Knowledge identification in medium sized enterprises under the context of quality improvement: An exploration in manufacturing companies in China

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Abstract:

As a fundamental element of knowledge management (KM), knowledge identification is a crucial issue in contemporary business organisations. As evidenced by research, medium sized enterprises (MEs) contribute constructively and significantly to economic development, society stabilisation and employment increase. Their healthy survival and growth are of critical importance to a nation. Among the approaches ensuring the successful development of MEs, quality improvement (QI) is a crucial one. However, what is and how to identify the knowledge most relevant to the MEs' QI, the drives and sources for identifying the QI knowledge (QIK) as well as the underpinning rationales, are currently lacking of sufficient exploration. A research focusing on these issues has been strongly emphasised by literature and attested by this research itself of its meaningfulness. Through analysing empirical data collected and attested by a combination of firstly semi-structured interview, focus group following a case study strategy and then a structured interview, this exploratory research has obtained and prioritised the up-to-date answers to these questions, leading to the enrichment of the theoretical understanding of KM approaches in operations with a consideration of quality management. Real world MEs can rely on these findings as a guidance to obtain, select and apply appropriate QIK for their operations performance improvement. The findings can also be referential for knowledge identification and application in view of QI in other type business organisations.

Key words: knowledge identification, quality improvement (QI), medium sized enterprise (ME), case study

Introduction

Among the strategic factors crucial to businesses' operations efficacy, quality improvement (QI) with its ultimate aim of continuously satisfying the customer's expectations on manufacturing and service products/processes (Slack and Brandon-Jones, 2019; Dean and Bowen, 1994), is a fundamental one for securing an organization's continuous growth and competitive position in the marketplace (Arndt, et al. 2019; Akwei and Zhang, 2018; Lorentz, et al., 2016; Dean and Bowen, 1994; Honarpour, et al., 2017, 2018; Asif, et al., 2013). Consequently, the knowledge focusing on QI and its effective and efficient management is pivotally important.

Meanwhile, as a fundamental component of national economy, small and medium sized enterprises (SMEs) serve as a key contributor to ensure the sustainable development of a country. They provide service and manufacturing products to customers and contribute to various aspects of a society and a nation. Their existence and prosperity ensure and propel the stability and growth of economic systems and the well-being of people (Batista, et al., 2019; Mat, et al., 2018; Dangayach and Laosirihongthong, 2012; Mathur, et al., 2012; Salles, 2006; Wee and Chua, 2013; Desai, 2008). The vast number of SMEs operating successfully in various business sectors also evidence in their own right of their critical role to a country. The figures from European Union (Brink and Madsen, 2015; Šatanová, et al., 2015; Leopoulos, 2006) further manifest SMEs' importance: more than 99% of all the existing enterprises are SMEs, and they provide more than 60% of the total employment, as well as more than 50% of value contribution to the economic systems. Similar phenomena as such can also be observed in other regions, such as in China, SMEs are a main industrial organisation type attracting domestic and international investments, and function as one of the driving forces underpinning the country's development (MOC, 2012). These hard facts, alongside that the SMEs and especially many medium sized enterprises (MEs) have already developed or are developing an international business outreach (OCED, 2009; Loane and Bell, 2011; Cardoza and Fornes, 2013), further demonstrate their value to a country and the whole world. Consequently, to sustain SMEs' healthy survival and continuous development is of strategic importance to both SMEs themselves and a wide range of their internal and external stakeholders (Mat, et al., 2018; Brink and Madsen, 2015; Massaro, et al., 2016; Kumar, et al., 2016; Coltorti, et al., 2013).

Mindful of that MEs have become an indispensably crucial drive in economic recovery and growth (Massaro, et al. 2016; Coltorti, et al., 2013), it is of both practical and theoretical meaningfulness to explore and understand more in-depth on the key strategic elements of MEs'

business operations, while knowledge associated with QI (QIK) is one of them. Nonetheless, the existing KM literature has a scarce of focus on MEs (Soto-Acosta, et al., 2018; Hu, et al., 2019; Massaro, et al., 2016), especially with the particularly focused areas such as QIK. Hence to fill in the gap, this research concentrated on seeking an in-depth understanding of issues relevant to identification of QIK in MEs. One particular point needs to be highlighted herein is that this research is purposed through concentrating on a particular knowledge stream – QIK as a backcloth, to explore the relevant issues of knowledge identification in MEs; consequently the primarily targeted contribution area from this research is KM in operations, alongside a QI focus.

Many MEs have been committed towards implementing appropriate QI strategy to pursue operations excellence (Kumar, et al., 2016). While due to the diversity of MEs themselves and their difference to the large enterprises (LEs), and also owing to organisation size's heavy impact on the processes of KM (Shrafat, 2018), as well as a common situation faced by MEs – resources constraint, not all the currently existing knowledge of QI strategies and techniques (majority of which are with a focus on LEs) is suitable for or can be applied by MEs (de Guimarães, et al., 2018; Brink and Madsen, 2015; Durst and Edvardsson, 2012); therefore, MEs strongly need to know exactly what QIK is relevant to them and why, and more importantly how to obtain it or create new QIK in case of not currently existing, all these can be realised through QIK identification. However currently there is a dearth of theoretical comprehension on QIK identification issues to guide the MEs' practice for realising the aforesaid need; a circumstance as such highlights that it is highly necessary to explore the QIK identification, which is an important part of MEs' business operations (Centobelli, et al., 2019; Massaro, et al., 2016).

Therefore, this research is endeavoured to obtain in-depth insights through finding answers centring an overarching leitmotif (the general research question focus): knowledge identification apropos of QI aspects in MEs. This inclusionary topic will be further operationalised and developed into concretised research questions in Methodology section for empirical investigation.

The focused MEs of this exploratory investigation on QIK identification are selected from manufacturing sector, on the grounds of that manufacturing is a fundamental cornerstone of economy (Colotla, et al., 2018; Pitelis and Antonakis, 2003), as well as that research findings from manufacturing MEs can have a wider referential significance within and beyond their own industrial sector.

The ultimate purpose of conducting this particular research contains two facets: i) obtaining in-depth insightful understanding focusing on knowledge identification in MEs alongside shedding new lights to the theories of KM for QI, while with issues associated with knowledge identification in MEs as the primary focus and QIK itself as a supplementary but critical investigating aspect; ii) providing a handy guidance to MEs on the identification of QIK for utilisation in their endeavour to improve and sustain their operations efficacy.

This paper is proceeded as follows: the next section is the general research background literature review, followed by the introduction of the methodology directing the research conduct, after which the analysis of data is presented, then the conclusions, implications, limitations and future research finalise the paper.

Research background literature review

Currently, the vast majority of the exiting SME focused literature do not separate SEs and MEs, and has the content fundamentally concentrating on SMEs as a whole (Tortorella, et al., 2015; Coetzer, et al., 2012). Thus this paper starts from SMEs, however as illustrated by the literature review, its centred content basically goes towards MEs, due to MEs' importance to national and global economies' development and recovery from recession, as well as the significant research attention aroused by MEs (Massaro, et al. 2016; Coltorti, et al., 2013).

Defining medium-sized enterprises (MEs) for this research

Currently, for MEs, there is not a consensual definition applied globally. The definitions of ME are often different in different countries, even between different industries within the same country; the only common attribute possessed by MEs is that all of them are not-large (Loecher, 2000; National Bureau of Statistics, 2018; Desai, 2008). Herein this paper, (1) with a consideration of that the chosen case companies at the first stage of the research have direct stakeholders of their business from EU countries (one of them – UK), (2) also taking into consideration of that there is a strong alignment between EU and UK on the definitions of SME, (3) as well as that the authors have planned a follow-up future comparative research project, which is also called for by researchers such as Centobelli et al. (2018) and Massaro, et al., (2016), the ME definition from Companies Act (2006) of UK is adopted in number of employees, i.e., a ME is a company with employee number between 50 and 250.

As aforementioned, MEs are very important to the current economic systems (Massaro, et al. 2016; Coltorti, et al., 2013), they play a critical role in supporting the economic recovery from the global financial crisis and underpinning many country's national growth;

they function as a driving force for industrial districts to develop their strength in facing global competition (Coltorti, et al., 2013).

And as contended by research, KM is a salient propeller for MEs' performance betterment and it contains various aspects (Centobelli et al., 2018; Durst and Edvardsson, 2012; Massaro, et al., 2016). In view of the complexity of KM, in this research, to ensure a realisable scale, the exploration focuses on issues centring one key element of KM in MEs – identification of the QIK suitable for MEs.

Knowledge management (KM) issues in view of MEs

KM is an approach containing relevant processes and structures to support various processes and contents of knowledge creation, transfer, storage, etc. (Costa et al., 2016; Durst and Edvardsson, 2012; Bojica and Fuentes, 2011; Royand Thérin, 2008; Wee and Chua, 2013; Pillania, 2008). It is a fundamental and critically important strategic as well as operational approach to ensure any business including MEs (Batista, et al., 2019; Hu et al., 2019; Centobelli, et al., 2019; Higgins, 2009; Coyte, et al., 2012; Spender, 1996; Nonaka and Teece, 2001) to survive and gain an advantageous position in fierce market competition.

Hitherto, the research on KM has been conducted extensively, however mainly focuses on LEs, there is an obvious insufficiency of research on key KM elements in MEs (Shrafat, 2018; Massaro, et al., 2016; Serenko, 2013; Durst and Edvardsson, 2012). Due to the existence of resource constraints faced by MEs as well as the differences of MEs to LEs (Shrafat, 2018; Brink and Madsen, 2015; Cohen and Kaimenakis, 2007; Durst and Edvardsson, 2012), the KM approaches in MEs may have their own characteristics and be different from that in LEs in the content, implementation form and suitable industrial settings, which deserve an extensive exploration (Shrafat, 2018; de Guimarães, et al., 2018; Massaro, et al., 2016; Durst and Edvardsson, 2012). Nevertheless, in this research for a concentrated investigation and also due to the salient importance of manufacturing MEs (Pitelis and Antonakis, 2003), the authors do not focus the research on KM as a whole entity and in a full industrial spectrum of MEs; instead they explored a main element of KM – knowledge identification and only in manufacturing MEs and focusing on QI as a general background context. Such a decision of research focus is also due to that there is a lack of distinction of the existing KM research between different types of MEs (Massaro, et al., 2016; Durst and Edvardsson, 2012). Meanwhile, in addition to the aforementioned, based on that manufacturing enterprises account for the biggest percentage of business revenue among all the industries within Chinese SME sector (Ning, 2018; Liu, 2008) and that the backbone role of manufacturing industries to

national economies world-wide (Colotla, et al., 2018; Pitelis and Antonakis, 2003), as well as because of that the research on Chinese MEs is much fragmented and disconnected with insufficient coverage (Cardoza and Fornes, 2013), the case MEs are selected from Chinese manufacturing industries to seek insightful understandings. The obtained insights from this research could also be potentially relevant to more businesses in different industries/regions. The findings from such a research fill in the gap of lack of research in this field in certain countries including China (Massaro, et al., 2016; Cardoza and Fornes, 2013) as well.

Elements of knowledge management (KM)

Although there is not a universal agreement with regard to the elements comprising KM, KM process in MEs basically contains knowledge identification, knowledge creation/acquisition, knowledge storage/retention, knowledge transfer and knowledge utilisation (Durst and Edvardsson, 2012).

Knowledge identification refers to that in order to effectively manage organisational knowledge, an organisation needs to clearly understand what and where knowledge is available and whether it is/should be obtained internally or externally, as well as its relevance to the business operations (Durst and Edvardsson, 2012; Shan, et al., 2013). Knowledge creation/acquisition focuses on the construction and consolidation of new knowledge, which can be generated internally and/or acquired externally from various sources. And because of that in practical environment, knowledge identification and knowledge creation/acquisition do not have a clear boundary separating them (Shan, et al., 2013), thus in this paper when knowledge identification is mentioned, its connotation also contains the facet of knowledge creation/acquisition. Knowledge storage/retention refers to the processes and activities of documenting and codifying knowledge, to record and form a company's knowledge pool, as well as to avoid the loss of knowledge caused by employee retirement, leaving or oblivion of the newly created knowledge, etc. Knowledge transfer refers to the measures and procedures for transferring and sharing knowledge within an organisation or between organisations. Knowledge utilisation concerns with the forms and procedures of applying the appropriate knowledge within an organisation to create value for customers and itself, as well as for the other stakeholders.

Among the aforementioned KM elements, knowledge identification has been insufficiently researched (Honarpour, et al., 2017; Tow, et al., 2015; Durst and Edvardsson, 2012), more exploration on it is much demanded for enriching the theoretical understanding

and providing practical guidance to KM activities, especially in MEs (Centobelli, et al., 2019; Durst and Edvardsson, 2012; Massaro, et al., 2016).

Quality management and continuous improvement of quality

Quality and its management have already been in existence for very long time, could be ever since the special group of primates became human beings, when they intentionally made tools. They would need to check and ensure the quality of the stuff they have produced, namely they need to manage the quality. Needless to say, the systematic and scientific quality management emerged not until the modern century; especially in recent five or so decades, there have been many researchers contributing to its theory development and practical execution, such as the leading figures of Dean and Bowen (1994), Slack, et. al. (2016), as well as Deming, Juran and Crosby (Dean and Bowen, 1994).

Resonating to Dean and Bowen's viewpoints (1994), Slack and Brandon-Jones (2019) contended that quality is a critical (manufacturing/service) product attribute of consistently conforming to the expectations from customers. While quality management refers to the process containing a series of procedures and operations activities to realise this consistent conformance (Slack, et. al., 2016; Slack and Brandon-Jones, 2019). Namely as contended by researchers in the relevant fields (e.g., Dean and Bowen, 1994; Honarpour, et al., 2017, 2018; Slack, et. al., 2016), quality management inherently entails that organisations carry out relevant initiatives to ensure the manufacturing/service products to satisfy the customer demand, to comply with industrial/national/international standards and to fulfil the intended function of the products; and meanwhile their production/provision processes should be built with sufficient capacity and capability to ensure the realisation of all these mentioned elements. And continuous improvement on the quality performance of the products and processes is one of the critical aspects of quality management initiatives in businesses (Dean and Bowen, 1994; Chuang, et al., 2015; Honarpour, et al., 2017, 2018; Asif, et al., 2013). Quality improvement (QI) has been researched for many years and its importance to the management efficacy as well as the organizational sustainable growth has been well evidenced on account of its positive and effective impacts on the different aspects of business operations (Dean and Bowen, 1994; Honarpour, et al., 2017, 2018). A criticality as such of QI to businesses manifests its meaningfulness of functioning as a general context for researching knowledge identification issues.

Quality improvement knowledge (QIK) identification in medium-sized enterprises (MEs)

Knowledge has heavy impacts on MEs' performance improvement and sustainability. It is also well known that QI plays a critical role in ensuring a company's strategic competitiveness (Slack, et. al., 2016; Noble, 1995).

Thus far, research has clearly evidenced that knowledge is a fundamental element of QI; and vice versa, QI can also facilitate knowledge identification (creation) and dissemination (Honarpour, et al., 2017; Linderman, et al., 2004; Shan, et al., 2013; Dean and Bowen, 1994). Naturally, to identify/possess useful QIK becomes an essential capability and is of strategic importance to MEs. QIK in this research context is defined as the explicit and tacit continuous quality improvement knowledge and their associated content and implementation procedures/activities integrated by logical reasoning to ensure a thorough and efficient knowledge apprehension and application. Its content elements/aspects will be explored in this research as a contextual backcloth for the study on knowledge identification in MEs. QIK is acquired/created as well as stored in an organisation's database or in the employees' mind-set, and can be applied in maintaining and improving the performance of the operations process and the quality of products/services.

There is a large amount of QIK available encapsulated by the sourceable strategic/philosophical thoughts with the titles of such as: total quality management, six sigma, lean, etc. However, these existing knowledge in general was developed and applied with a focus on LEs, entailing a strong doubt of their suitability for MEs; and in fact, the differences of KM in various aspects between MEs and LEs (Shrafat, 2018; Brink and Madsen, 2015; Durst and Edvardsson, 2012) have been evidenced by existing research on KM. For example, Xu, et al. (2005) believe that LEs treat KM more systematically than MEs, and they can also have more resources and capability to use more extensively and more advanced IT systems in their KM process than MEs can. In the same vein, McAdam and Reid (2001) as well as Durst and Edvarsson (2012) deem that compared to LEs, MEs are less advanced with regard to KM and characterised with mechanistic approaches and lacked of input in KM systems and approaches as well as less capable in constructing knowledge. Shrafat (2018) finds that MEs and LEs see the key elements of KM and the approaches to apply them being very different. Shrafat's thought resonates the viewpoints from Centobelli, et al. (2018) arguing that MEs operate in a more informal and social manner in their operations and are apt to devote less resources for building up a KM technological structure and mechanism. According to Moffett and McAdam (2006), LEs tend to deal with their knowledge issues through team collaboration based on cross functional resources, while MEs are inclined to rely on managers to provide guidance in KM processes and activities. Mat et al. (2018) emphasized the phenomenon of that resources

constraint of MEs leads to the lack of organisational infrastructure resulting to reduced ability for enhancing the operations efficiency and effectiveness. Evidence to these viewpoints, de Guimarães, et al. (2018) argued that LEs have a formal organisational/technological structure than MEs for knowledge and management promotion. The interpretation on Durst and Edvarsson's (2012) contention could be regarded as a consolidated understanding of the current debate on the issue of difference in KM between LEs and MEs, namely, even though KM is an important part for any type businesses, the actual construct of KM is disparate between LEs with richer resources and MEs with a clear constraint of resources; meanwhile on account of the diversity of different sized businesses, a ME is barely comparable to other sized organisations. Supported by the contentions from Mat et al. (2018) and Guimarães, et al. (2018), the viewpoints from Durst and Edvarsson (2012) a few years ago seem still taking a strong current stance that majority SMEs do not have a clearly defined KM strategy and they handle KM mainly focusing on operational level knowledge processes and activities, and paying less attention to the establishment of procedures/channels to ensure collaboration on knowledge identification and usage among all level employees and functional units.

Following and summarising the aforementioned insights, one can confidently argue that the concrete QIK applied in LEs may not or not directly suit for MEs, and the ways of knowledge identification followed by LEs might be inappropriate or need to be adapted for application by MEs, therefore a situation as such manifests a necessity and provides a contextual backcloth for further exploring issues of QIK relevant to MEs with a particular concentration on knowledge identification (Soto-Acosta, et al., 2018; Shrafat, 2018; Moffett and McAdam, 2006). Namely, a research on the current characteristics of knowledge identification (in QI area) of MEs will provide valuable contribution to the fields of KM and meanwhile to operations quality excellence.

Methodology employed by this research

The research was conducted through three stages.

On account of that the research questions explore the "unknown", the "how" and the "why" with regard to the concrete elements of QI knowledge identification, the authors have adopted case study as a main strategy for the first and second research stages, supplemented by a structured interview at the third stage. The first stage covers the data collection and analysis in two case MEs, and it also provides a scrutiny on the coverage of the concrete research questions (derived based on literature review, seen in next sub-section) consisting of five theme questions and questions for an additional exploration of external and internal business

associated factors' (EIBAFs') impacts on QIK identification (Sitharam and Hoque, 2016); the EIBAF questions are included in the enquiry to enrich the insights obtained. The second stage is a further examination/triangulation on the first stage findings using another four case MEs. The third stage examines and further concretises the findings and prioritisation in more MEs.

In view of this research's exploratory purpose, at the first stage, the semi-structured interview and focus group methods for data collection were applied, and then through triangulation and summarisation to consolidate and primarily prioritise the insights obtained from this stage; afterwards, at the second stage, in the additional four case companies, focus group sessions were performed with the aim to triangulate and attest the first stage findings; while at the third stage, structured interviews were conducted with QI related managers in 40 manufacturing MEs, to further examine the inclusiveness and currency of the findings as well as to triangulate and concretise in more details the prioritisation of the elements.

The aforementioned research stages and their content elements are illustrated in Figure 1 for a comprehensive presentation of the research process. And further details are briefed in the sub-sections followed.

Figure 1. Research stages and content elements and their logical relationship
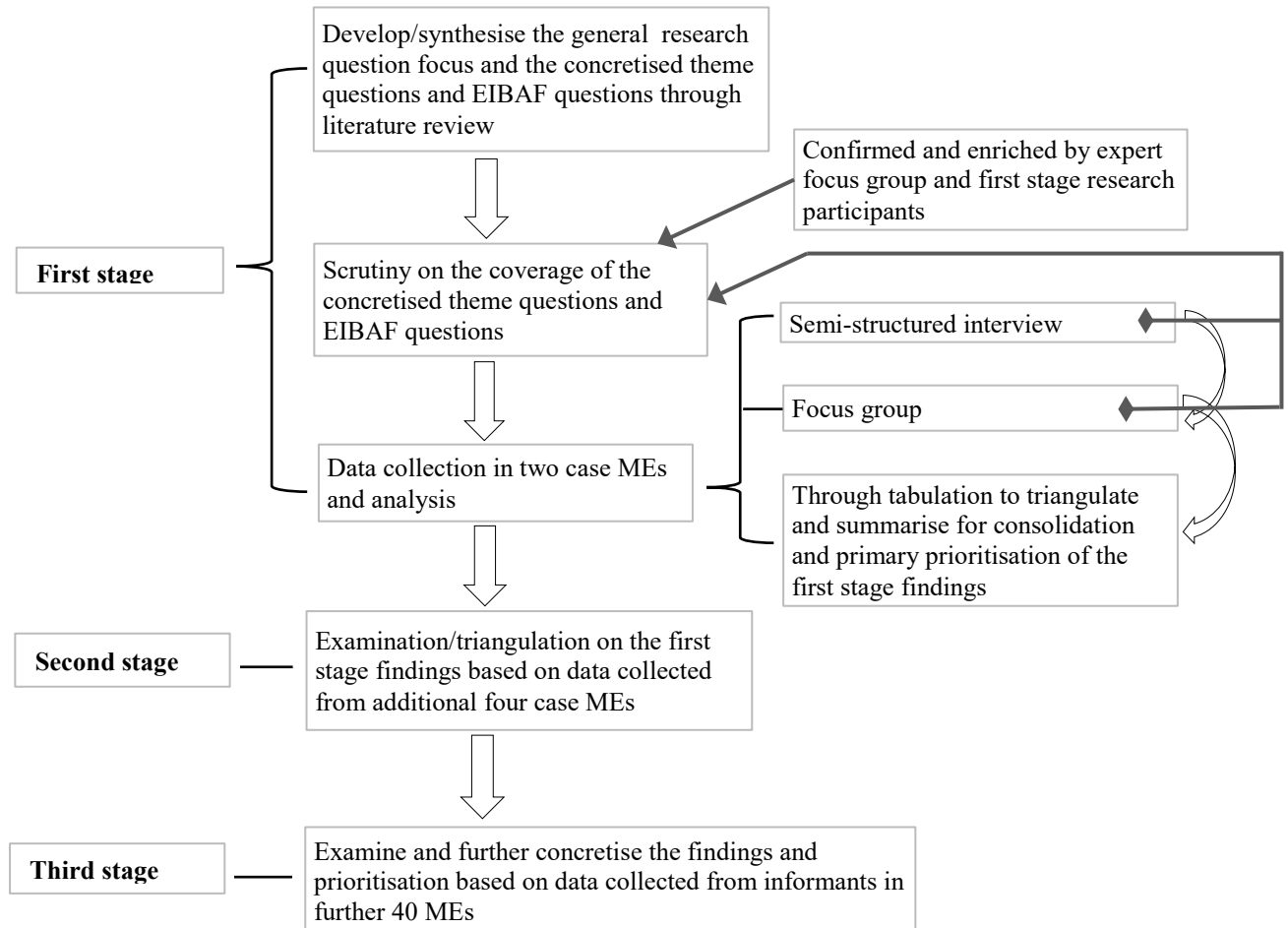
The concretised research questions to be explored in this research

Revealed by and summarising from the existing research, as well as indicated by the overarching research leitmotif, knowledge identification in MEs has in itself many aspects deserving/awaiting researchers to further explore (Centobelli, et al., 2019; Massaro, et al., 2016; Durst and Edvardsson, 2012), including such as what existing knowledge is needed by MEs and why, what actions should be undertaken for MEs to acquire knowledge and why, how to distinguish the knowledge useful for MEs' business operations with that less/not meaningful to them, and how (what techniques/tools [approaches] do MEs use) to identify (acquire/create) knowledge and why, whether external sources or internal sources are more important to MEs' QIK identification and why, etc. Meanwhile, as aforementioned, in this research, knowledge identification also includes knowledge creation/acquisition (Shan, et al., 2013; McAdm and Reid, 2001).

From the academic research and practical exploration thus far, many QI concepts, strategies and tools have been developed and implemented in business operations and turned out to be effective in many similar or different situations (Arndt, et al. 2019; Akwei and Zhang, 2018); however, majority of them were originated from the research and practice in LEs. Since MEs are different from LEs in the aspects of such as organisational structure, management practices (de Guimarães, et al., 2018; Brink and Madsen, 2015; Durst and Edvardsson, 2012), it would be too hasty or even risky to directly implement in MEs the QIKs which were initially applicable in LEs, without in advance examination and scrutiny. In order to ensure that the really appropriate knowledge can be selected for implementation in enhancing MEs' operations performance, MEs need to follow certain ways (methods/approaches) to distinguish between the more and less relevant QIKs; what are these concrete approaches is a question needing to be answered based on empirical information (Massaro, et al., 2016). Meanwhile as argued by researchers (such as Centobelli, et al., 2019; Moffett and McAdam, 2006; Massaro, et al., 2016), before MEs can commence the determination on what available QIKs are critical to a ME's operations, there is an essential prerequisite process/activity to be enacted, that is identifying QIKs from different sources (Massaro, et al., 2016; Moffett and McAdam, 2006). For identifying the knowledge, what techniques/tools (approaches herein) can be used by MEs become one of the major considerations (Massaro, et al., 2016; Durst and Edvardsson, 2012). To carry out a business initiative, there must be either an internal or external drive or both to initiate/motivate the activities, it is not an exception for MEs' KM in a broad view and QIK

identification in a focused lens. Nonetheless, the drives for motivating the MEs to pursue the QIK are much lacked of current and adequate research (Games and Rendi, 2019; Durst and Edvardsson, 2012; Moffett and McAdam, 2006), a situation as such entails the critical necessity and meaningfulness of an exploration on this aspect to obtain insights of the factors propelling the QIK identification process. The last but not least issue associated with QIK identification is whether external or internal source is relied on by MEs for obtaining QIKs. There are researchers thus far having discussed this issue, arguing that knowledge can be sought of from external sources (Games and Rendi, 2019; Evans, et al., 2013); however, to the contrary as contended by de Guimarães, et al. (2018), knowledge is most efficiently acquired through internal sources. Nonetheless, according to Durst and Edvardsson (2012), knowledge should be created/attained from both internal and external sources, although MEs are sometime forced to solely rely on the latter due to their inherent constraints. Alongside these debates, with a consideration of the backcloth topic area of QIK – an essential element of knowledge management in business operations, and in view of that hitherto to the best of the authors' knowledge, there is not a consensual understanding of the most appropriate sources of QIK's identification, a further exploration on this aspect to clarify the situation necessitates itself.

Drawn from the viewpoints discoursed above, the overarching leitmotif focused by this research is further detailed and operationalised into five concretised theme questions (the questions are coded from Qki_1 to Qki_5), while Qki_1 also indicates the backcloth stance for this research exploring and discussing knowledge identification of QI in MEs:

Qki_1: What QIK is essential for MEs? And why?

Qki_2: How do MEs distinguish (methods/approaches used) the more relevant and less relevant QIK to their business operations? And why?

Qki_3: What techniques/tools (approaches) do MEs use in their QIK identification process? And why?

Qki_4: What function as the initiating drives for QIK identification activities? And why?

Qki_5: Do MEs rely on internal sources or external sources in identifying QIK? And why?

Starting from Qki_1 as both a concretised research question and a research context indicator, all the above numerated questions are going to be answered through the empirical exploration. These research questions are also treated as structural themes (Cepeda and Martin, 2005) in data sorting and analysis.

Alongside these theme questions, some additional questions (EIBAFs, seen in sub-section of Research process at the first stage and in Appendix 1) as well as emergent follow-up questions during the interview and focus group processes will be enquired for obtaining richer data.

Briefs on case study strategy, interview and focus group for research

Case study is an effective strategy that has been often used to analyse emerging issues in a focused context, for clarifying vague viewpoints or unclear understandings for theory refinement (Voss, et al., 2002), as well as finding answers to ''why'' and ''how'' research questions (Yin, 2018, 1994). Case study has already been applied by researchers in investigating contemporary topics in the field of operations management (Dreyer, et al., 2016; Bouzon, et al., 2015; Vlachos, 2015; Okike, 2014), and there are also calls for more extensive application of case study in researching issues in the relevant fields (Childe, 2016; Childe, 2011; Steenhuis and de Bruijn, 2006); while the contextual focus of this research – QIK, is one of those issues falling into this remit.

Semi-structured interview, structured interview and focus group are often used in the same or similar types of research in the field of KM (e.g., Wee and Chua, 2013; Coyte, et al., 2012) and they are very effective in obtaining comprehensive data of the focused topics. Through interview and focus group sessions, based on the research participants' narrative discourses, insightful understandings of knowledge identification for QI can be obtained for enriching theory and guiding practice (Tam and Gray, 2016; Rittenhofer, 2015; Frishammar, 2003).

Research process at the first stage

For the empirical data collection at the first stage in the two case companies, the individual interviewees had been selected following a snowball approach, which means that an interviewee recommends the next research participant; this way according to Tam and Gray (2016) can avoid researchers' bias impacting the objectivity of data and consequently improve the reliability of research findings. The interviewees are all from the functional areas either directly in or closely involved with quality management and improvement, and they were categorised into four groups based on their roles in the organisation: managers, functional staff, production foremen and production line operators. This type of diverse representation of participants follows replication logic (Yin, 2018, 1994), namely to have participants from different categories to secure data collection from multiple levels/perspectives. An approach as

such can ensure a triangulation of viewpoints to gain more inclusive insights. Within each category, ensured by the management of the case companies, as many as interviewees per the researchers' discretion can be approached. Such a generous support allowed the realisation of a saturation of data (Tam and Gray, 2016). Namely the interview process on the different types of participants was only stopped respectively until the emergence of data redundancy – only the same comments (the wordings might be different while the content meaning is the same) were conveyed, no additional information was added by new interviewees. Interestingly, to the surprise of the authors, the saturation situation appeared quite early from all the individual participant categories in both cases, started from either the third or the fourth interviewees. This phenomenon accords the contention from Centobelli, et al. (2018) that MEs run their operations business activities in a more informal and social manner, which deemed by the authors can enhance the internal communication and understanding of technical and management issues among the corresponding peers; consequently this situation leads to the shared consensual viewpoints on certain business issues, such as QIK related among colleagues at the same or similar ranks and areas.

For each individual interview session, the duration varied from around 60 minutes to 80 minutes, as a result of the respondents' various characteristics, such as job role and the skills of communication, etc., as well as further probing and follow-up enquiry on some points during the interviews.

The interview, with open-ended questions (seen in Appendix 1 for research questions in the far left column), had been carried out following a pre-designed research data collection and analysis protocol (Appendix 3) to ensure a standardisation of topics and format across interviews. Table 1 summarises the general profile of research participants at this stage. All of them had willingly and voluntarily participated in the interview, and have been working in their respective companies at least two years.

Table 1. General profile of participants at the first stage (Participants' and companies' names are not revealed due to confidential request)

Interviewee category	Number of participants	
	Case A	Case B
Manager	5	4
Functional staff	6	5
Production foreman	6	5
Production line operator	7	6

During the interviews, notes were taken by two authors independently and simultaneously following the same protocol guidance. This approach allows the enhancement of the completeness and accuracy of information attainment through after-session supplementation and triangulation.

Alongside the five themed research questions, during the enquiry, some general external and internal business associated factors (EIBAFs) highly heeded by the existing research and deemed by researchers that can impact QIK identification, have also been asked. These questions include: (1) What is the respondents' view about the current general national economic development situation (mindful of SMEs)? Whether/how does this situation affect their QIK management? The external macro-economic environment can heavily influence the relevant business activities and processes in MEs, this is evidenced by contemporary research (Sitharam and Hoque, 2016; Choochote, 2012); (2) What is the specific industrial segment their business production focuses on (reflected by the products)? Whether/how does this specialty affect their QIK management? Company specific industrial segment conditions can enhance or imped the KM efficacy, thus it is an important element to be explored (Cerchione, et al., 2015); (3) What technologies has their company implemented in the KM process? Whether/how do these technologies affect their QIK management? Technologies related to QIK management in a business refer to information and communication technologies (ICTs), their availability and implementation in MEs can have a direct impact on the efficacy of KM (Cerchione, et al., 2015; Choochote, 2012).

While during the interview sessions, in Case company A, vast majority of the managers and functional staff have raised the factor of the status of business operating condition (growing/profitable or declining/in deficit) as an element to consider, this proposition received support from three different type interviewees – all managers, vast majority of the functional staff and production foremen in Case B, therefore this factor has also been included in the above enquiry list of EIBAFs for later stage research as the EIBAF Question (4) What is their company's current operating condition? Whether/how does it affect their QIK management?

After interviews completed and their respective note contents summarised and further examined and confirmed by the individual corresponding interviewees, focus group sessions were organized with the same research participants in each individual category groups respectively in the two case companies; the aim of the focus groups is to obtain further recapitulated consensual viewpoints (or potentially some contradictory viewpoints) through examining a collective list of the insights summarised from the individual interviews. The

actual number of the focus group sessions' participants ranged from 4 to 7 people respectively, which is in line with the usual focus group sizes (Wang, et al., 2011-12). The focus group members concentrated on the same set of research questions and answers as that in the interviews, and the discussion processes were facilitated by two authors and the findings were also noted by both of them at the same time, to ensure the comprehensiveness and accuracy of the recapitulation.

The focus group sessions' outcomes without any raised contradictory views from the two case companies concur with the summarised interview findings. Based on this, the within and cross-case analyses have been performed.

The research questions and their answers (their content has also been confirmed by the later research stages) from interviews/focus group sessions were coded as in Appendix 1 for effective consolidation of the attained data and further analysis.

One particular attribute for the research analysis process at this stage needs to be highlighted is that for this research, the authors did not use any software to assist the data analysis, while carried out that manually through tabulation. The choice of this approach follows the contention from published literature for avoiding the disadvantage of software analysis that forces researchers to focus on volume and breadth rather than on depth and meaning, which are very critical for the type of research reported by this paper (St John and Johnson, 2000). The usage of tabulation approach although less efficient, gives more opportunities for the authors to grasp and distil more subtle and detail connotations. The analysis contained mainly three phases: (1) corresponding to each theme question, two authors separately recorded/summarised into the tables of the individual answers with the same meaning respectively, and the frequency of their occurrence as well as the type/number of participants raising them; (2) then they still individually prioritised these answers following the prioritisation rules as described in Research finding summarisation section; (3) after that, the two authors collectively summarised their respectively prioritised answers to a finalised consensual version through further comparison, synthesis and triangulation (e.g. Costa, et al., 2016). There was no disagreement between the two analysers for the answers' (this stage final) prioritisation and content, otherwise a third co-author would have repeated an additional analysis in this phase for a further scrutiny and attestation.

The case companies at the first stage

Following the replication logic from Yin (2018, 1994), this research's first and second stages are designed as a multiple case study. At the first stage, the two case manufacturing MEs

were selected based on the following criteria: (1) they are MEs based on the size (employee number); (2) the managers and employees in the companies have the willingness to share with the researchers their practices/strategies with regard to QIK management; (3) the businesses have been operating in the marketplace for at least three years' time, such a sufficient time length allows them having formed their general pattern of KM practices/strategies; (4) the businesses have demonstrated a healthy and prosperous survival status. The purposively selected case companies following these criteria provided the researchers a solid foundation for effectively and efficiently collecting representative and meaningful data with easy access.

These two companies are both a joint venture, this means that they are knowledgeable of up-to-date management practices and strategies for business operations, due to the integration of technological/managerial know-how brought in by the business partners from both developed countries and the local. Meanwhile, nearly all their employees including top/senior management are Chinese that brought significant Chinese impacts to the organisational culture and mentality. These two aspects ensure that the two companies demonstrate the current up-to-date management style with Chinese culture elements that are representative characteristics of Chinese manufacturing MEs; therefore the findings from them on QIK identification can also function as reference to other MEs.

The general profiles of the two case companies are summarised in Table 2 (for the inclusiveness of the research information, Table 2 also presents the general profiles of the other case companies at the second stage).

Table 2. Profiles of the case companies (company names are disguised due to confidential request)

Case company	Size (employee number)	Business focus (specialty industry within manufacturing sector)	Business operating condition	Location (economic development level) *	Years in Business
A (Stage 1)	246	Components manufacturer and supplier in automobile industry	A continuous growth in recent 4 years	Northern region in China (less developed region)	6
B (Stage 1)	200	Components and sub-assemblies manufacturer and supplier in automobile industry	A slow but stable growth ever since the commencement of business	Middle region in China (developed region)	4
C (Stage 2)	232	Components manufacturer and supplier in home appliances production industry	A short time period downturn 3 years ago, while business grows in recent years	Middle region in China (developed region)	9

D (Stage 2)	135	Electronic device manufacturer and supplier in electronic instrument manufacturing industry	A stable growth in recent 3 years	Northern region in China (less developed region)	5
E (Stage 2)	93	Plastic toy manufacturer and supplier in toy manufacturing industry	The growth rate has seen a slowdown in recent 3 years, but still survives healthily	Eastern/Costal region in China (developed region)	10
F (Stage 2)	212	Wood home-furniture manufacturer and supplier in furniture manufacturing industry	A business with stable market demand ever since the commencement of business, with a stable profit level.	Southern region in China (developed region)	12

∗ Economic development level of the regions in China is based on Qi (2015) and National data (2018)

Within the research process, the participants have been encouraged and also required by the researchers especially their top management to articulate frankly their thoughts, and have been assured by the management that they will be valued even more if they can identify the weaknesses of operations for further improvement.

The second stage to triangulate and attest the previous stage findings – additional four case companies' focus group sessions

Since the first stage findings are from joint venture MEs, although these case companies are very much Chinese styled, there still could be a possibility that they possess some differences from MEs purely owned by Chinese. With a concern as such, also with a consideration of that these two MEs are in the same industrial specialty segment, to ensure a wider coverage of the samples, following the same selection criteria and process, as displayed in Table 2, additional four purely Chinese owned MEs in different specialty segments of manufacturing industry in different regions were selected as the second stage case companies. However, the research method used in the second stage cases is only focus group. The focus groups were also formed by people from the same categories as aforementioned (this time each category group consists of either five or six participants except one case company's manager group consisting of four people). The conduct of the focus group sessions followed exactly the same way as that in the previous stage; nevertheless, the answers to the five themed research questions discussed in this round of focus groups are organised in the form as that already summarised and prioritised into most/more/less emphasised elements at the first stage, as presented in the section of

Research finding summarisation. The focus group participants were required to evaluate whether the prioritisation levels are appropriate as well as whether there are elements to be added or deleted. The participants were asked to rate their degree of agreement to the respective prioritisations against a five point scale (from 5 – Strongly agree to 1 Strongly disagree). And if their agreement degree is below 3 (unsure), they should provide their own prioritisation (any from most/more/less emphasised) correspondingly. Those prioritisation levels received an across category group average agreement rating below 3, will be amended according to the average values quantified from the newly proposed prioritisation levels at this stage, before finalised at the third stage research.

The third stage – additional structured interview attestation on the prioritisation and inclusiveness of the findings from the previous stages

A possibility could still exist that only a few cases cannot give sufficient confidence for firms to be convinced of the applicability and the prioritisation of the elements. Hence, despite the exploratory nature of this research, the authors conducted a third stage 40 structured interviews (Hagaman and Wutich, 2017; Rowley, 2012), through WeChat or telephone whichever convenient for the respondents to obtain viewpoints from managers in charge of QI and quality related management issues (Brettel and Rottenberger, 2013; De Clercq, et al, 2015) in Chinese manufacturing MEs. A sample size of forty is the upper range for number of participants in an interview research for obtaining enough data, as argued by researchers of research methodology study (Hagaman and Wutich, 2017; Seidman, 2006). The questionnaire used by this round interview contains mainly close-ended questions, with two additional sets of open-ended ones. The close-ended questions enquire from the interviewees their rating on each answer (as in Appendix 1 – QIK identification focused elements/approaches/tools) to the corresponding theme questions, following a five points scale: 5 - Very Important; 4 - Important; 3 - Moderately Important; 2 - Slightly Important; 1 - Not Important. The open-ended questions enquire whether the interviewees think there are still any elements missed out or to be deleted from the current findings and their importance level in case of addition, and the reason for addition or deletion, as well as the answers to the EIBAF questions. The selection of interviewees followed the snowball approach. The authors intentionally endeavoured to make sure that the interviewed managers came from MEs in various manufacturing business segments, including fast moving goods manufacturers, electronic device producers, car components manufacturers, food production companies, etc.; and they locate in different regions in China. An approach as such provides an effective mechanism to triangulate the

insights from multiple informants with diversified background to ensure the findings' inclusiveness. The interview sessions were carried out by the authors separately at a same time period to increase the efficiency, on account of that the conduct process of the structured interviews is fairly straightforward. All the participants in this stage interview sessions have at least two years' experience and in-depth involvement in QI processes and activities, and have been leading QI projects with the involvement of different hierarchical level/functional employees, thus have obtained substantial understandings and insights on the QIK's components and its process management in practice.

Validity and reliability

The five concretised theme research questions of QIK identification used for the research are based on the literature review focusing on the issues relevant to KM in MEs, and they have also been further confirmed by a focus group consisting of four experienced professionals in the field of business operations. The experts in this focus group were required to evaluate the themed research questions with regard to their appropriateness, importance and necessity to the field of KM with a consideration of quality and MEs, and also required to raise any additional elements missed out from the original research design. Figure 2 illustrates the focus group evaluation ratings on the themed research questions on a five point scale (from 5 – highly appropriate/important/necessary, to 1 – inappropriate/unimportant/unnecessary). The ratings for all the five theme questions are very high. Meanwhile, the focus group did not identify any addition or deletion needed. Nonetheless, such a high-rating result might be due to that a four-member focus group is still a little less of diversity of viewpoints, people might doubt of its convincingness. Therefore, in the later stage case study and interview sessions, the participants were also enquired about their views on the possibility of deletion/addition to the five concrete theme research questions, as a further examination. The answer from these stages of no addition/deletion further validated these questions' meaningfulness. Based on the evaluation outcomes as such, the content validity has been confirmed.

Figure 2. Focus group evaluation on the theme questions
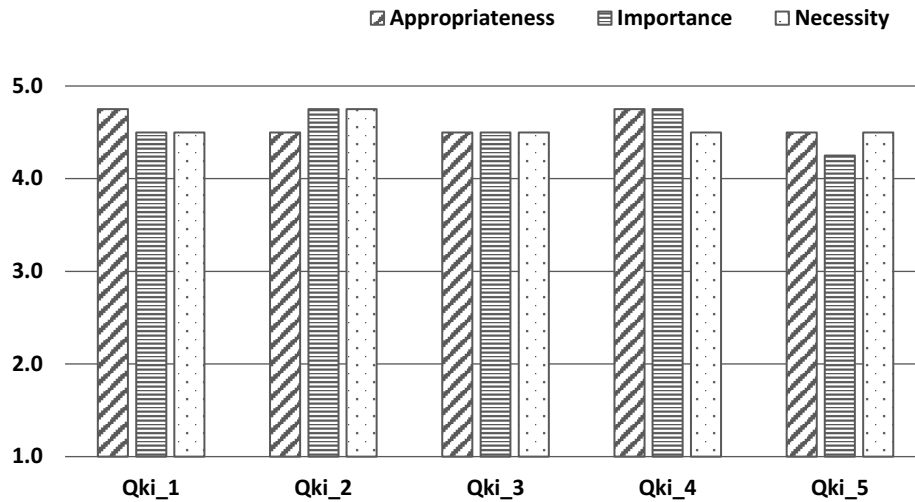
For the additional EIBAF questions, they have been confirmed of their meaningfulness by the research participants during the data collection process from different category groups, and for majority of them there also exist literature underpinning, as aforementioned.

And to comply with the approach of multiple source evidence for case based research validity (Cepeda and Martin, 2005; Yin, 1994), this research has bonded its conduct process to the arrangement at follows:

The case companies at the first and second stages are from different regions with different economic development levels (with the potentially diversified employee knowledge and skill backgrounds), thus the research findings between the cases can be compared to seek repetition or contradiction of viewpoints to consolidate and enrich the understandings (Yin, 2018, 1994; Cepeda and Martin, 2005). Meanwhile within each case company, the participants are from different functional areas and at different organisational hierarchical levels associated with QIK management and/or implementation. For the interviews, the data achieved the saturation (Tam and Gary, 2016), ensured by the wholehearted support and participation of the case companies. These methods secured the construct validity of the research (Yin, 2018, 1994).

To further ensure the validity at the first stage, before focus group sessions the semi-structured interview summaries have been sent to the respective interviewees for their examination (O'Connor and Gibson, 2003) of accuracy and potentially additional comments/opinions. The feedback from the respondents has confirmed the accuracy and appropriateness of these records, this also endorsed the validity. The focus group sessions at

the first and second stages, besides an in-depth consolidation of the interview findings to reach a consensus in the participant category groups, have further evidenced and attested the research validity. The third stage interview sessions' outcome (with respondents from MEs with diversified regional and industrial specialty backgrounds) of no element addition/deletion also provides a confirmation on the validity of the research.

To ensure and evidence the reliability of the research findings, the following two approaches have been implemented: (1) the designed research data collection and analysis protocol (Rose, et al., 2015) (Appendix 3) has been followed carefully during the research process; (2) the analysis of the data has been firstly conducted by two of the authors separately and then the findings were integrated through triangulation synthesis. And a further endeavour of comparison with available literature has also been made whenever possible. In addition to all these, the Intra-class Correlation Coefficient (ICC) and Cronbach's α have been calculated on the structured interview data, an ICC score of 0.64 and Cronbach's α of 0.98 confirm that the interview findings have a good level of reliability (Fleiss, 1986; Wortzel 1979).

Research finding summarisation

First stage research findings

The data collected/summarised from each interview and finalised in focus group sessions cover the viewpoints of respondents from different hierarchical levels and functions within the companies, they provide a solid foundation for within-case and cross-case analysis. Appendix 1 and 2 are the final summary based directly on the first stage findings (and also attested by later research stages). The within-case and cross-case analyses on the findings have synthesized a set of characteristic attributes of QI focused knowledge identification in MEs.

The answers are further classified as less, more and most emphasised through the analysis introduced at following.

Corresponding to the five themed questions, for both Case A and Case B, there is a lack of all-round consensus among the respondents from different category groups; and what most salient is that within each case, the managers and production line operators do not have any congruence with each other's viewpoints. This could be a natural reflection on the difference of their responsibility corresponding to their roles in the organisation. The managers and functional staff as well as production foremen have a consensus on some viewpoints among all or any two of them; while the functional staff, production foremen and production line operators also share same viewpoints on some issues among all or any two of them. Meanwhile,

there are some viewpoints only held by people belonging to just one individual category group. A phenomenon as such highlights the complexity and diversity of the QIK demand and understanding under different contexts by different individuals at different workplaces assuming different roles with different hierarchy/responsibility levels. This also partially accords with the points raised by Durst and Edvarsson (2012) that MEs' managers sometime are reluctant to support knowledge sharing, although the findings from this research do suggest that the management in the case MEs does support knowledge dissemination within the organisation, while the facts reveal that they still need to devote further effort to perform this task more perfectly. Such a phenomenon hints a general need of training across the whole organisation on relevant QIK management issues to ensure an organisation-wide common understanding, which can lead to more effective and efficient QIK activities. The necessity of training to ensure the efficacy of KM initiatives has been also advocated by relevant research (Oumaya and Gharbi, 2017; Kumar, et al., 2016; Calvo-Mora, et al., 2016; Pillania, 2008).

Corresponding to the EIBAF questions, the viewpoints from the participants in the two case companies demonstrate a higher level of within and cross case congruence. They all think the current external macro-economic environment is good as a result of the fast development of Chinese economy in recent decades, and MEs alongside other type businesses have received strong support from the government. The national effort and resources provided to grow the small and medium sized businesses are very substantial, evidenced by for example the establishment of China Centre for Promotion of SME Development in 1980s' (Chinasme, 2017), which provides various supports and resources to SEs and MEs. They contend that the well-developed macro-economy is helpful for enriching the sources for them to obtain QIKs. The participants all believe that their businesses' industrial specialty does not impact their QIK management related issues. The respondents from both cases deem that ICT systems can help in QIK identification and application processes and activities. Both companies are growing well in their business, the healthy growth entails both the commitments towards QIK identification and the benefits obtained from QIK management.

Prioritisation of the answers to the theme questions

For a more effective guidance to MEs on the application of the research findings in their QIK identification process, herein the identified viewpoints/approaches/practices (answers to the five themed questions) are classified into three prioritisation levels: most emphasised ones, more emphasised ones and less emphasised ones. Most emphasised ones are those answers having consensus of agreement by respondents of two or more category groups within each

case and also there is supportive congruence between cases, i.e., in one case company there is an agreement between two or more individual category groups and meanwhile in another case company there has one or more category groups' consensus to this; more emphasised ones are those answers having an consensual agreement between respondents in two category groups within one case company or agreed by two individual category groups respectively from two case companies; while less emphasised ones are those viewpoints only held by respondents in one individual category group of one case company. Further details of the theme questions' answers are listed at below.

For Question 1: What QIK knowledge is essential for MEs?

Of the viewpoints, the most emphasised ones include: (i) (Qki_1-5) The knowledge of the content and procedure of the tools, methods and strategies in tackling quality problems – case company employees (CCEs) treat this type knowledge as of essential and very important to decide concrete QI activity plans. One can confidently argue that without a clear understanding and provision of these important elements, QI cannot be eventually achieved. (ii) (Qki_1-6) Understanding of the quality management and problem reporting procedures – CCEs see this knowledge as critical and essential for instant and thorough communication to underpin QI actions. Clearly, an accurate apprehension and effective compliance with the procedures can ensure the efficacy of QI application. (iii) (Qki_1-2) Skills for quick response to occurring problems – CCEs deem this kind of knowledge a fundamental competence set and crucial for smooth running of operations. (iv) (Qki_1-4) The ways to identify problems – CCEs treat this knowledge as basic however of critical importance. Undeniably, to identify quality problems is the first step of an operational process of QI.

The more emphasised one is: (Qki_1-1) Problem analysis and countermeasure development – this knowledge in CCEs' eyes is fundamental and essential to QI initiatives. The knowledge as such is undoubtedly important for the realisation of QI.

The less emphasised ones include: (i) (Qki_1-3) Approaches to summarization of learning and experience and dissemination of the QIK. (ii) (Qki_1-7) The best training courses for enhancing QIK. (iii) (Qki_1-8) The prevention methods avoiding quality problems' occurrence.

Heretofore according to the authors' searching result, these findings have not appeared in the existing literature on knowledge identification in MEs, namely they are new to ME KM field in this regard. Meanwhile, one can also notice that the above points are the general

dimensions of the needed QIK, not the content details, which can be further enriched by future research.

For Question 2: How do MEs (methods/approaches used) distinguish the more relevant and less relevant QIK to their business operations?

Among the answers, the most emphasised ones, namely the most applied methods are: (i) (Qki_2-3) Benchmarking QIK with that in quality focused books and other literature – this approach is regarded by the CCEs as effective in supporting swift identification of relevant knowledge and obtaining the needed knowledge. (ii) (Qki_2-4) Testing best practice QIKs in the operations process, to base on their implementation results to decide which QIK is highly relevant – CCEs view this approach as very practical and effective, and they have also noticed the implementation of such an approach by other organisations. This approach is also supported by existing literature of its usefulness (Brink and Madsen, 2015). (iii) (Qki_2-5) Obtaining the relevant QIK packages from the managers and functional staff in charge of quality, following the instruction to apply the QIK – this approach is regarded by CCEs as easy, convenient, effective and efficient to know what QIK to use and how, in view of their busy daily routines. Research from Coyte, et al. (2012) and Moffett and McAdam (2006) resonates this approach.

The more emphasised ones are: (i) (Qki_2-1) Problem oriented thinking and action, to figure out the needed QIK during the process of resolving problems – this approach is perceived as efficient and effective, seen by CCEs as popularly applied in practice. (ii) (Qki_2-7) Based on the self-learnt knowledge through self-studying relevant material and attending courses – CCEs perceive this approach as effective although it might take longer time to achieve the intended outcome. This approach can find the endorsement of its applicability from existing research (Brink and Madsen, 2015).

The less emphasised ones include: (i) (Qki_2-2) "Reverse engineering" type backwards learning – starting from the expected outcome to find the needed knowledge. (ii) (Qki_2-6) Attending conferences in the field of quality management to learn from the presentation/discussion of the most up-to-date QIK. The reason for less weight received by these two approaches from practical professionals is the aforementioned common phenomenon facing MEs – resource constraints. MEs might need to call on external supports, such as governmental financial incentives, for additional resources to enhance their QIK identification and other relevant activities.

For Question 3: What techniques/tools (approaches) do MEs use in their identification process of QIK?

None of the answers to this question can be classified as most emphasised. Such a situation evidences the context oriented characteristic of QIK identification approaches – mutual selection between the QIKs and their application settings as well as the altering applicability of a certain QIK to different situations.

The more emphasised ones include: i) (Qki_3-1) Tracking the realisation of the targets and outcomes and monitoring the implementation of the corresponding approaches for realising the targets – this method is deemed by the CCEs as a quite effective way to identify and implement QIK and enrich people's work life content. (ii) (Qki_3-2) Examining the feedback from the users of the particular knowledge – this method is considered by CCEs as a very direct way to know whether certain QIK has a high applicability. (iii) (Qki_3-3) Obtaining QIK through searching relevant quality focused literature, which is in congruence with the contention in existing research (Massaro, et al., 2016). (iv) (Qki_3-5) Obtaining feedback from production foremen and operators on the best QI approaches that they have developed in their daily work – this method is regarded by CCEs as an effective approach for ensuring internal learning and knowledge accumulation for building up a knowledge organisation. (v) (Qki_3-8) Listening to the management's and/or functional staff's instruction, communicating with peers in the same and other production lines and shops – CCEs believe that this method ensures a quick attainment of QIK with its associated implementation guidance. This approach has been proposed in the relevant research (Coyte, et al., 2012) and is a convenient and effective way of QIK identification and potentially can also lead to new QIK creation (Centobelli, et al., 2018).

The less emphasised ones consist of: (i) (Qki_3-4) Seeking advice on QI from professionals in quality management field from other organisations through communication/networking – the practical respondents seem not perceiving this technique as important, although it receives support from literature (Costa, et al., 2016; Brink and Madsen, 2015; Roy and Thérin, 2008). Meanwhile the viewpoint of this technique's unimportance can also be seen in literature, although rare (Huggins and Johnston, 2009). A situation as such might be caused by that due to lack of sufficient channels or resources (time, funding, etc.) (Mat, et al., 2018), many MEs' employees do not have much opportunity to network with professionals from other organisations, even though they may desire to. (ii) (Qki_3-6) Analysing the outcome of the QI through group works to finalise the content and application procedure of QIK. (iii) (Qki_3-7) Reading documents from the functional departments on QI tools/procedures. (iv)

(Qki_3-9) Recording outcomes of the application of certain knowledge, then classifying the QIK to respective categories.

For Question 4: What function as the initiating drives for QIK identification activities?

The most emphasised elements are: (i) (Qki_4-3) Responsibility for the organisation's QI – CCEs do recognise this driving force as of essential leading to QIK identification and implementation and it promotes all businesses to improve their quality performance. This view is in accordance with existing research findings (Arndt, et al. 2019; Durst and Edvardsson, 2012). (ii) (Qki_4-5) Demonstrating personal knowledge and capability for obtaining career promotion or other incentives – this is an internal drive for employees' personal development, it might also be a reflection of the organisational culture's impacts on the individuals' career aspiration in the case companies.

The more emphasised ones include: (i) (Qki_4-1) The organisational positioning in marketplace and perception of QIK's importance – these are prerequisites for businesses' successful operation as considered by CCEs, and can also find advocacy of their importance from relevant literature (Akwei and Zhang, 2018; Durst and Edvardsson, 2012). (ii) (Qki_4-2) Top management's attention and motivation as well as incentives to QIK identification – CCEs see these elements of strategic importance; without them, seldom can any initiative be successful in an organisation. These driving forces have been also advocated by researchers in relevant fields, demonstrating their meaningfulness to KM practice (Durst and Edvardsson, 2012; Wee and Chua, 2013).

The less emphasised ones include: (i) (Qki_4-4) Willingness of the employees to identify/create new effective QIK – this resonates existing research findings (Brink and Madsen, 2015; Durst and Edvardsson, 2012), however, interestingly the CCEs do not view this as much important; this might be due to that the case companies have already built this mentality in the employees' mind-set, thus they deem it a natural part of their working life and not as a special factor. (ii) (Qki_4-6) The customer companies' high requirement on product quality – this drive has also not been considered as critical by CCEs. (iii) (Qki_4-7) The pursue of ISO9000 quality accreditation – this drive is perceived by CCEs as less important. (iv) (Qki_4-8) Higher quality leading to more profit of the company, consequently resulting to employees' more personal income – this view is endorsed by Durst and Edvardsson (2012), however this drive seems having not attracted too much of the CCEs' attention. (v) (Qki_4-9) Unwillingness to let down the mangers' trust on managing well the production lines – this is

not viewed by CCEs as much important. (vi) (Qki_4-10) Punishment on low quality production – this drive is also not viewed widely by CCEs as crucial.

For Question 5: Do MEs rely on internal sources in identifying QIK or do they rely on external sources?

Among the answers, the most emphasised one is: (Qki_5-3) Only rely on internal sources – in CCEs' eyes, seeking QIK from internal sources is a most efficient and convenient way for QIK identification, and subject less to the resource constraints. This is to some extent against many people's common-sense, and also dissent from some of the existing literature arguments (de Guimarães, et al., 2018; Raymond, et al., 2016; Calvo-Mora, 2016; Durst and Edvardsson, 2012).

The more emphasised one is: (Qki_5-2) Attaining QIK from both internal and external sources – CCEs believe this approach is effective in identifying the appropriate QIK with high quality and possibly also more in quantity. This approach is in line with arguments from existing research (Costa, et al., 2016; Raymond, et al., 2016; Calvo-Mora, 2016; Bojica and Fuentes, 2011; Roy and Thérin, 2008; Coyte, et al., 2012).

The less emphasised ones include: (i) (Qki_5-1) Mainly internal sources, external sources serve as supplementary/complementary. (ii) (Qki_5-4) More from external sources to get the most up-to-date QIK relevant to the company's business operations. This argument has literature support (Games and Rendi, 2019). Nonetheless, from this research, one can notice that only a small portion of CCEs see this as important.

As indicated by the summarised reasons detailed in Appendix 2, the explanation from the case respondents on the reasons of those answers have reflected very much their practical oriented mind-set, namely by exploring on: (i) the types of QIK, (ii) the way for determination of QIK's relevancy to business operations, (iii) the methods of identifying QIK, (iv) the drives for identifying QIK, as well as (v) the sources to seek QIK, the ultimate aim is to ensure the efficacy and convenience of knowledge identification activity.

The second stage – the additional case companies' focus group findings

These case companies are all in a good business operating condition (the authors also sought to find MEs that are in a struggling operating condition, however could not obtain access to such ones). And for the answers to questions focusing on EIBAFs, there is a very high level of consistency between the first and second stages from the category groups within and cross cases.

For the themed research questions, result from these further focus group sessions reveals that for the vast majority of the answers and the answers' prioritisation from the previous stage, the further case companies employees' viewpoints (with average agreement degree above 3) are in congruence with them; and they have not raised any point for addition/deletion besides what have already been attained from the first stage research. There are however, some differences on a few elements' prioritisation level. Table 3 (in next sub-section) highlights the elements with prioritisation levels different between the first and second stage findings. The most interesting point revealed by the examination on the additional cases' data is that although these companies have different background situations including such as the geographical location associated economic development levels, the companies' concrete business operating situations, as well as the application of ICT and the industrial specialty segments they locate in, the viewpoints (answers to the themed research questions) do not demonstrated major difference. This might hint that currently MEs in Chinese context have a certain level of similarity in their approaches and attitudes towards QIK identification issues. This understanding is to be further attested by the third stage interviews.

The third stage – the structured interview findings

From this round of interview sessions, for the open-ended questions, answers to the enquiry of whether the interviewees think there are any elements missed out from the current findings and their importance level – thirty-eight of the participants do not think there are other points necessary to be included in the list; the rest two felt that there could be something new in the near future, but neither of them was sure what that could be. This hints a possible future research focus. And there is no suggestion on deleting any of the elements.

For the answers to the EIBAF questions, the interviewees although from MEs with various backgrounds, also demonstrate a high level of consensus with the viewpoints highly similar to that from the previous two stages' findings. While only from the perspective of economic development level of the regions where the MEs locate in, there are two elements showing a significant difference between MEs from developed regions and those from less developed ones: (1) Qki_3-9 – MEs from less developed regions pay more attention to this element; (2) Qki_4-7 – MEs in the developed regions see it more valuable. Nonetheless, in view of their prioritisation levels from previous stages and the ratings at the third stage, both elements are finally assessed as less emphasised, indicating their relatively low significance to MEs.

For the close-ended questions, the importance ratings to each individual answers (approaches/viewpoints) are summarised and depicted in Figure 3. For a straightforward comparison, the answers are organised corresponding to the prioritisation groups derived from previous stages.

Figure 3. Importance (average) ratings on each individual answers from interview sessions
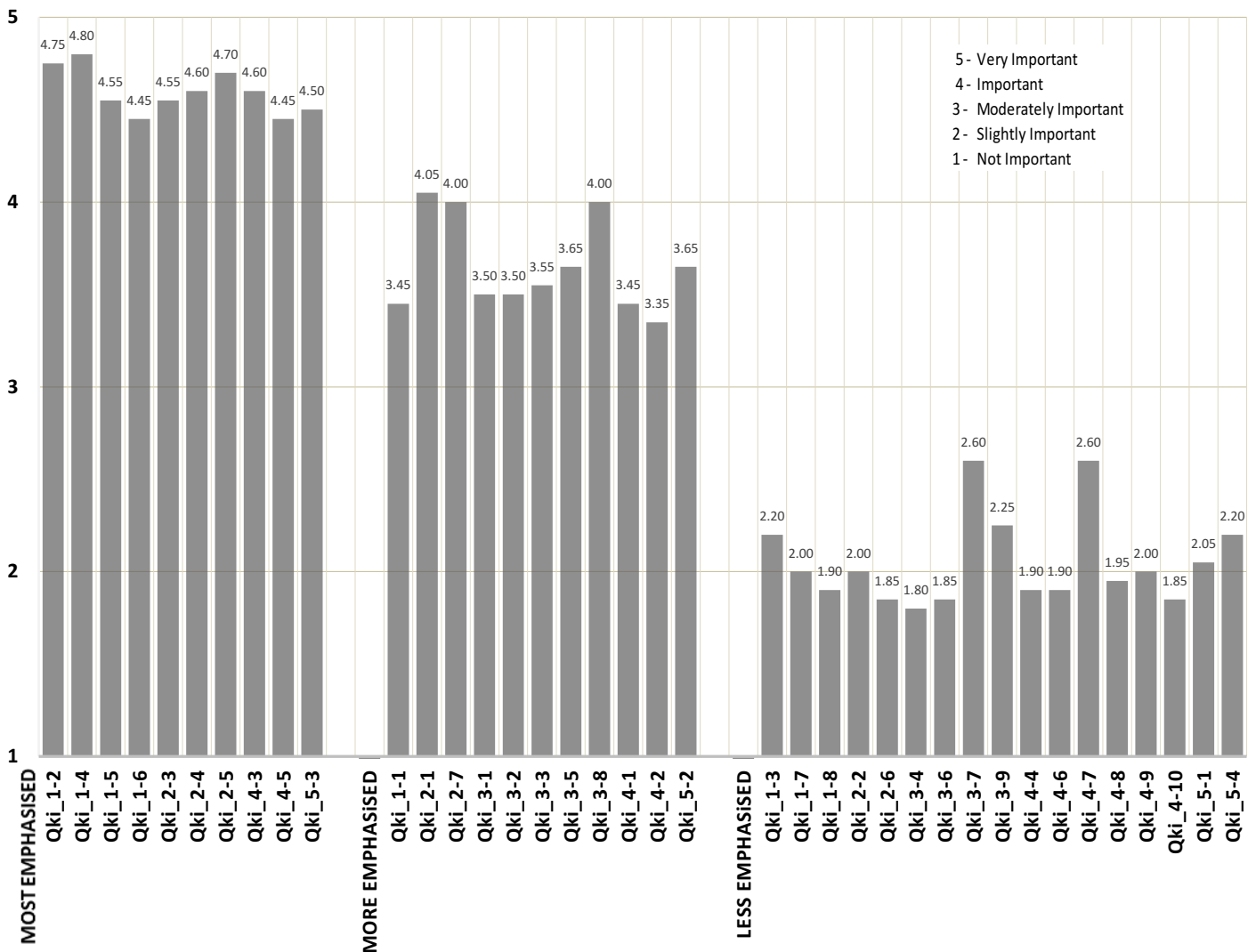
From Figure 3, one can notice that there is a correspondence between the levels of prioritisation classification in stage two and the scales in stage three, namely: "Most emphasised" corresponds to scale 4 and above; "More emphasised" falls into scale range of 3 to 4; "Less emphasised" corresponds to scale below 3. From the third stage, one can obtain a clear insight that in general, the previous two stages' findings (concrete answers to the theme questions and prioritisation on those elements) have in general received a further attestation;

the congruence on the prioritisations between these stages on the answers is illustrated clearly by Figure 3. Nonetheless, there are still a few elements' prioritisation needing to be finally adjusted based on the evaluation differences at different research stages; these adjustments are summarized in Table 3. While when the research stages' ratings have differences, the authors follow the stage three's importance ratings, on account of that they come from more respondents in more MEs.

Table 3. Adjustment on the priority levels of some QIK elements (answers)

Answer codes	Content	Identified/ adjusted prioritisation at stage I / II	Importance rating at stage III	Prioritisation adjustment at stage III	Final prioritisation decided at stage III *
Qki_2-1	Problem oriented thinking and action, to figure out the needed QIK during the process of resolving problems	More emphasised (Identified at Stage I)	**4.1**	More emphasised to most emphasised	**Most emphasized**
Qki_2-6 *	Attend conferences in the field of quality management to learn from the presentation/discussion of most up-to-date QIK	From less emphasised to more emphasised (Adjusted at Stage II)	**1.9**	Still less emphasised as that at Stage I according to Stage III evaluation	**Less emphasised**
Qki_2-7	Based on the self-learnt knowledge through self-reading relevant material and attending relevant courses	More emphasised (Identified at Stage I)	**4**	More emphasised to most emphasised	**Most emphazized**
Qki_3-7	Read documents from the functional departments on quality improvement tools/procedures	From less emphasised to more emphasised (Adjusted at Stage II)	**2.6**	Still less emphasised as that at Stage I according to Stage III evaluation	**Less emphasised**
Qki_3-8	Listen to the management's and/or functional staff's instruction, communication with peers in the same and other production lines and other production shops	More emphasised (Identified at Stage I)	**4**	More emphasised to most emphasised	**Most emphasized**
Qki_4-4 *	Willingness of the employees to identify/create new effective QIK	From less emphasised to more emphasised (Adjusted at Stage II)	**1.9**	Still less emphasised as that at Stage I according to Stage III evaluation	**Less emphasised**
Qki_4-9 *	Unwillingness to let down the mangers' trust on managing well the production lines	From less emphasised to more emphasised (Adjusted at Stage II)	**2**	Still less emphasised as that at Stage I according to Stage III evaluation	**Less emphasised**

* Stage 3's rating outweighs that from other stages

"Takeaways" for MEs' QIK identification

Based on the findings from the above three research stages, for a convenient and handy guidance to MEs' QIK identification in practice, the approaches that have received a

prioritisation at and above more emphasized level (scale rating above 3) are summarised in Table 4. Meanwhile, as illustrated by Table 4, in addition to attest the prioritisation from the previous stages, the stage three supplements the research findings through further differentiation (minor rankings) within each prioritization levels (major rankings) based on the structured interview rating score corresponding to each element (from I – highest minor ranking to II, III… – lower minor rankings).

The practical MEs can selectively apply the concepts/approaches listed in Table 4 (based on their major and minor classification ranks) in their QIK identification initiatives, to enhance their operations quality performance, particularly their ability to identify QIK and consequently lead to their continuous growth in the competitive global marketplace.

Table 4. The concepts/approaches to be applied at higher priority for MEs' QIK identification

Priority level (major rank)	Aspect focused	Minor rank (within each priority level)	Answer codes (as seen in Appendix 1)	Content of the concepts/approaches
Most emphasised	What QIK knowledge is essential for MEs?	I*	Qki_1-2	Skills for quick response to occurring problems
			Qki_1-4	The ways to identify the problems
		II	Qki_1-5	The knowledge of the content and procedure of the tools, methods and strategy in tackling the quality problems
		III	Qki_1-6	Understanding of the quality management procedure and problem reporting procedure
	How do MEs distinguish the more relevant and less relevant QIK to their business operations?	I	Qki_2-5	Obtain the relevant QIK packages from the managers and functional staff in charge of quality, following the instruction to apply the QIK
		II*	Qki_2-3	Benchmarking QIK with that in quality focused books and other literature
			Qki_2-4	Test best practice QIKs in the operations process to see the results to decide which QIK is highly relevant
		III	Qki_2-1	Problem oriented thinking and action, to figure out the needed QIK during the process of resolving problems
		IV	Qki_2-7	Based on the self-learnt knowledge through self-reading relevant material and attending relevant courses
	What function as the initiating drives for QIK identification activities?	I	Qki_4-3	Responsibility for the organisation's quality improvement
		II	Qki_4-5	Demonstrate personal knowledge and capability for obtaining career promotion or other incentives
	Do MEs rely on internal sources in identifying QIK or do they rely on external sources?	N/A	Qki_5-3	Only rely on internal sources
More emphasised	What QIK knowledge is essential for MEs?	N/A	Qki_1-1	Problem analysis and countermeasure development
	What techniques/ tools (approaches) do MEs use in their	I	Qki_3-5	Obtain feedback from production foremen and operators on the best QI approaches that they have developed in their daily work

identification process of QIK?	II	Qki_3-3	Obtain QIK through searching relevant quality focused literature	
	III*	Qki_3-2	Examine the feedback from the user of the particular knowledge	
		Qki_3-1	Track the realisation of the targets and outcomes and monitor the implementation of the corresponding approaches for realising them	
What functions as the initiating drive for QIK identification activities?	I	Qki_4-1	The organisational positioning in marketplace and perception of QIK's importance	
	II	Qki_4-2	Top management's attention and motivation as well as incentives to QIK identification	
Do MEs rely on internal sources in identifying QIK or do they rely on external sources?	N/A	Qki_5-2	From internal and external sources that both are treated as heavily important	

* Elements with the same rating

Concluding remarks and future research

This research has explored the issue of knowledge identification under the context of quality improvement in MEs – an important KM topic, which is lacking of research and needing to be further extensively explored. The research findings have been firstly consolidated based on data of semi-structured interview and focus group sessions from empirical case MEs and then further attested by an additional round of structured interview triangulation.

The key research findings as summarised in Table 4 and further supplemented in Appendix 1 and 2, have revealed the critical insights mainly focusing on five themed aspects of QIK identification in MEs. A comparison has also been made between the research findings and the arguments from the existing related literature whenever available, under the backcloth of that the literature with a focus on the particular topic of this research is scarce. The five themed aspects include (i) essential QIK knowledge for MEs, (ii) how MEs distinguish the more relevant and less relevant QIK to their business operations, (iii) techniques/tools (approaches) MEs use in their QIK identification process, (iv) the initiating drives for QIK identification activities, (v) which sources (internal/external) MEs rely on in identifying QIK.

Meanwhile, there is a clear sign that the current well developing macro-economic system in China provides a good support and increasingly enriched resources for QIK management in MEs. While regional economic development difference seems not saliently impacting the QIK identification issues in MEs.

Based on analysing the findings, the authors have prioritised the answers to the five theme questions respectively into three groups – less/more/most emphasised ones, and also provided further within group (minor) ranking on individual elements within each prioritisation level (major ranking). Usually, the elements of those most/more emphasized (listed in Table

4) by CCEs should be put at the first priority to be selected for implementation in practice. Nevertheless, the less emphasized ones should not be totally neglected, some of them might be a better approach in a certain contextual situation.

Implications

Corresponding to that the contemporary research focusing on QIK identification within MEs is very scarce and lacks of a comprehensive coverage, and there is an obvious demand of new and more understandings on QIK identification in MEs, theoretically this research's findings constructively contribute to the field of KM study in MEs, through adding into the knowledge pool the new and much demanded insights of the types of QIK needed by MEs, and especially the critical aspects associated with knowledge identification in MEs. Practically, the elements identified/prioritised by this research for QIK identification can be applied and followed by MEs in their quality management and improvement process, to contribute effectively to their sustainable growth and healthy survival. The management of MEs can be guided by the findings of this research to determine the best ways/contents to train and facilitate their employees in learning and identifying the effective and efficient QIKs and implementing them in practice. Namely, MEs can use the major importance prioritisation and further minor rankings of the relevant answers as a referential guidance, to determine the type of QIK with high appropriateness to implement in their operations, especially to select and execute the approaches of high applicability for QIK identification, to train employees with highly relevant concepts/tools for QIK identification to enhance their KM skills and capability. The findings of the research can also serve as a useful reference to other types of enterprises in their knowledge management processes.

Meanwhile, the investigation methods and the way of their usage in this research, especially focus group' implementation in practical environment, can also serve as an exemplar for MEs' management and employees in charge of KM to follow in their knowledge identification processes as well as other business activities in the field of QI and other areas, due to their ease and effectiveness of application.

Limitations

As an exploratory investigation, this research however has its limitations. One limitation entails from the case study research strategy itself and the sample size of the structured interview. Namely in view of the vast amount of MEs in China, although the coverage on the diversity of MEs has already been addressed through the case MEs' selection as well as the number of

interviews – a sample size supported by existing research (Hagaman and Wutich, 2017; Seidman, 2006), there is still a possibility that the findings are not exhaustive and need to be further attested. Another limitation is that this research only focused on manufacturing MEs and within China, one could doubt that whether the findings can also reflect the situations in service MEs, as well as manufacturing/service MEs in other countries. These aspects deserve further empirical investigation.

Future research

As an exploratory study, the current research findings provide insightful direction for future research work, which can focus on a series of issues as detailed at following.

Corresponding to the existence of inconsistency of the viewpoints between different category groups of employees in the case study, especially between managers and production line operators, a further case study can be conducted to identify the concrete approaches and possibility to align the mentality and thoughts among them. In view of the potential diversity of MEs in different contexts/environments, a comparative investigation on the QIK identification issues between MEs in China and those in European countries following the same strategy as in this research, can shed more lights into this less researched area. With a consideration of the type and scale of this research, a large scale survey investigation can be launched to further examine the current findings in a wider range of MEs in different industries/regions/countries, including service MEs; meanwhile, the details corresponding to the different type QIKs' content elements/aspects needed by MEs can also be further substantiated by the survey. Also a comparison can be carried out between MEs, SEs and LEs on the similarities and differences of the elements/approaches of their QIK identification, as well as the reasons for that, through a combined strategy of case study and interview. Apropos of the potential change of relevant insights with the time elapsing, a regular longitudinal study on MEs' QIK identification can continually contribute more understandings to the focused area, with regard to what new concepts/approaches having been developed, and what currently important ones having become less important or valueless, as well as what currently unimportant ones having become more important.

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Appendices

Appendix 1. Summary of the findings (answers to "what/how" of research questions)

Question code/content	Answers and their associated codes	Resonating directly/ indirectly from SME literature	Case A respondents holding the viewpoints	Case B respondents holding the viewpoints
Qki_1 What QIK knowledge is essential for MEs?	Qki_1-1) Problem analysis and countermeasure development	N/A	Manager	Manager
	Qki_1-2) Skills for quick response to occurring problems	N/A	Manager, Production foremen	Manager
	Qki_1-3) Approaches to summarization of learning and experience and dissemination of the QIK	N/A	Manager	N/A
	Qki_1-4) The ways to identify the problems	N/A	Functional staff, Production foremen	Production foremen
	Qki_1-5) The knowledge of the content and procedure of the tools, methods and strategy in tackling the quality problems	N/A	Functional staff, Production line operator	Functional staff, Production line operator
	Qki_1-6) Understanding of the quality management procedure and problem reporting procedure	N/A	Functional staff, Production line operator	Production foremen, Production line operator
	Qki_1-7) The best training courses for enhancing QIK	N/A	N/A	Functional staff
	Qki_1-8) The prevention methods avoiding quality problems' occurrence	N/A	N/A	Production foremen
Qki_2	Qki_2-1) Problem oriented thinking and action, to figure out the needed QIK during the process of resolving problems	N/A	Manager	Functional staff

How do MEs distinguish the more relevant and less relevant QIK to their business operations?	Qki_2-2) "Reverse engineering" type backwards pondering - Starting from the expected outcome to find the needed knowledge	N/A	Manager	N/A
	Qki_2-3) Benchmarking QIK with that in quality focused books and other literature	Massaro, et al., 2016	Manager, Functional staff	Manager
	Qki_2-4) Test best practice QIKs in the operations process to see the results to decide which QIK is highly relevant	Brink and Madsen, 2015	Manager, Functional staff	Manager, Production foremen
	Qki_2-5) Obtain the relevant QIK packages from the managers and functional staff in charge of quality, following the instruction to apply the QIK	Coyte, et al., 2012	Production foremen, Production line operator	Production line operator
	Qki_2-6) Attend conferences in the field of quality management to learn from the presentation/discussion of most up-to-date QIK	N/A	N/A	Manager
	Qki_2-7) Based on the self-learnt knowledge through self-reading relevant material and attending relevant courses	Brink and Madsen, 2015	N/A	Functional staff, Production line operator
Qki_3 What techniques/ tools (approaches) do MEs use in their identification process of QIK?	Qki_3-1) Track the realisation of the targets and outcomes and monitor the implementation of the corresponding approaches for realising them	N/A	Manager	Production foremen
	Qki_3-2) Examine the feedback from the user of the particular knowledge	N/A	Manager	Production foremen
	Qki_3-3) Obtain QIK through searching relevant quality focused literature	Massaro, et al., 2016	Functional staff	Production foremen
	Qki_3-4) Seek advice on quality improvement from professionals in quality management field from other organizations through communication/networking	Brink and Madsen, 2015; Roy and Thérin, 2008; Costa, et al., 2016	Functional staff	N/A
	Qki_3-5) Obtain feedback from production foremen and operators on the best QI approaches that they have developed in their daily work	N/A	Functional staff	Functional staff
	Qki_3-6) Analyse the outcome of the quality improvement through group works to finalise the content and application procedure of QIK	N/A	Functional staff	N/A
	Qki_3-7) Read documents from the functional departments on quality improvement tools/procedures	N/A	Production foremen	N/A
	Qki_3-8) Listen to the management's and/or functional staff's instruction, communication with peers in the same and other production lines and shops	Coyte, et al., 2012	Production foremen, Production line operator	N/A
	Qki_3-9) Record outcomes of the application of certain knowledge, then classify the QIK to respective categories	N/A	N/A	Manager
Qki_4 What function as the initiating drives for QIK identification activities?	Qki_4-1) The organizational positioning in marketplace and perception of QIK's importance	Durst and Edvardsson, 2012	Manager	Manager
	Qki_4-2) Top management's attention and motivation as well as incentives to QIK identification	Durst and Edvardsson, 2012; Wee and Chua, 2013	Manager	Functional staff
	Qki_4-3) Responsibility for the organization's quality improvement	Durst and Edvardsson, 2012	Functional staff, Production foremen, Production line operator	Functional staff, Production foremen, Production line operator

	Questions	Resonating literature			
	Qki_4-4) Willingness of the employees to identify/create new effective QIK	Durst and Edvardsson, 2012; Brink and Madsen, 2015	Functional staff	N/A	
	Qki_4-5) Demonstrate personal knowledge and capability for obtaining career promotion or other incentives	N/A	Functional staff, Production foremen, Production line operator	Production foremen	
	Qki_4-6) The customer companies' high requirement on product quality	N/A	N/A	Manager	
	Qki_4-7) The pursue of ISO9000 quality accreditation	N/A	N/A	Manager	
	Qki_4-8) Higher quality leading to more profit of the company, consequently resulting to employees' more personal income	Durst and Edvardsson, 2012	N/A	Functional staff	
	Qki_4-9) Unwillingness to let down the mangers' trust on managing well the production lines	N/A	N/A	Production foremen	
	Qki_4-10) Punishment on low quality production	N/A	N/A	Production line operator	
Qki_5 Do MEs rely on internal sources in identifying QIK or do they rely on external sources?	Qki_5-1) Mainly internal sources, external sources serve as supplementary/complementary.	N/A	Manager	N/A	
	Qki_5-2) From internal and external sources that both are treated as heavily important	Bojica and Fuentes, 2011; Roy and Thérin, 2008; Costa, et al., 2016; Raymond, et al., 2016; Calvo-Mora, 2016; Coyte, et al., 2012	Functional staff	Manager	
	Qki_5-3) Only rely on internal sources	N/A	Production foremen, Production line operator	Production foremen, Production line operator	
	Qki_5-4) More from external sources to get the most up-to-date QIK relevant to the company's business operations, internal sources serve as supplementary/complementary.	Durst and Edvardsson, 2012	N/A	Functional staff	

EIBAFs	Questions	Resonating literature	Case A respondents' opinion	Case B respondents' opinion
	(1) What is the respondents' view about the current general national economic development situation (mindful of SMEs)? Whether/how does this situation affect their QIK management?	Choochote, 2012; Sitharam and Hoque, 2016	Good macro-economic environment, which is in support to all businesses including MEs – From all category groups, all employees know this clearly from various channels. With a general well developing external economic environment, MEs can have more opportunities to obtain more QIKs from external sources as mentioned by them.	The same as that in Case A.
	(2) What is the specific industrial segment their business production	Cerchione, et al., 2015	Their business production focus has been answered by	The same as Case A.

	focuses on (reflected by the products)? Whether/how does this specialty affect their QIK management?		all participants, seen in Table 1. They all do not think the QIK management has been affected from their industrial specialty.	
	(3) What technologies has their company implemented in the KM process? Whether/how do these technologies affect their QIK management?	Choochote, 2012; Cerchione, et al., 2015	Case A has implemented emails system based on intranet, central database and can also use internet if needed. They see technology a strong support to their QIK management.	Case B also has implemented emails system based on intranet, central database, but they do not connect to internet. They also see IT as a good support to their operations performance.
	(4) What is their company's current operating condition? Whether/how does it affect their QIK management?	N/A	Very good with growing profits. The growth partially comes from the application of some new techniques learnt through QIK identification, this leads to that people pay more attention to QIK.	Good and also profit grows. A good operating conditions have given them more motivation to use any available approaches and means constructive to the business, including QIK identification.

Appendix 2. The reasons (from case respondents) for the respective answers (answers to the part of "why" of the five themed research questions)

Answer codes	Case A respondents' reason for the answer	Case B respondents' reason for the answer
Qki_1-1	Fundamental to the QI projects	Critical and essential for QI actions
Qki_1-2	Critical for resolving the quality problems for a smooth operations process	A kind of must capacity for employees, especially people working at the front line positions
Qki_1-3	This kind of knowledge can help the employees and consequentially the whole organization to continuously improve on quality performance, as well as in other aspects, thus essential	N/A
Qki_1-4	Critical knowledge for any quality problems to be resolved	Without the understanding of this knowledge, people cannot even start the QI process
Qki_1-5	Essential for deciding the appropriate tools/methods for concrete quality problems and the development of detailed action plans for tackling the problems	Very important knowledge for determining activities and steps to be followed and carried out for QI projects at any scale and scope
Qki_1-6	Very critical for an instant and thorough communication of quality issues at all levels in the whole company	Essential for the commitment and triggering on resolving quality problems and launching QI projects
Qki_1-7	N/A	Good sources for further improving employees' knowledge and capability for QI
Qki_1-8	N/A	Essential for enhancing the current achievements of QI and ensuring and sustaining the quality performance to continuously reach a higher level
Qki_2-1	Inspired by practices in some other organizations, and proven an effective way in the company's daily operations	This is a very effective and efficient approach to identify and attest the usefulness of the knowledge of concern
Qki_2-2	A technique appeared at a relatively high strategic level, however, when facilitated by experienced employees, turned out to be very easily to be operationalised to deal with quality issues at both strategic and daily operational process levels	N/A

Qki_2-3	An effective technique learnt from academic education system – comparing literature to find something more meaningful and critical	Benchmarking is a popular approach implemented in many fields, here in the company, people selected a knowledge intensive source to benchmark with – quality focused literature
Qki_2-4	A very practical and effective approach for determining relevant knowledge – this has been proved during its practice	An appropriate measure which has been implemented by many organizations, which results to our trust on the application of this approach
Qki_2-5	Easy, convenient and quick way to know what the QIK is associated with a certain process or work	Most efficient and effective method to obtain QIK under a context of fulfilling a busy daily routine
Qki_2-6	N/A	A very effective approach to obtain and understand especially the newest QIK relevant to the business
Qki_2-7	N/A	This approach might need a little longer time, however, the effect of this kind of learning can help people to more accurately decide the most relevant QIK for the company's business operations
Qki_3-1	It is the most effective way to seek and prove the most relevant QIK	The identification of most appropriate QIK can be integrated into daily work, and becomes a part of daily working life and makes people feel more fulfilling in their career
Qki_3-2	The user knows most clearly the outcome of the application of certain knowledge in business process	As front line workers, people can see clearly whether a certain QIK works properly or not
Qki_3-3	Published literature usually tells the up-to-date new knowledge that can be applied in practice directly or through adaptation	One of the most conveniently available sources for obtaining large amount of relevant QIK, can be accessed 24/7
Qki_3-4	A very practical way to seek practically applicable knowledge	N/A
Qki_3-5	An effective approach to ensure an internal learning and accumulation of QIK	An approach to consolidate knowledge tackling quality issues from internal employees, meanwhile functions as a channel for employees directly contributing to building up a knowledge organization
Qki_3-6	Based on collective effort, commitment as well as wisdom, this approach is very effective and efficient in consolidating QIK	N/A
Qki_3-7	This is a most time saving approach for people in production to obtain QIK in resolving operations problems	N/A
Qki_3-8	This approach can save people's time in finding relevant QIK for application and receiving direct advice on the pitfalls or critical elements during the application	N/A
Qki_3-9	N/A	A very practical way has been followed by people in prioritising the importance of QIK after it has been confirmed as effective
Qki_4-1	Without a strong quality performance, it is very difficult to sustain business development and competitiveness, if not impossible	QIK can ensure the quality performance at a high level, which is one of the prerequisites of a healthy survival of business operations
Qki_4-2	Without top management support, it is very difficult to have sufficient resources (including human resources, time, etc.) for QI; motivating measures in financial or other terms can drive the commitment of employees for QIK identification and application	Management, especially top management tend to have a holistic view of the business in different aspects, they can provide people in the whole organization effective guidance and motivation on identifying QIK focusing on various business processes
Qki_4-3	Identification and implementation of QIK is essential to fulfil a performance objective of daily operation – to maintain and improve the product quality	An element of job description is to do best to improve the quality of work, while the identification of QIK is the first step to realise this
Qki_4-4	To contribute more to the company's business operations through identifying QIK and applying it in operations process	N/A

Qki_4-5	Through identification of new QIK to demonstrate the personal knowledge and capacity, to realise the esteem and self-actualisation within the organization	Identifying more QIK can enrich personal profile, which is a good support of career development
Qki_4-6	N/A	Only with the identification and implementation of appropriate QIK in the company's business operations process, the company can always meet and even exceed the customers' ever increasing demand on high product quality
Qki_4-7	N/A	QIK identification is a part of ISO 9000 system requirements
Qki_4-8	N/A	The financial gains for both the company and individual employees from high quality products through the application of QIK motivates the high level of people's commitment towards the identification of QIK
Qki_4-9	N/A	A very cooperative and trust working relationship between managers and common employees promote people work hard to ensure a smooth running of production, through application of various means, including identification and usage of QIK
Qki_4-10	N/A	To avoid receiving punishment for low quality production, seek QIK and implement it to ensure a high quality process
Qki_5-1	The internal stakeholders know more clearly and accurately the internal operations processes and the hidden problems, only they can select the most effective QIK corresponding to the concrete problems and to solve them	N/A
Qki_5-2	A comparison of QIK obtained from two different sources can produce an in-depth thinking and better QIK. Internal sources can create new QIK and test identified QIK to attest its applicability, external sources can provide directional guidance, methods and experience	According to a Chinese idiom: "Listen to both sides and you will be enlightened; heed only one side and you will be benighted", namely to triangulate information from different channels can make obtained knowledge more comprehensive and reliable, and meanwhile more sources can also provide more knowledge
Qki_5-3	Positioned at production line, the most convenient and time efficient way to identify handy and useful QIK relevant to daily work is from the internal documents/people within the organization	There is a lack of opportunity and time as well as resources for identifying knowledge from external sources
Qki_5-4	N/A	With internally already available QIK having been mastered, to enrich the QIK database, external sources must be consulted with for obtaining more and new knowledge

Appendix 3. Data collection and analysis protocol for the research

Field investigation

- The access to case companies is obtained through communicating with the case companies' CEO/General manager; during the communication, the researchers have assured the confidentiality of data and that the research paper's content will be based on the data confirmed by the participants of their accuracy and appropriateness;
- Data collection is conducted by following the phases at below:
- ➢ Obtain the informed consent after disclosing aim, background of the research, etc. to the interviewees;
- ➢ Obtain permission from the interviewees for note taking and the agreement on an after-session examination on the summary of the interview content;

- To all interviewees, a few identical general questions will be asked to obtain the information mainly about: the position, length of working in the case company, the functional areas working in;

- Then the research questions listed in the Methodology section will be asked sequentially for seeking the answers from the interviewees. Probing and follow-up will be conducted when necessary for the respondents to clarify their viewpoints or to seek further understanding on the new aspects inspired by the respondents' expounding;

- After the completion of an interview session, decide with the interviewee a time to communicate on the summary of interview information for further validation of the data accuracy and potential additional comments and insights. The summary is worded in a way to be concise and succinct for the ease of understanding and accurate capsulation of the respondents' viewpoints;

- Then in focus group sessions with the same research participants to obtain the consensual viewpoints (on the answers summarised from interview sessions) corresponding to the research questions in each individual category groups in the case companies respectively;

- The additional four case company's focus group sessions at the second stage will be carried out following the same procedure/format as that in the first stage two case companies, using the prioritised list of answers from the previous stage research findings.

- A third stage 40 structured interviews are then conducted through WeChat or telephone, to further examine the previous stages' findings.

Data analysis

- At first stage, after focus group sessions completed, a within-case analysis will be firstly conducted on the findings between the category groups within each case to examine for triangulation and synthesis of the findings within the certain case settings;

- Then a cross-case analysis will be conducted, to triangulate the viewpoints identified between cases for repetition and/or contradiction; afterwards, the summarized elements of the answers to the research questions will be prioritized/consolidated for theoretical comprehension and practical guidance; and whenever possible, comparison will also be made with the existing contentions obtained from the available relevant literature;

- To enhance the insights obtained from the above process, a further examination at second stage based on the data from additional four case companies' focus group sessions will be made to seek corroboration and/or contradictory contentions.

- To finalize the conclusions for this research, based on the third stage structured interview data, analysis will be carried out to attest and concretize in more details of the prioritization of the answer elements, as well as whether there are still missing points or deletions from the previous stages.