and aimed to understand the average spending on over-the-counter drugs and food supplements, for hospital and domiciliary health services. A sub-section of the personal data field required how many respondents suffered from chronic diseases and which were specifically. The second section dealt with health education, important because, in the cases of chronic illnesses and not, this dimension leads to the improvement of the personal knowledge on the own disease and on the patients’ health literacy. The third section concerned communication and relationships, important because, especially in chronic patients, a good quality relationship and communication with the physician and the nurses and other health operators, enable the healthcare system to better understand individuals’ needs. The fourth section was about health self-management, important because, in both chronic and non-chronic patients, it highlights, the sense of responsibility of the patient in a healthcare process in which the intensity of the participation of the assisted is more challenging in terms of dynamism, and this determines the development of positive care behaviors. The fifth section was about patient involvement, important because it is necessary to involve the assisted in the care process to enable him/her to become an active part of the same part. The sixth section was about Web 2.0, focusing on the development of new technologies able to investigate the health opinion mining, as, e.g. through the analysis of online health communities.

The questionnaire was disseminated via computer-assisted web interview (CAWI) through a random sampling on the population of the Social Media as Facebook, WhatsApp and personal e-mails. Each construct has been built using multiple indicators adapted from the literature review and dimensions were tested through Likert scales, Nominal scales and Emoji Rating Scales.

Finally, 450 questionnaires were recollected, excluding cases presenting missing values that were appropriately invalidated.

Data were analyzed through R (www.r-project.org/) and SPSS software to test our hypotheses as from the literature and computing descriptive statistics. SPSS stands for statistical product and service solutions (http://spss.com) and provides many tools for data analysis enabling researchers to speed up research processes and data computation. R is open-source statistical software (www.cran.org) allowing you processing and manipulating

<table>
<thead>
<tr>
<th>S/N</th>
<th>Hypotheses</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1</td>
<td>There is a positive relationship between physician relationship and self-management</td>
</tr>
<tr>
<td>H2</td>
<td>There is a positive relationship between physician relationship and participation</td>
</tr>
<tr>
<td>H3</td>
<td>There is a positive relationship between self-management and patient empowerment</td>
</tr>
<tr>
<td>H4</td>
<td>There is a positive relationship between participation and patient empowerment</td>
</tr>
<tr>
<td>H5</td>
<td>There is a positive relationship between physician relationship and patient empowerment</td>
</tr>
</tbody>
</table>
data, the brainchild of Gentleman and Ihaka available on the market since 1996 (Ihaka and Gentleman, 1996).

Thus the hypotheses were tested below related to the research questions via structural equation modeling (SEM) to evaluate the weight of these dimensions in relation to patient empowerment; specifics for tested dimensions are reported in Table III; conceptual model is illustrated in Figure 1; the hypotheses are provided below.

4. Results
4.1 Internal analysis and evaluation of consistency
Verifying the consistency of the model an internal analysis was conducted. It can consider the $\alpha$ coefficient acceptable for this study, according to Cronbach (1951), recording a value between 0.7 and 0.8. As shown in Table IV, the model has a Cronbach’s $\alpha$ of .751.

4.2 Results of structural equation modeling
Pearson correlation coefficient (PCC) is an indicator evaluating the existence of a causal relationship between variables and measure how strong is this relationship (Adler and Parmryd, 2010) (Table V). Correlations between variables must be verified before testing the hypotheses, according to Kline (2015). The correlation between physician relationship and self-management has a PCC equal to 0.723 indicating a satisfying strong positive correlation between these variables; this is also the strongest correlation for the model.

The relationship between physician relationship and participation is quietly strong, with a positive correlation of 0.591, indicating a good positive relationship between these variables.

<table>
<thead>
<tr>
<th>Independent variable</th>
<th>Definition</th>
<th>Literature references</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physician relationship</td>
<td>Communication that provides useful or needed information, receiving advice about treatments and ask questions about their own condition</td>
<td>Smailhodzic et al. (2016)</td>
</tr>
<tr>
<td>Self-management</td>
<td>The active participation by people living with chronic conditions in managing their own health and care</td>
<td>Martz (2017)</td>
</tr>
<tr>
<td>Participation</td>
<td>Individual patient participation in treatment decisions, involvement in service development, integration of user perspectives in the evaluation of services</td>
<td>Castro et al. (2016)</td>
</tr>
<tr>
<td>Patient empowerment</td>
<td>Is a process that helps people gain control over their own lives and increases their capacity to act on issues that they themselves define as important</td>
<td>Ekman et al. (2016)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cronbach’s $\alpha$</th>
<th>Number of items</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.748</td>
<td>4</td>
</tr>
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<th></th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
</tr>
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<tbody>
<tr>
<td>Physician relationship</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-management</td>
<td>0.723</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Participation</td>
<td>0.591</td>
<td>0.620</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Patient empowerment</td>
<td>0.673</td>
<td>0.580</td>
<td>0.581</td>
<td>1</td>
</tr>
</tbody>
</table>

Table III. The independent variables

Table IV. Cronbach’s $\alpha$ in our model

Table V. Adjacency matrix with Pearson correlations in the model
Self-management and patient empowerment has a PCC equal to 0.581, posing evidence of a quite strong positive correlation. Following, the relationship between participation and patient empowerment emerged as a medium strong positive correlation with a correlation coefficient of 0.580.

There is a good positive relationship between physician relationship and patient empowerment with a correlation coefficient of 0.673, indicating another considerable relationship between dimension that will be discussed in Paragraph 5. Correlations are shown in Figure 2.

4.3 Fit indices
Evaluating the fitness of our model, various fitness indices were computed, including the coefficient of determination (\( R^2 \)), Pearson’s product-moment correlation coefficient and the standard error (SE) for the model. Fitness indices are reported in Table VI. As shown in the table, the Pearson’s product-moment correlation coefficient in the model is equal to 0.781, indicating a good causal relation (Lee Rodgers and Nicewander, 1988). The model has an adjusted \( R^2 \) of 0.610 demonstrating a good capability in explaining the variability of the response data in the SEM. Finally, computing the SE in the model, it found out a value of 0.742, indicating an inconsiderable error in the computed results.

4.4 Discriminant validity, multicollinearity test and bias of the estimators
SE is defined as the estimate of the standard deviation of the estimator in a sampling distribution, indicating the possible variation from the calculated value, in the model adopted SE has a value of 0.781, as reported in Table VI, indicating inconsiderable bias in the estimators. Significance has a value of 0.000, and, contrarily to what it would seem, this value indicates not a good significance in the results according to Nicholls (2001). Motivations in choosing these estimators could be found in the target population, not enabling to choose other dimensions to test the model and in the enormous computation due to the overall 12,000 tested modalities. In conclusion, the choice of estimators in the model can be considered well appropriate for this study (Table VII).

5. Discussion
Results from our quantitative analysis, conducted via SEM, presented quite good correlations in the model between the dimensions as shown in Figure 2.
First, results highlighted a strong positive relationship between physician relationship and self-management (H1). This positive correlation is in line with the literature review; an example could be the studies from Mahapatra (2017) and Karlson et al. (2018), underlining that a good relationship between physician and patients and good communication have a good impact on self-management and patient perceptions.

According to Heisler (2007), involving elder patients with chronic diseases (e.g., diabetes) in shared goals and in the decision-making process has a positive impact on self-care, and then on self-management, other than on their behavior. Allowing patients to be better-informed through the strongest relationship with their physician it can be seen an ameliorated approach in relation to their lifestyle and their motivation in pursuing healthy behavior, as for example in the case of patients on a diet, or in blood glucose monitoring.

Furthermore, values in the model show a quiet good positive relationship between physician relationship and participation (H2). These results are aligned with other authors in the literature, as for example Magnezi et al. (2015), conducting a study about the relationship between physician and patients into the patients’ participation context, highlighting that the main part of their sample would like to be considered as a friend of their physician.

Thus, these scholars stated that is necessary to have a sort of emphatic and kind relationship with the healthcare professionals and operators, needing a human-to-human relationship, based on personal needs and demonstrating that human relationships (human capital) are viable in the healthcare field.

Nevertheless, on the other hand, relationships and participation are studied by Eldh et al. (2006) exposing the case of participation and non-participation in healthcare. In their study, authors noticed that in the relationship between physician and patients, knowledge is preferable that information, because information is useful for patients only if this is given on the person’s needs, satisfying some temporarily needs and not allowing people to manage their health condition. Knowledge is useful when patients, being informed on their condition, become acknowledged of their illness situation and able to handle it.

Going forward, results are showing a quite good positive relationship between self-management and patient empowerment (H3). According to Anderson and Funnell, 2010, the results are in line with the literature, and as these scholars stated the patient empowerment is both a process and a result. On this regard, patient empowerment can be viewed as a process, intended as an educational intervention with the purpose of increasing patients’ ability in critical thinking and in managing their health condition. Moreover, according to Iskaksson et al. (2015), viewed as an outcome, patient empowerment is a strong sense of self-management and then self-efficacy emerged from the empowering process. As highlighted in the literature review (Jeon et al., 2010; Lirussi, 2010), there is a strong linking between self-management and patient empowerment, mainly when it is investigating chronic illnesses.

Furthermore, a good positive relationship between participation and patient empowerment emerged in the model (H4). The results are confirmative of other studies in the literature, as for example with the study conducted by Castro et al. (2018), highlighting

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Eigenvalue</th>
<th>Condition index</th>
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<tbody>
<tr>
<td>1</td>
<td>21.257</td>
<td>1.900</td>
</tr>
<tr>
<td>2</td>
<td>1.395</td>
<td>4.084</td>
</tr>
<tr>
<td>3</td>
<td>0.281</td>
<td>9.091</td>
</tr>
<tr>
<td>4</td>
<td>0.269</td>
<td>9.233</td>
</tr>
<tr>
<td>5</td>
<td>0.230</td>
<td>10.055</td>
</tr>
<tr>
<td>6</td>
<td>0.201</td>
<td>10.746</td>
</tr>
<tr>
<td>7</td>
<td>0.149</td>
<td>12.509</td>
</tr>
<tr>
<td>8</td>
<td>0.145</td>
<td>12.656</td>
</tr>
</tbody>
</table>

Table VII. Eigenvalues and condition indices
that there is a strong relationship between patient participation and their empowerment due to specific characteristics of physicians and operators as a positive attitude, social skills, being an open-minded person and the ability to put situations in a perspective way focusing on the most important features and aspects.

Moreover, according to Donnelly et al. (2018) who conducted a study on patient participation and care-planning meetings, the results can conclude that nowadays there is a considerable attention on new models and plans for healthcare management and organization, as CPM and communication between operators, due to an increased participation and empowerment in the patients, with a noticeable effects in elder people, mainly if affected from a chronical disease.

According to this last consideration, it is possible to conclude that patient participation is crucial for effective patient empowerment.

Finally, a quite strong positive relationship between physician relationship and patient empowerment emerged in the results (H5). This result is in the wake of the literature review, according to Petrič et al. (2017), conducting an analysis focused on digital patient-physician relationship related to functional and dysfunctional empowerment and highlighting that the main difference between these two types of empowerment is into who is addressed: individual empowerment is related to personal growth in handling chronic illnesses and collective empowerment is related to a social aspect amenable to patient-physician relationship.

In conclusion, all the discussed results are aligned with the literature review and, according to this last consideration, it can be stated that the conceptual model developed is fitting the healthcare trends in academic studies.

6. Conclusions and practical implications

This paper has developed a research framework for exploring and improving patient empowerment through the analysis of the effects produced by a satisfying physician relationship on patient involvement in the healthcare process. The study developed a research framework research by means of a questionnaire disseminated via CAWI through a random sampling on the population of the Social Media as Facebook, WhatsApp and personal e-mails. The results of the 450 questionnaires are analyzed through covariance-based SEM and pointed out the quiet strong positive relationship between physician relationship and patient empowerment through the mediation of the effects that a positive relationship between physician and patient generates on the behaviors the patient has in the participation of the healthcare process and in the management of his/her own health.

The paper discussed above the consistency of the results emerged from the research with the studies developed by other scholars, however, interesting studies could be carried out to analyze how the relationship between doctor and patient could be mediated by the use of tools that could stimulate the development of a satisfying relationship, as e.g. social media.

The research can provide useful hints to healthcare organizations for understanding and affecting the dynamics with which patient participates in the healthcare process and manages his/her health by promoting patient empowerment acting on the features of the relationship between physician and patient, e.g. through communication training courses and/or the adoption of tools and strategies that can promote the development of a satisfying relationship.

The main practical implications of this work can be found in various practices of technological-communicative progress within health organizations. On the one hand, the main problem is precisely from the point of view of human-to-human interaction, since health professionals should learn new ways, also of a digital nature, to improve their relationship with the patients and thus create new ways of putting in relation, as well as assistance dynamics based on empathy and trust (Pellegrini, 2017; Ortiz and Rosenthal, 2019), of ways to promote a relationship of care increasingly tailored to the patient and which allows for the promotion of self-management and health education through the involvement of the patient himself.
Another practical implication can be found within the healthcare organizations themselves, as the implementation and the creation of environments aimed at developing relations with health professionals and the continuous involvement of these in welfare practices, e.g. greater relational development of contact points and information points, such as the implementation of augmented or virtual reality within health facilities that allow referencing useful Web 2.0 portals to a safer and closer use of the patient’s medical information, or greater attention to the formation of customer care satisfaction manager who can constantly monitor patients in their state of health and their physical-emotional satisfaction as well as providing them with important information on hospital, home and extended dynamics concerning the health world.

The considerations conducted in this paper are restricted to physician relationship and needs further research aimed to analyze and evaluate the changes in the patient behaviors influenced by empowerment also for aspects not strictly related to patient empowerment as the strengthening of healthcare provider loyalty programs or the interaction among patients in the healthcare organization.

References


Rynd Selected References


Further reading


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Integrated internal audit in management system
A comparative study of manufacturing firms in Malaysia

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Faculty of Business and Accountancy,
University of Malaya, Kuala Lumpur, Malaysia, and
Haslida Abu Hasan
University of Malaya, Kuala Lumpur, Malaysia

Abstract
Purpose – The purpose of this paper is to investigate the implementation of integrated internal audit management (IIAM) and compare the implementation of IIAM by Malaysian firms with different certifications (ISO 9001, ISO 14001 and OHSAS 18001).

Design/methodology/approach – This study involves three studies on the implementation of integrated internal audit processes. Furthermore, this study compares the implementation of the audit in the selected firms. The qualitative research methodology was adopted to analyse the data.

Findings – This study is an exploratory study and the findings indicate the differences between the implementation of the internal audit process across different firms. All the firms are highly motivated and demonstrate resource management whilst implementing the IIAM while firms experiencing the same difficulties. The study also found that all of the firms are enjoying similar benefits.

Research limitations/implications – The scope of this research paper is limited to three Malaysian manufacturing firms with different quality certifications: ISO 9001, ISO 14001 and OHSAS 18001. Thus, the finding cannot be generalised to all firms in Malaysia. However, the findings are significant as they present an interesting comparison between the implementation of IIAM by manufacturing firms in Malaysia.

Originality/value – Although the integration of management systems has been analysed many times, this study focussed on the comparison of firms’ practices of the IIAM.

Keywords Manufacturing firms, Integrated internal audit, Management system

Paper type Case study

1. Introduction
Increasing competitiveness and economic demands have driven many firms to adopt various management tools. There are various benefits of adopting management tool including improving product quality, streamlining processes and the reduction of environmental damages (Simon et al., 2014). Firms seek quality certifications, such as ISO 9001 Quality Management Systems (QMS), ISO 14001 Environmental Management Systems (EMS) and OHSAS 18001 Safety Management System and Occupational Health (OHSAS) to gain competitive advantages and, subsequently, increase their business growth (Sampaio and Neves, 2012). In the Malaysian context, while the implementation of the integrated management system (IMS) is rather new compared to other developed countries, its implementation has helped create a more dynamic management system in Malaysia (Arifin et al., 2009). In this light, the IMS has been considered as a system that can minimise workload, cost and human resources in the context of middle-income countries like Malaysia (Arifin et al., 2009).

IMS is defined as “a set of interconnected processes that share a pool of human, information, material, infrastructure, and financial resources in order to achieve a composite of goals related to the satisfaction of a variety of stakeholders” (Karapetrovic and Willborn, 1998). Rajendran and Devadasan (2005) recognised the need to adopt an integrated standard
for auditing systems, such as QMS, EMS, and Occupational Safety and Health Management System (OHSAS) which are some of the most widely implemented standards around the world (Domingues et al., 2015).

For many years, firms have used individual certification to increase their management systems. However, scholars have argued that this approach is often marred with bureaucracy, high cost and redundancy. Kymal (2015) claimed that quality standard certifications are expensive to obtain where each standard certification costs around $50,000–$70,000, while the cost of maintaining the standard is around $30,000–$35,000. In response to this issue, various studies have focussed on the establishment of IMS (Nunhes et al., 2016). Over the years, IMS audit or integrated internal audit management (IIAM) has been acknowledged as an efficient management system which saves time, eliminates bureaucracy and reduces the use of human, technical and financial resources (Abad et al., 2014; De Oliveira, 2013; Karapetrovic and Casadesus, 2009; Zeng et al., 2007).

Therefore, this study aims to investigate and compare the implementation of IIAM by different firms in the Malaysian manufacturing industry. Each of these firms has been awarded at least two MS standards. The comparison made in this study will help to identify the implementation pattern of the audit process in selected firms and help to propose other factors that could affect this process.

2. Literature review

Perhaps the most widely used definition of an audit is presented in Karapetrovic and Willborn (1998b) where it is defined as “systematic examination to determine whether activities and related results conform to planned arrangements and whether these arrangements are implemented effectively and are suitable for the organisation’s policy and objectives”. Thus, organisations with IMS status are expected to implement integrated internal and external audits (Bernardo et al., 2017; Karapetrovic and Willborn, 1998; Kraus and Grosskopf, 2008; Savino and Batbaatar, 2015; Simon et al., 2014).

Past studies argued that integrating the different management systems’ audits could encourage continual improvement activities and, at the same time, enhance efficiency (Simon et al., 2011; McDonald et al., 2003). Therefore, audit integration can be defined as “managing the processes, improving firm performance, cutting costs, as well as driving continual improvement” (Kraus and Grosskopf, 2008). It was observed that IIAM assists firms to ensure the quality and safety attributes of the products and services offered to achieve business sustainability (Simon and Yaya, 2012).

2.1 Integrated internal audit management (IIAM)

Figure 1 illustrates the stand-alone standardisation system. Several studies indicate that the adoption of integrated systems is becoming more common than the stand-alone systems (see e.g. Bernardo et al., 2009; Karapetrovic and Casadesus, 2009). Studies have also reported that many organisations implement different standards certifications and adopt IMS to overcome the limitations of single standardisation. According to Bernardo et al. (2015), the integration of audit processes is part of IMS. In this light, the implementation of an

![Figure 1. Stand-alone standards of management systems](image-url)
integrated approach could help increase audit efficiency as audit processes can be conducted together with fewer auditors (Chaney and Kim, 2007; Helpert and Lazarine, 2009; Brand and Sagett, 2011). In this regard, the integrated process considers risk and audits (Kymal, 2015) and Figure 2 illustrates an IMS.

2.2 Integrated audit process

According to ISO 19011: 2012 (clause 3.1), an “audit” is defined as a “systematic, independent and documented process for obtaining audit evidence and evaluating it objectively to determine the extent to which audit criteria are fulfilled”. According to this standard (clause 3.1, Note 3), “an integrated audit” occurs when “two or more management systems of different disciplines (e.g. quality, environmental, occupational health and safety) are audited together”. Integrating these stand-alone standards into a single management system will result in fewer documentation and processes that need to be managed, which in turn, will save the cost to implement and maintain the standards (Kymal, 2015). Refer to Figure 3.

The integration of management systems can be defined as “putting together different function-specific management systems into a single and more effective MS” (Beckmerhagen et al., 2003). Hence, integration allows processes, procedures, work instructions and checklists to be combined to cut cost and enjoy combined benefits.

Figure 2. Integrated management systems

Source: Kymal (2015)

Figure 3. Integration in one site

Source: Kymal (2015)
2.3 Motivations

Previous studies have highlighted that firms are driven to obtain the IMS certification by both internal and external factors (Domingues et al., 2015; Llopis and Tari, 2003; Park et al., 2007). Therefore, it is time to determine what the relationship is between internal and external motivations and how it influences the adoption of IMS audits. This study may assist firms in identifying the factors hindering the success of their IIAM implementation (Jang and Lin, 2008).

Numerous studies have investigated firms’ motivations for implementing MSs, their implementation experiences and the benefits received. Studies advocated that the implementation of an integrated system has many benefits, such as cost savings, reducing financial loss, more streamlined operations, better external image, improved customer satisfaction, compliance with legislation, effective allocation of responsibilities and enhanced employee motivation (Asif et al., 2010; Douglas and Glen, 2000; Karapetrovic and Willborn, 1998; Rocha et al., 2007; Salomone, 2008; Zeng et al., 2011; Zutshi and Sohal, 2005). Furthermore, a study by Crowder (2013) highlighted that firms implement IMSs to fulfil their desire to improve their services and increase quality within the organisations.

2.4 Benefits and difficulties

The implementation of an IMS has many different objectives. Past studies have emphasised that IMS implementation increases a firm’s efficiency and effectiveness (e.g. Karapetrovic and Casadesús, 2009; Curkovic et al., 2008; Khebila et al., 2010). Numerous recommendations have been made to reduce operational costs by combining audit tasks and documentation (e.g. Bamber et al., 2004). Other than that, plenty of discussions have been made on the perceived benefits of implementing the IMS (Bernardo et al., 2009; Karapetrovic and Willborn, 1998; Zeng et al., 2007). In this light, IMS promotes good teamwork, minimises administration costs and, at the same time, improves efficiency in managing the systems. Moreover, IMS allows firms to reduce redundancy and duplication of activities, remove unnecessary tasks and responsibilities, as well as increase resource management efficiency. The combined implementation of an IMS and IIAM can ensure higher efficiency and effectiveness when carrying out audits (Simon et al., 2011).

Despite the several benefits cited above, there are some difficulties in the process of integration of an internal audit (Karapetrovic and Willborn, 1998). These difficulties have been discussed in studies like Asif et al. (2009), Karapetrovic et al. (2006) and Zutshi and Sohal (2005). Later, it is known as the deficiency of human resources and government support. Other internal difficulties highlighted included cross-functional issues, lack of resources and limited employee participation, and this could hinder the implementation of IIAM (Asif et al., 2009; Matias and Coelho, 2002; Karapetrovic and Willborn, 1998; Zutshi and Sohal, 2005).

3. Research methodology

Three firms located in the Klang Valley were selected as the sample for this study. To achieve the research objectives, the case study method was applied. The method was used as it allows the identification of cases, processes, as well as behavioural effects (Yin, 2009). A case study is defined as an “empirical inquiry that investigates contemporary phenomenon within its real-life context, when the boundaries between the phenomenon and context are not clearly evident, and where multiple sources of evidence are used” (Yin, 2009). In this case, while prior studies used the quantitative approach to get answers from the management representatives, this study used the qualitative method similar to Abad et al. (2014) and Karapetrovic et al. (2006). The data collected through this method are able to support the analysis of the existing databases.
3.1 Case selection

All three firms involved in the research received at least two MS certifications. This is to assure the multiple MSs and, hence, the possibility of their integration. To ensure the cross-organisational comparability of the findings, the selected firms have been certified according to the latest standards. This is important because there are significant differences between the different versions of the standards.

The selected cases were examined from the comparative cross-organisational perspective. Thus, comparative case studies could be engaged to examine the processes and determinants of IIAM effectiveness in organisations across different industries (Yiu and Pun, 2012). The organisational perspective may influence the employees to set personal and professional objectives, task completions and resource management within an organisation to attain the set goals (Lok and Crawford, 2004). In this regard, a comparative analysis was done to study the relationships amongst the cases and the aspects (variables) identified (Keman, 1993). The qualitative comparative analysis was first introduced by Charles Ragin in 1987 to overcome the basic problem in cross-case analyses (Ragin, 1987). The comparison was made between the exploratory and observation unit of analysis (Ragin, 2014). The scope of the case studies is limited to a small number of cases (Ragin, 2014). In this light, the IIAM practices in each firm were investigated and then compared. Thus, the unit of analysis for this study is the firms that have implemented IIAM.

3.2 Data collection and the analysis of the findings

The data were collected using a semi-structured questionnaire which is widely used in qualitative studies (Yin, 2009). Information was extracted through closed- and open-question responses during the interviews. These questions encouraged the interviewees to expand on the topic being discussed. The interview questions were adapted from Asif et al. (2010) (see Appendix). The informants included employees assigned to manage the MSs, i.e. the senior manager, head of auditors and internal auditors who are in charge of the matters of the MSs.

The interview questions focussed on the implementation of IIAM and were divided into two sections. Section A was comprised of questions on general company information, the number of resources invested, motivation to carry out the IMS, the audit process and the anticipated benefits that led to the decision to implement the IIAM, the benefits gained and the difficulties encountered by the organisations. Section B of the questionnaire required the participants to rank the factors listed based on motivation, stakeholder influence, and the difficulties and benefits of the IIAM implementation.

Interviews were conducted as part of the preliminary study to verify the tentative model developed based on the literature review. The semi-structured questions found to be more effective way to encourage respondents to talk openly about their thoughts and experience (Muzaimi et al., 2017). Three interviews were conducted with managers of the selected manufacturing firms. The interviews were conducted either in the researcher’s house or the interviewees’ offices based on their convenience.

Only three firms were selected for this study. The sample size was kept small because there was no database or directory that listed manufacturing firms that had implemented IMSs. This made it hard to find firms with at least having two management systems in place (e.g. QMS and EMS/QMS and OHSAS/EMS and OHSAS). Consequently, manufacturing firms implementing the IMS were selected from the Federation of Malaysian Manufacturing (FMM) 2017 Directory (Federation of Malaysian Manufacturers, 2017). The study also involved firms that were not FMM members, the firms were identified using the SIRIM QAS International Directory of Certified Products and Firms 2015 (SIRIM, 2015). Prior to conducting the interviews, the senior manager, head of auditors and internal auditors of the firms were contacted via phones to obtain their consents. The interviews were conducted from late April to May 2018.
The cases were chosen from a convenience sample of three firms that had received MS certification. The firms were chosen based on the relationship established between the firms and the researcher from an earlier cooperation. This good relationship made it easier for the researcher to conduct the interviews with the firms’ management or the management representatives.

Table I details the interviews, including type of the firms, interviewees’ names and their positions. Two out of three interviews were conducted using a video call or a phone call, whilst the third interview was conducted face-to-face.

Table II highlights the characteristics of each case study. The names of firms are not disclosed to protect the privacy of the companies. Each firm was coded with letters of A, B or C, respectively. Each interview lasted between 95 and 120 min. In addition to the interviews, the researcher also kept some field notes. The interviews were transcribed and the field notes were cross-checked afterwards. The documents, records and archives of the IMSs were thoroughly assessed to verify the data. The document assessment involves scanning (superficial examination), reading (thorough examination) and interpretation. This approach combines elements of content analysis and thematic analysis. Content analysis is the method of organising data into categories that correspond to the central questions of the research (Bowen, 2009) while thematic analysis helps recognise the pattern within the data and the emerging themes become the categories for analysis (Fereday and Muir-Cochrane, 2006).

Furthermore, records of internal audits, minutes of ISO management reviews, quality plans, plants’ sales records, etc. were used to establish the integration levels of the audits conducted as well as the benefits and challenges of the IMS implementation. Data triangulation involves multiple sources, i.e. interviews, documents, observations, site visits and websites, were used to substantiate the level of the top management commitment, the human and other resources allocated for the IMS initiatives and planning for future adoption of other TQM tools and merging them into existing IMS.

The qualitative approach was adopted for the data analysis to examine different concepts, such as experience in managing various ISO standards and the integration “in terms of their meaning and interpretation in specific contexts of inquiry” (Denzin and Lincoln, 2006). Finally, the collected data were categorised into the specific themes and compiled in the form of written case reports. The reports were sent to each participant for validation. The validated cases are presented in the results section. The “convergent lines of inquiry” was carried out to ensure construct validity (Yin, 2009). The tests of validity and reliability conducted in this study are summarised in Table III.
4. Findings and discussion

The results of the cross-case analyses are presented below. Table IV presents the comparisons of the cases and themes developed to help identify the patterns (Creswell, 2013; Yin, 2009). In this research, the results of the case studies are classified into similar and different patterns (Bernardo et al., 2017). The table illustrates the data and findings about IIAM adopted in each firm, which allows the researcher to make comparisons between these firms.

<table>
<thead>
<tr>
<th>Validity/reliability</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal validity</td>
<td>Specification of a clear research framework</td>
</tr>
<tr>
<td></td>
<td>Inferences and pattern matching in relation to prior research</td>
</tr>
<tr>
<td></td>
<td>Triangulation of analysed data and discussion amongst the researchers</td>
</tr>
<tr>
<td>External validity</td>
<td>Cross-case analysis extending previously conducted within case analysis</td>
</tr>
<tr>
<td></td>
<td>Explanation of rational for the case selection</td>
</tr>
<tr>
<td></td>
<td>Detailed case background information</td>
</tr>
<tr>
<td>Reliability</td>
<td>Established interview protocol</td>
</tr>
<tr>
<td></td>
<td>Comparable questionnaire items</td>
</tr>
</tbody>
</table>

**Source:** Adapted from Schneider et al. (2014)

<table>
<thead>
<tr>
<th>Version</th>
<th>Aspect</th>
<th>Firm A</th>
<th>Firm B</th>
<th>Firm C</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISO 14001:2015</td>
<td>OHSAS 18001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5. Top management</td>
<td>5. Top management</td>
<td>5. Workers</td>
<td></td>
</tr>
<tr>
<td>Top 5 benefits</td>
<td>1. KPI</td>
<td>1. Eliminate waste</td>
<td>1. KPI</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Improve image</td>
<td>2. KPI</td>
<td>2. Improve image</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Reduction of audits</td>
<td>3. Improve risk management</td>
<td>3. Improve risk management</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5. Eliminate waste</td>
<td>5. Eliminate individual MS conflicts</td>
<td>5. Greater employee competencies</td>
<td></td>
</tr>
<tr>
<td>Top 5 difficulties</td>
<td>1. Inadequate HR</td>
<td>1. Resistance to change</td>
<td>1. Resistance to change</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Lack of internal competencies</td>
<td>2. Lack of IMS standard</td>
<td>2. Organisation structure</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Organisational structure</td>
<td>3. Organisational structure</td>
<td>3. Lack of internal competencies</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5. Resistance to change</td>
<td>5. Resistance to change</td>
<td>5. Product diversification</td>
<td></td>
</tr>
</tbody>
</table>

**Table IV.** Comparative case analysis

<table>
<thead>
<tr>
<th>Process</th>
<th>Different</th>
<th>Integrated process systematically (fully)</th>
<th>Manage MS process individually (not integrated)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resources</td>
<td>People, methods and budget</td>
<td>People and technology</td>
<td>People and technology</td>
</tr>
</tbody>
</table>
4.1 Similar patterns

The discussion shows the same patterns across the firms.

4.1.1 Motivation. The firms have listed their top five motivations that have driven the firms to implement IIAM. As shown in Table IV, all three firms implemented IIAM due to the requirements of internal and external stakeholders. Two (firm A and B) out of three firms have listed customers, international requirements, competitors and top management as their motivations for IMS adoption. One exception is firm C where IIAM adoption is basically based on internal factors, such as the top management and employee demand. Various studies have revealed that firms seek certification to gain higher profits (Kim et al., 2011; Llopis and Tari, 2003; Singels and Water, 2001; Terziovski et al., 2003; Yahya and Goh, 2001). Various management systems have been implemented to fulfil the requirements and preferences of different stakeholders (Ahsen, 2014). However, based on the stakeholder theory, firms integrate their management systems efforts with the demands of the stakeholders. This allows them to contribute to the economy, environmental protection and social development. These efforts are effective when there is an integrated system to facilitate the MSs across different parties (Donaldson and Preston, 1995).

In regards to the motivation of firm A, the general manager described that:

The role of the IMS is to facilitate continuous improvement of our quality and environmental management systems, including safety and communication and to motivate employees to achieve customer satisfaction through meeting their requirements & product specifications, as well as to achieve our yearly budget targets and also corporate social responsibility (e.g., preserving the natural environment).

Firm B motivated its employees by acknowledging that IIAM is “the tools to save cost and resources needed, and to improve the efficiency of management systems”. Meanwhile, firm C considered IIAM as a tool “to fulfil customer requirements”.

4.1.2 Benefits. All the representatives of the firms agreed that the implementation of IIAM has helped to fulfil the firms’ key performance indicators (KPIs), enhanced the firms’ image and visibility, improved risk management, as well as eliminating wastage. The manager of firm B highlighted the practiced process elimination as the firm implements the IIAM:

We had to combine and eliminate some processes and procedures to meet the IMS requirements. After some time, we noticed there were some reductions, especially in resources used, waste, time, and cost of operation as a whole. At the same time, it has improved firm image, opened more opportunity for new business and improved environment protection.

Firm C is aware that achieving the KPI was one of the ultimate goals in pursuing the IIAM. The head of auditor of firm C shared that:

If people get the buy in of the IMS, the implementation will help to achieve firm performance (KPI) as a whole, this includes the reduction of costs, time savings, and behavioural changes. Later, it will improve the firm’s image in the long run.

The general manager of firm A highlighted the importance of IIAM in ensuring that firms are able to manage their daily operations efficiently and effectively:

With the integration, the firm operates more efficiently and effectively. This generates profit improvement as we gain a better corporate image. These activities will lead to improvement of quality, productivity, delivery, yield ratio, and inventory control. Its implementation will also lower the cost of operations and save time.

4.1.3 Difficulties. In addition to the benefits of implementing IIAM, the firms also have to take into account the difficulties they faced in its implementation. They highlighted several
difficulties, including the resistance to change, lack of human resources, inadequate internal competencies, unclear organisational structure and lack of product diversification. The head of auditors of firm C summarised:

Employees play important roles as change agents in any improvement activities carried out by an organisation. Thus, educating them well before implementing the IMS will speed up the process of integration. If the employees are ready to change, the IMS could contribute to better productivity, processes and performance.

Firm A also discussed the obstacles of its implementation. The general manager stated that:

However, during the process of integration, there were some obstacles encountered. Amongst them were the lack of competencies in implementing the IIAM and too many layers of structure in the firm. These issues hindered the firm-wide implementation of the IIAM.

This statement is also supported by a study that highlighted the difficulty faced by auditors who are not qualified to perform integrated audits (Bernardo et al., 2017).

4.2 Different patterns
The differences between the three firms are related to the process of audit integration and the resources used in IMS adoption.

4.2.1 Audit process. Integrated audits allow firms to achieve an efficient audit process while obtaining the benefits gained from the audits, such as process improvements (Hoy and Foley, 2015). While the process of audit integration varies across firms, typically, the audit process involves planning, conducting, report writing and following up any corrective or improvement actions (Gryna et al., 2007). For firm A, the firm has implemented a systematic IIAM and has received a strong support from its management. The general manager stressed that:

The essential feature of IMS is that the top management must be committed to implement quality initiatives, facilitate continuous improvement, and at the same time, innovate the management system from time to time to sustain/improve their competitive advantage. Motivation, commitment, and participation from all employees are some of the important factors. The process of implementing the IMS was smooth as we are an ISO certified firm and the process of standardisation can be integrated systematically, especially internal audit. Consequently, this process will improve the quality of our products, enhance customer satisfaction, and increase profit.

This statement is supported by Bernardo et al. (2017) who found that integrating the audit process varied across firms and countries. Firm B has implemented partial IMS and while the audit process is still not fully integrated with all other systems, it is moving towards that direction. According to the quality manager of firm B:

To survive in this industry, we have to fulfil customer expectations and at least be on par with our competitor. In this firm, we are very flexible to ensure the IMS implementation success. For example, we have set up many internal audits (even though only partially integrated) and management reviews, as well as setting up the KPI that needs to be achieved each year. We work based on the target that we set. It is very helpful because it will reduce redundancies and improve the efficiency and effectiveness of the operations.

The head of auditors of firm C shared the firm’s audit practices and the MS implemented in the firm. The firm’s management has the intention to integrate the MS in the future as they believe that integration cannot be achieved overnight. It was highlighted that:

The firm has various types of management systems such as ISO9001, ISO14001 and ISO18001, however we are not practicing the IMS (including when performing audits) due to some difficulties.
We acknowledge that the benefits of the audit process have improved the internal process when implementing individual management systems. The firm believes that the IMS provides more benefits and we are looking for integration in the future.

This statement is supported by Fernández-Muñiz et al. (2012) who mentioned that the audit process helps firms comply with their legal obligations, improve their organisational system and documentation system, while MS certification improves their corporate images since the certification can bring positive publicity for firms.

4.2.2 Resources. The representatives of the three case study firms agreed that people (employees) are one of the most important resources in the implementation of IIAM. According to Rebelo et al. (2014), human resources are the most valuable resources of any company or country, but not always the most valued. Thus, the greatest assets of any organisation, any region or any country, are the people with their technical know-how (Santos and Escanciano, 2002). In the dynamic capabilities theory, firms can integrate, build and reconfigure their competencies and resources (Teece et al., 1997) which are perceived as strategic options. Firms will be able to execute strategic changes to adapt to new environment (Zahra et al., 2006). Thus, in this study, integrated resources, such as audit teams, procedures and processes, were able to improve firm performance.

This can be viewed based on the statement made by firm A:

In regard to the resources deployed in implementing the IMS and IIAM, firm A has allocated some budget to sustain and improve the QMS, EMS, safety, SS, Lean, etc. At the same time, the firm has also been conducting training of the firm’s staff to create awareness and ensure that the methods applied are appropriate and right the first time. This may improve firm performance.

Firms B and C embrace technology as one of the resources that can expedite their daily operations. Firm B agreed that resources are a very important component in IIAM. The manager highlighted:

Implementing integration activities has increased efficiency and each procedure has been simplified accordingly. IMS also encourages employees to come out with ideas to solve the problems. The firm could easily utilise the resources (human, technology, and others) to maximise the profit.

According to the head of auditor, firm C wants to fulfil:

The mission of the firm is to provide customers worldwide with superior cable solutions based on state-of-the-art technology and consistent excellence in execution, ultimately delivering sustainable growth and profit through the implementation of integrated audits.

The comparative analysis between the three cases of IIAM implementation by individual firms shows that there are more similarities than differences (Table IV). Here, the same aspects could be easily identified based on the similar patterns, except for the internal audit process and resources used. These findings are in line with a previous study that reported that dissimilarities were mostly observed in integrated internal audits as compared to external audits (Simon and Douglas, 2013).

5. Conclusion

The study shows that, in general, the implementation of internal audit integration across the firms was similar. In this light, all firms have at least two MS certifications for audit integration. All three firms also show a similar motivation to implement IIAM, gained the similar benefits and faced the same difficulties in the implementation of IIAM. All of these aspects reflect the common IIAM implementation patterns across the three firms.

Some small differences in the patterns of implementation have been identified. These differences include different IIAM processes and the resources used. In this light, Firm A has
implemented a full integration system, firm B has implemented a partial integration system and firm C has implemented a stand-alone system with the intention to implement an integrated system in the future. In regards to the resources used, all of the firms agreed that human resource was an important factor to ensure the success of IIAM. At the same time, other resources, like integrated methods, financial resources and technology capabilities are needed to support its implementation. Therefore, it has been revealed that there are similarities and differences that need to be investigated further as the implementation patterns identified may be used by other firms to start their integrated internal audit in the future.

The findings of this exploratory and qualitative study can be beneficial to academics, industry players and certification bodies. In the academic field, this study has contributed to a better understanding of IIAM and further examined its relationship with a firm performance by considering other relevant variables. Furthermore, as internal auditors need to integrate their audit processes, the present study has examined whether internal factors derived from the dynamic capability theory, such as capabilities, play important roles in IIAM. Meanwhile, theories such as the stakeholder theory could be used to discuss the influence of external factors, including stakeholders’ pressure, in the implementation of IIAM as it is essential to identify the internal factors of IIAM that could be manipulated to achieve a fully integrated system. This study might also benefit practitioners/auditors/managers and help them to develop an appropriate framework to enhance IIAM in the manufacturing industry. Lastly, it can help certification bodies to train auditors (internal and external) to become more competitive, capable and skilful.

A limitation of this study is its small sample size. As the study only focuses on three cases, the findings cannot be generalised to the whole population of MS certified firms in Malaysia. Thus, future studies could include more firms to overcome this limitation. In addition, it will be good to focus on how IIAM could influence firm performance and other aspects like business sustainability.

References


**Further reading**


**Appendix**

**SET A**

Survey questions:


2. Motivation for integration of MSs: What type of MSs that organisation employs? What is the role of IMS in the overall management system of organisation? What is your motivation for integration of MSs?

3. What are the resources invested in implementing IMS?

4. Did any stakeholder demand this MS? What do you think is the most important factor in the decision to carry out integration of MSs?

5. What are the imperatives/essential features of this IMS? Process and outcomes of integration of MSs? How the integration of MSs proceeds and affects the operations?

6. What changes take place sequentially during integration? What types of operational improvements have resulted (if any)? How the integration results in these business sustainability and competitive advantage? What types of savings resulted after integration of MSs?

7. Could you please give a few examples? What is the impact of IMS on social and environment? How the integration affected the relationship with stakeholders? With suppliers, customers, regulators and others? What type of supplier practices prevail in organisation? What is the impact of integration on the customers and customer-related aspects?

8. How integration affects the productivity, efficiency, cycle time, setup time and other performance metrics used in your organisation?

9. What is the role of employees in an IMS?

10. How do you manage the product flow? What options are commonly used for this purpose?

11. What type of improvement strategies are used in organisation? What about quality circles, 5S, SPC and TPM?
### SET B

Please rank your answers based on the number of questions. (e.g: 1 (most important) and 13 (less important))

<table>
<thead>
<tr>
<th>Question 1—Importance of the twelve identified factors as motivation for the implementation of the IMS</th>
<th>Rank Your answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>The twelve factors identified on the questionnaire</td>
<td>1.1 - Improve the company’s image, near its customers and other stakeholders</td>
</tr>
<tr>
<td></td>
<td>1.2 - Rationalize and optimize the management of the several resources</td>
</tr>
<tr>
<td></td>
<td>1.3 - Facilitate the management of the three components of sustainable</td>
</tr>
<tr>
<td></td>
<td>1.4 - Development of the company versus the business</td>
</tr>
<tr>
<td></td>
<td>1.5 - Increasing requirements of customers and other stakeholders</td>
</tr>
<tr>
<td></td>
<td>1.6 - Competitive advantage</td>
</tr>
<tr>
<td></td>
<td>1.7 - Strategic vision of the business</td>
</tr>
<tr>
<td></td>
<td>1.8 - Natural evolution of the MSs in the company</td>
</tr>
<tr>
<td></td>
<td>1.9 - The continuous improvement of the QMS, EMS, and others MSs goes through the integration</td>
</tr>
<tr>
<td></td>
<td>1.10 - Having the MSs implemented separately results in additional costs, creating unnecessary bureaucracy, and an organizational structure less efficient and less lean</td>
</tr>
<tr>
<td></td>
<td>1.11 - Growing appreciation of the IMSs by the major customers</td>
</tr>
<tr>
<td></td>
<td>1.12 - As consequence of the globalization and the growing business requirements</td>
</tr>
<tr>
<td></td>
<td>1.13 - Another – what? (write your suggestion)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question 2— Influence of stakeholders on the performance and evolution of the IMS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>The nine stakeholders identified on the questionnaire</td>
<td>2.1 - Guidelines, policies, and objectives of the international group in which the company is inserted</td>
</tr>
<tr>
<td></td>
<td>2.2 - Customers</td>
</tr>
<tr>
<td></td>
<td>2.3 - Competitors</td>
</tr>
<tr>
<td></td>
<td>2.4 - Insurers</td>
</tr>
<tr>
<td></td>
<td>2.5 - Suppliers</td>
</tr>
<tr>
<td></td>
<td>2.6 - Official entities related to the issues of Quality, Environment, Occupational Health, and Safety</td>
</tr>
<tr>
<td></td>
<td>2.7 - Workers and/or their representatives</td>
</tr>
<tr>
<td></td>
<td>2.8 - Financial institutions</td>
</tr>
<tr>
<td></td>
<td>2.9 - Group of directors and managers of the company</td>
</tr>
<tr>
<td></td>
<td>2.10 - Another – what? (write your suggestion)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question 3—Main difficulties in the context of the development and implementation of a model for IMS-QES</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>The seven</td>
<td>3.1 - Deficit of human and material resources due to the strongly</td>
</tr>
<tr>
<td>Difficulties identified on the questionnaire</td>
<td>Potential benefits resulting from the implementation of the IMS</td>
</tr>
<tr>
<td>--------------------------------------------</td>
<td>---------------------------------------------------------------</td>
</tr>
<tr>
<td>3.1 - Resistance to change</td>
<td>4.1 - Better and greater visibility of operation of the company in the concerned MSs</td>
</tr>
<tr>
<td>3.2 - Resistance to change</td>
<td>4.2 - Elimination of conflicts between individual MSs, and consequent resources optimization, namely human resources</td>
</tr>
<tr>
<td>3.3 - Organizational structure</td>
<td>4.3 - Elimination of several organizational and operational waste, resulting from an individual implementation of each MSs</td>
</tr>
<tr>
<td>3.4 - Diversity of products and services vis-a-vis customer’s requirements and legal and other requirements</td>
<td>4.4 - Common management policy, objectives, goals and key process indicators (KPIs) related to the performance of MSs</td>
</tr>
<tr>
<td>3.5 - Not explicit, as an objective of the company, the integration of the individual MSs</td>
<td>4.5 - Improvement of the internal and external image and credibility of the company with focus in the areas of QMS, EMS and OHSAS</td>
</tr>
<tr>
<td>3.6 - Lack of internal competences on IMSs</td>
<td>4.6 - Involvement and consolidation, by all collaborators, of a culture of continuous improvement, attitudes and values in the scope of the concerned MSs</td>
</tr>
<tr>
<td>3.7 - Lack of an international standard for IMSs</td>
<td>4.7 - Reduction of the number of internal and/or external audits</td>
</tr>
<tr>
<td>3.8 - Another – what? (write your suggestion)</td>
<td>4.8 - Improvement at the level of the risk management through an integrated and systematized approach</td>
</tr>
</tbody>
</table>

**Question 4** — Potential benefits resulting from the implementation of the IMS

4.9 - Greater employee valorization and motivation as a result of greater scope of its competencies, tasks and responsibilities with consequent “empowerment”

4.10 - Integrated management of the several components of sustainability

4.11 - Improvement of the partnership relationships with suppliers and of dialogue and compromise with others relevant stakeholders, contributing to the competitiveness of the company

4.12 - Another – what? (write your suggestion)

Others suggestions: (write your suggestions)

**Question 5** — Do you agree that SS can be one of quality initiatives in achieving IMS? Or other quality initiatives implemented, please specify:

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An exploration of quality management practices in the manufacturing industry of Ethiopia

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Abstract

Purpose – Total quality management (TQM) has long been viewed as a strategy to attain business excellence. However, it is relatively a new concept in the context of emerging economies. Particularly, this is far beyond the reality in the context of African countries, in general. The purpose of this paper is to study the current state of TQM implementation in the manufacturing industry of Ethiopia (MIE). The study also focuses on several comparisons, between large and medium companies, and ISO and non-ISO companies with regard to the adoption of TQM practices.

Design/methodology/approach – The study draws on top- and middle-level managers from sample companies. Data were collected using a structured survey questionnaire. After testing scale reliability and validity, descriptive and factor analysis were used for the data analysis.

Findings – The findings, in general, indicated that Ethiopian manufacturers have implemented TQM at a moderate level (grand mean value of 2.86 on 0–5 scale). It is revealed that ISO companies are significantly adopted TQM practices than non-ISO companies, whereas no difference was found between large and medium companies.

Originality/value – Given the importance of understanding TQM and paucity of research on the topic in Ethiopia, the study provides practical insights and groundwork that can guide practitioners to understand the drivers of TQM in the region. Particularly, the study is useful to plan corrective actions on practices that are likely to obstruct TQM implementation in the MIE. Moreover, the study adds to the empirical literature that may yield important insights on TQM for under-researched emerging economies, particularly for the eastern part of Africa, where nations share similar cross-cultural norms, economic, social and ethnic settings.

Keywords Africa, Manufacturing, Ethiopia, ISO, Total quality management (TQM), Large and medium companies

1. Introduction

TQM is an integrative organizational-wide philosophy that aimed toward continuously improving the quality of products/processes and meet/exceed customers’ expectations (Prajogo and McDermott, 2005). With the increased globalization of markets, TQM has become necessary for organizations all over the world to develop competitive strategies. Since the last two decades, TQM has become a well-established field of research for academia. The discipline will also take several more decades to mature and for nations and economies to digest its benefits (Maguid, 2006).

Following the introduction of TQM in Japan, it has been spread predominantly in developed countries such as the UK, Australia and the USA (Khanna, 2010). It is relatively a new concept that is increasingly being adopted in emerging economies in pursuit of higher market share (Sinha et al., 2016). Scholars highlighted that while TQM in the west lacks a theoretical basis, knowledge of TQM in developing economics is almost totally lacking (Thiagaragan et al., 2001). According to Madu (1997), many companies in developing countries do not know how to implement TQM. Relatively, TQM has been considerably researched in Asian developing countries (e.g. China, India and Malaysia) (Khanna, 2010). The research into TQM in the context of African countries is far beyond reality. Currently, the African Union has approved “Agenda 2063” called “Common African Position” for all countries in the continent (African Union Commission, 2015). The major facet of the agenda
is to build a prosperous and united Africa by 2063 through sustainable development and realization of industrialization. To achieve this ambition, implementation of TQM would be of an undeniable path, as supported by different scholars (Crosby, 1995; Djerdjour, 2000). They stated that the only way a developing nation can establish a sustainable basis of development is to improve the quality of its products.

The present study considered Ethiopia as an emerging economy and conducted an exploratory study on TQM practices in the manufacturing industry. The manufacturing industry of Ethiopia (MIE) is characterized by a low level of development, with a share to GDP stagnated at 5 percent over the last 20 years (Altènburg, 2010). Currently, the Ethiopian government has shown impressive dedication to create the preconditions for a socially inclusive industrial transformation. The manufacturing sector is required to grow at a faster rate than other economic sources (agriculture and service). Ethiopia seeks a contribution of 22 percent to GDP from the manufacturing industry (MIE, 2014). However, the current performance of the industry is not enjoyable (Addis et al., 2019). Previous studies revealed that the nature of problems is multifaceted that seem to explain the underperformance of the industry (Addis, Dvivedi and Abebe, 2017). Apart from dozens of issues, quality-related problems have been identified as the stumbling block for the development of MIE (Addis, Dvivedi and Beshah, 2017), and sometimes the challenge is referred as “low-quality trap” (Altènburg, 2010, p. 9). It is also justified that quality will remain as the future challenges of competitiveness for organizations in Ethiopia (Beshah and Kitaw, 2014). Despite this, significant efforts have not been made by academicians/industrialists to introduce appropriate management philosophies in the MIE, even basic quality tools and techniques (Kahsay et al., 2007). A survey in the MIE carried out by Beshah and Kitaw (2014) considered only firms that applied for the “Ethiopian quality award.” However, scholars highlighted that one would not expect the experiences of award participants represent all organizations in a country (Powell, 1995). Another study carried out by Kitaw and Bete (2003) could also not represent the current situations in the MIE. Owing to a lack of current empirical studies, it is difficult for MIE to obtain sufficient information to look for intervention areas for improvement and support the TQM implementation process. This arises the need to capture up-to-date information regarding TQM practices in the Ethiopian manufacturing landscape.

The present study aims to explore the current level of TQM practices in the MIE and identify intervention areas for improvement. Specifically, the study sets the following objectives: to identify a set of TQM practices being practiced in manufacturing organizations, to investigate the degree of implementation of the practices in the MIE and to make comparisons between medium and large companies and ISO and non-ISO companies with regard to TQM practices.

The rest of the paper is organized as follows. Section 2 presents the literature review regarding TQM and its practices. Section 3 presents the research methodology, followed by data analysis and discussion in Section 4. Subsequently, conclusion and implication of the study are provided in Section 5.

2. Literature review

In a world of imperfect information and understanding, latent opportunities for performance improvement are always abundant. TQM methods provide some novel ways of converting a portion of these latent opportunities into recognized opportunities and recognized opportunities into actual improvement (Thakkar et al., 2006). TQM is viewed as an organization-wide philosophy requiring employees at every level of an organization to meet/exceed customer’s requirements (Addis et al., 2019). Since its introduction, QM has become a key concern for many organizations. It is implemented worldwide to achieve improvements in organizational effectiveness and became the buzzword in the management of practices (Prajogo and Sohal, 2003). It has been well accepted by managers and quality practitioners as a change
management quality approach. Organizations that have implemented QM gain advantages in various aspects of organizational performances. Some of the benefits are improved financial performance (Augustyn et al., 2019), established knowledge management (Honarpour et al., 2018), increased profitability (Hailu et al., 2018), improved labor productivity (Belay et al., 2014), improved open innovation (Rold et al., 2017), green innovation (Li et al., 2018), improved job satisfaction (Addis et al., 2019), etc. QM can, therefore, be seen as a way to gain a competitive advantage in the world market.

TQM is now part of a much wider concept that recognizes the importance of quality processes and addresses overall organizational performance. TQM considers all activities of the overall management function that determine and implement quality policy, objectives and responsibilities within the system. As there are many definitions of quality, QM has also been described in different ways over the years. Defining the term has remained a controversial issue debated in the literature (Bäckström, 2009). The inability of the researchers to reach consensus on the common definition may arise from the concept being changeable and adaptable to the spirit of the time and context-specific factors. QM is defined better by ISO 8402 as “a management approach of an organization centered on quality, based on the participation of all its members, and aimed at long-term success through customer satisfaction and benefits to all members of the organization and society” (ISO, 1994). From this definition, it is evident that TQM recognizes the importance of quality for organizations to achieve long-term success.

Successful implementation and execution of strategies are partly dependent on the manager’s ability to nurture a work climate that can make people motivated (Addis, Dvivedi and Abebe, 2017). Managing best-known factors of QM are among strategy execution processes in organizations (Arunachalam and Palanichamy, 2017). According to Dean and Bowen (1994), TQM implementation can only be accomplished by a set of critical success factors that support the TQM philosophy. Talib and Rahman (2012) also assert that the benefits of TQM can be achieved through identifying the sets of common TQM principles and practices. Consequently, many authors have conducted research on identifying a set of factors essential for the implementation of QM. An empirical survey on critical success factors of TQM was first introduced and operationalized by Saraph et al. (1989). The effort made by Saraph et al. sets a new direction for TQM researchers and practitioners interested in identifying various factors that are considered essential to the success of TQM implementation. Scholars identified set of TQM factors with different terminologies like “practices” (Flynn et al., 1995), “constructs” (Ahire et al., 1996), “critical factors” (Silas and Ebrahimpour, 2002), “elements” (Powell, 1995), etc. Regardless of using different terminologies, however, the meaning of the factors has remained the same (Martin and Adair, 2016). Due to their profoundness, the present study prefers to call the factors as “practices”.

There is a consensus view that TQM should be defined in a wide range and the process must involve many aspects of it (Martin and Adair, 2016). However, agreements were not made on the number of practices that should be incorporated while exploring TQM in organizations (Naser et al., 2011). Some researchers use less than four and others more than ten practices to capture the TQM construct. For instance, Dean and Bowen (1994) defined TQM using 3 practices, Das et al. (2008) identified 10 practices and Powell (1995) suggested 12 practices. Inconsistencies in literature make it difficult to reach a conclusion on the range of practices and on the standard definition of TQM. After an in-depth comparison of 18 research studies, the present study identified seven practices of TQM that have the highest frequency of occurrences as part of a TQM program in manufacturing organizations. The list of practices together with their sources is presented in Table I. The sources are selected based on four criteria:

1. the number of samples they used (number of firms and number of participants);
2. studies that validate the practices;
As indicated earlier, TQM should be defined in a wide range and the process must involve many aspects of it. Accordingly, this study considered five additional practices that help to define widely the fundamental principles of TQM. The additional practices are “cross-functional product design” (Cua et al., 2001), “internal quality management usage” (Ahire et al., 1996), “zero-defects mentality” and “benchmarking” (Powell, 1995) and “continuous improvement” (Conca et al., 2004). Therefore, 12 TQM practices are proposed as a framework that was felt most salient for manufacturing organizations. The set of practices constitute the hard (i.e. tools and techniques) and soft (i.e. people-related factors) elements of TQM. Balancing the hard and soft elements are recognized as important for the successful implementation of TQM (Sila and Ebrahimpour, 2002). This explains that promoting and upgrading only hard practices may not necessarily improve performance, because ultimately it is “people that make quality happen” (Prajogo and Cooper, 2010).

3. Research methodology
3.1 Survey administration
According to the report published by Ethiopian central statistical agency, more than 64 percent of manufacturing industries are located in Addis Ababa and Oromia region (ECSA, 2012). A total of 302 large and medium (L&M) companies found in six major industrial groups in Ethiopia. The study has taken a sample of 200 L&M companies from the industrial area of Addis Ababa and some part of Oromia. They were randomly selected with their corresponding addresses from the list of “Business Register for Large and Medium Scale Manufacturing Industries” published by Ethiopian chamber of commerce and sectoral association.

Questionnaire is a popular data collection method in the studies of TQM (Khanna, 2010). To that end, the present study prepared a structured survey questionnaire based on the identified 12 practices of TQM. To construct the survey questionnaire, measurement items were adopted from Powell (1995), Ahire et al. (1996), Cua et al. (2001) and Conca et al. (2004). These studies were considered because they have a sound theoretical basis, as well as strong evidence of reliability and construct validity. The list of practices is provided in

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Practices</th>
<th>Supporting literature</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Top management commitment</td>
<td>Saraph et al. (1989), Flynn et al. (1995), Powell (1995), Ahire et al. (1996),</td>
</tr>
<tr>
<td>4</td>
<td>Teamwork</td>
<td>Jun et al. (2006), Ooi et al. (2007), Karia and Assari (2006)</td>
</tr>
</tbody>
</table>
Table II with their corresponding measuring items. The questionnaire contains 50 items that aimed to measure the extent of implementing different TQM practices. The questionnaire was tested and refined by means of a pilot study in six selected companies. A five-point Likert scale was employed to rate each measuring items on their level of practicing with 1 meaning “very low” and 5 “very high.” A “moderate” level is indicated at 3. The internal consistency and reliability of each practice were evaluated using Cronbach’s \( \alpha \) measurement (Nunnally, 1978). The questionnaire has two sections. The first section presented the purpose of the questionnaire and the second section provided the question items with rating scales.

The survey addressed to the top and middle management staff of the sample companies such as general/deputy manager, inspection and quality control department, operation/production management, marketing and purchasing departments. The reason for focusing on these groups is the expectation that they are more knowledgeable and familiar with organizational development strategies including QM practices (Ahire and Ravichandran, 2001). The survey instrument was distributed to the sample companies through web-based and personal distribution methods. It was planned to get at least one response from each of the sample companies. Initially, the response rate was not encouraging and, thus, various methods were used to improve the response rate including phone calling and e-mail messaging. As a result, 116 responses were collected resulting a 58 percent response rate.

3.2 Data analysis

The responses were assigned numeric codes and entered into SPSS version 20 statistical package for the analyses. Descriptive statistical analyses were conducted for the general profile of respondent companies and industrial groups. Also, mean and overall mean were calculated for individual measuring items and for each of the practices, respectively, to analyze the current level of TQM practices. Factor analysis was undertaken for the study variables. Reliability of the survey instrument has been verified by using Cronbach’s \( \alpha \) (Nunnally, 1978). \( t \)-test has been conducted to compare mean differences between L&M companies and between ISO & non-ISO companies with regard to the practices.

4. Survey results and discussion

4.1 General profile of respondents

Profile of the respondent companies was analyzed based on their size (i.e. number of employees). The study considered medium companies ranges between 50 and 150 employees while large companies are with more than 150 employees (Temtime and Solomon, 2002). Breakdown of the companies is presented in Table III. According to the results, 55.2 percent of respondents are categorized under large-sized companies, with the remainder being medium-sized companies (i.e. 44.8 percent). Also, the study presents a number of responses according to the industrial groups (Table IV). The industrial groups are textile and apparel products industry (20.6 percent), leather and leather products industry (21.6 percent), metal and steel products industry (14.7 percent), chemical industry (10.3 percent), food and drinking products industry (24.2 percent) and rubber and plastic products industry (8.6 percent).

The study was sought to examine where the MIE is in the quality race. The companies were first asked whether they have implemented TQM or not. Companies did not fully implement the TQM philosophy yet, rather 24 percent of them acquire ISO 9001 standard. Previous studies also reported that only ten industries across the country implemented ISO 9001 (Kahsay et al., 2007). These indicate that the MIE puts less effort to introduce appropriate management philosophies and meet standard requirements.
<table>
<thead>
<tr>
<th>Practices</th>
<th>Measuring items</th>
<th>Mean</th>
<th>SD</th>
<th>Factor loading</th>
<th>α value</th>
<th>Overall mean (Rank)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top management commitment (F1)</td>
<td>Top-level managers actively participate in continuous improvement programs (F11)</td>
<td>3.02</td>
<td>1.26</td>
<td>0.907</td>
<td>0.752</td>
<td>2.86 (7)</td>
</tr>
<tr>
<td></td>
<td>Quality issues are reviewed in the company’s top management meetings (F12)</td>
<td>2.43</td>
<td>0.98</td>
<td>0.726</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Top-level managers attach quality in relation to cost objectives (F13)</td>
<td>3.17</td>
<td>1.14</td>
<td>0.704</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Top-level managers arrange adequate resources for employees’ training (F14)</td>
<td>3.03</td>
<td>1.27</td>
<td>0.761</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Top management empowers employees to solve quality problems (F15)</td>
<td>2.34</td>
<td>1.11</td>
<td>0.726</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Customer focus (F2)</td>
<td>Quality-related customer complaints are treated with top priority (F22)</td>
<td>2.56</td>
<td>0.96</td>
<td>0.726</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>The goal-setting process for quality within the company is comprehensive (F16)</td>
<td>3.17</td>
<td>1.09</td>
<td>0.752</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Participation of employees (F3)</td>
<td>Our company collects extensive complaint information from customers (F21)</td>
<td>2.72</td>
<td>1.14</td>
<td>0.789</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Quality-related customer complaints are treated with top priority (F22)</td>
<td>2.56</td>
<td>0.96</td>
<td>0.703</td>
<td></td>
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<tr>
<td></td>
<td>Our company conducts a customer satisfaction survey every year (F23)</td>
<td>2.34</td>
<td>1.19</td>
<td>0.780</td>
<td></td>
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<tr>
<td></td>
<td>Marketing research is conducted to collect suggestions for improving products (F24)</td>
<td>2.70</td>
<td>1.23</td>
<td>0.780</td>
<td></td>
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</tr>
<tr>
<td>Education and training (F4)</td>
<td>Employees are involved in quality-related decision-making processes (F31)</td>
<td>2.69</td>
<td>1.11</td>
<td>0.849</td>
<td>0.742</td>
<td>2.65 (10)</td>
</tr>
<tr>
<td></td>
<td>Employees are actively participating in quality audit process (F32)</td>
<td>2.64</td>
<td>1.01</td>
<td>0.904</td>
<td></td>
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<tr>
<td></td>
<td>Employees are encouraged to fix problems they find (F33)</td>
<td>2.42</td>
<td>1.20</td>
<td>0.867</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Technical assistance is provided for employees to help them solve quality problems (F34)</td>
<td>2.88</td>
<td>1.11</td>
<td>0.890</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Employees are recognized for superior quality performance (F35)</td>
<td>2.62</td>
<td>1.16</td>
<td>0.906</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supplier’s relationship (F5)</td>
<td>Resources are available for quality-related training in the company (F41)</td>
<td>2.78</td>
<td>1.27</td>
<td>0.799</td>
<td>0.801</td>
<td>2.84 (8)</td>
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<tr>
<td></td>
<td>Quality-related training is given to all employees in the company (F42)</td>
<td>2.43</td>
<td>1.24</td>
<td>0.907</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Training is given in the “total quality and continuous improvement” concepts throughout the company (F43)</td>
<td>3.17</td>
<td>1.28</td>
<td>0.764</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Training is given in the basic statistical techniques (e.g. histogram and control chart)</td>
<td>2.99</td>
<td>1.07</td>
<td>0.894</td>
<td></td>
<td></td>
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<tr>
<td>Cross-functional product design (F6)</td>
<td>Our company has established long-term co-operative relations with suppliers (F51)</td>
<td>2.79</td>
<td>1.19</td>
<td>0.793</td>
<td>0.791</td>
<td>2.92 (5)</td>
</tr>
<tr>
<td></td>
<td>Our company gives feedback on the performance of suppliers’ products (F52)</td>
<td>3.08</td>
<td>1.32</td>
<td>0.782</td>
<td></td>
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<tr>
<td></td>
<td>Our company regularly examine suppliers’ technical capability and delivery performance (F53)</td>
<td>2.88</td>
<td>1.05</td>
<td>0.887</td>
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<td></td>
<td>The customer requirements are thoroughly considered in new product design (F61)</td>
<td>2.98</td>
<td>1.13</td>
<td>0.715</td>
<td>0.761</td>
<td>3.27 (1)</td>
</tr>
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<td></td>
<td>Various departments participate in new product development (F62)</td>
<td>3.42</td>
<td>1.03</td>
<td>0.847</td>
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<tr>
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<td>New product designs are thoroughly reviewed before production (F63)</td>
<td>3.18</td>
<td>1.15</td>
<td>0.826</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Quality function deployment is used extensively in product design (F64)</td>
<td>3.51</td>
<td>1.08</td>
<td>0.880</td>
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</table>

(continued)
<table>
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<tr>
<th>Practices</th>
<th>Measuring items</th>
<th>Mean</th>
<th>SD</th>
<th>Factor loading</th>
<th>α value</th>
<th>Overall mean (Rank)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Internal quality information</strong></td>
<td>Availability of the cost of quality data to managers (F71)</td>
<td>2.94</td>
<td>1.15</td>
<td>0.728</td>
<td>0.709</td>
<td>2.93 (4)</td>
</tr>
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<td></td>
<td>Visual display of quality information at work stations (F72)</td>
<td>3.31</td>
<td>1.12</td>
<td>0.698</td>
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<td>Visual display of quality performance vs goals (F73)</td>
<td>3.05</td>
<td>1.28</td>
<td>0.753</td>
<td></td>
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<tr>
<td></td>
<td>Transmittal of defect information to specific work stations (F74)</td>
<td>2.93</td>
<td>1.25</td>
<td>0.433</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Availability of scrap and rework data (F75)</td>
<td>2.76</td>
<td>1.34</td>
<td>0.742</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Zero-defects mentality</strong> (F8)</td>
<td>A program for continuous reduction in defects (F82)</td>
<td>2.61</td>
<td>1.11</td>
<td>0.881</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>A plan to reduce rework drastically (F83)</td>
<td>2.72</td>
<td>1.10</td>
<td>0.706</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Teamwork</strong> (F9)</td>
<td>All employees are involved in quality improvement teams (F91)</td>
<td>2.99</td>
<td>1.24</td>
<td>0.749</td>
<td>0.709</td>
<td>2.86 (6)</td>
</tr>
<tr>
<td></td>
<td>Cross-functional teams are established for solving quality problems (F92)</td>
<td>2.88</td>
<td>0.97</td>
<td>0.918</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Resources are available for supporting quality-related teams (F93)</td>
<td>2.62</td>
<td>1.25</td>
<td>0.728</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Workplace decisions are made through consensus (F94)</td>
<td>2.96</td>
<td>1.07</td>
<td>0.877</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Benchmarking</strong> (F10)</td>
<td>We are engaged in extensive benchmarking of competitors’ products that are similar to our primary product (F101)</td>
<td>2.88</td>
<td>0.99</td>
<td>0.886</td>
<td>0.719</td>
<td>2.69 (9)</td>
</tr>
<tr>
<td></td>
<td>We have engaged in extensive benchmarking of other companies’ business processes in other industries (F102)</td>
<td>2.32</td>
<td>0.93</td>
<td>0.756</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Benchmarking has helped improve our product (F103)</td>
<td>2.87</td>
<td>1.06</td>
<td>0.789</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Process control</strong> (F11)</td>
<td>A program to manage internal processes to reduce overall product delivery cycle times (F111)</td>
<td>3.02</td>
<td>1.11</td>
<td>0.761</td>
<td>0.721</td>
<td>3.07 (3)</td>
</tr>
<tr>
<td></td>
<td>Measurement of quality performance in all internal processes (F112)</td>
<td>3.05</td>
<td>1.09</td>
<td>0.726</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Extent of using SPC tools for process control (F113)</td>
<td>3.29</td>
<td>1.27</td>
<td>0.879</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Knowledge of production employees in using SPC tools (F114)</td>
<td>2.77</td>
<td>0.91</td>
<td>0.726</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Willingness of the organization to use SPC in the future (F115)</td>
<td>3.22</td>
<td>1.14</td>
<td>0.304</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Continuous improvement</strong> (F12)</td>
<td>Our company established a database that provide information on internal operation (F121)</td>
<td>2.98</td>
<td>1.24</td>
<td>0.541</td>
<td>0.706</td>
<td>3.14 (2)</td>
</tr>
<tr>
<td></td>
<td>Our company established a database that provide information on its costs and finances (F122)</td>
<td>3.18</td>
<td>0.97</td>
<td>0.842</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Our company uses PDCA cycle for process control and improvement (F123)</td>
<td>3.18</td>
<td>1.25</td>
<td>0.661</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Production equipment is maintained well according to maintenance plan (F124)</td>
<td>3.22</td>
<td>1.09</td>
<td>0.577</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Grand mean value: 2.86

Note: *The items were eventually deleted to improve construct validity*
4.2 Status of TQM practices in the MIE

The main objective of the study was to analyze the implementation level of TQM practices in the MIE. The study refers to interpretation of the mean scores as follows: $1.00 - 1.80 = $worst, $1.80 - 2.60 = $low, $2.60 - 3.40 = $moderate, $3.40 - 4.20 = $high and $4.20 - 5.00 = $very high (Sugiyono, 2008). The mean values for individual items and for each of the practices are presented in Table II. Figure 1 shows the overall mean values of TQM practices. The overall mean values range from 2.52 to 3.27, which corresponds to “low” and “moderate” level of practicing TQM.

TQM practices “cross-functional product design,” “continues improvement,” “process control,” “top management commitment (TMC),” “supplier’s relationship,” “training,” “benchmarking” and “participation of employees” were found as moderately practiced TQM factors in the MIE. Among them, “cross-functional product design” (3.27) was found as highly practiced in the MIE. Scholars emphasized that quality should be produced starting from product design (Ahmad and Yusof, 2010). Imai (1997) also reported that “Gemba” kaizen could not be effective if the product design completion is poor. The MIE gives better focus for product design; however, it needs further improvement as the rating was found in “moderate” category. “Continues improvement” and “process control” were found as the second and third practices of TQM. However, the overall mean value (i.e. 3.11) for continuous improvement reflects a lower degree of practicing compared to India (3.65) (Kumar et al., 2011), Indonesia (4.25) (Bahri et al., 2012) and Pakistan (3.767) (ul Hassan et al., 2012). Taking into consideration on some differences in measuring items, this comparison perhaps indicates that MIE still has a long way to go in the journey toward continuous improvement.

“TMC” is also found as moderately practiced in the MIE. Experiences from different countries confirmed the prominence of TMC for the implementation of TQM in any organizations (e.g. ul Hassan et al., 2012). Direct comparisons with different countries may not be reasonable due to the usage of different measuring items. Nevertheless, the mean value 2.86 for TMC reflects a lower degree of practicing in the MIE compared to mean ratings of manufacturing firms in Pakistan (3.398) (ul Hassan et al., 2012), Indonesia (4.18) (Bahri et al., 2012) and Turkey small- and medium-scale enterprises (SMEs) (4.49) (Bas, 2008). It is implied that the MIE has a long way to go in the journey toward TMC. Previous studies also reported similar findings regarding TMC in the MIE. In their study on the MIE, Kahsay et al. (2007) reported that 62.8 percent of the companies did not establish PDCA cycle, 50 percent do not

<table>
<thead>
<tr>
<th>Size of company</th>
<th>Number of respondents</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium (50–150 employees)</td>
<td>52</td>
<td>44.8</td>
</tr>
<tr>
<td>Large (150 and above employees)</td>
<td>64</td>
<td>55.2</td>
</tr>
<tr>
<td>Total</td>
<td>116</td>
<td>100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Industrial group</th>
<th>Medium</th>
<th>Large</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Textile and apparel products industry</td>
<td>10</td>
<td>14</td>
<td>24</td>
<td>20.6</td>
</tr>
<tr>
<td>2</td>
<td>Leather and leather products industry</td>
<td>14</td>
<td>11</td>
<td>25</td>
<td>21.6</td>
</tr>
<tr>
<td>3</td>
<td>Basic iron and steel products industry</td>
<td>8</td>
<td>9</td>
<td>17</td>
<td>14.7</td>
</tr>
<tr>
<td>4</td>
<td>Chemical and chemical products industry</td>
<td>4</td>
<td>8</td>
<td>12</td>
<td>10.3</td>
</tr>
<tr>
<td>5</td>
<td>Food and drinking products industry</td>
<td>12</td>
<td>16</td>
<td>28</td>
<td>24.2</td>
</tr>
<tr>
<td>6</td>
<td>Manufacture of rubber and plastic products</td>
<td>4</td>
<td>6</td>
<td>10</td>
<td>8.6</td>
</tr>
<tr>
<td>Total</td>
<td>52</td>
<td>64</td>
<td>116</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

Table III. Breakdown of the respondent companies

Table IV. Number of responses according to industrial groups
have long- as well as short-term quality policy and 57.1 percent of the organizations have no information about the product quality of their competitors.

Another remarkable point was found regarding the practice of “supplier’s relationship”. Supplier’s aspect has been found as a moderately practiced aspect of TQM in MIE. The survey results obtained in Turkey’s manufacturing firms (Bas, 2008) and Malaysia’s companies (Arumugam et al., 2009) also depicted low concern for suppliers’ side in organizations. Scholars, however, emphasized that supplier management is an important factor of TQM because materials and purchased parts are often a major source of quality problems (Zhang, 2000). Organizations that pursue suppliers with QM philosophy would enable to reduce the chance of getting a high rejection rate and reduce total quality costs. The MIE should give considerable emphasis on a supplier’s relationship to improve operational efficiency. Emphasis should also be given for people’s management (empowerment and involvement) to function at optimum efficiency and achieve long-term success by meeting/exceeding the requirements customers (Prajogo and Cooper, 2010).

On the other hand, some of the important practices of TQM were found as the least practiced in the MIE. “Customer focus” and “zero defect mentality” are practiced at a lower level with overall mean values of 2.59 and 2.54, respectively. According to Zhang (2000), customer focus is the degree to which a company embarks to satisfy the customers’ needs and expectations in a continuous manner. Hence, if companies do not manage their customers properly, the chance of losing them for competitors will be higher. The MIE should establish customer-focused strategies to make their customers being part of the company and value their feedback. This enables to facilitate the journey toward achieving business excellence, as extensively supported by different scholars (e.g. Arumugam et al., 2009; Kumar et al., 2011).

Overall, the finding of the present study indicates that the MIE is in a “moderate” level with regard to TQM implementation. The grand mean value is 2.86 on 0 to 5 Likert scale, indicating the MIE have an extended way to go to the successful implementation of TQM.

4.3 Reliability and construct validity of the survey instrument
The reliability of the survey instrument was verified using Cronbach’s $\alpha$. It assesses the homogeneity and inter-correlation of the items used in the survey instrument. An $\alpha$ value of 0.70 or more are considered acceptable, as suggested by Nunnally (1978). As presented in Table II, the values of the Cronbach’s $\alpha$ were ranging from 0.704 to 0.801. Therefore, the instrument used in this study was valid and reliable. Also, some of the $\alpha$ values were found to be further improved if some items are removed from the related construct. Table V presents the improved $\alpha$ values. Deletions of some items raise the reliability of
their respective TQM practice. Overall, the reliability of the instrument has been proven to be acceptable.

Construct validity of the instrument was also factor analyzed through principal components analysis using varimax rotation. A survey instrument has construct validity if it measures the theoretical construct or trait that it was designed to measure (Das et al., 2008). In this study, each item was individually tested for construct validity. According to Hair et al. (2005), factor loadings greater than 0.30 are considered to meet the minimal level; loadings of 0.40 are considered more important; if the loadings are 0.50 or greater, then they are considered highly significant. In this study, a factor loading of 0.50 was used as the cut-off point (Das et al., 2008). The factor analysis results are presented in Table II. The factor loadings of F74 and F115 were found below 0.5, and they were dropped due to a poor factor loading. Finally, the survey instrument containing 48 items is found to have good construct validity.

4.4 Test of significant differences

Significance tests were carried out to investigate the differences between L&M and ISO and non-ISO companies with regard to the adoption of TQM practices. An ordinary comparison t-test has been used to evaluate the following hypotheses:

(1) To test for significant differences between L&M companies in the extent of implementing TQM practices:
   • $H_0: \mu_L - \mu_M = 0$; i.e., There are no significant differences between L&M companies in the extent of implementing TQM practices.
   • $H_1: \mu_L - \mu_M \neq 0$; i.e., there are significant differences between L&M companies in the extent of implementing TQM practices.

(2) To test for significant differences between ISO and non-ISO companies in the extent of implementing TQM practices:
   • $H_0: \mu_{ISO} - \mu_{non-ISO} = 0$; i.e., there are no significant differences between ISO and non-ISO companies in the extent of implementing TQM practices.
   • $H_1: \mu_{ISO} - \mu_{non-ISO} \neq 0$; i.e., there are significant differences between ISO and non-ISO companies in the extent of implementing TQM practices.

4.4.1 Comparison between L&M companies. Comparative data on L&M companies are provided in Table VI. It was expected that TQM practices among the large companies would be higher and better established than the medium-sized companies. However, it can
be seen from Table VI that there were no significant differences between L&M on the mean of TQM practices at 0.05 significance level. Thus, there is no sufficient evidence to reject the null hypothesis. The statistical result shows that both of the companies are at a similar level in the extent of implementation of TQM, except three of the practices. Significant differences were observed in “employee empowerment,” “training” and “benchmarking.” They are practiced at a higher level in large companies than medium-sized companies. These three practices can also be regarded as the potential hindrance for medium companies to implement TQM, as they are ranked as the least practiced TQM with mean values of 2.47, 2.55 and 2.49, respectively. It illustrated that employees in medium companies are rarely empowered and were seldom invited by management to discuss quality issues. It may depict that TQM practices in Ethiopia are mainly pushed from top management to shop-floor workers. Also, medium-sized companies should give proper emphasis on the practice of “zero-defects mentality” (2.46) and “customer focus” (2.56) to improve their competitiveness with large companies. Scholars argued that medium-sized companies may use their inherent advantages over larger companies. Organizational structure, short lines and effective communication are relatively simple in medium-sized companies (Lee, 1995; Walley, 2000). Further, Lee (1995) stated that managers may easily inspire and motivate their employees for the implementation of TQM in SMEs. These inherent characteristics make the implementation of TQM to be easier in medium-sized industries than larger firms. Accordingly, medium-sized companies in Ethiopia may consider these advantages to make the process of TQM implementation visible and more easy. However, other barriers in Ethiopia such as financial sources need to be recognized that are among the major impediments for SMEs to achieve anticipated benefits from the TQM approach (Walley, 2000).

4.4.2 Comparison between ISO and non-ISO companies. The second hypothesis was to explore if ISO companies execute TQM practices significantly differently from non-ISO companies. “ISO companies” refer to companies that implemented ISO 9001:2008 and “non-ISO companies” refer to companies that did not implement the ISO 9001 series. It was anticipated that TQM practices are executed higher among the ISO 9001 certified companies than non-certified companies. The statistical results are presented in Table VII. It was proven that there are significant differences between mean responses of the ISO 9001 certified and non-certified companies in ten of TQM practices at 0.05 significance level. In particular, ISO 9001 certified companies had the greatest significance difference in “cross-functional product design.” Obviously, non-ISO companies must improve their competitiveness by moving to all functions from product design to manufacturing and even

<table>
<thead>
<tr>
<th>Practices</th>
<th>( \mu_{\text{Medium}} ) (n = 52)</th>
<th>( \mu_{\text{Large}} ) (n = 64)</th>
<th>p-value</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1. Top management commitment</td>
<td>2.82</td>
<td>2.90</td>
<td>0.624</td>
<td>Not Sig.</td>
</tr>
<tr>
<td>F2. Customer focus</td>
<td>2.54</td>
<td>2.60</td>
<td>0.249</td>
<td>Not Sig.</td>
</tr>
<tr>
<td>F3. Employee empowerment</td>
<td>2.51</td>
<td>2.91</td>
<td>0.029</td>
<td>Sig.</td>
</tr>
<tr>
<td>F4. Employee involvement</td>
<td>2.85</td>
<td>2.71</td>
<td>0.816</td>
<td>Not Sig.</td>
</tr>
<tr>
<td>F5. Training</td>
<td>2.84</td>
<td>3.03</td>
<td>0.012</td>
<td>Sig.</td>
</tr>
<tr>
<td>F6. Supplier’s relationship</td>
<td>2.90</td>
<td>2.93</td>
<td>0.487</td>
<td>Not Sig.</td>
</tr>
<tr>
<td>F7. Cross-functional product design</td>
<td>3.25</td>
<td>3.28</td>
<td>0.327</td>
<td>Not Sig.</td>
</tr>
<tr>
<td>F8. Internal quality information usage</td>
<td>2.91</td>
<td>2.95</td>
<td>0.591</td>
<td>Not Sig.</td>
</tr>
<tr>
<td>F9. Zero-defects mentality</td>
<td>2.48</td>
<td>2.52</td>
<td>0.419</td>
<td>Not Sig.</td>
</tr>
<tr>
<td>F10. Benchmarking</td>
<td>2.55</td>
<td>2.84</td>
<td>0.028</td>
<td>Sig.</td>
</tr>
<tr>
<td>F11. Process control</td>
<td>2.95</td>
<td>3.17</td>
<td>0.149</td>
<td>Not Sig.</td>
</tr>
<tr>
<td>F12. Continuous improvement</td>
<td>3.09</td>
<td>3.20</td>
<td>0.054</td>
<td>Not Sig.</td>
</tr>
</tbody>
</table>

Note: Statistically significant difference at \( p < 0.05 \)
Customer focus, employee involvement, zero-defects mentality and benchmarking have also been observed as the potential hindrance for non-ISO companies. They were ranked as the least implemented TQM practices by non-ISO companies with mean values of 2.26, 2.41, 2.37 and 2.26, respectively. Nevertheless, significant differences were not observed between ISO and non-ISO companies only in two of the practices, i.e., internal quality information usage and training. Both types of companies are equally familiar to ensure the quality level of their products and realized that unskilled manpower significantly impacts the overall efficiency of their companies.

ISO companies have been identified as superior in implementing TQM practices than non-ISO companies. The finding is congruent with a previous study (ul Hassan et al., 2012). They all showed that TQM practices are significantly executed in ISO companies. The findings together revealed an increasing realization that ISO certifications significantly improve the effectiveness of TQM implementation.

In summary, it should be highlighted that the mean level of TQM implementation in all groups (i.e. medium, large, ISO and non-ISO) are laid in “moderate” and “low” category, except some practices in ISO companies. This finding absolutely indicates that there is still a long way to successfully implement TQM practices in the MIE regardless of their size and type.

5. Conclusion
The present study contributes to the dearth of research on TQM in emerging economies, particularly in the eastern part of Africa. Whereas past research has solely focused on the developed world, the present study has focused on exploring the adoption of TQM practices in Ethiopia. The study also focuses on several comparisons, between L&M, and ISO and non-ISO companies with regard to the adoption of TQM practices. The results, in general, showed that TQM is implemented at a moderate level (grand mean value of 2.86 on 0–5 scales) in the MIE. Relatively, greater emphasis is given for cross-functional product design, continuous improvement and process focus, whereas zero-defect mentality, customer focus and participation of employees are among the least practiced TQM factors in the MIE. The study also revealed that ISO companies were found as significantly adopting TQM practices than non-ISO companies, whereas no difference was found between L&M companies. Overall, the study provided important insights for the MIE where the greater emphasis should be placed in future quality improvement programs.

### Table VII.
*t*-test for equality of means TQM practices – comparison by company type

<table>
<thead>
<tr>
<th>Practices</th>
<th>$\mu_{\text{non-ISO}}$ ($n=89$)</th>
<th>$\mu_{\text{ISO}}$ ($n=27$)</th>
<th>$p$-value</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1. Top management commitment</td>
<td>2.63</td>
<td>3.62</td>
<td>0.002</td>
<td>Sig.</td>
</tr>
<tr>
<td>F2. Customer focus</td>
<td>2.62</td>
<td>3.59</td>
<td>0.018</td>
<td>Sig.</td>
</tr>
<tr>
<td>F3. Employee empowerment</td>
<td>2.58</td>
<td>3.46</td>
<td>0.023</td>
<td>Sig.</td>
</tr>
<tr>
<td>F4. Employee involvement</td>
<td>2.50</td>
<td>3.28</td>
<td>0.031</td>
<td>Sig.</td>
</tr>
<tr>
<td>F5. Training</td>
<td>3.08</td>
<td>3.18</td>
<td>0.259</td>
<td>Not Sig.</td>
</tr>
<tr>
<td>F6. Supplier’s relationship</td>
<td>2.89</td>
<td>3.69</td>
<td>0.012</td>
<td>Sig.</td>
</tr>
<tr>
<td>F7. Cross-functional product design</td>
<td>2.71</td>
<td>3.72</td>
<td>0.018</td>
<td>Sig.</td>
</tr>
<tr>
<td>F8. Internal quality information usage</td>
<td>2.93</td>
<td>3.07</td>
<td>0.187</td>
<td>Not Sig.</td>
</tr>
<tr>
<td>F9. Zero-defects mentality</td>
<td>2.37</td>
<td>2.87</td>
<td>0.027</td>
<td>Sig.</td>
</tr>
<tr>
<td>F10. Benchmarking</td>
<td>2.26</td>
<td>2.72</td>
<td>0.033</td>
<td>Sig.</td>
</tr>
<tr>
<td>F11. Process control</td>
<td>2.84</td>
<td>3.52</td>
<td>0.028</td>
<td>Sig.</td>
</tr>
<tr>
<td>F12. Continuous improvement</td>
<td>2.83</td>
<td>3.39</td>
<td>0.001</td>
<td>Sig.</td>
</tr>
</tbody>
</table>

Note: Statistically significant difference at $p < 0.05$
The study has important implications for the industry. It is revealed that ISO companies are necessarily executing TQM practices better than non-ISO companies. It suggests that Ethiopian manufacturers should consider ISO series standards as a starting point to progress to TQM strategy. Experiences from Singapore show that many organizations adopting TQM have chosen ISO 9001 certification as a stepping-stone toward TQM (Quazi and Padibjo, 1997). Indian companies have also viewed ISO standards as the starting point for TQM implementation (Khanna, 2010). Likewise, it might be practical for the MIE to focus on ISO series standards to use it as walkway toward TQM. Of course, implementation of ISO requirements alone may not contribute much to quality improvement, because it necessarily not contains the full set of TQM practices (Ahire and Ravichandran, 2001).

Although the study has found interesting results, more studies need to be conducted in the domain of TQM. Considering the findings of the present study, studies can be conducted to identify the barriers of TQM and develop a comprehensive implementation framework for the MIE. Researches may also explore the individual role of TQM practices in determining various levels of performances as conducted in several previous TQM studies (e.g. Yusuf et al., 2007; ul Hassan et al., 2012).

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Further reading


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Emergence in TQM, a concept analysis

Everard van Kemenade
Van Kemenade ACT, Nuenen, The Netherlands and HU University of Applied Sciences Utrecht, Utrecht, The Netherlands

Abstract
Purpose – The question answered in this paper is: what does the concept of emergence mean in the context of total quality management? The purpose of this paper is to develop a definition for emergence by discovering the structure of the phenomenon and to suggest its implications for total quality management.

Design/methodology/approach – The concept analysis follows the method proposed by Walker and Avant (2014). A first step of the method is a general search on the internet and a literature review executed in scientific databases. Due to the limited search results in the field of quality management a support search has been done in three quality management journals and the method of berry picking was added.

Findings – This concept analysis provides attributes of the concept of emergence as well as antecedents and consequences. Emergence is the phenomenon where out of a network of interacting internal and external elements in the course of time arises a coherent new pattern, that is unpredictable, unexpected, unplanned and irreducible to the separate parts. To make emergence happen an organization needs to react to a complex environment that is in un-order far-from-equilibrium. It needs to be (part of) a complex adaptive system. Emergence might rather lead to a (dynamic) bandwidth wherein the result moves, than to a (static) new order.

Research limitations/implications – In the literature review little is found about the consequences of emergence. A hypothesis is formulated in this area that needs further research.

Practical implications – Only as the authors know and agree upon the definition and meaning of the concept of emergence and the characteristics of the Emergence Paradigm the authors can effectively adjust or develop quality management instruments and tools to support or facilitate emergence in complex organizations.

Originality/value – There is a limited amount of literature on systems theory and complexity theory in quality management. Even less on the phenomenon of emergence. There is no concept analysis on the subject of emergence.

Keywords Total quality management, Emergence

Paper type Research paper

1. Introduction
Emergence is a concept that “emerges” in the domain of quality management. Van Kemenade and Hardjono (2019) named one of their four quality paradigms the Emergence Paradigm, a new mindset for quality management next to the Empirical Paradigm of measurement, the Referential Paradigm of models and the Reflective Paradigm of professional reflection. Van Kemenade and Hardjono just roughly describe the Emergence Paradigm. At the same time the authors assure the importance of the Emergence Paradigm for quality management in increasingly complex environments. The question answered in this paper is: what does the concept of emergence mean in the context of total quality management? Purpose of this concept analysis is to clarify emergence, to develop a definition for emergence in the context of total quality management by discovering the structure of the phenomenon. Only then we can define and develop more effectively the way to act, its quality instruments and opportunities.

2. Method
Since the aim of this research is to scientifically define a concept, the method of Walker and Avant (2014) is used. This method is considered to be a very influential way to analyze a concept for scientific purposes (Nuopponen, 2010). Walker and Avant (2014) propose to search many general sources: dictionaries, thesaurus, colleagues and available literature.
“You must consider all uses of the term” (p. 167). The authors divide the task in several steps. Paragraph 3 describes the use of the concept, divided in two substeps: general sources (&3.1) and scientific sources (&3.2). Paragraph 4 describes the attributes of the concept (&4.1), model case (&4.2), antecedents (&4.3) and consequences (&4.4). In a new step that is added to the Walker and Avant-model by the author, the antecedents and consequences are related to the model case (&4.5).

3. Use of the concept of emergence

3.1 General sources

To start the concept analysis keywords “emergent,” “emergence” have been searched in databases Google, visualthesaurus, Wikipedia and online dictionaries. Emergence originates from the Latin verb “emergĕre.” That is composed of “ex” (out) and “mergĕre” (to sink), together meaning evolve, coming to the surface. In seventeenth century, medieval Latin the word emergentia was used for an unforeseen happening. The visualthesaurus[1] gives the following description of “to emerge” (Figure 1).

The Oxford Dictionary gives two definitions for the noun emergence. First: the process of coming into existence or prominence. In a sentence: “This and other corroborative facts imply a widespread emergence of land at the close of the Ordovician period.” A synonym would be appearance, arrival and coming out. A second definition close to the first is the process of becoming visible after being concealed. An example is given of an insect crawling out of its cocoon. Synonyms mentioned are: disclosure, becoming known, coming to light, exposure, unfolding, publication, publicizing, publishing and broadcasting[2]. We summarize both meaning of emergence in the word: “to arise” (also see Corning, 2002).

The whole and the some of the parts. There is another definition that is used to describe a variety of phenomena in a variety of scientific disciplines. There, it is not enough when the happening arises. Oxford dictionary gives as one of the meanings of emergent (of a property): “arising as an effect of complex causes and not analysable simply as the [sic.] sum of their effects” (underlining by me). So, the whole is more than the some of its parts. Practically you can see this emergence in such different examples as a flight of starlings, the occurrence of a traffic jam, the development of colors, temperature, space and time, in the liquidity of water, in the fractal patterns in snowflakes. Often an ant hill is mentioned as an example of a new pattern that an individual ant could never have achieved. A well known example of emergence is the butterfly effect mentioned by mathematic and meteorologist Lorenz. The movement of the wings of a butterfly in Brasil can have an influence on the emergence of a tornado a month later in Texas (In the original text by Lorenz (1963), he spoke about a seagull in a not specified place).

Emergence in this sense stems from philosophy. Aristoteles mentions in Metaphysics Book Η 1045α 8–10: “[... ] the totality is not, as it were, a mere heap, but the whole is something besides the parts.” However, it can be seen in many scientific disciplines like information science.

Figure 1. Visualthesaurus results for emerge
technology, cybernetics, thermodynamics, econonomy, language science, biology, chemistry, medicin, mathematics and management sciences. It is used in arts, architecture and religion. In psychology we know the concept of Gestalt. Van Bouwel (2006) states that the idea of emergence is regularly used in sociology as well “to indicate that as a result of the interaction of different parts, something new evolves, that the (complex) whole has properties that cannot be reduced to the parts of which it is composed” (p. 4) [3].

**Systems theory and complexity theory.** Emergence is a central concept in systems theory. Von Bertalanffy (1968) provides the funding of the general systems theory:

The meaning of the somewhat mystical expression, “the whole is more than the sum of parts” is simply that constitutive characteristics are not explainable from the characteristics of isolated parts. The characteristics of the complex, therefore, compared to those of the elements, appear as “new” or “emergent”. If, however, we know the total of parts contained in a system and the relations between them, the behavior of the system may be derived from the behavior of the parts. We can also say: While we can conceive of a sum as being composed gradually, a system as total of parts with its interrelations has to be conceived of as being composed instantly. (Bertalanffy, 1968, p. 55)

Holman (2010) describes emergence in short as “order arising out of chaos.” Conti (2010) describes the importance of systems theory for quality management. “Life is an emergent property. Intelligence is an emergent property. Love is an emergent property. Organizational excellence too is an emergent property” (Conti, 2010, p. 8). In the 1960s of the last century the interdisciplinary complexity theory developed from systems theory. There complex adaptive systems (CAS) are defined that have properties like self-organization, complexity, interdependence, chaos, self-similarity and emergence. “Emergence is also central to complexity science; indeed, complexity has been described as the study of emergent processes in complex systems” (Lichtenstein, 2000, p. 486). That brings us closer to the scientific notion of emergence.

### 3.2 Use of the concept: science

To investigate the use of the concept emergence a literature review has been executed. Based on the general search the choice was made to exclude literature on “to emerge” in the meaning of just to arise, since that is not what is meant in the Emergence Paradigm. We choose for the use in systems thinking and CAS, because of its value for organizational development. Table I shows characteristics of the searches.

**Supporting search.** It appeared that 23 percent of the articles found was related to management science; 20 percent to informatics, 17 percent to psychology. The remaining 40 percent was divided over musical science, environmental science, philosophy, architecture, sociology, healthcare and biology. There was one article found in the field of quality management. Because of the limited output in management sciences a new search is done in three magazines: *TQM Journal*, *TQM* and *Business Excellence Management in the International Journal for Quality and Reliability Management*. Furthermore the “berry picking-method” (Bates, 1989) was used by following references, footnotes, citations, authors mentioned in articles found in the first searches. Those two further activities delivered another 34 articles. That makes the total of studies included in the literature review 64.

### 4. Findings

According to Walker and Avant (2014) a good concept analysis provides attributes, antecedents and consequences. Attributes are “critical characteristics that help to differentiate one concept from another related concept and clarify its meaning.” One needs to describe which characteristics the concept has and which it has not. Antecedents are “events or incidents that must occur or be in place prior to the occurrence of the concept.” Consequences
<table>
<thead>
<tr>
<th>Keyword</th>
<th>Criteria for inclusion</th>
<th>Database</th>
<th>Original search result</th>
<th>Excluded after reading title and abstract</th>
<th>Excluded after reading full article</th>
<th>Results used in the research</th>
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</thead>
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<tr>
<td>Take 1: emergence in title and systems theory in keywords</td>
<td>Free text peer reviewed, English</td>
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<td>38</td>
<td>Emerge in meaning of to arise (11); Emergency in stead of emergence (10); Only abstract available (1)</td>
<td>No description or definition of emergence (4)</td>
<td>12 articles</td>
</tr>
<tr>
<td>Take 2: emergence in title and systems theory in keywords</td>
<td>Free text peer reviewed, English</td>
<td>Business Search Premier</td>
<td>8</td>
<td>Emerge in meaning of to arise (4); Dubble (1)</td>
<td></td>
<td>3 articles</td>
</tr>
<tr>
<td>Take 3: emergence in title</td>
<td>Free text peer reviewed, English</td>
<td>Emerald Group</td>
<td>94</td>
<td>Dubble (4); Emerge in meaning of to arise (65), emergency in stead of emergence (11)</td>
<td>2 no definition of emergence, 4 emerge in meaning of to arise</td>
<td>8 articles</td>
</tr>
<tr>
<td>Take 4: emergence in title and complex adaptive systems in keywords</td>
<td>Free text peer reviewed, English</td>
<td>Academic Search Premier Business Search Premier</td>
<td>9</td>
<td>Emerge in meaning of to arise (2), emergency (1)</td>
<td></td>
<td>6 articles</td>
</tr>
<tr>
<td>Take 5: Emergence in title and complex adaptive systems in keywords</td>
<td>Free text peer reviewed, English</td>
<td>Business Search Premier</td>
<td>1</td>
<td></td>
<td></td>
<td>1 article</td>
</tr>
<tr>
<td>Total</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>30 articles</td>
</tr>
</tbody>
</table>
zijn “events or incidents that occur as a result of the occurrence of the concept – in other words the outcomes of the concept” (definitions in Walker and Avant, 2014, p. 173).

4.1 Attributes of emergence

What it is. There are many different views on the concept of emergence. After Aristoteles, it takes till 1875 until the philosopher Lewes re-introduced and coined the concept. Lewes (1877, reprinted in 1886) stated:

Every resultant is either a sum or a difference of the co-operant forces; their sum, when their directions are the same – their difference, when their directions are contrary. Further, every resultant is clearly traceable in its components, because these are homogeneous and commensurable. It is otherwise with emergents, when, instead of adding measurable motion to measurable motion, or things of one kind to other individuals of their kind, there is a co-operation of things of unlike kinds. The emergent is unlike its components insofar as these are incommensurable, and it cannot be reduced to their sum or their difference. (p. 412)

Thereafter the concept experienced a fast extension toward other disciplines as mentioned in Paragraph 3.1. Many researchers agree – in different wordings – that emergence has got to do with the whole being more than the sum of its parts (Bertalanffy, 1968; Goldstein, 1999; el-Hani and Pereira, 2000; Weick, 2000; Macbeth, 2002; Bunge, 2003; Kurtz and Snowden, 2003; Midleton-Kelly, 2003; Roux, 2003; Chesters and Welsh, 2005; Graves, 2007; Wolf and Holvoet, 2004; Clayton, 2006; McCarthy et al., 2006; Juriado and Gustafsson, 2007; Kaufman, 2007; Snowden and Boone, 2007; Kim, 2008; Wan, 2011; Schröder, 2014; Ritchey, 2014; Barouch and Ponsignon, 2016; Karimi-Aghdam, 2017; Roundy et al., 2018). Anderson (1972) states:

The ability to reduce everything to simple fundamental laws does not imply the ability to start from those laws and reconstruct the universe […] At each level of complexity entirely new properties appear. We can now see that the whole becomes not merely more, but very different from the sum of its parts. (p. 395)

Advantage of the choice is that the qualitative aspect is emphasized in stead of the quantitative. In line with these authors preference is given to the qualitative attribute of novelty, emergence leads to new patterns. That is the tipping-point where the structure of the network is changed irreversable. After mixing oil, vinegar and egg suddenly mayonaise is created. The new pattern is coherent (Goldstein, 1999; Wolf and Holvoet, 2004).

What it is not. Emergence can be seen in “what it is not.” Emergence is unpredictable (el-Hani and Pereira, 2000; Gunderson and Holling, 2002; Clayton, 2006; Snowden and Boone, 2007; Kim, 2008; Sawyer, 2005; Ritchey, 2014) and unexpected (Macbeth, 2002; Patel and Ghoneim, 2011). Emergent properties are irreducible to the lower-level phenomena from which they emerge (e.g. el-Hani and Pereira, 2000; Kim, 2008). There is a debate between scientists about the causal influence between the levels (see e.g. Kim, 1992, 2008). Kim (2008) discerns same-level causation, from upward causation and downward causation. Especially, downward causation is not accepted by all. That makes Clayton (2006) express that regarding the causal influence: “much work remains to be done” (p. 4).

Several scientists talk about the unplanned process (Weick, 2000; Juriado and Gustafsson, 2007; Lifvergen et al., 2011). Bratman (1999) claims that human beings are planning agents: “Our [sic.] capacities for planning are an all purpose means, basic to our abilities to pursue complex projects, both individual and social” (p. 82). In Shared Agency (2014), Bratman seeks to establish a framework for understandable basic forms of sociality. He proposes that a rich account of individual planning agency facilitates the step to these forms of sociality. However, emergence is an unplanned social activity. Lifvergen et al. (2011) make a fundamental distinction between planned change and emergent unplanned change (see Table II).
Other related concepts. The concept of synchronicity is coined by Jung (1952/1993). Synchronicity is about “temporally coincident occurrences of acausal events.” That is different from the likelihood of coincidence. Synchronicity and emergence are sometimes considered to be identical (Cambray, 2002). However, in synchronic emergence the emergent phenomena exist at the same time as the phenomena on the lower level they originate from. In the case of synchronic emergence at a certain moment in time novelty revolves around the idea of irreducibility and hence synchronous emergence is usually identified with strong emergence, synchronicity is part of emergence. Some scientists give a more specific meaning to synchronicity than is done here above. Heijblom (2005) adds the characteristic of meaningfulness by saying that synchronicity is about “deemed improbable coincidence of circumstances that one personally experiences as unlikely and meaningful” (p. 23). Jaworski (1998) goes even further. In the preface of his book on synchronicity he states:

We all know these perfect moments, where things come together in an almost unbelievable way, where events that you could never have predicted, let alone steer, lead you in your path in a curious way.

In that case the togetherness of the elements leads by chance to something meaningful, even something perfect. That looks a lot like the new patterns in emergence.

Besides synchronicity “synergy” is associated with emergence. However, synergy “refers to the combined (cooperative) effects that are produced by two or more particles, elements, parts or organisms – effects that are not otherwise attainable” (Corning, 2002, p. 22). The elements, possibly humans, are presented at the same time and at the same time with the result (synchronicity); they cooperate (synergy). Only if, as a result of their interaction, they achieve a new pattern, we call it emergence.

Related also is “serendipity.” In the case of serendipity like in emergence something new evolves, something unexpected, unpredictable. However, it is as it were a by-product.

The discovery takes place, while searching consciously and planned for something else (in that way America was discovered and products like penicillin and viagra were invented by chance).

Finally Noordhoek (2019) distinguishes “surgent” from “emergent.” He used the word “surgent,” from “to surge,” meaning “to rise.” In his research on the quality of associations he agrees that emergence plays a role there. But, he says, sometimes an active element or actor is needed to achieve that result (and then the outcome is no longer unplanned, more predictable and more expected). In most cases he studied some element within the association that put effort in reaching consensus over the concept of quality. In that attribute of an active component surgent differs from emergent, where the new pattern arrises more or less spontaneously.

The definitions of these four related S-concepts are summarized in Table III.

To describe the interrelationship of these related concepts and their relation to emergence the following comparison is proposed (see Figure 2).

<table>
<thead>
<tr>
<th>Planned change</th>
<th>Emergent change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Almost always accompanied by unexpected consequence</td>
<td>The outcome is not the preconceived solution, but the development of the most appropriate solution for the stakeholders concerned</td>
</tr>
<tr>
<td>Appropriate for structural changes</td>
<td>Appropriate for cultural changes</td>
</tr>
<tr>
<td>Appropriate for economic-based change</td>
<td>Appropriate for organizational capacity building</td>
</tr>
<tr>
<td>Appropriate for new organizational structures</td>
<td>Appropriate for change process targeting work processes</td>
</tr>
</tbody>
</table>

Table II. Planned change vs emergent change according to Lifvergen et al. (2011)
Some events occur simultaneously, the actors are present at the same time (synchronicity). They interact, cooperate, what can lead to synergy. Even a new pattern can evolve (novelty). If that process is planned by an actor and achieved through his actions we call it a surgent process. If the new pattern is a coincidence, rather a by-product of other plans, we call it serendipity. If it was not planned, but still evolves, we call it emergence. Some, like Jaworski (1998), use the term synchronicity only when the new pattern that emerged is perfect.

It leads to the following attributes of emergence: interaction, synchronicity, unpredictability, unexpected, unplanned, novelty and irreducibility (as shown in list below).

Attributes of emergence:
- the whole is different than the sum of its parts;
- interaction/synergy between internal and external elements;
- that occur at the same time (synchronicity);
- unpredictable;
- unexpected;
- unplanned;
- leading to new coherent pattern (novelty); and
- irreducible to the separate parts.

The following definition of emergence is proposed: emergence is the phenomenon where out of a network of interacting internal and external elements in the course of time arises a coherent new pattern, that is different from its parts, irreducible to the separate parts unpredictable, unexpected and unplanned.

4.2 Case
Walker and Avant (2014) suggest writing several cases to clarify the concept: a model case, a borderline case, a related case, a contrary case and an illegitimate case. Only the model case on the teaching team Master Integrated Care Design is presented in this article.
The Master Integrated Care Design from the Utrecht University of Applied Sciences started in 2007 as a not government financed course with four students and four part-time teachers. The external developments in the world of work ask for healthcare and social work professionals who are capable to make connections, to design innovative interventions and who can make integrated care happen. Participants in the two-year program exactly develop these competences. The program appeared to be very popular. Since the start the amount of students gradually increased to 133 first year students and 64 second year students in 2018–2019. Since 2017 the master program got its official financing from the Ministry of Education and Sciences in the Netherlands. In 2018, the program is (re-) accredited by the Dutch-Flemish Accreditation Organisation. The growth of the program led to increased pressure on the teachers. They searched in their network within (internal interaction) and outside the university (external interaction) for completion. That caused an exponential growth of the teacher team to 20 staff members. The team that emerged is different than the some of its parts. It is extraordinary in its diversity of gender, ages, experience, scientific discipline. Yet it is very harmonious in a sense that it is new to all members (novelty) and that is not easy to explain. The harmony stays also when new members are asked to join in (synchronicity). Synchronicity can also be noted in the way team members fit in the curriculum. The quality of the cooperation creates continuous learning of the group as a whole and of individuals within (synergy). The new pattern is coherent, was unexpected and unpredictable. It is not the result of planning (unplanned). Some instruments are used to sustain the team coherence (co-teaching, journal club and social events). Result is that the master program is highly appreciated by the students, even now it has grown, as the data of the National Dutch Student Survey (Nationale Studenten Enquete) 2018 show (score 92 on a 100 point scale). The master program takes the shared third place of all masters in the Nederlands as mentioned in the Mastergids.

4.3 Antecedents
Antecedents are "events or incidents that must occur or be in place prior to the occurrence of the concept" (Walker and Avant, 2014).

Emergence occurs as a reaction to the context, the environment. Patel and Ghoneim (2011) state: “Emergence is the apparently sudden and unexpected occurrence of systemic (system-wide) events initiated by the environment that result in a form that is different from the existing form of the system" (Patel and Ghoneim, 2011, p. 425). Also see Bartezzaghi, 1999; Weick, 2000 and Hayes, 2002. Some times it is stated that emergence is a reaction on crises (Holden, 2005; Chaffin and Gunderson, 2016).

Emergence occurs in particular in a complex environment (el-Hani and Pereira, 2000; Mitelton-Kelly, 2003; Snowden and Boone, 2007; Ritchey, 2014). el-Hani and Pereira (2000) state: “When aggregates of material particles attain an appropriate level of organizational complexity, genuinely novel properties emerge in these complex systems” (p. 133). Roux puts it this way: “Technological change is conceptualized as the result of a dynamic and complex process emerging from interactions among properties of the constituting components” (Roux, 2003, p. 11).

Emergence occurs in a context of un-order:

Un-order is not the lack of order, but a different kind of order, one not often considered but just as legitimate in its own way. Here we deliberately use the prefix "un-" not in its standard sense as "opposite of" but in the less common sense of conveying a paradox, connoting two things that are different but in another sense the same. Bram Stoker used this meaning to great effect in 1897 with the word "undead," which means neither dead nor alive but something similar to both and different from both. (Kurtz and Snowden, 2003, p. 465)
Emergence occurs in a situation of far-from-equilibrium (Cilliers, 1998; MacIntosh and MacLean, 2001; Macbeth, 2002; Chan, 2001):

In 1989, Nicolis and Prigogine showed that when a physical or chemical system is pushed away from equilibrium, it could survive and thrive. If the system remains at equilibrium, it will die. The “far from equilibrium” phenomenon illustrates how systems that are forced to explore their space of possibilities will create different structures and new patterns of relationship. (Chan, 2001, p. 6)

MacIntosh and MacLean (2001) state:

A primary concern of complexity theory is with the emergence of order in so-called complex systems which exists far-from-equilibrium in an irreversible medium. Such order manifests itself through emergent self-organisation which occurs as a limited number of simple order-generating rules operate across a densely interconnected network of interacting elements to selectively amplify certain random events through positive feedback. (p. 4)

Cilliers (1998) tells us, that “Complex adaptive systems operate under conditions far-from-equilibrium, which means there is continual change and response to the constant flow of energy into the system. ‘Equilibrium is another word for death’ ” (Cilliers, 1998, p. 4).

Øgland (2008) talks about the design of a Quality management System and concludes that “having the organization maintain disequilibrium was a part of the QMS design” (p. 485).

**Emergence and complex adaptive systems.** The results lead to the question what the relation is between complexity and emergence. Axelrod and Cohen (2000) first define a system, a complex system before taking about CAS: “A system includes one or more populations of agents and all of the strategies that those agents employ. A complex system is one in which the actions of agents are tied very closely to the actions of other agents in the system. When the agents in a system are actively trying to improve themselves (“adapt”), then the system is a Complex Adaptive System.”

Mitleton-Kelly (2003), Snowden and Boone (2007) and Palmberg (2009a, b) consider emergence to be a characteristic of a complex system. The development of emergence here is considered to be the other way around: one of the characteristics of a CAS (Holland, 1998, 1995; Holden, 2005; Clayton, 2006; Lollai, 2017). Holland (1998) defined CAS as “comprised of interacting agents that constantly and mutually affect each other.” Greven (2019) talks about two other important characteristics of complexity thinking: self-organization and emergence. Emergence then is “a situation where out of a certain level of complexity a new [sic.] pattern of dynamic arises that cannot be described as the some or the separate parts.” However, most scientists consider interacting agents that constantly and mutually affect each to be a prerequisite, an antecedent of emergence.

Holden (2005) states in her concept analysis of CAS – also using the method of Walker and Avant – that emergence is the most important consequence of a CAS and that complexity is an antecedent of emergence. Also Holland (1992) speaks of CAS and mentions a.o. non-linearity and diversity as characteristics. That supports the idea that CAS are antecedent of emergence, they can “produce” emergence (Lollai, 2017). In the words of Clayton (2006) however, “the difficult part, both empirically and conceptually, is ascertaining when and why the complexity is sufficient to produce the new effects” (p. 4).

A similar chicken and egg causality dilemma occurs regarding self-organization. Domingues et al. (2015) study Integrated Management Systems as CAS. One of their conclusions is that self-organization inherently arises from Management System’s integration. Bahskar (1989) defined emergence as the process where the interactions between actors such as co-workers in an organization, lead to development structures that organize these interactions – self-organization. However, most scientists state that emergence occurs when there is self-organization (Goldstein, 1999; MacIntosh and MacLean, 2001; Mitleton-Kelly,
Mitleton-Kelly (2003): In an organisational context, self-organisation may be described as the spontaneous coming together of a group to perform a task (or for some other purpose); the group decides what to do, how and when to do it; and no one outside the group directs those activities. (p. 20)

The group has shared intentions (Ellis and Herbert, 2011; Taillard et al., 2016). Building shared intentions (Bratman, 2014; Sawyer, 2005) is part of the emergence process. When actors’ intended actions are interdependent they develop shared intentions – that is individual intentions that several actors have in common. Palmberg (2009a, b) talks about a shared vision. Van Kemenade and Hardjono (2019) talk about shared values.

Emergence and the actors. Emergence presupposes non-linearity of the relation between the elements (Macbeth, 2002; McCarthy et al., 2006; Wimsatt, 2008). Macbeth (2002): “Non-linear systems produce the important result that small effects can have unforeseen and unforeseeable outcomes” (p. 728).

Emergence occurs by diversity of the elements or actors strengthens emergence. Emergence is also enhanced by diversity because of the greater interaction and richer patterns (Holden, 2005). Juriado and Gustafsson (2007) state that the emergent communities of practice in their case study emerged by “diversity, the number and the fluidity of the individuals and organisations involved.” Also (2006) mentions diversity.

Emergence occurs if the actors are interdependent (Palmberg, 2009a, b; Ellis and Herbert, 2011; Bratman, 2014).

Emergence is fostered by improvisation. Haenisch (2011):

[The term [emergence] points to the characteristics of a collective creativity that cannot be understood in terms of individual accomplishment or ability, but instead as a social practice in which the central authority of artistic authorship is transformed into an aesthetic collaboration, one that is not reducible to a simple “sum” or chain of individual creative contributions, but that brings about an additional value, thus contributing to an improvisation’s success (p. 187).

Spann (2018) refers to improvisation and argues how important improvisation is for emergence of quality in organizations.

Emergence and instruments. Macbeth (2002) talks about the need for creative discourse as a means for emergence. Snowden and Boone (2007) call it “dissent and formal debate.” Leaders must create the conditions: “they have to probe, sense and respond” and “Because outcomes are unpredictable in a complex context, leaders need to focus on creating an environment from which good things can emerge, rather than trying to bring about predetermined results and possibly missing opportunities that arise unexpectedly.” Ellis and Herbert (2011) advise management to ensure that lines of communication flow across the network. Fundin et al. (2019) stress the importance of creativity. Van Kemenade and Hardjono (2019) prefer to talk about the creative dialogue. Kelly (1994, p. 469) mentions “growth by chunking”:

The only way to make a complex system that works is to begin with a simple system that works. Attempts to instantly install highly complex organization – such as intelligence or a market economy – without growing it, inevitably leads to failure.

Ellis and Herbert (2011) suggest management to apply simple design principles, because they turn into rules. Palmberg (2009a, b) quotes Zimmerman et al. (1998, p. 26) who state:

It does show that simple rules – minimum specifications – can lead to complex behaviors. These complex behaviors emerge from the interactions among agents, rather than being imposed upon the CAS by an outside agent or explicit, detailed description.
Below list summarizes the antecedents of emergence.

Antecedents of emergence:

1. Reaction on context:
   - Complex environment.
   - Un-order.
   - Far-from-equilibrium.

2. Reaction from CAS:
   - Self-organization.
   - Shared values/shared intentions.
   - Visionary leadership.

3. Reaction by actors:
   - Non-linearity between the actors.
   - Diverse.
   - Interdependent.

4. Reaction through instruments:
   - Improvisation.
   - Communication: informal/through creative discours.
   - Dialogue.
   - Simple rules.

4.4 Consequences

According to Walker and Avant (2014) consequences are “a result or outcome of the concept or phenomenon of interest.” In the literature, little information was found on this topic. Truex and Baskerville (1998) describe emergence in linguistics and states a.o. that emergence does not contain balanced behavior nor any ideal of progress. That is in conflict with the intention of Van Kemenade and Hardjono (2019) regarding the Emergence Paradigm, that is aimed precisely at quality improvement. According to Juriado and Gustafsson (2007) emergent patterns serve as knowledge reservoirs for other parts of the system and contribute to strategic development and innovation. Others like Shiba and Walden (2006) would call it “breakthrough.” Weick and Westley (2002) consider that the result of emergence of learning communities is a “common identity.” Bogenrieder and Nooteboom (2002) call that a code, “a highly tacit one, perhaps better called a shared system of meanings.”

Vargo and Akaka (2012) describe the Service-Dominant Logic and its service (eco)system view that considers ecosystems to be emergent dynamic networks of actors and their interactions. A service ecosystem is “a relatively self-contained, self-adjusting system of resource-integrating actors connected by shared institutional arrangements and mutual value creation through service exchange” (Vargo and Lusch, 2016, p. 10). Service ecosystems emerge and are maintained through continuous efforts of individual actors to create value for themselves, and for others, and the value of each interaction is measured at an individual level as well as broader (e.g. meso or macro) systems levels. Individual actors (at the micro-level) actively strive to collaborate with others to create value, and these collaborations may, under the right conditions, allow service ecosystems to emerge across the meso and macro levels and to remain viable. In their view an ecosystem can be the consequence of emergence.
In the case that emergence occurs on the base of un-order, crises, far-from-equilibrium, the question about the consequence of emergence is interesting. Has a new order been established? Vidgen and Wang (2006) mention the development of a steady state. Macbeth (2002) states that that does not have to be the case all the time. And if a new order has been established, this is again very temporary. Again and again the shape and nature of the change needs to be taken into account. Over and over again the antecedents and consequences can be defined: like in the model case.

Consequences of emergence:

- common identity;
- innovation, breakthrough;
- bandwidth of equilibrium; and
- service ecosystem.

4.5 Again the model case: teacher team master integrated care design

If we look at the antecedents and consequences the majority can be seen in the model case. In the world of work of healthcare there was (and probably still is) un-order and far-from-equilibrium, surely when we talk about integrated care. The master program and the development of a team have been a reaction to developments in the context. That is, in terms of Snowden and Boone (2007) a complex environment. The development in the direction of a learning community took place (and still does) by self-organization, no one has ordered that. We can see non-linearity and diversity of the participants. In the development of the learning community continuously improvisation, creative discourse and dialogue have been used frequently. Regarding the consequences the “common identity” or “shared system of meanings” are visible what can be shown by joint and individual ambassadorship for integrated care. After the emergence of the learning community we cannot speak about a new order or balance. The context moves continuously, just as the (members in the) community. This means we should rather talk about a (dynamic) bandwidth, wherein the result moves than about a (static) new order.

Regarding the emergence of the learning community and its characteristics, the concept analysis resulted in attributes and a new definition of the concept of emergence. Possible consequences have been presented. Insights are given on what precedes. Special attention in that respect is given to CAS, one of the antecedents of emergence. Possible consequences have been presented.

5. Discussion

Only as we know and agree upon the definition and meaning of the concept of emergence and the characteristics of the Emergence Paradigm we can effectively adjust or develop quality management instruments and tools to support or facilitate emergence in complex organizations. This concept analysis resulted in attributes and a new definition of the concept of emergence. Possible consequences have been presented. Insights are given on what precedes. Special attention in that respect is given to CAS, one of the antecedents of emergence. Possible consequences have been presented.

Van Kemenade and Hardjono (2019) make a distinction between four quality paradigms: the Empirical Paradigm, the Reference Paradigm, the Reflective Paradigm and the Emergence Paradigm. The first three paradigms each have their “master brain” that steers quality improvement, being respectively the manager, the customer and the professional (cfr. Freidson, 2001). The Emergence Paradigm, however, has no one behind the wheel. Emergence is unplanned, unlike what we know from the PDCA-cycle (empirical paradigm) or PDSA-cycle (reference paradigm). The implication of this concept analysis is, that when the context is complex, in un-order, far-from-equilibrium, something else is needed.

[…] it should be noted that some elements of the most recent ISO 9001 standard seek to give QMSs an arrangement closer to the more recent complex system approach. Some aspects, in fact, such as a certain peripheral responsibility in managing processes, breakthrough improvements, and enhancing internal competence as a development factor, seem to be an attempt to embrace more recent approaches based on complexity.

Lusch and Vargo (2014) talk about Goods-Dominant (G-D) logic vs Service-Dominant (S-D) Logic. S-D logic considers systematic interaction among multiple actors with varying and changing viewpoints on what constitutes values, that implies a high level of uncertainty. These are called eco-systems. There is a need now for “non-predictive” approaches to market and management. Emergence has the potential to be one of the answers.

When we relate the results of the concept analysis to research done by Van Kemenade and Hardjono (2019) new attributes of emergence have been discovered. Van Kemenade and Hardjono (2019) mentioned in the description of the Emergence Paradigm shared values, “shared leadership,” the use of tools like improvisation, dialogue and appreciative inquiry and the application of principles from systems theory. This concept analysis adds diversity and self-organization of the component parts.

The research did not search for the concept “emergent organisation,” because this concept analysis was looking for the process of emergence not its result. However, new information might have been collected using these search terms.

6. Implications
This research makes further deepening of Emergence Paradigm possible. This deepening is needed because of the complexity of our organizations in an un-ordered context. It is precisely there that the role of leadership and quality managers in the emergence paradigm could lie: supporting organizations to constantly develop and adapt to changing
environments. Do leaders more often need “to let go”? Do quality managers need to bring people together without requesting predefined output? Do quality managers need to gather more narratives than only satisfaction rates and performance indicators?

More research is needed about how we can facilitate the process of emergence. Ellis and Herbert (2011) state that emergent behaviors can coalesce and form informal structures, which may then be readily formalized. Lusch and Vargo (2014) suggest effectuation theory:

Effectuation takes the view that actors operating under [sic.] uncertainty cannot predict the future but can take actions that effect it, a step or two at the time. In essence actors are constantly adapting and learning as they go along and making adjustments to actions they can control. (p. 26)

A similar process might lead to emergence.

This concept analysis discovered that in quality improvement activities we can bring people together and foster interaction. We can exchange “who we are, what we know and whom we know” (Lusch and Vargo, 2014, p. 26). We can share intentions and values. We can stimulate creative discourse, dialogue and improvisation. And then – maybe – novelty emerges.

Notes
1. www.visualthesaurus.com
2. https://en.oxforddictionaries.com/definition/emergence

References


Further reading


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An application of value stream mapping in auto-ancillary industry: a case study

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Abstract

Purpose – Lean manufacturing (LM) plays a major role in eliminating wastes (activities/resources) in a manufacturing organization. Value stream mapping (VSM) is one of the critical tools in LM which will help in identifying wastes in materials and information flow in a specific product family. The purpose of this paper is to illustrate the significance of VSM in the auto-ancillary industry in enhancing the productivity and the quality.

Design/methodology/approach – A case study approach is followed to demonstrate the significance of VSM in identifying various wastes in the auto-ancillary industry. The study has been performed by implementing seven critical steps. A product family is identified based on the customer demand and a cross functional team with specialized experts was formed. The overall processes with sequence are mapped using process flowchart. A cross functional team has been formed to develop the current state of VSM and perform a critical analysis to identify shortcomings. An investigation was performed to overcome the existing shortcomings by identifying opportunities. The relevant kaizens to improve the current state have been proposed. The cross functional team of experts have performed a feasibility study on implementation of proposed kaizens. Finally, a future state of VSM after implementation of feasible kaizens has been reported.

Findings – The results show that future state of VSM brings out the positive impact with respect to process ratio, TAKT time, process inventory level, total lead time and bottleneck time. The proposed improvement also helped to achieve higher customer satisfaction in terms of increased quality, reduced cost and on time delivery.

Research limitations/implications – Present study is focussed on a single product family cell in one of the auto-component organization.

Originality/value – Helps practitioners in the auto-component industry to implement the VSM effectively in their organization.

Keywords Lean production, Value stream mapping, Kaizen

Paper type Case study

1. Introduction

In the ever changing global dynamic market, Indian manufacturing organizations have been facing two main challenges. First one, existing practices becoming obsolete due to the emergence of advanced manufacturing system philosophies. Second, the dynamic nature of change in customer thinking and requirements. Globally customers have started demanding for the state-of-the-art products and services in short time periods, with high quality and low price (Ho et al., 2005; Jasti and Kodali, 2016). The Indian manufacturing organizations need to enhance their present industrial practices to survive among the global competition. The Indian manufacturing industry is a significant contributor towards Indian economy development which is one of the fastest developing economies in the world. The contribution of Indian manufacturing industry towards Indian economy has stagnant over two decades (Jasti and Kodali, 2019). The Indian manufacturing sector is struggling to achieve better productivity and quality due to lot of issues which needs to be addressed to improve productivity and quality of Indian manufacturing industry. The growth of productivity in Indian manufacturing sector was very low as compared with China, Singapore and Pakistan (Bhamu et al., 2012). This indicates that Indian manufacturing
industry has to improve its productivity as well as quality to compete with the global manufacturing leaders.

Indian economy was a protected economy until early 1990's. The economic liberalization in India has opened its gates for global manufacturing organizations to serve and fulfill the requirements of Indian diverse markets. The global manufacturing organizations with the help of advanced manufacturing strategies were able to produce better quality products with low cost and this resulted in tough competition for the Indian manufacturing organizations. Indian manufacturing organizations were not able to compete with global manufacturing players due to limited resources, less skilful labour and outdated technology (Jasti and Kodali, 2014). Similar situation was faced by Japanese manufacturing industry during early 1950's. The Japanese manufacturing industry overcame these challenges by the implementation of advanced manufacturing strategies such as total quality management, total productive maintenance and lean manufacturing (LM). To take corrective actions in this direction, Indian manufacturing organizations have to redefine, redesign and improve their production systems to compete with the global manufacturing players in both global and domestic dynamic markets (Dangayach and Deshmukh, 2001; Yusuf and Adeleye, 2002; European Commission, 2004; Modarress et al., 2005; Singh et al., 2006). Accordingly, it required a set of practical tools and techniques that will help improve the value of the processes and also redesign the manufacturing systems (Marchwinski and Shook, 2003) to suit Indian industry for global competition. The lean thinking has the potential and value stream mapping (VSM) tool (Rother and Shook, 1998; Pavnaskar et al., 2003) can be applied to achieve the required objectives. Indian manufacturing organizations have started their journey towards operational excellence in the manufacturing systems and are being aware of the lean thinking and application. The present study has focussed on demonstrating a few inputs on the significance of advanced manufacturing systems in Indian manufacturing organizations.

The primary objective of the present research is to investigate how VSM is placed into practice and finding the answers for the following questions:

- **RQ1.** What kind of challenges the practitioners faced while implementing the VSM in the real scenarios?
- **RQ2.** Is the VSM really an effective tool in developing countries like India?
- **RQ3.** Can we correlate theory and practical implementation effectively?
- **RQ4.** How to implement VSM in Indian organizations?
- **RQ5.** What resources and knowledge required to implement VSM effectively in Indian manufacturing organizations?
- **RQ6.** What is impact of VSM on productivity, quality and lead time?

All these questions have been answered by conducting a case study which is reported in this research paper. This work also assessed how suitable the VSM is and also developed an appropriate piece of instruction for future practitioners.

The research work reported in this paper is arranged as follows: Section 2 is devoted to discuss about the various contributions in the field of LM and VSM to establish the state of the art. Section 3 is focussed on the organization where the case study was conducted. Section 4 is devoted to explain the research methodology used to perform VSM. Section 5 is focussed on the key elements of case study to present VSM of current state and propose a future-state implemented by kaizens. It also discusses results of the study with respect to productivity, lead time and quality of the product and answering the questions posed in Section 1. Finally, in Section 6 conclusions and future work were reported.
2. Literature review

2.1 Lean manufacturing

Automotive industry is considered to be one of the key industries with approximately 70 m fresh vehicles manufactured per year. This manufacturing industry has initiated lots of novel ideas and also changed our most fundamental views of manufacturing processes (Womack and Jones, 1996). During First World War period, Henry Ford and Alfred Sloan have implemented the mass production that helped USA to dictate the global economy. However, consumers have started to think differently and demanded more quality and better service after Second World War. These consumer requirements were not fulfilled by mass production and Eiji Toyoda and Taiichi Ohno have proposed a new manufacturing strategy, i.e., Toyota Production System during 1950s to cater to those requirements. Subsequently, Japanese manufacturing industries started capturing majority of the world markets. The western manufacturing industries were losing the demand of their products. These western industries have sent the researchers to identify the clue to the success story of Japanese manufacturing industries. John Krafcik has coined the term “lean production system” in 1988 while performing a review of Toyota Production System (Womack et al., 1990). The same term got the popularity through the book *The Machine that Changed the World* published from Massachusetts Institute of Technology, USA (Womack et al., 1990).

LM is a concept that was developed based on the Toyota Production System. Toyota Production System is a highly successful production system due to its mark on increasing Japanese manufacturing industry’s productivity and quality of the products with limited resources (Jasti and Kurra, 2017). Subsequently, it has been developed as a global methodology. It integrates different set of tools and techniques to eliminate the wastes from the manufacturing operations and helps the manufacturer to meet customer’s requirements and expectations of the product (Hines and Taylor, 2000). LM is one of the proved advanced manufacturing philosophies to help achieve excellence in manufacturing functions by elimination of waste. Waste is an activity that has not added any value to the product with respect to customer requirements. LM is aimed to recognize and eliminate every activity performed in product design, manufacturing and supply chain within the organization or among organizations that do not add any value to the product (Womack et al., 1990; Womack and Jones, 1996; Rother and Shook, 1998; Marchwinski and Shook, 2003). LM is defined as:

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\text{[\ldots]} \text{ use less of everything – half the human effort in the factory, half the manufacturing space, half the investment in tools, half the engineering working hours to develop a new product in half of the time. Also, it requires keeping far less than half the inventory on site, results in fewer defects, and produces a greater and ever growing quality of products. (Womack et al., 1990)}
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LM is a philosophy that plays a critical role in enhancement of modern manufacturing operations across manufacturing industries in the globe (Voss, 1995; Holweg and Pil, 2004; Kumar et al., 2006). Hopp and Spearman (2000) and Chen et al. (2005) have argued that LM has one of the critical reasons for contemporary improvements in the aspect of productivity and quality across different industrial sectors.

2.2 Value stream mapping

VSM is one of the critical tools in the implementation of LM across the manufacturing organizations (Alay, 2016). The VSM mainly concentrates on the examination and enhancement of manufacturing systems with separated flow lines (Rother and Shook, 1998). Hayes and Wheelwright (1979) have defined and developed VSM procedure in the product-process matrix. According to Andreadis et al. (2017), no organization is able to implement lean principles without utilizing VSM. VSM offers several advantages over other mapping techniques. The advantages are: it acts as a foundation for effective implementation of LM principles, provides the links between manufacturing processes
and supply chain activities, displays product flow, process flow and information flow, relates production planning and demand forecasting with production schedule, flow of the product within the shop floor and also provides information on inventory levels in different phases of the production schedule (Braglia et al., 2006). In recent past, VSM has developed as most effective methodology to implement LM principles within the internal activities of the organizations and to link supply chain activities around those organizations (Hines and Rich, 1997a, b; Hines, Rich and Esain, 1998; Hines, Rich, Bicheno, Brunt, Butterworth and Sullivan, 1998; Hines and Taylor, 2000; McDonald et al., 2000, 2002; Whitman et al., 2001; Sullivan et al., 2002). However, there are few limitations reported in the implementation of VSM: it is a pencil and paper-based technique resulting in limited accuracy, high variety and low volume product organizations were not able to implement VSM effectively due to the involvement of hundreds of industrial components and processes (Braglia et al., 2006). The primary objective of this study is to demonstrate the application of VSM especially in a large scale auto-ancillary organization located in India.

According to Abdulmalek and Rajgopal (2007) and Braglia et al (2006), VSM is one of the critical tools to implement LM strategy in a manufacturing industry. VSM is a universal language that can be communicated in the form of symbols. It is useful as an appropriate and fundamental instrument to analyze material as well as information flow in the manufacturing system (Jones and Womack, 2000). According to Rosentrater and Balamuralikrishna (2006) and Dal Forno et al. (2014), VSM is a technique that is useful in identifying all value added as well as non-value-added activities performed within a plant, i.e., starting raw material coming from the vendor into the plant through conversion to finished product as well as delivery to the customer. VSM mainly concentrates on the investigation and enhancement of disconnected flow lines in manufacturing operations (Rother and Shook, 1998). It is a qualitative tool that helps to minimize inventory in the production cells and also to reduce throughput time (Kalsaas, 2002). According to Seth et al. (2008), VSM can be implemented in any organization, to any activity of concern expanded from downstream to upstream around the organization. However, while developing VSM of current state there is a possibility of committing mistakes which leads to new problem creation instead of solutions and benefits to the organizations (Dal Forno et al., 2014). Hence, a detailed study has been planned to investigate the development of VSM and the process to be followed to identify and differentiate the value-added activities from non-value-added activities in the literature.

VSM is helpful in identifying waste activities throughout the organization and also across the supply chain of a product (Bhamu et al., 2012). It helps in improving the productivity and quality in the organization and reducing the manufacturing cost and lead times of the product (Dal Forno et al., 2014). Although VSM provides several benefits, the utilization of VSM involves some complications and restrictions. According to Liker and Meier (2006), it is a simple method of developing product, information and process flow. It looks simple to develop a current state map but when the process lacks standardization it is difficult to capture the reality. It is also very difficult to perform VSM on a complex processes such as automobile production. Jasti and Sharma (2014) have identified difficulties in developing a current state map and also proposed a simple process flowchart to simply the development process of current state map. According to Jasti and Sharma (2014), there is a need of complete plan of action to develop effective VSM. It requires a cross functional team consisting of VSM experts, production experts and facilitator from the workplace to perform VSM effectively. This kind of team formation helps in understanding the production line problems through facilitator, the need of VSM for that particular condition through VSM expert and the production expert provides appropriate insights of production systems.

McDonald et al. (2002) have successfully implemented VSM within a high-performance motion control products manufacturing plant to identify and eliminate waste activities within a product cell. Lummus et al. (2006) have proved the application of VSM in a
physician clinic to improve patient satisfaction by reducing waiting time as well as bringing down stress on the medical staff. Lasa et al. (2008) have found application of VSM in plastic industry to improve productivity, reduce lead time and process inventory in the product cell. Solding and Gullander (2009) have performed an analysis on application of VSM by using a simulation tool to model and assess various complex conditions. Andrade et al. (2016) have reported the impact of VSM by using a simulation tool. This study has utilized a simulation tool to show possibility of reducing the lead time, improving the quality and productivity in an automobile manufacturing organization. However, this study did not implement VSM in real scenario as reported from Brazil.

A few case studies have been published on VSM application in Indian auto-ancillary industry. Sahoo et al. (2008) have reported the VSM application to identify waste activities and to improve various aspects of a production system. Seth et al. (2008) have applied VSM in a cottonseed oil organization and reported their work in a case study approach. Vinodh et al. (2010) and Singh et al. (2010) have tested application of VSM in an Indian manufacturing industry and reported the positive impact of VSM on reducing idle time, cycle time, inventory and defects. Gurumurthy and Kodali (2011) have performed VSM using simulation software and discussed the importance of VSM and effectiveness of simulation software. The software helped to check various dynamics of the manufacturing system. Bhamu et al. (2012) have conducted a case study in one of the automobile organization to improve productivity and quality by applying VSM. This work revealed that there is a positive impact on productivity and quality. Singh and Singh (2013) have reported the positive impact of VSM in an auto-ancillary organization by using a case study approach. It has been proved that VSM is useful in improving productivity, quality, work-in-process inventory and reducing manufacturing cost and lead time.

Vinodh et al. (2015) have reported similar study on application of VSM and showed that VSM has improved the quality and productivity, and reduced the lead time and work-in-process inventory of the production line. However, it can be observed that the past research was conducted and analyzed the application of VSM in small and medium scale manufacturing organizations. It can be observed that there was a very few research studies published to address the problems faced by Indian automobile and auto-ancillary industry especially from the large scale Indian automobile and auto-ancillary industry. Lacerda et al. (2016) have implemented VSM in one of the original equipment manufacturer from automobile sector. Kumar and Kumar (2016) have analyzed the importance of VSM in LM implementation with the help of case study approach in an Indian manufacturing organization. Singh et al. (2017) have conducted an investigation on use of VSM in the casting industry. The study has reported that VSM helped in reducing net cycle time of operations and elimination of non-value-added activities. Devi et al. (2018) have implemented VSM in one of the wet grinder manufacturing organization’s assembly line. This study also reported the reduction of TAKT time and non-value-added activities in the assembly line.

2.3 Kaizen

Any task can be classified into three categories: value-added work, Muda and incidental work. Incidental work does not add any value to the product, but it is required in the current production system. Value-added works are useful in adding value to the product. Finally, Muda defined as a process that does not create any value to the product and is not required to fulfill the customer needs. VSM is useful in identifying various types of muda and incidental work activities in a particular work. But it would not provide any solution (Jasti and Sharma, 2014). LM helps in developing the solutions through various other tools such as kaizen.
Imai (1986) has discussed about the significances of kaizen: it is a continuous process, helps in improving productivity, enhances the workplace, eliminates hard work and helps operators to conduct experimentation on their work using a scientific method, apart from helping to spot and remove wastes in the organization processes. It is difficult to achieve continuous improvement without appropriate kaizen implementation. Hence, various researchers have focussed on proposing various methods to implement kaizen effectively (Álvarez-García and Río-Rama, 2018). However, many research studies have reported that kaizen is difficult to implement in an organization without understanding and applying appropriate methodology (Gautam et al., 2012; Arya and Jain, 2014). These problems have been faced across the world apart from Japan (Katsuki, 2008; Gautam et al., 2012). To overcome these difficulties a standard kaizen sheet is developed to propose appropriate kaizen by taking the practitioners inputs.

The present study observed various benefits in finance, inventory, cycle time and productivity by implementing VSM and kaizen collectively. Hence, this study investigates and reports the application of VSM and kaizen in one of the fastest developing auto-ancillary organization using case study research. The organization is located geographically in multiple locations across the globe.

3. Brief description of the company
The case study was conducted in one of the auto-ancillary organization located in southern part of India which we call as ABC Limited. ABC Limited is a major supplier of automotive ancillary products to various original equipment manufacturers across the globe. It is a multinational company located in different countries such as India, Germany, USA. It has involved in different business sectors such as automobile, aerospace, defence equipment and oil and gas. It has around 10,000 workforces globally with an yearly revenue of around $1bn. It has established five production plants in India and another five plants across the world. ABC Limited management and employees are committed towards implementation of LM principles by keeping long term view about the future of the organization. ABC Limited management have decided to upgrade the manufacturing plants as per requirement to implement LM principles. It has organized brainstorm sessions across the organization with employees and external lean consultants to formulate LM strategy that will be suitable to implement lean principles effectively across organization. One of the critical elements in development of LM framework is VSM.

This research reported here was performed as a part of that project. ABC Limited is in development of the complete solution that starts from product designing, through manufacturing and finally testing and validation of the auto product. The few major customers are: Volvo, General Motors, Tata Motors, Mahindra and Mahindra, Bosch and Maruti Suzuki. The organization has formulated a strategy to develop all upcoming units to suit the implementation of LM and environment conscious processes. The organization also focussed on redesigning and modernizing the existing production systems by using LM to attain superiority in the operations. The project was implemented in crankshaft production line to meet the customer requirements. The organization has instructed the supervisors and managers of production line to involve in the present project and assist the team of experts. The team has spent around four months to identify different activities, develop the current state map, propose appropriate kaizens, develop future-state map and implement future-state map in the production line.

4. Research methodology
The study has adopted a case study research approach to validate the utilization of VSM. The case study research approach is useful to perform investigation on real-life situation, and provides the basis for the use of thoughts and enhancements of present methods
Yin, 1994). The focus of VSM has been to identify the wastes in-process, information and material flows. Rother and Shook (1998) has proposed a step-by-step method to perform a VSM which contains five steps to implement VSM effectively in the production cell. The steps are:

1. select a product family;
2. model the current state of VSM;
3. analyze the wastes and propose kaizen events;
4. model the future state of VSM; and
5. make a work plan and achieve it.

The previous mentioned steps have some ambiguity about who has to perform investigations and also the complex nature of development of current state map. To overcome these difficulties, the authors have enhanced the above methodology and proposed a more structured methodology to address the problem with seven steps:

1. identify and select a product family;
2. form a cross functional team to address the problem;
3. map the processes in the production line;
4. develop/Model current state VSM;
5. analyze the wastes and propose kaizen events;
6. propose a future-state VSM after incorporating possible kaizens; and
7. make a work plan and achieve it.

The reported study has followed these steps: selected a product family to apply VSM, formed a cross functional team with five experts, i.e., academic experts, professional expert, manufacturing excellence team member and employee working in the production cell. The authors of present study have participated in the project as academic experts (VSM experts). The study has formulated process flow and process information with the help of development of process flowchart. The team has faced difficulties in collecting the production data. To overcome the difficulties, the study has utilized the process flowchart with simplified operations syllabus to collect the production data. The study has utilized the standardized work sheet to find out the cycle time of the operator. Subsequently, it has monitored and noticed the actual cycle times of machine and manpower in the actual scenario. The VSM experts gathered complete set of data with the help of manufacturing excellence team member (organization facilitator).

The study has modelled current state map with VSM by gathering appropriate data from the developed process diagram. The VSM experts have visited all the work stations to compare actual data with standardized data with respect to various production parameters. The VSM experts also collected information on operator difficulties while performing the actual work. This information helps in identifying the problems faced by the operators. A critical analysis of the current state is performed to help identify the shortcomings in the existing production line and also proposed various kaizens to improve the performance of existing production line. The cross functional team has developed a standardized kaizen sheets to propose, present and understand Kaizens implemented in the production line. In Step 6, all proposed kaizens were incorporated in current state and developed a future state with VSM. Finally, an execution plan was prepared to implement future state of VSM. Figure 1 shows the complete set of VSM steps from the literature in the form of a flowchart. Figure 2 shows the proposed set of VSM steps in the form of a flowchart.
5. Implementation and results
This section reports the steps followed in detail with the corresponding results.

5.1 Identify and select a product family
One of the critical production cells that has underperformed as compared with respect to the customer demand been identified and selected for the research. The output of the cell is a...
machined crankshaft. A forged crankshaft is supplied to the machining production cell. Primary inspection is carried out to check the specifications and later necessary machining operations are performed on crankshaft to manufacture the final product.

5.2 Form a cross functional team to address the problem
The cross functional team formed consists of five experts: academic experts, professional expert, top management representor, manufacturing excellence team member and employee working in the production cell. Academic and professional experts mentored the complete team. Production cell employee is continuously providing relevant information on the basis of requirements. The organization management has formed an organizational manufacturing excellence task force to perform the improvement activities. The special task force team member was a critical person, who continuously involved and actively participated in the project. Subsequently, the organization has conducted three days' workshop on VSM and kaizen implementation in the organization.

5.3 Map the processes in the production line
Hines and Rich (1997a, b) have reported that the process flowchart is one of the critical VSM tool. Rother and Shook (1998) have proposed a methodology to collect initial information about the production cell. This work followed similar approach to collect initial data of the production cell. The process flow diagram of the selected production cell has been shown in Figure 3. Figure 3 is helpful in identifying the sequence of machines and major operations performed on the product. There are 24 machines and 65 activities were performed on those machines. A separate data collection sheet was prepared and shared to gather complete information about 65 activities of the production cell with respect to cycle time, lead time and waiting time. The process flowchart used to collect information of each activity has been shown in Figure 4. Figure 4 is helpful in identifying sequence of operations in minute level included distance travelled, waiting time and cycle time. All the activities performed in the production cell have been categorized into five categories: operation, transport, delay, inspection and storage. It was observed that 65 activities were performed in the current state. Complete data in terms of distance travel and time spent on a particular activity were identified from the process flowchart and also verified with the standard tables maintained.
by the operations management department. Various critical issues such as bottleneck operation, non-value-added activities, process time, total lead time and TAKT time were estimated with the help of process flowchart. This kind of practice is helpful in identifying various minute operations and compares these operations with the existing standard activities. It is also simplified the development of current state map. According to Liker and Meier (2006), one of the critical and difficult steps of VSM is development of current state map. It can be simplified by developing process flowchart with detailed information. Jasti and Sharma (2014) have utilized similar approach to simplify and develop current state map.

5.4 Develop/model current state VSM
To develop current state of VSM, information on sequence of operations performed from the process map diagram is collated. This information was cross verified by team members that were involved in the development of the production line. Figure 5 shows the current state of the production cell. The current state has provided complete information about various functions performed in the production cell. This will also help to identify value-added and non-value-added activities in the production cell. The critical information such as number of operators needed, work-in-process inventory, process cycle time, changeover time and also existing problem at the each work station were provided by the developed VSM. The timeline listed in current state have two components:

1. the lead time denoted on the top bar of the timeline; and
2. the processing time given on the bottom.

According to Goldratt (1990), every system will have at least one constraint; otherwise the organization will make unlimited profits. It was observed that the super finishing of journal pin operation was the bottleneck operation in the production cell with 12 min cycle time. A huge amount of time spent on non-value-added activities in the production cell, which was 936 min. The root cause identified for the non-value-added activities was huge in-process inventory in the production cell with 78 components. The total process time was 154.77 min and the total lead time of the production cell was 1,008 min. The production cell process ratio and TAKT time were 15.36 per cent and 12 min, respectively. There were numerous problems identified in inventory, distance travelled, process ratio and TAKT time.

5.5 Analyze the wastes, propose and implement possible kaizens
Various problems have been identified on thorough investigation. Some of the critical observations are: there was around 15 metres free space between pin finish grinding and journal finish grinding machine which is not necessary and utilized one excess workforce to handle the component between the two work stations. It was also identified to and fro movements of components between front end grinding operation and front end rough

<table>
<thead>
<tr>
<th>Process Flow Chart 1: Current State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work: Machining of crankshaft</td>
</tr>
<tr>
<td>Method: Present/Future</td>
</tr>
<tr>
<td><strong>Activity</strong></td>
</tr>
<tr>
<td>Operation</td>
</tr>
<tr>
<td>Transport</td>
</tr>
<tr>
<td>Delay</td>
</tr>
<tr>
<td>Inspection</td>
</tr>
<tr>
<td>Storage</td>
</tr>
<tr>
<td>Distance (m)</td>
</tr>
<tr>
<td>Time (min)</td>
</tr>
<tr>
<td>Operation</td>
</tr>
<tr>
<td>Distance (m)</td>
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<tr>
<td>Time (min)</td>
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</tbody>
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Figure 4.
The process flowchart using to collect data information of each activity
Figure 5.
The current state map of the production cell
boring operations. There was a long distance between gear end grinding operation and front end grinding operation and also long distance (12 metres) and road passage between front end rough boring operation and magnetic crack detection inspection. It was observed that pin grinding operation has produced defective items (ovality and leaking of oil). Two journal super finishing grinding operations were fully automated, but needed operators to load the jobs. FOD super finish grinding is providing defective outputs with various defects such as varied sizes and oil leakage. There were to and fro movements between super finishing of journal pin operation and inspection operation. It was also observed that there was a long gap between washing and inspection operation. All these problems hampered productivity, quality and increased inventory level in the production line. It was also observed that there was a long gap between washing and inspection operation. Similarly, the study has identified around 35 problems in the production line.

Current state VSM is critically reviewed and 35 kaizens were proposed using a standard kaizen sheet which is shown in Figure 6 to improve productivity, quality, safety, delivery, morale and reduce cost of the production cell. The total kaizens proposed are distributed among all the categories of kaizens as shown in Figure 7. Some of the proposed suggestions and their responsibility in the production cell were given in Table I.

5.6 Propose a future-state VSM after incorporating possible kaizens
LM philosophy has provided certain guidelines to construct a future VSM (Rother, and Shook, 1998; Marchwinski and Shook, 2003). Few indicative guidelines are mentioned here: TAKT time is a critical parameter in deciding pace of production, bottleneck operations are useful in deciding production schedule, production cell design should be aimed at achieving single piece flow, if not possible, try to incorporate pull production, try to achieve overall process improvement with the help of cycle time or reduce over time (Las et al., 2008). All these modifications suggested by team of experts were incorporated in the future VSM which is shown in Figure 8. The following improvements were achieved: brought down the process inventory from 78 numbers to 50 numbers, drastically reduced the total lead time of production cell from 1008 min to 600 min, improved process ratio from 15.5 to 25.80 per cent reduced workforce to four numbers in which three were un-skilled workers and one was skilled worker.

<table>
<thead>
<tr>
<th>KAIZEN SHEET</th>
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<tbody>
<tr>
<td>Company Emblem</td>
</tr>
<tr>
<td>Name of the manufacturing division:</td>
</tr>
<tr>
<td>Kaizen Theme: To Provide Safety Guard</td>
</tr>
<tr>
<td>Problem:</td>
</tr>
<tr>
<td>Counter Measure:</td>
</tr>
<tr>
<td>Before Counter Measure:</td>
</tr>
<tr>
<td>Analysis:</td>
</tr>
<tr>
<td>Proposed Counter Measure</td>
</tr>
<tr>
<td>Root Cause:</td>
</tr>
<tr>
<td>Machine</td>
</tr>
<tr>
<td>Implemented By:</td>
</tr>
</tbody>
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Figure 6.
The sample of kaizen sheet
5.7 Make a work plan and achieve it

Both the management and employees of the production line were consulted by the expert team to help train and educate the employees to implement the proposed suggestions to improve the production cell performance. After the employees acceptance future VSM is implemented and envisaged benefits that were mentioned in future state were realised. Various machines were shifted to avoid space between two work centre and to and fro movement of the components. This also helped to avoid some of the machines in the production cell.

The production cell output was closely monitored for next three months with respect to various performance measures. The results were summarized in Table II. There was a positive impact with increase of process ratio (10 per cent), reduction in total distance travelled by crankshaft in the production cell (38 metres), reduction in-process inventory (28 components). TAKT time was reduced (1 min), total lead time reduced (408 min), production capacity per shift increased (11 components per shift). Workforce also has been reduced based on suggestions. All the questions raised in Session 1 were answered by conducting a study which is reported in this research paper. Literature review established how appropriate the VSM is and with the help of case study developed a suitable piece of instruction for future practitioners. First, RQ1, the practitioners have faced problems in implementing VSM effectively due to the lack of awareness of employees on VSM, there is a huge resistance from employees to implement VSM in the organization, hence, trust need to be built among the employees by creating awareness about benefits of performing the required tasks (Jasti and Sharma, 2014). To overcome these difficulties, the employees of the organization should be provided continuous training programs on VSM. The practitioners should have complete knowledge on VSM and the context in which it needs to be applied to implement the VSM effectively in the real scenario. It is one of the success formulas to implement VSM effectively in the organization. Second, the study has observed that the Indian industry professionals lack of knowledge to apply VSM effectively in the organization. Bhamu et al. (2012) also have reported similar finding in their VSM case study research. Hence, there is a need to create knowledge across the organizations to implement lean principles effectively in developing countries like India. Third, Liker and Meier (2006) have proposed a new developing methodology on creation of VSM. However, the practitioners lack the conceptual and implementation methodology knowledge. The VSM concepts have well established theoretically and also useful to apply in practical conditions.
<table>
<thead>
<tr>
<th>S. No.</th>
<th>Operation</th>
<th>Problem</th>
<th>Action decided</th>
<th>Responsible person</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Run out checking and length inspection</td>
<td>Excess run out problem</td>
<td>Run out to be monitored and controlled in hardening stage</td>
<td>Heat treatment department</td>
</tr>
<tr>
<td>2</td>
<td>Both end re-centering and sigot turning</td>
<td>Frequent break down</td>
<td>Frequent reconditioning is required</td>
<td>Engineering department and electronics maintenance</td>
</tr>
<tr>
<td>3</td>
<td>FOD super finish grinding</td>
<td>Size variation, oil leakages, operator fatigue</td>
<td>CNC coding has to modify to perform super finishing operations in both end re-centering and sigot turning operation machine. One operator will be saved</td>
<td>Production cell manager</td>
</tr>
<tr>
<td>4</td>
<td>Two journal super finishing grinding operations</td>
<td>Both machines were fully automated. But, the operator was loaded manually</td>
<td>Auto loading was introduced and saved one manpower</td>
<td>Manager</td>
</tr>
<tr>
<td>5</td>
<td>Pin grinding operation</td>
<td>Ovality problem, oil leakages on platform</td>
<td>Poka yoke was introduced</td>
<td>Manager and maintenance department</td>
</tr>
<tr>
<td>6</td>
<td>Pin grinding and journal grinding</td>
<td>Excessive distance between two machines</td>
<td>Pin grinding to be shifted in place of free space so that continuous flow to journal grinding machine will be maintained. One casual will be removed</td>
<td>Engineering department</td>
</tr>
<tr>
<td>8</td>
<td>GE grinding and FOD finish grinding</td>
<td>Excess distance travel Job condition is poor Diamond quality poor No space for wheel to change Operator fatigue</td>
<td>Proper lay-out to be done More stock reduction in turning Imported diamonds to be used</td>
<td>Manager</td>
</tr>
<tr>
<td>9</td>
<td>Front end rough bore</td>
<td>Excess distance from last machine No job condition Job came out from jaw problem Excess scrap on this machine</td>
<td>Operator training about CNC Programme is adjusted as per standards Proper lay-out to be done</td>
<td>Manager</td>
</tr>
<tr>
<td>10</td>
<td>Front end finish bore</td>
<td>High cycle time</td>
<td>Skilled labour is required</td>
<td>Manager</td>
</tr>
<tr>
<td>11</td>
<td>Magnaflux and oil hole cleaning operation</td>
<td>Excess distance from last machine Tool wears out problem</td>
<td>New set of reamers to be used</td>
<td>Manager</td>
</tr>
</tbody>
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Application of VSM in auto-ancillary industry
<table>
<thead>
<tr>
<th>S. No.</th>
<th>Operation</th>
<th>Problem</th>
<th>Action decided</th>
<th>Responsible person</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>Balancing</td>
<td>Low productivity on Schenk Balancing machine</td>
<td>Up gradation of machine</td>
<td>Engineering Dept. and manager</td>
</tr>
<tr>
<td>13</td>
<td>Final inspection</td>
<td>Parameters were not checked</td>
<td>Check the critical parameters</td>
<td>Manager and quality manager</td>
</tr>
<tr>
<td>14</td>
<td>Lapping</td>
<td>High spindle RPM</td>
<td>Pulley to be changed</td>
<td>Manager and maintenance team</td>
</tr>
<tr>
<td>15</td>
<td>Super finish</td>
<td>Danger for operator safety</td>
<td>Surface finish to be monitored and maintained within specification on grinding machines only</td>
<td>Manager and engineering department</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High cycle time</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Poor surface finish problem</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Excess distance from last machine</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>No job condition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Washing</td>
<td>Excess distance from last machine</td>
<td>Proper lay-out to be done</td>
<td>Manager and engineering department</td>
</tr>
<tr>
<td></td>
<td></td>
<td>One excess operator is required continuously</td>
<td></td>
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<td>One excess operator is required continuously</td>
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<td></td>
<td></td>
<td>Washing and super finish operation should be done by single operator</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>One operator will be saved</td>
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Fourth, the study has proposed a seven steps methodology to enhance clarity of the VSM implementation procedure. There is a need to enhance the details of implementation steps, which will address all the issues faced in the practical scenarios. Fifth, the study has noticed that there is a need of infrastructure to implement proposed kaizen’s effectively in the production line. It is also require production consultants, VSM experts and production supervisors to implement VSM effectively. Jasti and Sharma (2014) have implemented similar approach in their case study research. Finally, Vinodh et al. (2015) and Singh et al. (2017) have reported that the productivity and quality of the production system can be improved by implementation of VSM in the organization. The present study outcome has also proved that VSM has enhanced quality of the product and productivity of the system, reduced the cycle time and manufacturing cost, improved the safety and morale of the employees with reduced delivery times. Hence, this study indicates that Indian manufacturing industry needs to implement VSM effectively to get positive impact with respect to customer satisfaction and sustaining global competition.

6. Conclusion

VSM has been proven as one of the critical tools in LM to improve performance and quality of the production cell. It has been proved that VSM is a useful tool for remodelling a production cell. One of the significant objectives of the present study is to check VSM application in an Indian large scale auto-ancillary organization. The present study anticipates to give VSM practitioners a reference for instigating lean principles in auto-ancillary industry. The present study has proposed seven steps methodology to perform VSM investigations. This kind of approach is useful to overcome existing difficulties to develop current state map. The study has posted six research questions. It was addressed these question by using a case study research work. In this case study approach, the study has begun with problem identification, formulation of cross functional team and identification of the processes involved in manufacturing an illustrative product. Subsequently, the study has focussed on developing detailed operational activities by using process flowchart. A current state map was created with the help of process flowchart. The study has investigated what were the problems in the production line through production consultants, operator interactions and standard operations sheets. The study has proposed different sets of improvements in the existing production system. The study helped in incorporation of all the possible improvements after thorough discussion with plant manager, production line operators and also involved top management during discussions. Finally, a future-state map was created by incorporating proposed feasible kaizens, which served as an aim for future lean activities. The investigation team has utilized VSM to identify the waste. Subsequently, kaizen events were applied to eliminate various types of wastes through appropriate solutions in the production activities. Finally, all the hurdles were identified and appropriate solutions were applied to overcome these hurdles and accomplish superior process efficiency.

The six research questions has addressed appropriate after conducting the research investigations in the present study. The study found that there is a need to develop conceptual knowledge on lean principles among the employees of the organization. It has

<table>
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<th>Table II. The comparison of results summary of the present study</th>
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<tr>
<td>Production planned by PPC</td>
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<tr>
<td>Total process time</td>
</tr>
<tr>
<td>Distance travelled by crankshaft in line</td>
</tr>
<tr>
<td>TAKT time for line</td>
</tr>
<tr>
<td>Process ratio for line</td>
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<td>Total lead time on line</td>
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noticed that Indian manufacturing industries need to create awareness among employees on how to implement lean practices in Indian manufacturing environment. There is a need of educating them on impact of lean principles and professional work also. The current state of VSM is the most critical part of VSM development. The study has proposed more precise way of current state of VSM development. The study has also proposed that there is a need of infrastructure to support kaizen development procedures. Finally, the proposed future VSM was implemented and positive impact on various factors was realised such as process ratio, production capacity. The study also reduced following factors: TAKT time (1 min reduced), total lead time (408 mins reduced), process ratio (10 per cent), distance travelled by crankshaft in the production cell (38 metres reduced) and process inventory (28 components reduction). All these achievements help to the organization to meet the customer demand. The study conducted a training session on VSM and kaizen to the employees of the production line, which enhanced the knowledge level of the employees. The management has shown interest in applying VSM concept and lean principles across the organization activities to help with enhancement of the overall effectiveness of their industry. The auto-ancillary company now intends to implement VSM strategy in other departments.

6.1 Limitations of the study
According to Jasti and Kodali (2015), LM is a long term philosophy and requires overall organization support. It might take more time and cost from the company to get the desired results. It is not prudent to generalize the outcomes of the study as the case study was conducted in a specific area of an Indian large scale auto-ancillary organization. This study calls for more number of case studies in different industries in future to generalize the outcome.

References


Further reading


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Airline service quality and visual communication

Do Iraqis and Germans airline passengers’ perceptions differ?

Dalia Suham-Abid and Natalia Vila-Lopez
Faculty of Economics, University of Valencia, Valencia, Spain

Abstract

Purpose – The purpose of this paper is to analyze differences in airlines service quality perceptions (service content) and visual communication styles (service form) between passengers from a high-context (HC) culture (Iraq) and from a low-context (LC) one (Germany). The theoretical support is based on Hall’s (1976) theory about cultural influences on consumers’ perceptions and on ethnocentric influences.

Design/methodology/approach – In this study, the authors compared two groups of passengers from two countries – Iraq (a high-context culture) and Germany (low-context culture) – that gave their opinions about two different airlines (Iraqi Airlines and Lufthansa). In total, 400 personal evaluations were obtained (100 for each company in each country).

Findings – The results have demonstrated that, first, regarding service quality perceptions, both groups of passengers differ, not due to the cultural context, but due to the ethnocentristic feeling, that is service quality values are higher when the domestic company is evaluated in both countries. Second, regarding visual identity perceptions, the cultural context explains perception differences, because the Germans evaluations are higher for both, the foreign company and the domestic one.

Originality/value – First, the authors have measured in the same study whether people from an LC culture differ from people from a HC culture with respect to how they perceive both the content of the service (the perception of service quality) and the form of the service (the perception of visual identity). In other words, the authors have compared not just the way a company delivers its services, but also how the company is visually presented. Second, the authors have studied a country that has seldom been analyzed from a marketing perspective, Iraq. Third, the authors have compared not just two cultures, but also two companies (a domestic one and a foreign one), in order to see if consumers tend to have more positive perceptions of a local company, regardless of the culture to which they belong. If this point is demonstrated, then some more implications related to ethnocentrism will be added for a better understanding of how to proceed in the international arena.

Keywords Airlines, Cross-cultural, Service quality, Visual identity

Paper type Research paper

Introduction

One of the main points of research has been the analysis of the varying perceptions of services among different cultures (Donthu and Yoo, 1998; Furrer et al., 2000; Liu et al., 2001; Basfirinci and Mitra, 2015). These studies suggest that companies must take into account the fact that consumers in different cultures perceive services and companies’ corporate visual identities differently, leading to different degrees of customer satisfaction. Thus, companies should adapt some aspects of their services marketing strategies if they want success in the global economy.

As stated by Mattila (2000), despite the growing interest in cross-cultural research in the hospitality literature, little empirical research has been conducted on the effects of culture on consumers’ assessment of service quality. As this is a vast topic, this paper will focus on the differences in service quality perceptions (service content) and visual communication styles (service form), because a service company should not only provide an excellent quality service, it should also seem superior (Melewar et al., 2017).

On behalf of all authors, the corresponding author states that there is no conflict of interest.
In this vein and based on the proposal of Mattila (1999) and Furrer et al. (2000), this paper wants to examine the impact of culture on customer evaluation of tourism services, following the International Adaptation School of Thought that holds that there are insurmountable country differences that make it impossible to standardize the marketing strategy. To analyze cultural differences, Hall’s (1976) concept of high-context (HC) vs low-context (LC) culture and Hofstede’s (1980, 1984) concept of cultural dimensions were, and still are, quite useful for cross-cultural communication studies. More specifically, similar to Mattila’s (1999) research, this paper aims to compare two countries: an HC country and an LC country, that is a western culture (Germany in our study) vs an eastern one (Iraq). These two scenarios were chosen because we had access to passengers from both of them who had recently used the two multinational airlines investigated in this work, each of them located on each of these two countries. The two countries were selected because they are tremendously different from each other in their cultural dimensions and their communication contexts (Hofstede, 2001). On the one hand, citizens from Iraq, an HC culture, show collectivistic behaviours that tolerate failures, paying higher attention to nonverbal communication (visual signs) and implicit information. On the other hand, the German people are more individualistic, less receptive to errors and lovers of clear and explicit communication messages, where the context (what is intuited by signs) is not so important (De Mooij, 2019). Both countries have been selected because of the steadily increasing cross-cultural exchange of business between them, especially after the American invasion of Iraq in 2003 and the economic and political changes that have followed. It has become a priority for Iraqi companies to get a better understanding of how to provide modern and up-to-date services after two decades of international business isolation.

Therefore, the main objective is to determine if the service strategy can be (or not) standardized cross-culturally in the airline industry. More specifically, this paper aims to compare if passengers from different cultures evaluate equally (or not) the content of service (service quality perceptions) and its form (service visual identity perceptions). The link between both sides of the same coin (service quality and corporate image) in the airline industry can be seen in the work of Hussain et al. (2015).

The justification is that customers’ decision of choosing airline is not only based on the quality of the airline service (service content), but also on their visual appearance (service form), because both dimensions determine the overall travel experience itself (i.e. the flight schedule, ticket prices, in-flight service, employee attitudes, facilities, ticketing procedures, visual meanings, etc.). In this scene, the following question emerges: to what extent the cultural background affects the way this service strategy is perceived (Cunningham, 2002) to recommend potential adaptations?

Specifically, two airline companies (Lufthansa and Iraqi Airlines), which both operate in both countries, were compared in relation to two strategic dimensions (service quality and visual identity). Both fields of research are relevant because of high competition in this sector and low calculated profit margins (Cunningham, 2002). We obtained 400 personal evaluations: 100 from Iraqis using a domestic company (Iraqi Airlines), 100 from Iraqis using a foreign company (Lufthansa), 100 from Germans using a domestic company (Lufthansa) and 100 from Germans using a foreign company (Iraqi Airlines).

These diverse data have permitted us to add value to the previous literature in three main areas. First, we have been able to measure in the same study whether people from an LC culture differ from people from an HC culture with respect to how they perceive both the content of the service (the perception of service quality) and the form of the service (the perception of visual identity). In other words, we have compared not just the way a company delivers its services, but also how the company is visually presented. Second, we have been able to study a country that has seldom been analyzed from a marketing
perspective, Iraq. As remarked by Thomas and Peterson (2017), much management research has been done in EEUU, whereas other countries remain deeply under investigated. Third, we have compared not just two cultures, but also two companies (a domestic carrier and a foreign one), in order to see if consumers tend to have more positive perceptions of a local company, regardless of the culture to which they belong. If we can demonstrate this point, then we will be able to add some more implications related to ethnocentrism for a better understanding of how to proceed in the international arena.

In sum, in line with Basfirinci and Mitra (2015), this paper aims to explain how best to act in order to satisfy diverse customer needs in the airline industry in order to guarantee an international company’s long-term success by considering two areas of research: whether the country belongs to an LC culture or to an HC culture, and whether the company is local or not.

### The concepts of service quality and visual perception across high- and low-context cultures

Different cultures communicate, perceive and value services and a company’s corporate identity differently. This understanding is essential for the marketing of cross-cultural service providers. Their products and services, as well as their communications, need to be designed with cultural differences in mind. This is a crucial and vital issue for organizations and their long-term success. Miscommunication is unnecessary, usually unproductive and can be very cost-intensive for organizations (Axley, 1984). Various aspects of culture eventually lead to different points of view, interpretations or evaluations, and consequently, people act or react to communications differently.

In this scene, the International Adaptation School of Thought has been followed, because, as the theory of product importance perceptions postulate, situational variables, such as the cultural context, will influence consumers’ product perceptions. Therefore, a completely standardized strategy will hardly work.

#### High context vs low context

Edward T. Hall (1976) proffers two main cultural dimensions for communication and time: the HC and LC concept. In outline, the central terms in Hall’s concept are context, information and meaning. Several scholars (Vargo and Lusch, 2004; Liao et al., 2008) follow this line of research.

As context is the central component in the HC/LC concept, defining this term seems to be essential for referring to Hall’s ideas. Coming from a Latin root, the term “context” means “to make a connection” (Rousseau and Fried, 2001). Context in Hall’s concept is “knitted together” with information; therefore, it is inextricably associated with the meaning of a message. The nature of context is usually, but not exclusively, nonverbal, reflecting implicit content. A person from an HC culture (such as Iraq) will set the context and the setting, and let the message evolve without referring to the problem directly (Hall, 1976). In the event of a conflict arising, non-confrontational, indirect and vague language is used in HC communication, relying on the listener’s or reader’s ability to grasp the meaning from the context. However, LC cultures (like Germany) tend to use a more explicit, direct and confrontational approach, to ensure that the listener receives the message exactly as it was sent (Hall, 1976; Gudykunst and Nishida, 1986; Choe, 2001). Previous research suggests that HC communication occurs in collectivistic cultures (like Iraq), whereas LC communication is predominant in individualistic cultures (like Germany) (Gudykunst and Nishida, 1986; Richardson and Smith, 2007).

#### The concept of service quality (service content)

Culture has a great effect on the overall process of perception for customers (Gudykunst and Nishida, 1986; Triandis, 2001), because customers from different cultural backgrounds are
accustomed to their own and known standards of service quality (Yeji, 2012). Ueltschy et al. (2007) stated that different customers express different levels of satisfaction with (the same or) similar service encounters, as each customer evaluates his/her satisfaction based on his/her culture and past experience.

Specifically, several works comparing an HC culture and an LC culture have demonstrated that differences with respect to their service quality perceptions really do exist (Mattila, 1999; Stauss and Mang, 1999; Yeji, 2012). It is stated that individuals from different cultures focus on different cue types to help them to evaluate an experience. For example, Mattila’s (1999) study found that the hedonic dimension of the consumption experience appeared to be less important for consumers from Asian countries, whose value structures tended to reflect the duties of life. By contrast, the hedonic dimension of the consumption experience was more important for Western respondents, whose core values concerned fun and enjoyment (Mattila, 1999).

Stauss and Mang (1999) found some interesting differences in their research about perceptions of airlines. They compared HC and LC cultures, including Japan, the USA and Germany, and demonstrated that foreign customers were dissatisfied when service providers did not meet their culturally determined expectations. For example, some role expectations of Japanese customers (such as avoidance of eye contact) were not satisfied by Americans or Germans.

In sum, the concept of service quality plays a central role in the understanding of customer satisfaction and retention in the areas of services and relationship marketing (Parasuraman et al., 1991; Furrer et al., 2000; Nimako et al., 2010; Muthupandian and Vijayakumar, 2012). Service managers need to be cognizant of the parts of the service delivery experience that are open to cultural influences, as opposed to those that remain stable across cultures, in order to ensure a successful outcome. This leads us to state our first null hypothesis:

**H1.** Service quality perceptions will not differ between HC culture consumers (Iraq) and LC culture consumers (Germany).

To measure service quality perception, one classic concept is the SERVQUAL measurement technique (Parasuraman et al., 1991). This tool divides service into five measurable quality dimensions (Furrer et al., 2000; Nimako et al., 2010; Vargo and Lusch, 2004; Wu, 2006; Basfirinci and Mitra, 2015): reliability of the service provider; assurance instilled by the provider; tangible aspects; empathy; and responsiveness of the provider to customer requests or reactions. According to Furrer et al. (2000), customers’ values and beliefs might change from one culture to another, so the relative importance of each of the SERVQUAL dimensions will differ. As we will explain in the following lines, service quality dimensions are strongly influenced by a customer’s social and cultural environment (Donthu and Yoo, 1998; Furrer et al., 2000; Yeji, 2012).

First, the reliability dimension is defined as the ability to perform the promised service dependably and accurately (Donthu and Yoo, 1998; Wu and Cheng, 2013).

The literature demonstrates that consumers in HC cultures tend to attach greater importance to reliability in service processes (Mattila, 1999) than consumers in LC cultures. The reason is that people in HC countries (like Iraq) that score high on power distance (in terms of Hofstede) tend to accept the fact that there is inequality between people. Specifically, in HC cultures with a high power distance, powerful customers expect service providers to be weaker than them (Donthu and Yoo, 1998; Yeji, 2012), resulting in extremely high treatment expectations in their service relationships. For this reason, according to Yeji (2012) and other researchers (Parks and Floyd, 1996), customers from HC cultures will attach greater importance to the reliability dimension.

In contrast, in LC cultures with a low power distance (like Germany), the differences between powerful and weak customers are small (Yeji, 2012). Because inequalities between
people should be minimized in LC cultures, customers are likely to attach a similar pattern of importance to the different service quality dimensions. It is also the case that in LC cultures, customers prefer to maintain a distance between themselves and the service provider, due to their desire for self-identity (Yeji, 2012), and pay less attention to reliability. These comments lead us to state the following null sub-hypothesis:

\[ H1a. \] HC consumers (Iraqis) and LC consumers (Germans) will not differ in their perceptions of reliability in service relationships.

Second, the assurance dimension relates to the knowledge of employees and their ability to convey trust and confidence.

Consumers in HC cultures tend to have more positive perceptions towards service providers than LC consumers. The reason is that in HC cultures (like Iraq), differences between weak and strong customers really do exist. Hence, weak HC customers are dependent on more powerful service providers. Thus, they will attach a greater importance to a feeling of assurance. They belong to collectivist cultures and they need protection (Yeji, 2012).

In contrast, due to their self-confidence and personal responsibility, LC consumers (Germany) expect to be assured to a lower degree; these consumers come from individualistic and self-confident cultures (Donthu and Yoo, 1998; Hofstede, 1980; Srite and Karahanna, 2006). In sales processes in individualistic LC cultures, the parties want to get to the point fast, whereas in collectivist HC cultures, it is necessary, first, to build a relationship and trust between the parties (Parks and Floyd, 1996; Yeji, 2012). This leads to following null sub-hypothesis:

\[ H1b. \] HC consumers (Iraqis) and LC consumers (Germans) will not differ in their perceptions of assurance in service relationships.

Third, the tangible dimension is associated with visually appealing materials, physical facilities and employees with a neat and professional appearance.

In HC cultures (like Iraq), tangibles are very important, as they reassure weak and insecure customers. Also, tangibles are important for HC customers, as they view these elements as symbols of respect (Yeji, 2012), and this is very important in HC cultures where symbols play a major role. Additionally, as argued by Donthu and Yoo (1998), customers in high uncertainty avoidance cultures use tangibles as surrogate measures of service quality, as these features are visible evidence of quality of service. Donthu and Yoo (1998) also explained that visible/tangible evidence helps customers in high uncertainty avoidance cultures to lower their perceived risk in service situations.

In contrast, in LC cultures (like Germany), tangibles are a means to reduce the closeness of service interaction. Consumers do not need aesthetic reinforcement and they do not rely on symbols. They are pragmatic and direct. For this reason, assurance and tangibles are less important in these cultures, and relationships with service providers are expected to be based on other dimensions (Donthu and Yoo, 1998), thus leading to the following:

\[ H1c. \] HC consumers (Iraqis) and LC consumers (Germans) will not differ in their perceptions of tangibles in service relationships.

Fourth, the empathy dimension can be considered to relate to whether the right amount of attention has been given to the customer.

Basically, customers in HC cultures (Iraq) are orientated towards the short term, so this dimension is less important for them. They do not expect the provider to show empathy and attention, because they do not believe in rules and formal guidelines (Donthu and Yoo, 1998).

By contrast, in LC cultures (like Germany), with a long-term orientation, sustainable long-term relationships with service providers are expected. In other words, in these
cultures, responsiveness, reliability and empathy are extremely important, and they can be seen resulting from the close relationships with service providers (Donthu and Yoo, 1991, 1998; Furrer et al., 2000), leading to following null sub-hypothesis:

\[ H_{1d}. \] HC consumers (Iraqis) and LC consumers (Germans) will not differ in their perceptions of empathy in service relationships.

Finally, the responsiveness dimension relates to willingness to help customers and to provide prompt service. It is communicated to customers by the length of time they have to wait for assistance, by the answers to questions and by the attention given to problems (Zeithaml et al., 2009).

So, given that responsiveness captures the time side of the service experience, with an emphasis on promptness in dealing with customers and their requests, this is more important in the context of an LC monochromic society (like Germany) than in an HC polychromic society where everything is relative and continually changing (Hall, 1976). This implies that in LC (individualistic) cultures, the parties want to get to the point fast, so they value responsiveness (Wu, 2009). The relative value assigned to time by each society causes the difference. The perception of time may affect the importance attributed by consumers to responsiveness in the cultural contexts mentioned, thus leading to the following:

\[ H_{1e}. \] HC consumers (Iraqis) and LC consumers (Germans) will not differ in their perceptions of responsiveness in service relationships.

Visual identity (service form)

In this part, we will try to explain how HC cultures and LC cultures also differ significantly with respect to each visual identity dimension: aesthetic appeal; written message; colours; and brands. Differences between LC cultures and HC cultures in these dimensions have been investigated in previous studies (Licht et al., 2007; Mattila, 1999; Van den Bosch et al., 2006; Thomas and Peterson, 2017), leading to the second main null hypothesis:

\[ H_{2}. \] Consumers in LC cultures (Germany) and consumers in HC cultures (Iraq) will not differ in their visual identity perceptions.

First, visual images are the kinds of images that a company uses to communicate about itself and its products. Different empirical works divide them into two distinct types of entities: simple images and complex images (Licht et al., 2007).

A simple visual image is a depiction that largely relies on explicit meaning. Relating this to the concept of HC and LC cultures, communication studies suggest that consumers in LC individualistic cultures, like German consumers, are more accustomed to simple visual images than to implicit visual images (Hofstede, 2001; Van den Bosch et al., 2006; Würtz, 2005). In contrast, a complex visual image is a representation that relies on implicit meaning, and communication research suggests that complex visual images are more easily processed by consumers in HC collectivist cultures (Thomas and Peterson, 2017), like that of Iraq.

This is because HC countries, with a high power distance score, do not tend to show any obvious hierarchy in images, and usually, no specific authoritative person appears in a visual image (Bansal and Zahedi, 2006). Groups are not involved in any specific task, and casual attire is worn. In contrast, in more individualistic cultures, only one individual is represented visually, and if a group exists, then the focus is on one individual only (Bansal and Zahedi, 2006).

Also, the research of Choi et al. (2005) and Zhou (2008) showed the connection between this cultural dimension and visual communication, through advertisement content, for example. Advertisements and branding strategies of high-context (collectivist) cultures (like Iraq) are
more likely to use family-oriented contexts, whereas LC (individualist) cultures (like Germany) mostly have advertisements with an individualistic context (Wu, 2009).

In sum, and as concluded by authors such as Miller and Krosnick (2000) or Thomas and Peterson (2017) (mass) communication depends to a great extent on signs and symbols, and its interpretation differs across cultures. Then, the following null hypothesis can be stated as follows:

\[ H_{2a} \] HC consumers (Iraqis) and LC consumers (Germans) will not differ in the importance they give to types of images (aesthetic appeal).

Second, regarding written messages (including letters, e-mails, books, magazines, the internet and so on), several communication studies suggest that consumers in HC collectivist cultures (like Iraq) find it easier to process complex visual images (McDonough, 2011). Further, it is suggested that consumers in these cultures perceive implicit verbal messages as more effective, so that advertising content consists of symbolic, nonverbal and indirect verbal messages in abundance.

By contrast, consumers in LC (individualistic) cultures (like Germany) value explicit verbal communication (Gudykunst and Nishida, 1986; Gudykunst, 2000; Hofstede, 2001; Würtz, 2005). In this sense, countries with an HC background tend to emphasize visual effects over text, and the context of a message carries more weight than its words. Countries with an LC background have an emphasis on words and text (Würtz, 2005; Liao et al., 2008). The written format is preferred, with an explicit and direct writing style (Cyr and Trevor-Smith, 2004), leading to the following:

\[ H_{2b} \] HC consumers (Iraqis) and LC consumers (Germans) will not differ in the importance they give to the written message (the functional benefit of the slogan).

Third, colour is considered to be an integral element of corporate and marketing communications, inducing moods and emotions, influencing consumers' perceptions and behaviour and helping companies to position themselves or differentiate themselves from the competition. Cultures differ in their aesthetic expressions, so colours have different meanings and aesthetic appeals in different cultures (Aslam, 2006). For example, there is a deep-rooted tradition of using green in Islamic countries as a corporate image colour. Some studies that have tested colour perception differences between HC cultures and LC cultures are those of McDonough (2011), Aslam (2006) and Licht et al. (2007). We can, therefore, predict the following:

\[ H_{2c} \] HC consumers (Iraqis) and LC consumers (Germans) will perceive and interpret company colours similarly.

Finally, regarding the role of brands in visual identity, this relates to social status; one's social status must be clear, so that others can show proper respect.

In many HC cultures (like Iraq), brands play a major role in expressing identity (Aslam, 2006). Given that power distance is high, higher classes use luxury articles or fashion items to appeal to social status needs. Everyone has his/her rightful place in the social hierarchy (De Mooij and Hofstede, 2002). Moreover, in male HC societies, performance and achievement are important; the latter must be demonstrated, so status brands or products such as jewellery are important status symbols, to show one's success (De Mooij and Hofstede 2002). Thus, brand perceptions will be stronger in this kind of culture.

By contrast, in LC cultures, the weight of a brand is weaker. People in LC cultures tend to view brands less as a status symbol and more as a functional item underlining their chosen lifestyle (Alden et al., 1999). Then, the last hypothesis can be stated as follows:

\[ H_{2d} \] HC consumers (Iraqis) and LC consumers (Germans) will differ in brand perception (brand as self-identity).
Methodology

Sector and countries analyzed

Air travel has become as common as driving on roads, and aeroplanes are a global mode of transportation, connecting most countries on all continents. Furthermore, flying to a faraway destination is an option available to a growing number of people, and this creates a world in which cultures are increasingly exposed to other cultures (Cunningham, 2002).

Iraq and Germany were chosen for this study, because these countries are quite distinct in terms of their positioning. Iraq can be considered as an HC culture and Germany as an LC culture. Moreover, since 2003, these countries have increasingly cooperated with each other, especially in the field of professional services (Spiegel-online, 2013), including security services, telecommunications and media services, like TV and radio (Abid, 2010).

To compare the two cultures, two companies were chosen: Iraqi Airways and Lufthansa. These are two rather different airlines economically, but also culturally. Nonetheless, both companies are the flag carriers of their own countries and, furthermore, they both operate in each other’s home cultures (Weber, 2009), serving passengers from both countries (Iraq and Germany).

Data collection method and procedure

In order to collect primary data to test our hypotheses, two research steps were followed: a cross-cultural focus group and a cross-cultural survey.

Qualitative phase: sample and technique. First, two focus groups were held, one in Iraq and the other in Germany. In total, 20 participants with either an HC (Iraq) or an LC (Germany) background took part. The participants were asked to answer questions about their perceptions of the two chosen companies, including the dimensions of service quality and the dimensions of visual identity. The profile of each participant and the composition of each focus group can be seen in Table I.

A content analysis was conducted to analyze this information. This was useful for the correct preparation of our questionnaire, which was then translated into two languages.
(English and German) and adapted to each company, so that, finally, six questionnaires, with open questions in English, Arabic and German, were prepared. We were then ready to obtain the primary data. To measure service quality perceptions, we used the scale devised by Parasuraman et al. (1991), Talib et al. (2011) and Wu and Cheng (2013), and to measure visual identity perceptions, we used the proposals of Van Riel (1997), McDonough (2011) and Wu (2009). Each item received a score between 1 (lowest value) and 5 (highest value).

Quantitative phase: sample and technique. Second, to test the proposed hypotheses, a survey with 200 participants (100 from Iraq, an HC culture, and 100 from Germany, an LC culture) was conducted. Each participant evaluated the two companies (Lufthansa and Iraqi Airways), so that we finally obtained 400 evaluations. This sample size is in line with previous studies, such as the Hussain et al. (2015), based on 300 valid questionnaires. We followed a convenience sample procedure to collect the data. As explained by Etikan et al. (2016, p. 2), “convenience sampling (also known as Haphazard Sampling or Accidental Sampling) is a type of nonprobability or nonrandom sampling where members of the target population that meet certain practical criteria, such as easy accessibility, geographical proximity, availability at a given time, or the willingness to participate are included for the purpose of the study”. Table II shows the sample profile. Following the work of Hussain et al. (2015, p. 170), the criteria for qualifying our sample were twofold: on the one hand, “the respondent had to be a passenger of the airline” and on the other hand, “the respondent had to have dealt with or communicated with airline staff at least once during the flight. A self-administered questionnaire was used”.

To evaluate the survey, an independent sample t-test was performed, using two independent samples.

Results

Before starting with the ANOVA analysis, Levene’s test was applied to assess the equality of variances between passengers from the two country groups. As these tests show, the variance of the items for both groups is not equal, that is the Levene’s test shows no significance in most of the cases, neither for items used to measure the content of service (service quality) nor for the items used to measure the forms of the service (visual identity) (Table III). Therefore, the ANOVA analysis can be applied to compare the means for both groups of passengers.

Starting with the items used to measure service quality perceptions (the content of the service), our results in Table III lead to affirm that 27 out of the 40 items differ between the two groups. Therefore, our first null hypothesis, \( H_1 \), should be rejected, given that passengers from Iraq show different service quality perceptions than German passengers.

More specifically, regarding \( H_{1a} \) (differences in perceptions of reliability do not exist), Table III shows that both groups of passengers really differ. So, this hypothesis should be rejected. Specifically, Iraqis perceive that the airline’s services are more reliable than the Germans when they evaluate Iraqi Airways (the means are significantly higher for three out of the five items used to measure reliability), whereas Germans perceive that the airline’s services are more reliable when they evaluate Lufthansa (the means are significantly higher

<table>
<thead>
<tr>
<th>Participants</th>
<th>Gender</th>
<th>Age</th>
<th>Income</th>
<th>Religion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group I 100 Iraqis (HCC)</td>
<td>Masculine 51%</td>
<td>20–75</td>
<td>Low 15%</td>
<td>Muslim 82%</td>
</tr>
<tr>
<td></td>
<td>Feminine 49%</td>
<td></td>
<td>Middle 25%</td>
<td>Christian 13%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>High 60%</td>
<td>None 5%</td>
</tr>
<tr>
<td>Group II 100 Germans (LCC)</td>
<td>Masculine 48%</td>
<td>20–75</td>
<td>Low 26%</td>
<td>Muslim 9%</td>
</tr>
<tr>
<td></td>
<td>Feminine 52%</td>
<td></td>
<td>Middle 32%</td>
<td>Christian 68%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>High 42%</td>
<td>None 23%</td>
</tr>
</tbody>
</table>

Table II. Quantitative study: 200 participants (400 questionnaires)
### Reliability

**Company 1: Iraqi Airways**

<table>
<thead>
<tr>
<th>Item</th>
<th>Iraqis Mean</th>
<th>Germans Mean</th>
<th>Levene's Test</th>
<th>t-Test</th>
<th>Sig.</th>
<th>t-Test</th>
<th>Sig.</th>
<th>H1a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provides services as promised</td>
<td>4.354</td>
<td>3.881</td>
<td>0.241</td>
<td>0.624</td>
<td>2.368</td>
<td>0.019</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Sincerely solves problems</td>
<td>4.364</td>
<td>3.890</td>
<td>1.157</td>
<td>0.283</td>
<td>1.093</td>
<td>0.276</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Performs service right the first time</td>
<td>3.980</td>
<td>3.431</td>
<td>0.256</td>
<td>0.613</td>
<td>3.249</td>
<td>0.001</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Maintains error-free records</td>
<td>3.667</td>
<td>3.679</td>
<td>0.791</td>
<td>0.375</td>
<td>0.058</td>
<td>0.954</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

**Company 2: Lufthansa**

<table>
<thead>
<tr>
<th>Item</th>
<th>Iraqis Mean</th>
<th>Germans Mean</th>
<th>Levene's Test</th>
<th>t-Test</th>
<th>Sig.</th>
<th>t-Test</th>
<th>Sig.</th>
<th>H1a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provides services as promised</td>
<td>5.141</td>
<td>5.642</td>
<td>1.128</td>
<td>0.290</td>
<td>3.562</td>
<td>0.000</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Sincerely solves problems</td>
<td>5.222</td>
<td>5.486</td>
<td>6.443</td>
<td>0.012</td>
<td>1.784</td>
<td>0.076</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Performs service right the first time</td>
<td>4.909</td>
<td>5.670</td>
<td>0.344</td>
<td>0.558</td>
<td>5.073</td>
<td>0.000</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Provides service at promised time</td>
<td>5.670</td>
<td>5.081</td>
<td>3.895</td>
<td>0.050</td>
<td>3.644</td>
<td>0.000</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Maintains error-free records</td>
<td>4.505</td>
<td>5.422</td>
<td>10.190</td>
<td>0.002</td>
<td>5.896</td>
<td>0.000</td>
<td>✔</td>
<td></td>
</tr>
</tbody>
</table>

### Assurance

**Company 1: Iraqi Airways**

<table>
<thead>
<tr>
<th>Item</th>
<th>Iraqis Mean</th>
<th>Germans Mean</th>
<th>Levene's Test</th>
<th>t-Test</th>
<th>Sig.</th>
<th>t-Test</th>
<th>Sig.</th>
<th>H1b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Has employees who instill customers confidence</td>
<td>4.818</td>
<td>4.330</td>
<td>0.649</td>
<td>0.421</td>
<td>2.787</td>
<td>0.006</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Has employees who make customers feel comfortable</td>
<td>4.818</td>
<td>4.193</td>
<td>0.071</td>
<td>0.790</td>
<td>3.465</td>
<td>0.001</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Has employees who are consistently courteous</td>
<td>4.687</td>
<td>4.752</td>
<td>12.360</td>
<td>0.001</td>
<td>−0.324</td>
<td>0.747</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Has knowledgeable employees who answer customers</td>
<td>4.424</td>
<td>4.147</td>
<td>5.464</td>
<td>0.020</td>
<td>1.453</td>
<td>0.148</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

**Company 2: Lufthansa**

<table>
<thead>
<tr>
<th>Item</th>
<th>Iraqis Mean</th>
<th>Germans Mean</th>
<th>Levene's Test</th>
<th>t-Test</th>
<th>Sig.</th>
<th>t-Test</th>
<th>Sig.</th>
<th>H1b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Has employees who instill customers confidence</td>
<td>4.555</td>
<td>5.706</td>
<td>8.497</td>
<td>0.004</td>
<td>−8.547</td>
<td>0.000</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Has employees who make customers feel comfortable</td>
<td>4.556</td>
<td>5.706</td>
<td>9.411</td>
<td>0.002</td>
<td>−7.213</td>
<td>0.000</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Has employees who are consistently courteous</td>
<td>4.717</td>
<td>5.963</td>
<td>1.104</td>
<td>0.295</td>
<td>−7.812</td>
<td>0.000</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Has knowledgeable employees who answer customers</td>
<td>4.818</td>
<td>5.789</td>
<td>13.059</td>
<td>0.000</td>
<td>−6.484</td>
<td>0.000</td>
<td>✔</td>
<td></td>
</tr>
</tbody>
</table>

### Tangibles

**Company 1: Iraqi Airways**

<table>
<thead>
<tr>
<th>Item</th>
<th>Iraqis Mean</th>
<th>Germans Mean</th>
<th>Levene's Test</th>
<th>t-Test</th>
<th>Sig.</th>
<th>t-Test</th>
<th>Sig.</th>
<th>H1c</th>
</tr>
</thead>
<tbody>
<tr>
<td>Has up-to-date equipment</td>
<td>3.949</td>
<td>3.651</td>
<td>0.034</td>
<td>0.853</td>
<td>1.473</td>
<td>0.142</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Has visually appealing facilities</td>
<td>4.000</td>
<td>3.761</td>
<td>0.753</td>
<td>0.387</td>
<td>1.184</td>
<td>0.238</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Has employees with neat and professional appearance</td>
<td>4.566</td>
<td>3.239</td>
<td>0.134</td>
<td>0.715</td>
<td>6.808</td>
<td>0.000</td>
<td>✔</td>
<td></td>
</tr>
</tbody>
</table>

**Company 2: Lufthansa**

<table>
<thead>
<tr>
<th>Item</th>
<th>Iraqis Mean</th>
<th>Germans Mean</th>
<th>Levene's Test</th>
<th>t-Test</th>
<th>Sig.</th>
<th>t-Test</th>
<th>Sig.</th>
<th>H1c</th>
</tr>
</thead>
<tbody>
<tr>
<td>Has visually appealing resources</td>
<td>4.222</td>
<td>1.2980</td>
<td>1.181</td>
<td>0.278</td>
<td>4.365</td>
<td>0.000</td>
<td>✔</td>
<td></td>
</tr>
</tbody>
</table>

**Table III.**

Differences between Iraqis and Germans: service quality dimensions

(continued)
for four out of the five items). So, the means are higher when the company of one’s own country is evaluated, which explains that the influence of ethnocentrism feeling is greater than the influence of the cultural context (Iraq vs German) to explain service reliability perceptions.

Regarding $H_{1b}$ (differences in perceptions of assurance do not exist), Table III shows, once again, that both groups of passengers differ. So, this hypothesis should be rejected.
Iraqis perceive greater assurance in the airline’s services than Germans when they evaluate Iraqi Airways (the means are significantly higher for two out of four items), and Germans perceive greater assurance when they evaluate Lufthansa in all the cases. So, the ethnocentric feeling explains assurance perception differences, not the cultural context.

To test $H1c$ (differences in perceptions of tangibles do not exist), Table III shows only slight differences exist and it could be accepted. For Iraqi Airlines, the two customer groups (Iraqis and Germans) only differ in two out of the four items. Additionally, Iraqi and German citizens do not differ significantly in three out of the four items when Lufthansa is evaluated, that is both groups have, more or less, the same opinion of the airlines’ services tangibles. Also, no ethnocentric effects exist for this dimension.

Regarding $H1d$ (differences in perceptions of empathy do not exist), Table III shows that we should reject $H1d$. Once again, Iraqis perceive a higher empathy than German people when they evaluate Iraqi Airways (the means are higher in three out of the five items), and Germans perceive a higher empathy when they evaluate Lufthansa (the means are higher in all the five items). An ethnocentric effect leads consumers to evaluate the company from their own country more positively.

Finally, regarding $H1e$ (differences in perceptions of responsiveness do not exist), Table III shows that the two passenger groups do not differ when they evaluate Iraqi Airways. In contrast, the means are higher in all of the four items when Lufthansa is evaluated. So, we should reject this hypothesis as far as German passengers tend to favour the domestic company.

Concluding with the items used to measure service visual identity (the form of the service), our results in Table IV lead to affirm that 22 out of the 24 items differ between the two groups. Therefore, our second null hypothesis, $H2$, should be rejected, given that passengers from Iraq show different service visual identity perceptions than German passengers.

Regarding aesthetic appeal, $H2a$ should be rejected. As Table IV shows, for Iraqi Airways, the two customer groups (Iraqis and Germans) do not differ significantly for two of the three items. On the contrary, Iraqi and German citizens differ significantly with respect to all three items when Lufthansa is evaluated. As shown by the values of Table IV, Iraqis generally assign lower punctuation to aesthetical items because HC cultures feel less attracted towards images. The results are in line with previous findings (Würtz, 2005; Van den Bosch et al., 2006).

Regarding written messages, $H2b$ should also be rejected. As Table IV shows, for Iraqi Airways, the two customer groups differ significantly with respect to all three items. Interestingly, Germans perceived a higher functional benefit of the slogan for both companies, and Iraqis perceived a higher power of the slogan to assure the level of assistance in both companies. This result is in line with previous literature that states that LC cultures will prefer written messages and quick and functional responses.

Regarding colour perceptions, $H2c$ should be rejected. For Iraqi Airways, the two customer groups differ significantly with respect to all the three items. Additionally, Iraqi and German citizens differ significantly with respect to the same items when Lufthansa is evaluated. Surprisingly, the results show that Iraqi consumers (HC) pay less attention to colours than Germans, for both companies.

Regarding brand expressiveness and identification, results in Table IV lead to reject $H2d$, that is both groups of passengers differ significantly with respect to all three items related when both companies are evaluated. Specifically, Iraqis give higher importance to brand expressiveness for both companies for most of the items.

**Conclusion and managerial implications**

First, with regard to service quality dimensions, we found that consumers in the two sample cultures (Iraq and Germany) differ in their perception of four out of the five service dimensions tested: reliability, assurance, empathy and responsiveness. By contrast, the groups do not differ significantly regarding tangibles. These results mean that when
### Aesthetic appeal of images

**Company 1: Iraqi airways**

<table>
<thead>
<tr>
<th>Item</th>
<th>Iraqis (mean)</th>
<th>Germans (mean)</th>
<th>Levene’s test</th>
<th>t-test</th>
<th>Sig.</th>
<th>H2a</th>
</tr>
</thead>
<tbody>
<tr>
<td>The chosen images attract my attention</td>
<td>4.444</td>
<td>4.459</td>
<td>7.488 0.007</td>
<td>−0.71 0.493</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>The chosen images help me identify the brand</td>
<td>4.384</td>
<td>4.817</td>
<td>3.205 0.075</td>
<td>−2.316 0.022</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>The chosen images are not interesting for me</td>
<td>2.061</td>
<td>2.119</td>
<td>0.001 0.980</td>
<td>−0.391 0.697</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

**Company 2: Lufthansa**

<table>
<thead>
<tr>
<th>Item</th>
<th>Iraqis (mean)</th>
<th>Germans (mean)</th>
<th>Levene’s test</th>
<th>t-test</th>
<th>Sig.</th>
<th>H2a</th>
</tr>
</thead>
<tbody>
<tr>
<td>The chosen images attract my attention</td>
<td>3.667</td>
<td>5.165</td>
<td>0.460 0.498</td>
<td>−8.492 0.000</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>The chosen images help me identify the brand</td>
<td>3.202</td>
<td>2.495</td>
<td>1.604 0.207</td>
<td>−4.070 0.000</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>The chosen images are not interesting for me</td>
<td>2.649</td>
<td>1.661</td>
<td>0.487 0.486</td>
<td>6.215 0.000</td>
<td>✔</td>
<td></td>
</tr>
</tbody>
</table>

### Functional benefit in the Slogan (text)

**Company 1: Iraqi airways**

<table>
<thead>
<tr>
<th>Item</th>
<th>Iraqis (mean)</th>
<th>Germans (mean)</th>
<th>Levene’s test</th>
<th>t-test</th>
<th>Sig.</th>
<th>H2b</th>
</tr>
</thead>
<tbody>
<tr>
<td>I like the way this slogan/logo explains the functional benefits I can expect from the brand</td>
<td>4.051</td>
<td>4.587</td>
<td>0.631 0.428</td>
<td>−2.729 0.007</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>This logo/slogan does not ensure me anything</td>
<td>2.717</td>
<td>2.330</td>
<td>0.416 0.520</td>
<td>−2.407 0.017</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>I do not like the way this slogan/logo ensures me how the brand will assist me in handling my daily life competently</td>
<td>3.394</td>
<td>2.000</td>
<td>6.501 0.012</td>
<td>−7.811 0.000</td>
<td>✔</td>
<td></td>
</tr>
</tbody>
</table>

**Company 2: Lufthansa**

<table>
<thead>
<tr>
<th>Item</th>
<th>Iraqis (mean)</th>
<th>Germans (mean)</th>
<th>Levene’s test</th>
<th>t-test</th>
<th>Sig.</th>
<th>H2b</th>
</tr>
</thead>
<tbody>
<tr>
<td>I like the way the slogan/logo explains the functional benefits I can expect from the brand</td>
<td>3.141</td>
<td>5.110</td>
<td>1.314 0.253</td>
<td>−11.543 0.000</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>This logo/slogan does not ensure me anything</td>
<td>2.980</td>
<td>5.174</td>
<td>0.219 0.641</td>
<td>−12.284 0.000</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>I do not like the way this slogan/logo ensures me how the brand will assist me in handling my daily life competently</td>
<td>3.818</td>
<td>2.633</td>
<td>9.194 0.003</td>
<td>5.493 0.000</td>
<td>✔</td>
<td></td>
</tr>
</tbody>
</table>

### Colours

**Company 1: Iraqi airways**

<table>
<thead>
<tr>
<th>Item</th>
<th>Iraqis (mean)</th>
<th>Germans (mean)</th>
<th>Levene’s test</th>
<th>t-test</th>
<th>Sig.</th>
<th>H2c</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colours are aesthetically (visually) pleasing to me</td>
<td>2.808</td>
<td>3.523</td>
<td>45.908 0.000</td>
<td>−3.584 0.000</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>I feel the colours have been well chosen</td>
<td>2.465</td>
<td>2.927</td>
<td>16.926 0.000</td>
<td>−2.515 0.013</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Colours are aesthetically (visually) appealing to me</td>
<td>2.990</td>
<td>2.459</td>
<td>1.677 0.197</td>
<td>2.831 0.005</td>
<td>✔</td>
<td></td>
</tr>
</tbody>
</table>

**Company 2: Lufthansa**

<table>
<thead>
<tr>
<th>Item</th>
<th>Iraqis (mean)</th>
<th>Germans (mean)</th>
<th>Levene’s test</th>
<th>t-test</th>
<th>Sig.</th>
<th>H2c</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colours are aesthetically (visually) pleasing to me</td>
<td>4.222</td>
<td>4.890</td>
<td>10.738 0.001</td>
<td>−3.191 0.002</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>I feel the colours have been well chosen</td>
<td>4.040</td>
<td>5.126</td>
<td>6.940 0.009</td>
<td>−5.021 0.000</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Colours are aesthetically (visually) appealing to me</td>
<td>4.152</td>
<td>5.193</td>
<td>30.473 0.000</td>
<td>−4.649 0.000</td>
<td>✔</td>
<td></td>
</tr>
</tbody>
</table>

### Brand expressiveness and identification

**Company 1: Iraqi airways**

<table>
<thead>
<tr>
<th>Item</th>
<th>Iraqis (mean)</th>
<th>Germans (mean)</th>
<th>Levene’s test</th>
<th>t-test</th>
<th>Sig.</th>
<th>H2d</th>
</tr>
</thead>
<tbody>
<tr>
<td>The brand makes me think that IA makes my life richer and more meaningful</td>
<td>3.535</td>
<td>2.193</td>
<td>16.880 0.000</td>
<td>7.062 0.000</td>
<td>✔</td>
<td></td>
</tr>
</tbody>
</table>

(continued)
evaluating service quality dimensions, consumers pay less attention to tangibles than to the other four dimensions, because they do not really discriminate between companies by evaluating aspects such as uniforms, equipment and so on. They are more worried about personal contact and the lack of mistakes.

The presence of passengers’ differences while evaluating service quality dimensions indicates that a global/standard service strategy is not appropriate. In particular, HC consumers (Iraqis) evaluate Iraqi Airways more positively than Germans, whereas Germans give higher values to Lufthansa than Iraqis. This means that companies will need to invest more to provide an excellent service when targeting foreign people than when attending domestic passengers, because the exigence level of foreigners is higher. So, the presence of an ethnocentric effect has been demonstrated, since when a passenger is evaluating a company, he/she assigns a better mark if the company belongs to his/her own country. This ethnocentric influence has removed the cultural effect.

Consequently, although the previous literature (Furrer et al., 2000; Yeji, 2012) suggests that companies attending clients from HC cultures (Iraqis) should pay higher attention to certain service quality dimensions (such as reliability and assurance), and those focused on LC cultures (Germans) should be more worried about other service quality dimensions (such as empathy and responsiveness), our results show that both groups give higher scores in all the dimensions when they are evaluating the company from their own country (Iraqi Airways in the case of the Iraqi sample and Lufthansa in the case of the German sample). So, the culture of the passenger determines a company evaluation, rather than the country of origin of this company (national vs foreign).

Second, when the visual identity dimensions are evaluated, this ethnocentric influence has not been demonstrated. In this case, the cultural background explains the obtained differences. On the one hand, LC consumers (Germans) scored higher in items related to images, the functional benefit of the slogan and colour (regardless of which company they were evaluating). On the other hand, HC consumers (Iraqis) assigned better marks to brand-related items (regardless of which company they were evaluating). These results support the previous literature that suggests that the cultural background of HC passengers (Iraqis) explains why do they tend to use implicit messages.

In sum, aside from the cultural context, companies in this industry should not forget that a strong ethnocentric effect exists when evaluating service quality. For this reason, managers should invest in training their employees on how to assist passengers from the domestic market and how to adapt their service when they face foreign passengers.

Also, service providers operating internationally should also invest in visual identity. Due to cultural differences in the perception of visual identity (e.g. symbols, signs, logos, colours or written text), companies need to pay attention to communicating with the right visual items to

<table>
<thead>
<tr>
<th>Item</th>
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<th>Germans (mean)</th>
<th>Levene’s test</th>
<th>t-test</th>
<th>Sig.</th>
<th>H2d</th>
</tr>
</thead>
<tbody>
<tr>
<td>The brand makes me think that IA expresses who I am as a person</td>
<td>3.303</td>
<td>1.495</td>
<td>38.216</td>
<td>10.872</td>
<td>0.000</td>
<td>✔</td>
</tr>
<tr>
<td>The brand makes me think that IA does not represent my deepest values</td>
<td>2.303</td>
<td>5.165</td>
<td>0.846</td>
<td>17.206</td>
<td>0.000</td>
<td>✔</td>
</tr>
<tr>
<td>Company 2: Lufthansa</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The brand makes me think that L makes my life richer and more meaningful</td>
<td>3.323</td>
<td>4.523</td>
<td>0.159</td>
<td>5.656</td>
<td>0.000</td>
<td>✔</td>
</tr>
<tr>
<td>The brand makes me think that L expresses who I am as a person</td>
<td>4.838</td>
<td>5.550</td>
<td>1.777</td>
<td>4.644</td>
<td>0.000</td>
<td>✔</td>
</tr>
<tr>
<td>The brand makes me think that L does not represent my deepest values</td>
<td>4.909</td>
<td>5.459</td>
<td>0.314</td>
<td>3.628</td>
<td>0.000</td>
<td>✔</td>
</tr>
</tbody>
</table>

Table IV.
avoid dissatisfaction and cultural misunderstanding. So, airlines need to avoid political or religious symbolism, as wrongly chosen symbols could lead to misunderstandings. On the one hand, in an HC context culture, companies should use more implicit messages and invest more in brand expression. On the other hand, in LC cultures, airlines should use visual images that are organized more simply and give higher importance to the functional benefit in the slogan. Given that ethnocentrism has not been demonstrated when comparing perceptions of visual identity, these recommendations are as valid for a domestic company as for a foreign company.

To summarize, our results confirm that the concept of HC vs LC is still important for understanding differences between passengers from different countries. However, this focus should be complemented with considerations of ethnocentrism, that is regardless of a person’s cultural context, it seems that his/her perception will be that the service quality of foreign airlines is worse than that of domestic airlines. Airlines should, therefore, invest more in foreign countries to improve the perceptions of their quality abroad. This ethnocentrism does not appear when evaluating visual identity.

Finally, there are some limitations that cannot be ignored. For example, there are additional sub-cultures in both countries. Future research can be done by taking these sub-cultures into consideration. Another limitation could be that the number of visual images to which a person has been exposed could affect the way he/she interprets things. In addition, his/her educational background could become a factor that also influences his/her interpretation. A person who is more highly educated may be able to understand the meaning behind the visual image more easily than a person who is less educated. This variable could also be considered in future studies. Also, further research can be done by taking more countries into consideration. For example, a country that is in between these two cultures on the HC/LC scale can also be taken into consideration for a future study. Additionally, more LC and HC cultures can be taken into consideration to test the cultural differences further.

References


Further reading


About the authors

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Dr Natalia Vila-Lopez is Professor in Marketing in the Department of Marketing at the University of Valencia. She has carried out research on topics such as competitive positioning, identification of strategic groups/competitive groups and the application of multidimensional scaling in marketing.


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The TQM Journal
The international review of organizational improvement
formerly The TQM Magazine

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