



**Knowledge Utilisation in Chinese Medium Sized Manufacturing Firms – An Exploration under the Backcloth of Quality Improvement**

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# Knowledge Utilisation in Chinese Medium Sized Manufacturing Firms – An Exploration under the Backcloth of Quality Improvement

## Abstract

**Purpose** – This paper reports findings of up-to-date insights to fill the knowledge gap of lack of theoretical and practical understandings of how knowledge is utilized in medium-sized enterprises (MEs) for ensuring their performance excellence, healthy survival and growth, particularly using the contextual background of quality improvement as the standing point to concretize the research content and research participants' mind-set for data collection.

**Design/methodology/approach** – The empirical data were attained by conducting firstly a multiple-case study and thereafter a structured interview. Insights were obtained through analysing the collected data as well as triangulating the findings with the contention from the extant literature where available.

**Findings** – A set of approaches for effective quality improvement knowledge (QIK) utilization in MEs have been identified and attested as well as prioritised for a clear guidance on their application by practical businesses.

**Originality/value** – As a pioneering study on the particularly focused issue, namely a current knowledge gap – QIK utilization in MEs, theoretically the research contributes to the enrichment of the current KM and QI literature with a primary focus on knowledge utilization in MEs. Practically its findings provide insightful guidance to practice on the approaches of QIK utilization.

**Keywords** Knowledge utilization, Medium-sized enterprises, China

## 1. Introduction

The importance of small and medium sized enterprises (SMEs) to national and global economy has been evidenced extensively (e.g., Kuratko, et al., 2001; Brink and Madsen, 2015). SMEs' pivotal contribution is reflected in various aspects, including that at the strategic level they drive and ensure the growth, stability of the economic systems and the well-being of the general public, and that at operational level they provide goods and services to customers, contribute to national taxation and secure employment locally, nationally and often internationally.

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3 The huge number of small sized enterprises (SEs) and medium sized enterprises (MEs)  
4 actively operating in different business sectors have also in their own right manifested their  
5 critical role in economic systems (Brink and Madsen, 2015; Šatanová, et al., 2015). Research  
6 has evidenced as well that in the current national and global economies, MEs function as one  
7 of the major forces playing a cornerstone role in driving the economic recovery and growth  
8 (Coltorti, et al., 2013; Massaro, et al., 2016). Therefore, the MEs' healthy survival and  
9 continuous growth are of salient importance not only to themselves but also to the various  
10 stakeholders in the contemporary economic systems (Brink and Madsen, 2015; Kumar, et al.,  
11 2016; Massaro, et al., 2016).

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19 Within MEs and other type organisations, quality as one of the important strategic factors is  
20 a fundamental operations capability underpinning and maintaining businesses' competitiveness  
21 in marketplace (Lorentz, et al., 2016). Many MEs have endeavoured in implementing various  
22 quality improvement (QI) approaches and techniques/technologies (Kumar, et al., 2016; Lee,  
23 2004; Kuratko, et al., 2001) for enhancing their performance and ensuring/improving their  
24 products' ability to fulfil the designed functionality and meet the customers' requirements.  
25 Meanwhile, the large amount knowledge of aforementioned QI processes,  
26 techniques/technologies, approaches, etc. comprising the body of QI knowledge (QIK), which  
27 exists/is being created externally and internally to the individual MEs and can be used for  
28 achieving their operations excellence. However, the extant research on KM in SME sector in  
29 general focuses on SMEs as a whole without differentiation, alongside the phenomenon that  
30 KM research mainly concentrates on large enterprises (LEs) (Durst and Edvardsson, 2012;  
31 Massaro, et al., 2016). Namely, alongside SEs, MEs as a particular type organization barely  
32 receive any research attention (Durst and Edvardsson, 2012; Tortorella, et al., 2015; Yasir and  
33 Majid, 2017).

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45 One needs to notice that since there is a heterogeneity between SEs, MEs and LEs (Brink  
46 and Madsen, 2015; Shrafat, 2018; Taura and Radicic, 2019), the means of utilizing the QIK  
47 tend to be different between different sized enterprises, namely the approaches used by LEs  
48 very possibly cannot be directly or effectively followed by MEs, the same phenomenon also  
49 applies to SEs in view of the possibility of applying their means of knowledge utilization in  
50 MEs. This contention has been resonated by Pett, et al. (2012) in their research revealing that  
51 these is a clear difference on learning/knowledge related aspects between SEs and MEs. This  
52 finding has been further attested by the very recent research from Klepić, et al. (2020) and  
53 Tamulevičienė and Androniceanu (2020), arguing the significant difference between SEs and  
54 MEs in many aspects of operations and the necessity for further investigation. Therefore there  
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3 is a clear need to study the particularities of the relevant issues in SEs and MEs through  
4 separated research focusing on them respectively. For a manageable scale, the empirical  
5 investigation of the research reported by this paper focuses on MEs. Meanwhile, as contended  
6 by research, the utilisation of knowledge is the most critical one among the facets of KM in  
7 business operations, since it directly adds value to businesses (Edvardsson, 2009), nonetheless  
8 there is a lack of research on its concrete approaches (Yasir and Majid, 2017; Massaro, et al.,  
9 2016; Durst and Edvardsson, 2012).

15 The aforementioned circumstances as a whole present a knowledge gap of the understanding  
16 of knowledge utilization approaches in MEs particularly herein apropos of QI. This research  
17 concentrates on this issue and its findings fill the gap, contributing to the current KM and QI  
18 literature by providing ME centred insights with a primary focus on the utilization approaches  
19 of KM alongside QI as the general contextual backcloth; meanwhile they also provide  
20 insightful guidance to practice of QIK utilization in MEs and are also referential to other type  
21 enterprises.

27 The industrial specialty of MEs focused by the research is manufacturing sector, on account  
28 of that it is a crucial cornerstone to economic development (Colotla, et al., 2018; Lorenz, et al.,  
29 2016; Pitelis and Antonakis, 2003), and that research findings from manufacturing MEs can  
30 also be referential to the businesses within and beyond the sector (Wang, et al., 2020).

34 In the rest of the paper, the background literature review is presented in next section  
35 covering the concrete aspects of the research, followed by the introduction of methodology  
36 directing the research activities, thereafter is the summarised findings and analysis, and then  
37 the paper finalises with concluding remarks and future research.

## 42 **2. Literature background of the research**

### 43 *2.1 Defining MEs in this research*

46 MEs are defined differently in different countries and sometimes even for different industrial  
47 sectors in the same country (Loecher, 2000). Within this research, in view of the close  
48 alignment between EU (Loecher, 2000) and UK definitions, and with a consideration of that  
49 the two case MEs at the first stage research are related to UK/EU, as well as that a planned  
50 follow-up larger scale project to compare between British/European and Chinese MEs, the  
51 definition from Companies Act (2006) of UK has been adopted in term of employee numbers;  
52 henceforth, in this paper, MEs refer to firms with a size of between 50 to 250 employees.

### 59 *2.2 KM in MEs*

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3 As a fundamental strategic as well as operational approach, KM ensures all types of businesses  
4 to successfully compete, survive and profit (Pino, et al., 2019; Bojica, et al. 2017).

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6 Heretofore, KM has been researched extensively, nevertheless the research largely  
7 concentrated on LEs or SMEs as a whole, and produced generalized insights without a focused  
8 consideration of MEs, resulting to the dearth of understanding of MEs' KM (Coetzer, et al.,  
9 2012; Tortorella, et al., 2015). Apropos of the differences of MEs' organizational structure,  
10 capabilities and business practices to other type businesses, as well as the resource constraints  
11 facing them (Durst and Edvardsson, 2012; Shrafat, 2018), the approaches for MEs' KM  
12 inherently have their peculiarity and dissimilarity from that of LEs and SEs (Wang, et al., 2020).  
13 However, as aforementioned, the understanding of them is not readily in place. The lack of  
14 exploration on pivotal elements of KM in MEs (Shrafat, 2018; Serenko, 2013; Durst and  
15 Edvardsson, 2012) not only illustrates the unthorough theoretical understanding of MEs' KM,  
16 but also entails that the practitioners in this segment cannot have relevant theoretical guidance  
17 in their business operations decision making (Booker, et al., 2008), which is very crucial for  
18 business success (Oliva and Kotabe, 2018). A situation as such merits further extensive  
19 investigation (Wang, et al., 2020; Durst and Edvardsson, 2012; Massaro, et al., 2016).  
20 Nevertheless, to make the investigation more concentrated, for a concrete standing point to  
21 attain in-depth insights and also with a further consideration of QI's pivotal importance to  
22 business success, this research does not examine KM as a whole entity and in a full range of  
23 MEs; instead, it focuses on QI knowledge (QIK) utilisation and in manufacturing MEs, with  
24 rationales further elaborated in next section.

### 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 *2.3 Knowledge utilisation, quality improvement (QI), case organization type and region* 42 *focused by this research*

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44 Knowledge utilisation concerns with the formats and procedures for the application of the  
45 appropriate knowledge within an organization for creating value to customers and generating  
46 revenue for the organization itself, as well as ensuring high level of operations performance to  
47 satisfy both the internal and external stakeholders. As evidenced by the existing research  
48 literature, knowledge utilisation is much inadequately explored in MEs as a separate contextual  
49 setting (Durst and Edvardsson, 2012; Massaro, et al., 2016). There is an absence of a holistic  
50 KM mechanism in many MEs in directing knowledge utilization (Centobelli, et al., 2018).  
51 Consequently more and further research is much needed in order to enhance the theoretical  
52 understanding of the associated issues and to provide guidance to real world MEs in their KM  
53 practices (Wang, et al., 2020; Durst and Edvardsson, 2012; Massaro, et al., 2016).  
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3        QI as a crucial functional process with its related activities contributes strategically in  
4        securing a company's competitiveness (Nobel, 1995; Lee, 2004). Meanwhile, different from  
5        other types knowledge, QIK focuses on quality – a core competitive factor of a business, with  
6        a particular attribute of integrating both strategic and operational dimensions of continuous  
7        improvement (Kuratko, et al., 2001; Šatanová, et al., 2015; Lee, 2004). The utilisation of QIK  
8        can ensure MEs to attain improved capability and enhanced competitive advantage. While in  
9        reality, MEs are not a scaled down version of LEs (Durst and Edvardsson, 2012) and also not  
10       a larger version of SEs, they have differences of organizational structure and management  
11       practices to that of LEs (Durst and Edvardsson, 2012; Brink and Madsen, 2015) and SEs.  
12       Consequently, the detail KM contents/procedures obtained from the research on LEs and SMEs  
13       as a whole may need to be acclimated to operationalise the QIK utilisation in the business  
14       context of MEs. Hence a research centring MEs' knowledge utilisation with QI as a general  
15       backcloth will contribute valuably to the KM literature and guide MEs' KM practice effectively.  
16       And currently, the coverage of research on MEs' KM among different countries is unbalanced;  
17       China, as a representative fast developing country and a newly emerging market as well as a  
18       globally driving force for economic development, has been largely neglected from research  
19       focus (Massaro, et al., 2016). Apropos of all the above-mentioned, it is considerably  
20       meaningful and critically necessary to obtain further and more insights of the issues relevant  
21       to ME KM in China.

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24       Meanwhile, within Chinese SME sector, manufacturing MEs yield the biggest contribution  
25       towards the total sectoral business revenue (Liu, 2008; Ning, 2018). Therefore in this research,  
26       manufacturing case companies are selected with the aim to obtain insightful understandings,  
27       which could be referential to KM in more and other type businesses as well (Wang, et al., 2020).

#### 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45       *2.4 Questions to be explored by the research*

46       Based on the learning and inspiration from the aforementioned extant literature (e.g., Pino,  
47       et al., 2019; Durst and Edvardsson, 2012; Massaro, et al., 2016), as well as further scrutiny by  
48       a focus group of experts, the detailed research question content is concretised as below.

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53       What are the various approaches used for utilizing QI knowledge in MEs ?

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56       The question also highlights the background context of this research – QI, namely with  
57       knowledge utilization as the primarily targeted aspect, alongside QI as a critical backcloth.

### 3. Research methodology followed by the research

The research is completed through three stages depicted by Figure 1 and further elaborated afterwards.

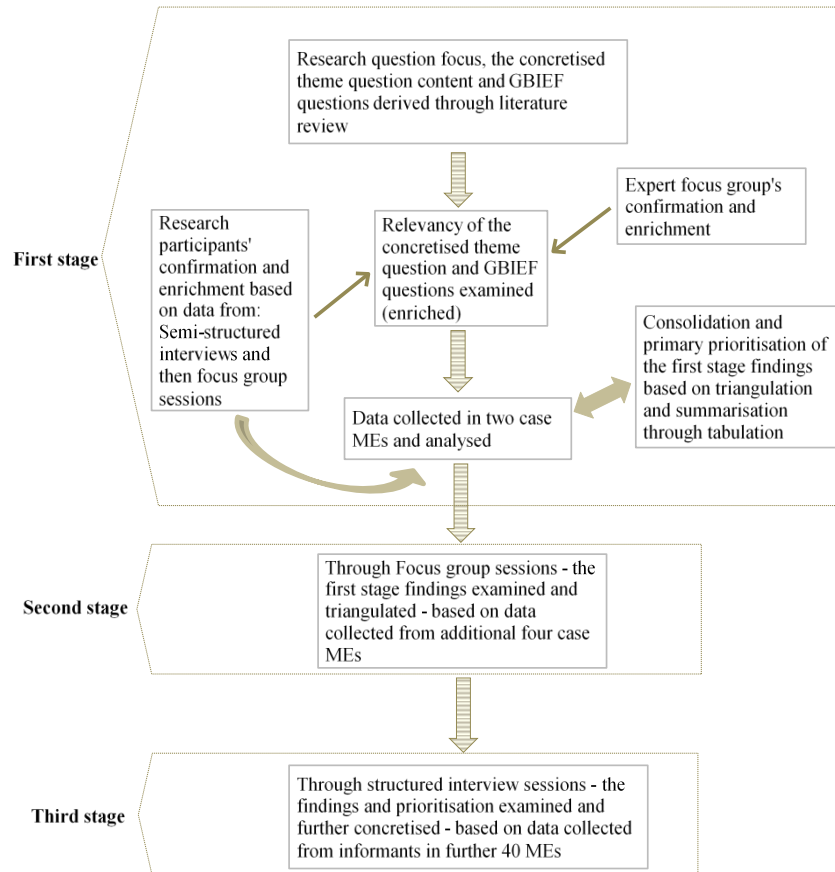


Figure 1. Research stages and comprising elements and their logical relationship

The research question was preliminarily derived from literature review following an approach of deductive content analysis (Elo and Kyngäs, 2008), and then its relevance has been further examined and ensured by a focus group. This research investigates the unknown aspect of QIK utilisation, correspondingly a case study strategy has been adopted to obtain, consolidate and finalise the first two stages' findings (Voss, et al., 2002; Yin, 2018) before their further attestation by interview with more respondents from manufacturing MEs locating in different industrial segments and regions. The first stage mainly focused on collecting and analysing data from two case MEs. At this stage, the data were firstly collected through a combination of semi-structured interview and focus group methods (participants comprised by case companies' employees categorised into four types), and then they were analysed through summarisation, comparison and triangulation to consolidate the findings. Afterwards, at the

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3 second stage, focus group sessions were organised in additional four case companies to further  
4 examine and attest the findings from the first stage. Finally, at the third stage, structured  
5 interviews have been conducted with 40 respondents from MEs with various specialties in the  
6 manufacturing sector to triangulate and finalise the findings.  
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10 In the whole research process, for data collection, all the participants preferred note taking  
11 of their discourses, hence this method had been followed to document the data. The interview  
12 transcription after each individual session was a further check and summarisation of the noted  
13 points by the authors (afterwards, the interview summary was sent to the respective interviewee  
14 for further examination of accuracy and inclusiveness before data analysis process). This way  
15 is less time consuming than transcribing data from oral recoding, therefore ensures a higher  
16 processing efficiency. While the summarised consensual viewpoints from the respective focus  
17 groups have been further confirmed by the group members at the end of each session.  
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23 A particular attribute to highlight is that in data analysis, no software package has been used  
24 to assist the process, all work has been conducted by the authors manually through firstly  
25 tabulation – an often used method by content analysis (Elo and Kyngäs, 2008), and then  
26 comparison, triangulation and synthesis (e.g., Costa et al., 2016). Although less efficient, this  
27 approach provides more opportunities for distilling subtle and detail connotations from the  
28 participants' discourses, avoids the drawbacks from analysis conducted by software (St John  
29 and Johnson, 2000).  
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36 Following the mentality of inductive approach for content analysis (Elo and Kyngäs, 2008),  
37 the narrations (data) with same meaning (wording might be different) were consolidated into  
38 summarised expressions (as the answers to the research question, they are basically the applied  
39 approaches for QIK utilisation) for convenience/effectiveness of understanding and  
40 presentation, the research question was coded as Qku representing the overarching research  
41 clou and meanwhile these answers to it were assigned with numerated extension respectively  
42 to Qku, as demonstrated in Table 3 and detailed in Appendix 1. Details of the procedure of data  
43 analysis are included in Appendix 2.  
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### 51 *3.1 Case study strategy, interview and focus group*

52 As contended by researchers (e.g., Yin, 2018; Voss, et al., 2002), case study can effectively  
53 ensure the exploration on emerging issues in a focused context, and to clarify vague viewpoints  
54 or unclear understandings to refine or enrich the existing theories. Case study as a research  
55 strategy has been frequently applied in investigating the contemporary issues (Vlachos, 2015).  
56 More extensive application of case study in research in the management related fields has also  
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4 been advocated (Childe, 2016). The focus of this research – QIK utilisation, falls into the remit  
5 where case study strategy can investigate effectively.  
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7 Within the three stages of empirical data collection, the methods of semi-  
8 structured/structured interview and focus group are implemented. The structured interview in  
9 this research was applied in an adapted manner (e.g., Wang, et al., 2020) by including a few  
10 open-ended questions for acquiring additional relevant information. These research methods  
11 have been often used in the same or similar types of research and been proven very effective  
12 in obtaining comprehensive data (e.g., Pino, et al., 2019; Wee and Chua, 2013; Coyte, et al.,  
13 2012). Based on the interviews and focus group sessions, insights on QIK utilisation are  
14 attained through examining, summarising and consolidating the viewpoints from research  
15 participants (Tam and Gray, 2016; Rittenhofer, 2015) following the data analysis protocol in  
16 Appendix 2.  
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### 26 *3.2 Research process at the first stage*

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28 At the first stage, to collect empirical data from the two case companies, a snowball approach  
29 has been followed in selecting the interviewees, namely a next interviewee is recommended by  
30 the previous research participant, to avoid researchers' potential bias affecting data objectivity  
31 and hence improve the research findings' reliability (Tam and Gray, 2016). The interviewees  
32 all come from the areas either directly or closely involved in QI; and according to their roles in  
33 the organizations, they were categorised into four groups: managers, functional staff,  
34 production foremen and production line operators. The diversity of participants' composition  
35 as such complies with the replication logic of case study research (Yin, 2018) – collection of  
36 data from multiple levels/perspectives can ensure an effective triangulation of viewpoints for  
37 a comprehensive coverage, and thus to obtain more insightful understandings. Within each  
38 participant category, supported by the case companies, the number of interviewees is not  
39 restricted. This ensured data saturation – information repetition appears without new points  
40 (Tam and Gray, 2016).  
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50 The duration of each interview session varied from around 30 to 45 minutes, due to the type  
51 of interview as well as the differences of the respondents' characteristics, e.g., their job roles,  
52 their communication skills, and that from the researchers' side – the amount of further probing  
53 on viewpoints during the interview processes. The saturation of data appeared after either 3 or  
54 4 interviews in all the category groups, this is rather early and might be a reflection of the  
55 alignment of mind-sets among the employees within the same categories.  
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In addition to the research question, a set of general background internal and external factors (GBIEFs) advocated by researchers and deemed by the authors as influential to QIK utilisation, have also been examined. They are: (1) What is the respondent's view on the current situation of the national economic development (with a consideration of SMEs)? Whether do they think/how does this economic situation affect the ME's QIK management? The heavy influence of external macro-economic environment on business processes and activities, has been contended by the existing research (Sitharam and Hoque, 2016; Choochote, 2012); (2) What specific industrial segment their business belongs to (as indicated by their products)? Whether do they think/how does their industrial specialty affect their QIK management? The conditions of a company's industrial segment can either positively or negatively affect the efficiency and effectiveness of KM, therefore to explore this issue is of critical meaningfulness (Cerchione, et al., 2015); (3) What information and communication technologies (ICTs) have been implemented in the company's business processes? Whether do they think/how do ICTs influence their QIK management? ICTs' direct impact on KM performance has been argued by researchers (Cerchione, et al., 2015; Choochote, 2012).

Meanwhile, during interview in Case company A, a new factor was raised by majority managers and all functional staff, namely, the status of business operating condition (in-growth/in-profit or in-decline/in-deficit); and the importance of this factor is supported by three different interviewee groups in Case B – all managers, vast majority of the functional staff and production foremen, hence this factor has also been enquired as (4) What is the current operating condition of their company? Whether/how does the operating condition impact their QIK management?

The interviews were conducted following the interview protocol (Appendix 2) to ensure the content and format standardisation. A total number of 9 managers, 11 functional staff, 10 production foremen and 13 production line operators participated at this stage research. Table 1 provides the general information of the interviewees from the two case MEs. The interviewees joined in the research on a voluntary base with active attitude. Their response to the research question was noted simultaneously by two authors following the mentioned protocol. The approach of using two researchers to take notes of the information at the same time and then triangulate that after-session, enhanced the completeness and accuracy of the attained viewpoints.

Table 1. The interviewees' general profile at the first stage research

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

The after-interview-session examination on the summarised notes' content by the respective interviewees, revealed no further amendment. Then focus group sessions were organized with the same respondents (interviewees) from the individual category groups respectively, to obtain consensual or potential contradictory viewpoints or further insights through scrutinising the summarised viewpoints from the interviews. The focus groups were facilitated by two authors and the findings from the focus groups had also been noted by the same two researchers simultaneously to ensure a comprehensive and accurate summarisation of the obtained insights, which were finalised at the end of the sessions.

The outcome of the focus group sessions has no contradictory viewpoint against the summarised interview findings correspondingly to the respective participant groups of the case companies. Based on this confirmation, within and cross-case analyses were conducted.

The detailed discourse of the finding analysis (including the criticality prioritization) is presented in Research findings and analysis section.

### *3.3 The case companies at the first stage*

In accordance with the replication logic (Yin, 2018), the first two stages of this research were designed as a multiple case study. At the first stage, following a convenience sampling strategy, two case companies were selected from two regions with different economic development levels (details seen in Table 2 for case companies A and B), for triangulation of primary insights obtained from them. They are both joint ventures in mechanical manufacturing industry, almost all of their employees are Chinese, including senior/top management. This situation entails that firstly their business operations have integrated with the up-to-date management practices and strategies brought in by the business partners, secondly the organizational culture has been impacted significantly by Chinese mentality. Consequently they can to a large extent represent Chinese manufacturing MEs with high level of management and strategic know-how of

business operations. All these serve as the rationale of them being selected as the first stage cases. The concrete selection criteria include: The case companies 1) should be MEs, 2) are willingly to share their KM practices and strategies, 3) should be in business for at least three years, that gives the organizations sufficient time in forming their inherent pattern of KM practices/strategies, 4) should have been surviving well in the marketplace. Through purposively selecting case companies according to these criteria, a solid foundation can be established for effectively and efficiently collecting the insightful data. The additional rationale of using two cases at this stage is to ensure a manageable scale at the beginning stage, meanwhile the exploration on them also functions as a pilot test on the inclusiveness of the elements to be enquired to secure the coverage of the investigation.

Table 2 summarises the general profile (company names are disguised per the confidential request) of the first stage case MEs. Meanwhile, with a consideration of the information inclusiveness, it also includes the general profile of the additional cases at the second stage.

Table 2. The general profile of the case companies

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 devices 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

\* The regional economic development level is based on Qi (2015) and National data (2018)

### 3.4 *The second stage focus group sessions to attest the first stage findings*

Although the first stage two case MEs are in general very much Chinese styled, they are joint ventures; namely they can potentially have some differences to the purely Chinese owned MEs, this might jeopardise the inclusiveness of the findings. To address this concern and also with a consideration of having more cases to obtain broader insights, following the same criteria and process as that for the first stage, four purely Chinese owned manufacturing MEs were selected as additional cases.

Nonetheless, only focus group has been used for data collection in these cases. The focus groups each consist of five to six participants except that one manager group has four people. The data analysis followed the same ways as that for the first stage cases; nevertheless, the points discussed in these focus groups are the prioritised findings as illustrated in Table 3/detailed in Appendix 1.

### 3.5 *The third stage – structured interview attestation on the prioritisation and inclusiveness of the findings*

There still is a possibility that the six cases at the previous two stages cannot fully examine and prove the applicability and the prioritisation of the elements of the findings. Hence, the authors carried out a third stage research of structured interviews with forty respondents from different manufacturing MEs, through WeChat or telephone whichever convenient for the interviewees, with the aim to attain more insights from managers (Brettel and Rottenberger, 2013; De Clercq, et al, 2015) in charge of QI related issues in MEs from various manufacturing industrial segments and regions in China. A sample with forty individuals is an upper range of number of interviewees in a research for obtaining sufficient data (Hagaman and Wutich, 2017; Seidman, 2006). There are both close-ended and open-ended questions in the questionnaire for this round interview. The close-ended questions require the interviewees to score the degree of their agreement to each prioritised individual answers to the research question (listed in Research findings and analysis), on a five point scale: 5 - Strongly agree; 4 - Agree; 3 - Unsure; 2 - Disagree; 1 - Strongly disagree. In case of agreement degree below 3 for any answer, the respective interviewee is required to provide his/her prioritisation level corresponding to that element.

The open-ended questions require the interviewees to raise any addition (and their importance level) and/or deletion on the current findings and the reasons for that, as well as the answers to the GBIEF questions. Following the snowball approach, the interviewed managers

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3 were selected from MEs in various manufacturing business segments, including fast moving  
4 goods manufacturers, electronic device producers, car component manufacturers, food  
5 production companies, etc.; and these MEs locate in different regions in China. Such an  
6 approach ensures the triangulation of the insights from multiple informants with diversified  
7 backgrounds to enhance the findings' inclusiveness. Due to the fairly straightforwardness of  
8 their conduct process, the structured interview sessions were carried out by the authors  
9 separately at a same time period for efficiency. All the interviewees at this round have at least  
10 two years' working experience and in-depth involvement in the field of QI, and have  
11 successfully led QI projects with the participation of employees at different hierarchical  
12 levels/functions. From these respondents, substantial and comprehensive insights have been  
13 obtained on QIK utilisation in practice.  
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### 24 *3.6 Validity and reliability*

25 In qualitative research, many people tend not to use the terms of validity and reliability.  
26 Herein however the authors "borrowed" them to express their research logic.  
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28 The research question is firstly developed from the literature review, and then has been  
29 verified and confirmed by a focus group (Wang, et al., 2016) consisting of four experienced  
30 professionals in the field. These focus group experts have evaluated the question in view of its  
31 appropriateness, importance and necessity to study MEs' QIK utilization. The evaluation  
32 scores are illustrated by Figure 2 on a five point scale (from 5 – highly appropriate/important/  
33 necessary, to 1 – inappropriate/unimportant/unnecessary). As demonstrated by the Figure, the  
34 scores are at very high value of above 4. The evaluation outcome as such has attested the  
35 content validity of the research question and the meaningfulness of the research foci.  
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43 The focus group has also recommended the necessity and classification criteria to prioritise  
44 the knowledge utilisation approaches identified from the research, to ensure better  
45 understanding, more insights and more convenient usage of QIK in guiding practice.  
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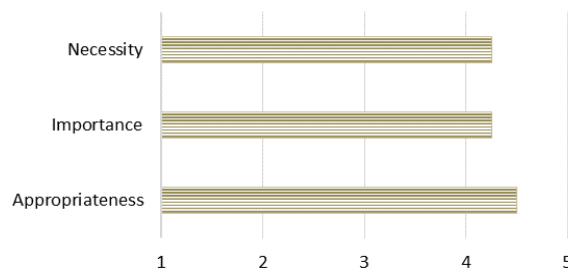


Figure 2. Focus group ratings on the research question

As aforementioned, for enhancing the validity of this research, the approach of multiple source evidence (Cepeda and Martin, 2005; Yin, 2018) has been followed, as detailed at below:

The case MEs are selected from different regions with different economic development levels, entailing a possibility of diversity of the employees' knowledge and skill profiles. Therefore the comparison between the findings from the cases can be effective in consolidating and enriching the understandings and insights through either repetition or contradiction of viewpoints (Yin, 2018; Cepeda and Martin, 2005). Meanwhile, the participants at the first and second research stages are from different functional areas and at different organizational hierarchical levels in management and implementation of QIK; and the interviews continually went on until reaching data saturation (Tam and Gary, 2016), owing to the case companies' wholehearted support and involvement in the research. After interview data having been collected, the summaries of the individual interviews have been sent to the corresponding interviewees for their examination (O'Connor and Gibson, 2003) on the content for accuracy and inclusiveness, and they were also required to add/delete any points that they deem necessary. The feedback from the participants' review has confirmed these records' accuracy and inclusiveness; this has further proved the validity. In the focus group sessions, a consensus among the viewpoints (answers) from the category groups respectively has been attained and confirmed, this constitutes an additional evidence and attestation to the research validity.

At the third stage, the interviewees are managers possessing sufficient knowledge and experience in the field of QIK management and from manufacturing MEs in different industrial segments. All these have secured the research's construct validity (Yin, 2018). The outcome of no addition/deletion to the content at this round also provides a confirmation on the research validity.

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3 For the additional GBIEF questions, they have been confirmed of their meaningfulness by  
4 the research participants during the data collection process; and for majority of them there also  
5 exist literature underpinning, as earlier mentioned.  
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8 To ensure and evidence the reliability of the research findings, the following two approaches  
9 have been implemented: 1) the designed research data collection and analysis protocol (Rose,  
10 et al., 2015) (Appendix 2) has been followed carefully during the research conduct; 2) the  
11 analysis of the data has been firstly carried out by the authors separately and then the findings  
12 were integrated through triangulation synthesis. And a further comparison with available  
13 literature has also been made wherever possible. Moreover, the Intra-class Correlation  
14 Coefficient (ICC) and Cronbach's  $\alpha$  have been calculated on the structured interview data, an  
15 ICC score of 0.6 and Cronbach's  $\alpha$  of 0.98 confirm that the interview findings have a good  
16 level of reliability (Fleiss, 1986; Wortzel, 1979).  
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#### 26 **4. Research findings and analysis**

##### 27 *4.1 Findings from the first stage*

28 Through the within-case and cross-case analyses, one can notice that there is a certain level of  
29 diversity with regard to the viewpoints (answers) among different category groups in the case  
30 companies. Nevertheless, the analysis still revealed that there are congruences among the  
31 answers of different categories within each case and very often between cases.  
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36 As a whole, the analysis on the data from the two case companies affirmed some general  
37 phenomena of that: i) There is a high level of congruence of viewpoints between or among  
38 manager, functional staff and production foreman category groups. ii) Congruence also can be  
39 observed between or among the viewpoints from production foreman, functional staff and  
40 production line operator groups. iii) Infrequently can the manager groups and the production  
41 line operator groups have agreement on respective viewpoints. Similar phenomenon to this has  
42 also been observed by some other researches, although they did not focus solely on MEs  
43 (Ouakouak and Ouedraogo, 2019). A situation as such might be caused by the difference of  
44 focuses on business operations' aspects by different people in an organization with different  
45 roles and at different hierarchical levels assuming different responsibilities. This circumstance  
46 also reflects that with regard to QIK utilization in practice, there is a certain level of broken  
47 link between different level employees of MEs, this happens even in the two case companies  
48 that indeed illustrated a wholehearted organization-wide commitment towards QIK utilisation.  
49 These findings, in line with the contention from the existing research (Yasir and Majid, 2017;  
50 Ouakouak and Ouedraogo, 2019; Inkinen, 2016), further highlight the importance of thorough  
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3 communication among all hierarchical levels/members of an organization and necessary  
4 trainings to employees on KM, as well as sufficient empowerment for employees to have more  
5 opportunities and access to strategic issues, for a better understanding, alignment and  
6 contribution to QIK management in both operational and strategic dimensions.  
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10 The answers to the research question can be prioritised, to obtain further insights leading to  
11 the enrichment of KM theories alongside quality management; they can also serve as practical  
12 guidance to MEs and other relevant organizations for their QIK utilisation. Particularly the  
13 prioritisation can clearly illustrate to the practical businesses the criticality level of the  
14 respective QIK elements for demonstrating their usefulness and meaningfulness. According to  
15 the consensual degree on each answer among the four category participant groups (determined  
16 by the number of category groups agreeing with a certain viewpoint), the answers are  
17 prioritised to five levels:  
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24 Level 1: Significantly critical element – the answer’s content has been conveyed  
25 consensually by two or more category groups from both of the two cases respectively;  
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27 Level 2: Highly critical element – the answer’s content has received congruence by one  
28 from the four category groups in one case and meanwhile by two or more category groups in  
29 another case;  
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32 Level 3: Fairly critical element – the answer’s content has been articulated by one category  
33 group respectively from each of the two cases;  
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36 Level 4: Slightly critical element – the answer’s content has been narrated by two or more  
37 category groups within only one case;  
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39 Level 5: Possibly uncritical element to be recognised – raised by only one category group  
40 and from only one case.  
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43 In MEs’ practical QIK utilisation processes, the first three level elements should have the  
44 higher priority to be considered, due to their cross-case congruence.  
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46 The answers’ prioritisation and content are detailed at below and tabulated in Appendix 1.  
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50 ***Among the QIK utilisation approaches proposed by the ME employees (MEEs):***

51 1) One has received Level 1 ranking (Qku\_2) – Document and standardise the externally  
52 acquired and internally created QIK formally, and print into brochures, use that in training and  
53 then as guidance for employees to cope with daily QI issues. The outcomes and achievements  
54 from the implementation of QIK need to be used to demonstrate its effectiveness, this will  
55 naturally lead to the departments and people in the company to actively apply the knowledge.  
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These points further endorse the contention from some researchers of the importance of documentation and standardised codification in effective KM (Oliva and Kotabe, 2018; Mohd.Rodzi, et al., 2015). However, the MEEs' viewpoints partially contradict to the arguments from the other existing literature that the documented knowledge often cannot be readily or directly used for business operations decision making, due to the complexity of some knowledge and the associated documentation (Oluikpe, 2015; Ouakouak and Ouedraogo, 2019). This partial disagreement deserves a future study.

2) One approach was ranked as at Level 3 – (Qku\_1) Dedicated department is in charge and delivers the necessary training and leads the implementation of the QIK. Namely, sufficient training sessions need to be organized by a formal unit to disseminate the knowledge quickly and extensively to every employee for QI actions. The importance of training of knowledge for ensuring its effective application has also been evidenced by other research on SMEs (Kumar, et al. 2016; Durst and Edvardsson, 2012). Nevertheless, in view of resource constraints (time, finance, etc.) faced by MEs, provision of sufficient amount of training and with a wide range of coverage casts a big challenge to them. This leads to the need of future research to find solutions with efficacy on how to provide effective training to employees based on the available capacity/capability of MEs.

3) Two approaches have received Level 4 ranking, they are – (i) (Qku\_3) Closely cooperate and communicate with relevant functional departments' staff/quality experts who are in charge of QIK and its implementation, to ensure sufficient and instant support to the operators in applying the QIK. Cooperation and communication between and among functions and employees ensuring effective KM process has also been evidenced in other research (Yasir and Majid, 2017; Oluikpe, 2015; Ibrahim and Heng, 2015). Herein this research, the MEEs in different organizations also mentioned that although cooperation and communication were not prioritised at a very high level, their role in the knowledge utilization cannot be ignored. (ii) (Qku\_5) Employees are encouraged to use and create new QIK in their work and report the results of the QIK usage, they are organised using team meeting time to introduce, arrange and examine the implementation activities of the QIK. To encourage employees' active involvement and engagement in knowledge creation, utilisation as well as associated creative activities is an observed practical phenomenon in businesses (Alrawi et al., 2013; Abdullah et al., 2013; Inkinen, 2016). While, the particular highlighted point from this research is that the case MEs have established a formal mechanism for employees to effectively and efficiently share, learn and utilise the up-to-date QIK in their operations activities and processes, which answered the call for the provision of a platform to facilitate employees' interaction in KM

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3 process (e.g., Yasir and Majid, 2017). The underlying reason for this approach not being  
4 prioritised highly is that since the MEs have already had this mechanism for a relatively long  
5 time, MEEs to some extent treat it as a natural routine part of their work life, without a peculiar  
6 awareness of it as a means for QIK management.  
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10 4) One approach is rated at Level 5 – (Qku\_4) Ensure the data used for quality analysis and  
11 control collected accurately and timely. The accuracy and timeliness of data for quality and  
12 other business operations purposes are emphasized by various researchers continually (e.g.,  
13 Yasir and Majid, 2017; Mohd.Rodzi, et al., 2015), however in this research, they are raised by  
14 only one MEE group in one case company and prioritised at the lowest criticality level. The  
15 reason for this is that they are deemed by case MEEs as a kind of common sense, due to that  
16 they have already become a taken-for-granted inherent element of their organizational culture.  
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22 In general, this research's findings clearly revealed that the MEs and their employees are  
23 aware of the importance of QIK utilisation apropos of the positive impacts of QIK application  
24 on business efficacy, product quality/reputation as well as the establishment and enhancement  
25 of a positive-thinking and active-learning organizational setting; and they have endeavoured in  
26 establishing effective mechanism to ensure QIK utilisation being operationalised in business  
27 practice.  
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32 Nevertheless, the data also revealed a situation of that no matter for which approach of QIK  
33 utilisation, there are always some people not fully aware of them, reflected by that none of the  
34 elements (answers) received a full congruence among all the category groups in both case  
35 companies. This phenomenon further resonates the aforementioned issue of broken link among  
36 employees at different levels and functions, even in organizations with high level of  
37 commitment towards KM.  
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42 Also interestingly, none of the approaches have been evaluated as at Level 2, it seems that  
43 there is no transit level between the most and less critical ones.  
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#### 48 ***For GBIEF questions***

49 All the participants from different categories in both case companies view the current  
50 economic development in China as very good and supportive to businesses including MEs,  
51 particularly as pointed out by some managers and functional staff that China has established a  
52 centre supporting SMEs' growth – China Centre for Promotion of SME Development  
53 (Chinasme, 2017). All these factors form a supportive environment for QIK as well as other  
54 resources' effective implementation in MEs. The MEEs do not see any special influence of  
55 their industrial specialty on the QIK utilisation, this to some extent is not fully in line with the  
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3 argument from some literature regarding the potential differences between its influence on  
4 different types of businesses (Massaro, et al., 2016). This circumstance casts a need of future  
5 exploration to seek more in-depth insights. Both the two case companies have not implemented  
6 ICT system with complicated software packages, they just use some basic elements of ICT,  
7 including email system, central database, basic intranet system. The participants all deem these  
8 ICT systems function effectively in their QIK management and utilisation processes. For the  
9 additional GBIEF of operating conditions' impact on QIK management, all MEEs noticed the  
10 positive support to QIK utilisation from their operating conditions' current healthy growth.  
11 This highlights the mutual relationship between QIK utilisation and the business performance  
12 of an organization.  
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#### 22 *4.2 Findings from the additional case MEs at the second stage*

23 Through the focus group sessions in the additional four case MEs, the identified and prioritised  
24 viewpoints from the first stage research have been scrutinised and evaluated further. There are  
25 no addition/deletion or change to the answers' content having been raised. Corresponding to  
26 each answer's criticality evaluation, these focus groups were checked on their agreeing levels  
27 to it (from 5 - Strongly agree to 1 - Strongly disagree). If the agreeing level is below 3, the  
28 focus group will be required to provide their new rating of the criticality. For those answers  
29 receiving a cross-group average agreeing level below 3, the criticality level will be changed to  
30 the rounded average of all the ratings (including those sticking to the old ones and those new  
31 ratings). This round examination ascertained that no answer's criticality level needs to be  
32 changed, indicating the consistency of the case companies' understanding and mentality in  
33 view of QIK utilization.  
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43 Here for inclusiveness of the information, the above-mentioned elements (answers) and the  
44 corresponding prioritisation levels identified from the first stage research, as well as attested at  
45 the second stage and finalised at the third stage are illustrated in Table 3 (in case of the  
46 prioritisation level difference between the previous stages and third stage, the ratings from the  
47 third stage will be the decisive score, due to that the third stage rating comes from more  
48 respondents from more MEs). As demonstrated by Table 3, the research findings at different  
49 stage illustrate no difference on the prioritization levels of the individual elements.  
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Table 3. The answers and the prioritization levels

Theme question	Answer code	First stage focus group evaluation	Second stage focus group evaluation	Third stage agreement degree to the first stage prioritisation	Finalised prioritisation level
Qku What are the various approaches used for utilizing QI knowledge in MEs ?	Qku_2	Level 1	Level 1	4.10	Level 1
	Qku_1	Level 3	Level 3	4.43	Level 3
	Qku_3	Level 4	Level 4	4.10	Level 4
	Qku_5	Level 4	Level 4	4.13	Level 4
	Qku_4	Level 5	Level 5	3.88	Level 5

Meanwhile, majority of the focus groups (75%) emphasised particularly on another point with regard to the Level 4/5 approaches – albeit they are not recognised by a wider range of people, they might be more appropriate in certain circumstances than the others. Thus they should not be ignored, although they are usually not the first ones to be considered in practical QIK utilisation. This point corroborates to the relevant findings in the first stage.

While for GBIEF questions, the answers at this stage demonstrated a high level of consensus to that from the first stage.

#### 4.3 Third stage structured interview attestation on the previous stages' findings

For the individual elements (answers), all of them have received further confirmation from the interviews on their prioritisation levels determined at the previous stages. For the enquiry on potential elements to be added to/deleted/changed from the current findings, the interview sessions yield no need of any amendment. This is a clear sign of the inclusiveness and meaningfulness of the identified elements. However, longitudinal research in the future is still necessary for exploring any changes on the concrete elements and their criticality levels.

In view of the GBIEF questions, although the interviewees come from MEs with various backgrounds, their answers are also highly consensual to the previous two stages' findings, with only an exception of that 22.5% of the MEs at this round do not even have IT implemented in their operations functions, thus the interviewees from these companies expressed two general dimensions of viewpoints: majority (67%) of the MEEs believe that with an implementation of ICT system in their operations functions' processes, the efficacy of the operations can be lifted

to a higher level through its support to knowledge dissemination and utilisation, while the rest MEEs (33%) believe that ICT is not so important to be used in operational processes in the business, the knowledge can be shared through oral and written documentation communication. This aspect illustrates partial contradiction to some existing literature contention (Cerchione, et al., 2015; Choochote, 2012) and deserves future research to understand more of it.

#### 4.4 “Takeaways” based on the research findings

To operationalise the selection process of the QIK utilisation approaches for the convenience of MEs in their KM practice for operations excellence, a framework based on the research findings has been developed as illustrated by Figure 3, for guiding the QIK utilization approaches’ implementation step-wise.

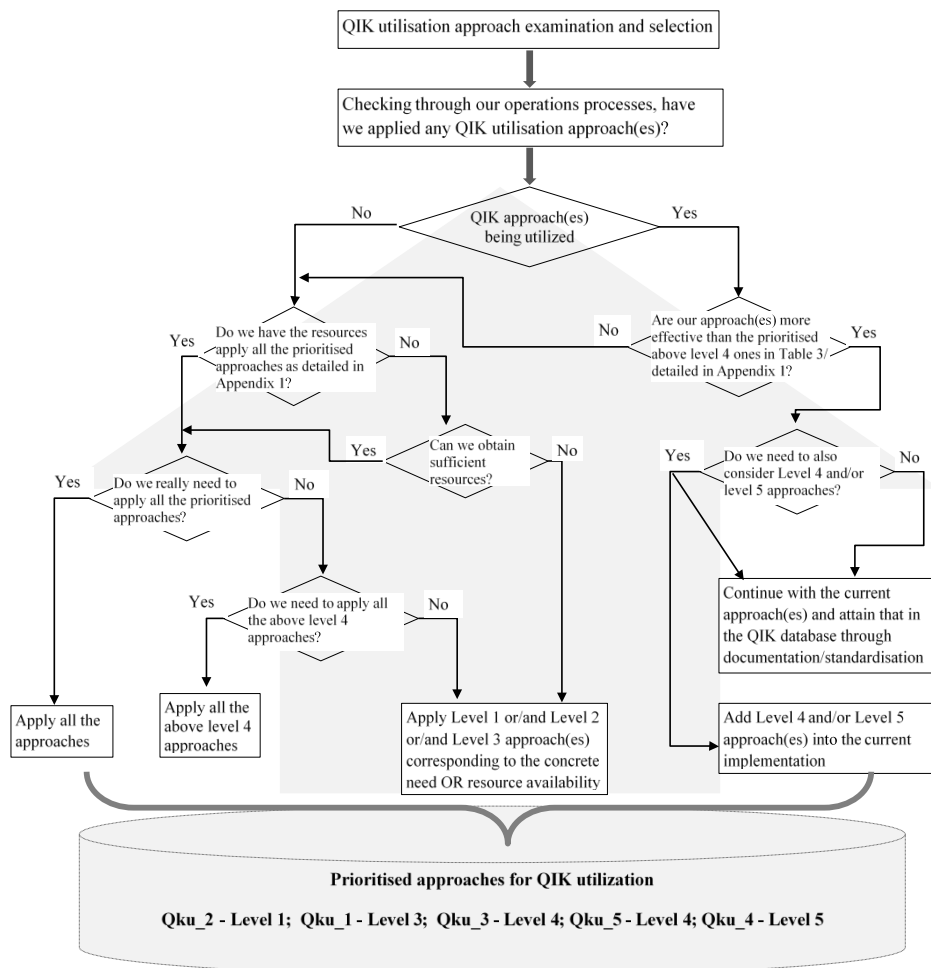


Figure 3. Framework for selection of QIK utilization approach(es) for implementation

To attest this framework's applicability, the same expert focus group for content validity has conducted the evaluation on its effectiveness and efficiency in helping the decision making for selecting the QIK utilization approaches, following a 5 point scale (from 5 – Very effective/Efficient to 1 – Ineffective/Inefficient).

Table 4 presents the evaluation results, which confirmed the usefulness of the framework.

Table 4. Evaluation on the framework of QIK utilization approach(es) selection

Aspects evaluated	Effectiveness	Efficiency
Average score of evaluation	4.75	4.25

## 5. Concluding remarks and future research

This paper presents an in-depth investigation on a critical component of KM in MEs – QIK utilisation, by focusing on: QIK utilization approaches in MEs. The research findings are obtained through analysing data collected following a multiple perspective approach by including people from different ranks and roles within manufacturing case MEs with various business specialties from different locations, which provide a holistic all-round comprehension of viewpoints. The meaningfulness and applicability of the findings have been examined and confirmed through the stages in the research.

In order to facilitate the understanding and implementation of the elements (the answers to the research question, namely the approaches of QIK utilisation) identified by the research, they have been prioritised into 5 different criticality levels (Table 3 and Appendix 1). The utilisation approaches weighted at and above Level 3 are suggested to be the ones considered at first instance when proceeding with QIK utilisation in practice, although the rest two lower level elements should not be ignored.

To further facilitate the decision making process of MEs in selecting the appropriate QIK utilization approach(es), a framework (Figure 3) has also been developed and can be used to guide the step-wise finalisation of the proper selection of QIK utilization approach(es).

### 5.1 Implications

Practically in managerial aspect, the findings from this research provide insightful knowledge for understanding the approaches of MEs' QIK utilisation, as well as provide guidance to real

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3 world business professionals on QIK utilisation activities. Through these means, theoretically  
4 conceptualised knowledge entity has been practised into concrete operational activities. By  
5 following the framework guiding the QIK approach selection, the management/employees in  
6 MEs can decide the appropriate QIK approach(es) to be used effectively and efficiently, to  
7 enhance their operations' performance leading to increased whole organization-wise  
8 competitiveness. And all these will naturally link to the prosperity of the business and  
9 consequently contribute to the sustainable development of the economy, society and well-being  
10 of the general public.  
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12  
13 In addition, the research procedure applied by this research can be followed as a guiding  
14 framework for MEs in investigating and analysing/resolving problems in the field of KM and  
15 others in their business operations. Meanwhile, these approaches of QIK utilisation used by  
16 MEs in their operations excellence initiatives can also be referential to other type organisations.  
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19 In theoretical aspect, the findings fill the gap of that the current KM research lacks of a focus  
20 on MEs, by concentrating on a particular area – QI in MEs as the contextual setting, under the  
21 backcloth of that the existing KM research findings are characterised with focus on either LEs  
22 or SMEs as a whole. Namely, the new insights on QIK utilization approaches in MEs serve as  
23 a supplementary set of knowledge complementing the extant KM literature. Starting from this  
24 research's findings, with more and further focused future research on the same/similar topic  
25 direction to this research, a concrete set of theories centring the QIK management particularly  
26 in MEs can be established, to clarify the blurred boundary of MEs and SEs in the field of KM  
27 with QI as a general backcloth.  
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### 30 31 32 33 34 35 36 37 38 39 40 41 *5.2 Limitations*

42 Although the diversity of the cases in the case study has been secured, and the number of the  
43 structured interviews has reached the upper range of this type research, the sample size is still  
44 relatively small, consequently the findings can still lack of certain level of generalisability.  
45 Also the case MEs are those operating in Chinese marketplace and in manufacturing industry,  
46 albeit there are joint ventures with international attributes of management style and mentality,  
47 there is still the possibility that some of the findings from this research cannot be directly  
48 applied by MEs in other industries and countries; they need to be cautiously applied and  
49 appropriate adaptations might need to be made on the relevant elements if necessary during  
50 application.  
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### 60 *5.3 Future research*



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3 Based on the above mentioned findings and concern of limitations, the following future  
4 research activities can be conducted to complement or supplement the insights attained from  
5 the current research:  
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- 8 • The case MEs in this research only come from manufacturing industry, the findings  
9 based on them might not be applicable on certain aspects in service MEs, hence a  
10 further case based research on QIK utilisation in service MEs will clarify this  
11 particular issue to a wider spectrum of industrial sectors/segments;  
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- 13 • Investigation can also be made through a survey method to extend the research scale  
14 and scope by including larger number of MEs in different industrial sectors and  
15 regions/countries, to further attest the applicability of the research findings, as well  
16 as the necessity of relevant ICT techniques and the means to use them in operations  
17 process for enhancing QIK utilization in MEs;  
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- 19 • A further survey exploration can be carried out by collecting data from a full  
20 spectrum of enterprises containing SEs, MEs and LEs, to examine the similarity and  
21 difference between/among them in details, particularly between SEs and MEs,  
22 corresponding to the focus of QIK utilisation investigated in this research, as well as  
23 some further elements such as the in-depth perception of real world businesses on  
24 QIK utilisation effects and the drivers/barriers of the utilization between different  
25 sized businesses;  
26
- 27 • A case study can be conducted focusing on the means to either reduce the complexity  
28 of knowledge and the associated documentation or to improve the employees'  
29 capability of understanding knowledge to enhance the QIK utilisation;  
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- 31 • A research centring the approaches to ensure the efficacy and sufficiency of training  
32 on QIK utilisation related issues against the limited resource availability, will  
33 produce constructive contribution to the business operations performance;  
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- 35 • Corresponding to the above planned research projects, regular longitudinal surveys  
36 and case studies can be conducted to seek further insights on the changes of the  
37 answers to the research question, as a consequence of circumstances variation due  
38 to the elapse of time, to amend or enrich the existing theories and practices of QIK  
39 utilization.  
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## 49 **Appendices**

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53 Appendix 1. Codes of the research question and answers as well as their finalised  
54 prioritisation level by the third stage research (ordered from the highest level to the lowest)  
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Research question	Answer Code	Answer Content Summary	Finalised critical level
Qku  What are the various approaches used for utilizing QI knowledge in MEs ?	Qku_2	Document and standardise the externally acquired and internally created QIK formally, and print into brochures, used that in training and then as guidance for employees to cope with daily quality improvement issues. The outcomes and achievements from the implementation of QIK need to be used to demonstrate its effectiveness, this will naturally lead to the departments and people in the company to actively apply the knowledge.	Level 1
	Qku_1	Dedicated department is in charge and deliver the necessary training and leads the implementation of the QIK; sufficient training sessions need to be organized to disseminate the knowledge quickly and extensively to every employee for quality improvement actions.	Level 3
	Qku_3	Closely cooperate and communicate with relevant functional departments' staff/quality experts who are in charge for relevant QIK and its implementation, to ensure sufficient and instant support to the operators in implementation of the QIK.	Level 4
	Qku_5	Employees are encouraged to use and create new QIK in their work and report the results of the QIK usage, they are organised using team meeting time to introduce, arrange and examine the implementation activities of the QIK.	Level 4
	Qku_4	Ensure the data used for quality analysis and control collected accurately and timely	Level 5

GBIEFs	Questions	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?	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 focuses on (reflected by the products)? Whether/how does this specialty affect their QIK management?	Their business production focus has been answered by all participants, seen in Table 1. They all do not think the QIK management has been affected from their industrial specialty.	The same as Case A.
	(3) What technologies has their company implemented in the KM process? Whether/how do these technologies affect their QIK management?	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?	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. 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;
- Data collection is conducted by carrying out the actions at below:
  - ❖ After disclosing aim, background of the research, etc. to the participants in the interview/focus group sessions, obtain the informed consent from them;
  - ❖ Obtain permission from the participants for recording or 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;
  - ❖ In Stage 1,
    - firstly the relevant enquiry questions will be asked 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/inclusiveness (including appropriateness) 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 finalised consensual viewpoints (on the answers summarised from interview sessions) corresponding to the enquiry 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 list of prioritised 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.

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- Data analysis

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- ❖ At the 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 enquiry question will be prioritized/consolidated for next stage attestation; 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 or contradictory contentions, as well as potential additions/deletions.
  - ❖ To finalize the conclusions for this research, based on the third stage structured interview data, analysis will be carried out to further attest and concretize the prioritization of the answer elements, as well as enrichment on insights and whether there are still missing points or deletions from the previous stages.