**A Continuous Improvement Implementation Framework for Manufacturing Companies: a Delphi Study-Based Approach for Development and Validation**

**Abstract**

**Purpose –** Due to the absence of industry and region-specific implementation guides, change efforts, in particular Continuous Improvement implementations, continue to report high failure rates. The purpose of this paper is, therefore, to present a finalised implementation framework specifically tailored for manufacturing companies.

**Design/methodology/approach –** A conceptual framework derived from the existing literature is validated, through a Delphi study, by an expert panel to review its content and suitability for a practical application.

**Findings –** This paper proposes a finalised framework tailored to the practical needs of users. The results of the Delphi approach offer a phased implementation framework that provides an overview of the implementation process of Continuous Improvement initiatives and the key activities involved. The framework is suitable for use by both business leaders and Continuous Improvement practitioners with varying degrees of previous implementation experience.

**Research limitations/implications –** The research was carried out in the UK and is specifically focused on the manufacturing industry. It is therefore not clear the applicability of the framework presented to other regions and industries. The framework, although validated through several phases of research, still requires practical application and testing.

**Originality/value –** Business leaders and Continuous Improvement practitioners will benefit from having the necessary content presented in a manner that will promote its practical application. It has also been demonstrated that the framework is robust in its content, incorporating the literature findings as well as the experience of an expert panel encompassing 20 people.

**Keywords:** Continuous Improvement, manufacturing companies, Implementation, Framework, Delphi method

**Paper Type** Research paper

**1. Introduction**

In order to conclude multi-phase research and provide a research output of practical relevance a finalised framework for the implementation of a Continuous Improvement (CI) initiative in manufacturing companies is presented. This output is achieved through the testing and revision of a conceptual framework originally derived from literature by an expert Delphi panel.

The phrase ‘CI’ is used concerning multiple organisational initiatives. CI is defined as a structured initiative to find and implement novel methods of working, i.e. attempting to make process advancements on a regular basis (Anand *et al.*, 2009). CI entails mass involvement in making relatively small changes, which are directed toward organisational goals on an incremental and unremitting basis (Bessant *et al.*, 1994). It develops over time, from tentative attempts and the self-conscious adoption of new ways of doing things, to the point where incremental improvement becomes embedded into the culture of the organisation (Caffyn, 1999).

A CI culture within a business will strive for sustained performance improvement of all systems and processes (Bhuiyan and Baghel, 2005). To achieve CI (quality and process improvement) within organisations, some structured approaches started with Total Quality Management (TQM) and the Toyota Production System (TPS) (Pegels, 1984), and later developed with Lean Manufacturing (LM) (Bhamu and Sangwan, 2014) and Six Sigma (SS) (Braunscheidel *et al.*, 2011) respectively. More recently, Lean Six Sigma (LSS) has been popular, combining the two previously separate approaches (Pepper and Spedding, 2010). Thomas *et al.* (2016) state that “LSS has become a leading business improvement methodology which has been successfully applied in a wide range of businesses”. These improvement approaches (i.e. TQM, TPS, LM, SS, and LSS) are each an evolution of the previous methodology, incorporating the effective aspects and adding new methods to further enhance the approach (Snee, 2010). The application of these tools and techniques will identify and eliminate sources of variation and waste, therefore enhancing customer satisfaction (Singh and Singh, 2015). Ultimately, all are focussed on improving organisational performance (Naslund, 2008).

Nowadays, globalisation, financial turmoil, and unpredictable business needs are prompting executives across the globe to improve the efficiency of their organisations and encourage innovation in operations, goods, and services in a highly dynamic manner (Rathilall and Singh, 2018). An organisation's ability to identify and implement positive changes on a continuous basis is enabled through CI initiatives, which provide the infrastructure for this to happen (McLean and Antony, 2017). McLean and Antony’s (2017) study indicates that TQM was the first systematic technique for improving product quality and operational efficiency while LM, SS, and later LSS followed it. Li *et al.* (2016) suggest that CI is becoming increasingly vital in today's manufacturing industry, where there is fierce competition. CI is the cornerstone of any manufacturing company that wishes to remain competitive. Therefore, the implementation and application of CI initiatives within manufacturing organisations is an important element to continue meeting the competitiveness challenge. In addition, CI initiatives ensure business flexibility and responsiveness, hence providing the ability for organisations to change quickly in line with their environment (Singh and Singh, 2012). A difficulty for manufacturing companies, especially those based in developing countries, is successfully making the shift from current approaches to a LSS system (Raval *et al.*, 2018) as managers commonly lack the knowledge about how to approach this transformational process (Ali et al., 2016). Furthermore, the investigation of Ali *et al.* (2016) indicates that during the transition, there are a number of obstacles to overcome, and lack of funding, resources, and futurist administration are just a few of the hurdles that make this transition difficult. Still, CI features and methods are becoming increasingly important to stay competitive in the global manufacturing sector. Numerous firms have adopted CI approaches to cope with competitors and efficiently meet consumer requirements, and most companies are continuously seeking greater advancements for entire system improvement (Khan *et al.*, 2019). However, a significant failure rate has been observed for CI programmes, despite the benefits they have brought to industrial companies (McLean and Antony, 2017). Seventy per cent of Lean implementations have failed (Pedersen and Huniche, 2011), with 60% of Six Sigma initiatives failing to achieve the desired results (Angel and Pritchard, 2008). In relation to change efforts, Klein and Sorra (1996) state that it is a failure in the implementation approach, and not the subject matter itself, that which leads to companies not achieving the expected benefits of the innovation they implement. The failure of improvement initiatives is typically due to poor deployment, with a particular challenge in the lack of roadmaps to follow (Snee, 2010). To understand the failure of CI programmes through improvement approaches (TQM, TPS, LM, SS, and LSS), the failure of LM to deliver CI oriented outcomes can be taken as an example. Quirin (n.d.) suggests that in most firms, LM is introduced with the goal of obtaining some quick wins utilising standard shop floor tools. However, as the implementation process progresses, the effort becomes stifled since it demands assistance from other departments. The idea is either not understood or is not fully accepted by top management. The lean activity fades away when competent employees attrite, the operations department changes or short-term goals become the norm. The difficulty is that most managers are still searching for large projects or their workers' accelerated efforts. CI programmes all appear effective and are sometimes accompanied by a lot of self-commitment, but they are rarely sustainable. Thus, the short-term achievement of CI oriented outcomes is not the main concern. There is, therefore, a need to develop a consistent framework that can deliver CI outcomes in a sustainable manner.

In this line, there is currently an absence of industry-specific Continuous Improvement implementation frameworks and models. Manufacturing companies, in particular, lack the knowledge required on how to implement an improvement initiative, evidencing the need for a guide to successfully implement these in their specific sectors (Albliwi *et al.*, 2014). One of the top limitations in the manufacturing industry in terms of CI is the absence of a roadmap for companies to follow (Albliwi *et al.*, 2015). Therefore, there is a dire need for developing and establishing a validated framework that can offer a roadmap to deliver CI in manufacturing companies. Based on this need, this paper proposes a validated framework tailored to the practical needs of users in manufacturing companies.

**2. Methodology**

The present study adopted eight themes (Motives & Expectations, Organisational Culture & Environment, Management Leadership, Implementation Approach, Training, Projects, Employee Involvement Levels, and Feedback & Results) that are commonly associated, according to the CI literature, with the failure of CI initiatives in manufacturing environments. These themes, however, had not been empirically validated. Consequently, there was an urgent need to empirically validate those themes first as the present study centred on them. Thus, this study validated those eight themes through the use of an online survey adapted from McLean and Antony (2016).

Following the validation of those eight themes, the present study integrated concepts extracted from the framework of McLean and Antony (2017), which offers a roadmap to deliver continuous improvements in manufacturing companies, to propose a novel implementation framework. Finally, the present analysis validated the framework by using the Delphi method. A summary of the research phases and outputs is shown in Figure 1.

**Insert Here - Figure 1. Research phases to date**

Research Phase 1: Systematic Literature Review

Eight main themes contributing to the failure of CI initiatives within manufacturing environments were identified through a systematic review of the literature: Motives & Expectations, Organisational Culture & Environment, Management Leadership, Implementation Approach, Training, Projects, Employee Involvement Levels, and Feedback & Results. The literature review was carried out in a structured and repeatable manner as advocated by Tranfield *et al.*, (2003). From the full review of 72 journal articles, 211 independent variables contributing to initiative failure were identified. For further detail on the methodology followed and the eight themes derived reference can be made to McLean *et al.*, 2017.

Research Phase 2: Online Survey

These eight themes were subsequently validated through a theory-testing online survey. The survey was sent to a cross-section of academics, business leaders, and continuous improvement practitioners. The combination of literature review and input from an expert panel comprising industry and academic input is similar to the approach taken by Ravel *et al.*, (2018) in their identification of Lean Six Sigma enablers.

Forty (97.6%) of the respondents with experience in Continuous Improvement failure, and therefore able to contribute to the full survey, believed that each of the eight themes identified from the systematic literature review contributed to the failure of Continuous Improvement initiatives. This high positive response rate strongly validated the findings from the systematic literature review (McLean and Antony, 2016).

Respondents were next asked to select the three themes that they felt contributed the most to the failure of Continuous Improvement initiatives. Through a Chi-square analysis, a statistical difference in the proportion of votes achieved by each theme was demonstrated. Subsequent t-tests of each theme versus the proportion of votes expected by chance confirmed that, in terms of high selection rate, Management Leadership and Organisational Culture and Environment were the two themes which had the strongest impact on the failure of Continuous Improvement initiatives.

Research Phase 3: Critical Literature Review

This phase of the research involved the thorough evaluation of existing implementation frameworks and models. The evaluation identified both strengths and limitations in each framework. The strengths, coupled with the themes and variables identified and validated in phases 1 and 2 of the research, were combined to produce the content of a new conceptual framework. Commonality was found in the format adopted for existing frameworks; a phased approach. This was also incorporated.

Twenty existing Continuous Improvement implementation frameworks and models were evaluated (McLean and Antony, 2017). The current offering of Continuous Improvement implementation models and frameworks did not fully satisfy the objectives of this research, which were:

1. An industry-specific model or framework (the manufacturing sector);
2. A model or framework that addressed each of the eight failure themes identified from the literature in phase 1 of the research;
3. A model or framework that guides a site-wide implementation (not simply a project)

The output of this phase of the research was the development of a new conceptual implementation framework specifically tailored to the manufacturing industry. The framework consisted of 4 phases, which were then subdivided into various factors and activities as shown in Figure 2. For a detailed review of the framework see McLean and Antony (2017).

**Insert Here - Figure 2. Original Conceptual Framework (adapted from McLean and Antony, 2017)**

To take this research to completion, and provide an output that both addresses a research gap and is of practical significance, the conceptual framework was subsequently reviewed by a panel of industry experts through a Delphi study. The combination of an initial literature review and Delphi study is similar to the approach used by Hinckeldeyn *et al.*, (2015), who suggested that this would ‘achieve more coherence in findings and a more complete overview’. Supplementing existing research with a Delphi study, specifically including individual interviews, is an appropriate approach as it allows the Delphi study to complement and triangulate these results along with the methodology of previous research’ (Saizarbitoria *et al.*, 2006).

**3. The Delphi approach**

The Delphi approach is used to gain group consensus on a complex issue through the use of group communication. This communication is facilitated by a coordinator who designs the questionnaires and analyses the results. The Delphi approach is regularly applied, but often in varying formats (Hinckeldeyn *et al.*, 2015; Eriksson *et al.*, 2016; Harland *et al.*, 2005).

Key to the approach is the ‘remote focus group’ which is created; the participants do not meet in person or communicate directly with each other (Inaki *et al.*, 2006). Each panel member (usually an expert in the area being investigated) provides their response independently of the other participants. Input from each expert, therefore, is not influenced by the personalities or experience of other members of the group. This should ensure a more honest and open input to the process. One of the main characteristics of a Delphi study is that a statistical response is obtained from the group to allow the analysis of the group’s opinion (Campos-Climent *et al.*, 2012). The main phases and features of a Delphi study are outlined in Figure 3.

**Insert Here - Figure 3. Main phases of a Delphi Study**

The success of the approach hinges on the correct selection of the expert panel. The capability and experience of the participants are more critical than the number of people involved (Wakefield and Watson, 2014). Harland *et al.* (2005) deliberately selected a panel of 25 participants based on job position rather than expertise. For this study, a clear panel make-up was desired, with a balanced mix of job roles and differing levels of CI experience.

Whilst there is not a single approach for conducting a Delphi study, the minimum number of rounds is considered to be two (Wakefield and Watson, 2014). It is common for the initial phase to be open-ended in nature, with the focus being narrowed in subsequent rounds towards a quantitative result. The facilitator of the study must develop a criterion set with which to measure the feedback of the surveys (Inaki *et al.*, 2006). This is typically done through the use of a Likert scale. Upon completion of a round, a decision is made as to whether another is necessary based on the level of consensus gained. Despite there being a common process and features of a Delphi study, within that some options exist. One of the key alternatives is to ‘seed’ the process with relevant information gathered from theory or prior literature. The seed is used as a point of reference from which to start the discussion. The seed is typically generated through the review of previous literature, frameworks or factors contained in practitioner journals (Worrell *et al.*, 2012).

The Delphi approach was utilised for the final stage of this research as it is well suited when the components to be included in the final solution are not known (Wakefield and Watson, 2014).

**4. Delphi study**

The Delphi study was conducted through the combination of two approaches. Initially, semi-structured interviews were completed with each participant. The interviews were seeded with the conceptual framework for the implementation of Continuous Improvement in manufacturing companies developed from the literature in Phase 3 of this research (Figure 2).

The interviews were used to review the framework and identify required updates based on feedback from the group. Interviews were used at this stage due to the richness of data that this method contributes to collecting. Saizarbitoria *et al.*, (2006) state that interviews are not only useful for validating literature findings but also for collecting new points of view that could guide future research. Similar to the approach taken by Krueger *et al.*, (2014) when reviewing a site Six Sigma implementation, the interviews were conducted one-to-one and were approximately one hour in duration. Each interview was audiotaped with the permission of the participant. This was fully transcribed and the transcription was shared with the interviewee to ensure accuracy.

Thematic analysis was then used to collate the feedback and update the framework accordingly. Braun and Clarke (2006) state that the purpose of thematic analysis is to identify, analyse and report patterns within data. The thematic analysis allowed the identification of key and recurring themes and sub-themes within the interview transcripts. The feedback received during the interviews was coded, with 17 main themes emerging through this process.

Following the interviews, an online survey was distributed to all interviewees. The survey was used to gain measurable feedback on the updates made to the original framework. The analysis completed demonstrated agreement on the final framework. The activities involved in this Delphi study, and the key points associated, are summarised in Figure 4.

**Insert Here - Figure 4. Activities involved in this Delphi study**

This broad starting approach followed by narrowing in subsequent rounds mirrors the approach of Ray and Sahu (1990: 29), who designed Round 1 ‘so that any panellist could express his views freely and independently’ before using Round 2 to gather panellist’s feedback through an ordinal scale. This allowed numerical scores to be calculated and consensus analysed.

***4.1 Interview questionnaire and online survey***

The option to have either a single panel design or to include several panels existed (Worrell *et al.*, 2012). A decision was made to use a single panel, but ensure that it had the diverse expert composition required. In line with the approach adopted by Schroeder *et al.* (2008: 538) interviewees were selected to ‘provide enough differences to support the development of an emergent theory that can potentially apply across industries and to different stages of implementation maturity’. To ensure this, a similar approach to that of Eriksson *et al.* (2016) was taken; the expert panel was comprised of several job roles. Through the selection of the panel, it was felt that the output would be suitable to different industries within the manufacturing sector, to various company sizes and to users with different levels of Continuous Improvement experience.

As with the Delphi study conducted by Campos-Climent *et al.* (2012), a balanced sample of experts was sought. In this study, there was an equal ratio of business leaders and CI practitioners/consultants taking part. The tailoring of the interview format to the respondent, the planned 1-2 hour duration of each interview, as well as each interview being tape-recorded with the permission of the respondent was similar to the approach taken by Schroeder *et al.* (2008).

After the open-ended nature of the interview, the online survey was used to narrow the discussion toward obtaining a consensus through the application of a five-point Likert scale to allow a quantitative analysis (Appendix A).

***4.2 The Delphi panel and the Delphi process***

A total of 23 people were invited to participate, with 20 participating in the initial interview and 19 completing the entire study. This compared favourably with response rates reported in other Delphi studies (Hinckeldeyn *et al.*, 2015). Potential panel members for this study were identified by utilising the networks of the authors. A clear panel make-up was desired, with a balanced mix of job roles and differing levels of Continuous Improvement experience. Suitable candidates were identified and approached directly or through a shared contact. A summary of each respondent’s current role, previous CI experience and whether the company had a CI initiative in place is shown in Table I.

Interviewee 1 (GB) was used as the pilot for both the interview format and the online survey. This person was selected for this role as he had experience with all job role types that would be interviewed and was, therefore, able to provide feedback from each perspective. As the pilot, the feedback from GB had not been included in the thematic analysis or final survey results.

**Insert Here Table I. Summary of interviewees**

A wide cross-section of business sizes was interviewed, with companies ranging from a single site with a turnover of £1 million and only 17 employees (Company F) to a company with 8,000 employees across various sites (Company G). Several of the companies that were interviewed were categorised as Small or Medium Enterprise (SMEs) based on the number of employees or turnover. An SME is defined by the European Union as a firm with less than 250 employees or with a turnover of less than €50 million (Altman *et al.*, 2010). It was also possible to gain a mix of experienced and inexperienced interviewees. This was important as the dual aim of the interviews was not only to develop a framework that represented best practices but also that would appeal to people new to the implementation of Continuous Improvement. The framework should aid the future uptake of these approaches in companies that were not yet practising them.

**5. The results**

***5.1 Delphi study round 1 - Individual interview***

The thematic analysis of the feedback received allowed its grouping into headings and sub-headings. The thematic analysis was completed using open coding as detailed by Krueger *et al.* (2014). The coding was achieved by reviewing the interview transcriptions and identifying the main concepts raised by the interviewees. Each of these was individually recorded and then organised into themed groups. This allowed the identification of the main theme titles emerging from the interviews and the pertinent points of view within each. The framework was updated in line with this. In total, 17 main themes were identified based on the original sub-themes. A summary of the six main themes leading to the update of the original framework is provided.

Theme 1: Level of detail

The majority of the interviewees agreed that the content was largely correct, and did not feel that any particular element should be removed. Some considered, however, that the level of detail was too high and that the layout of the information could be clearer. Several of the respondents suggested that whilst the current level of detail in the framework was necessary, it would benefit from an additional layer(s) above to provide a clearer overview of the phases and their purpose. It was felt by the business leaders and practitioners that by providing this, users would gain a general understanding and interest in the framework, before taking the time necessary to read the existing layer.

*“I can’t think of any gaps in the information. What I do think is there is a lot of information. It’s very busy” – SA1.*

*“There is a lot of stuff on there. If you were going to a company that hadn’t done any of this it would be a big challenge for them” – SC.*

*“I would envisage that business leaders probably don’t realise that there is as much in it. As a business leader…there is a danger they could be frightened by it” – RH.*

*“There is a lot. That can put some people off. I don’t know if it can be condensed?” – GF.*

*“Where is the top-level thing that is going to help me actually understand what I am trying to do? I think it is all about keeping it a bit simpler. For me, there are top-level things you can get wrong. From a human business point of view, give people more of a top-level steer” – CY.*

Theme 2: Visual Management

Several sub-headings appeared in each phase but the interviewees found difficulty in tracking the progress of these and linking them back to the information contained in other phases. It was considered to be a need for a clearer identification of the themes running throughout the framework and a better linking of the content within these.

*“You could have a strand that runs through it to do with Culture, Leadership and Communication. You could say these are all things to do with Leadership; as it flows through we are going to understand the Leadership piece. You need to stream it in one way or another” – CY.*

*“Where you are talking about Communication, for instance, I would try to have that linked so people could follow it” – SC.*

*“You could do Training on the same line all the way across, or in the same colour. There are so many things that link to each other that you could put them into boxes. You have Communication all the way across, management leadership all the way across” – EB.*

Theme 3: Phases

All respondents agreed that the phased approach was correct and the ideal scenario. In terms of an ideal framework and something to strive to achieve this was felt correct. Several respondents considered that there would be blurring between the phases during the practical application of the framework but that this was not ideal, and was not possible to capture it in the framework.

“*Agree with the phased format” – EB.*

*“Use of phases makes sense” – PR*

Several respondents, however, did query the timescale associated with completing each phase, and felt that the addition of this information would be beneficial.

*“Company will want to know how long this will take” – SM*

*“Show typically how long it would take to implement” – SA1*

Theme 4: Terminology

Some of the terminology within the framework was felt to be a little specialist and, therefore, not easily understood by someone new to Continuous Improvement. Where possible, some of this terminology was altered or removed entirely. Abbreviations such as ‘VoC’ (Voice of the Customer) and ‘TTT’ (Train the Trainer) were updated.

*“Some of these things are a little bit jargon” – GF.*

*“What’s ‘TTT’?” – SA1.*

*“What do you mean by Extended Diagnostic?” – NKP.*

*“I was turned off by Extended Diagnostic” – PR.*

*“When consultants come in and say I want to do a Diagnostic, I’m thinking I want you to fix my problem not produce a fancy report. I have always used the language ‘Gap Analysis’” – SA2*

Theme 5: Sustainability Loop

Some interviewees felt that the framework lacked depth within the final stage and could benefit from a more detailed ‘Sustain’ phase. This was added through the activities recommended by the interviewees. In this context, the existing sustainability loop was extended. Additionally, two separate return loops were included to represent the need for a consistent short-term evaluation and realignment, as well as the need for less a regular but more formal evaluation of the initiative that may lead to a more fundamental redesign.

*“There is not a lot in there about actual controls and how you control it” – PR.*

*“Finish with a fifth box which is sustainability. I would be tempted to express it as a box; ‘Sustainability’” – SA2*

Theme 6: Pilot Project

With the amount of detail and considerations within Phases 1 and 2, the impatience that could result from not seeing any change during these stages was commented upon.

*“Everything is there but I think you might lose some people. Some people might get lost because of the time it is going to take. You need to make sure there are things in there (alongside Phase 1 and 2); there are wins there” – SA1.*

It was, therefore, suggested by several respondents that a quick wins/pilots sub-phase should run alongside the Diagnostic and Design phases in order to inform the roll-out and feed the overall Design phase. This would be used to trial potential solutions and demonstrate to the business the benefits that can be achieved. This will aid buy-in, understanding and momentum-building.

*“Quick Wins buy you favour. Anything you can do to buy favour chips is going to help any initiative” – EB.*

*“Have you got somewhere a quick wins process? Whenever you embark on one of these programs you have got to create momentum. You have got to demonstrate that it works. Then you will start getting the snowball effect”- NP.*

Key interview findings

Through the interviews, there was consistent feedback gained with regard to some potential improvements and changes to the framework. These were incorporated into an updated version of the framework and distributed to the 20 respondents through an online survey. A summary was sent to each respondent of the points made during the interview, the original framework reviewed during the interview (Figure 2), an updated version of the original based on the feedback (Figure 5) and additional summary pages; the new top (Appendix B) and middle layers (Appendix C).

**Insert Here Figure 5. Updated framework based on interview feedback**

***5.2 Delphi study round 2 - Online survey***

The aim of a Delphi study is to reach a consensus on a topic under review. Despite the use of Delphi studies and Likert scales being common, there was difficulty in finding specific guidance on what would constitute consensus. When using a five-point Likert scale, Nordin *et al.*, (2012) looked for an average score of over 3.7 to demonstrate consensus, but reference is not made in the paper as to why this value was selected. Tastle *et al.*, (2005) developed a formula to quantify a level of consensus achieved from Likert responses. This ranges from 0 (no consensus) to 1 (full consensus) but no definitive level is given as demonstrating enough consensus has been reached. The most common measure used in the literature is the Interquartile Range (Campos-Climent *et al.*, 2012; Saizarbitoria *et al.*, 2006). The greater the range calculated, the greater the dispersion. Where the range is equal to zero, full consensus exists. The acceptable level of consensus is considered to exist when the range is equal to or less than 1.

When analysing the survey responses, it is possible to use either Likert-type or Likert scale data. Likert-type items are questions treated in isolation, whereas the Likert scale is used to combine four or more Likert-type items and summarise these using an overall score (Clason and Dormody, 1994). As they fall into the ordinal measurement scale, when analysing individual questions it is wrong to treat the responses as continuous, normal data (Boone Jr. and Boone, 2012). For this reason, it should be analysed using the median and mode as an indication of central tendency rather than the mean. For each statement, the level of agreement is, therefore, analysed using the mode (selected most often) response.

Where four or more questions relating to the same topic are asked, these can be analysed together at the interval measurement scale with the score averaged in order to provide an overall score for that topic (Boone Jr. and Boone, 2012). The selected responses were scored as follows:

1. Strongly Disagree
2. Somewhat Disagree
3. Neither Agree or Disagree
4. Somewhat Agree
5. Strongly Agree

Questions were asked in the survey under 10 different headings. Where four or more questions were asked under a single heading, an average score (mean) for that section was provided as well as the mode and median score for each individual question. Although no consistent guidance was found, where a mode or mean score of 4.0 or higher (‘Somewhat Agree’ or ‘Strongly Agree’) was established, a suitable level of consensus was considered to be reached. The results from the online survey are presented below in Table II.

**Insert Here - Table II. Table of survey feedback**

No further rounds of the survey were considered to be required on an individual statement or overall section where the mode and mean scores were ‘Somewhat Agree’ or ‘Strongly Agree’, indicating consensus amongst the respondents that an adequate level of agreement had been reached.

**6. The final framework**

Through the original interview responses and the subsequent Likert scale survey, the updated conceptual framework was validated by a group of business leaders and CI practitioners from the manufacturing industry. The final framework is constituted of three separate layers.

The top layer is designed to be a quick snapshot of the key themes, as well as provide a logo for the framework to help provide it with an identity. The purpose of this layer is to generate interest and intrigue the users and lead them to explore the subsequent layers in more detail. This need for an initial ‘hook’ was identified during the interviews.

*“There has got to be some way for a really high-level version of this. A logo, some kind of logo as well that encompasses what you are doing” – SA1.*

The graphics used in this layer could potentially be improved as those used are purely to give an indication of the concept. That said, the existence of the top layer, and therefore the use of the icons and logo, received positive feedback during the survey process.

The bottom layer retained a similar level of detail to the original conceptual framework that was used to seed the Delphi process. Survey questions relating to the continued need for this level of detail and, therefore, the existence of this bottom layer both received a mode response of ‘strongly agree’. Importantly, this level of detail was predominantly felt necessary for the CI practitioner, but probably not for the sponsor of the initiative, i.e. the business leader. This layer was, therefore, titled the ‘Practitioner Guide’. This layer retained the majority of the original content but it was, again, updated visually in line with consistent feedback from the interviews. The appearance has been improved through the addition of visual management in the form of swim lanes for each theme and colour coding. Additional phases in the form of the ‘Sustain’ and ‘Pilot’ were added along with predicted timescales for each phase and additional feedback loops.

The new middle layer; the ‘Management Overview’, is an abbreviated version of the ‘Practitioner Guide’, providing a simplified overview of the implementation process. The survey respondents felt that this was effective in providing an overview and is more likely to encourage interest and use of the framework.

The Delphi study demonstrated that whilst the majority of the content from the literature was correct, to be able to bridge the gap between academia and its practical application requires it to be captured and communicated in a user-friendly format.

What was developed is a layered framework that captures the implementation of best practices of manufacturing companies and communicates in a way that appeals to both experienced and inexperienced business leaders and practitioners.

**7. Evaluation of the final conceptual framework**

A focus group can be used to provide a shared discussion and review. In this instance, it was used to evaluate the final conceptual framework derived from the Delphi study from the point of view of inexperienced Continuous Improvement practitioners. The objective was to understand how useful the framework would be to people in the early stages of a Continuous Improvement application. Through the Delphi study, both inexperienced and experienced business leaders, as well as expert Continuous Improvement practitioners, were able to input and share their views. This left a final target user group to review the content; inexperienced Continuous Improvement practitioners. A further focus group was organised in order to achieve this.

Beck *et al.*, (1986) defined a focus group as 'an informal discussion among selected individuals about specific topics'. ‘The most common purpose of a focus group interview is for an in-depth exploration of a topic about which little is known’ (Stewart and Shamdasani, 1990). A focus group involves a group discussion on a particular topic which is typically structured through questions set by the researcher (Wilkinson, 1998). Participants, therefore, are gathered in order to share their knowledge or opinion on a specific topic that is of interest to the researcher (Parker and Tritter, 2006). The discussion typically takes place in an informal setting, allowing people to feel able to openly share their views on the specific topic under review (Bloor *et al.*, 2001). The discussion will typically be audio-recorded and subsequently transcribed in order to allow an analysis of the content through the likes of thematic analysis (Wilkinson, 1998).

In the case of the present study, the focus group involved a total of five qualified Lean Six Sigma Black Belts trained by the Institute of Six Sigma Professionals (ISSP). ISSP was established in 2011 in order to connect like-minded Six Sigma professionals. The Institute delivers accredited Lean Six Sigma training and organises best practice events in the UK.

The Black Belts worked for three manufacturing companies of different sizes and industries and had all met previously at the Lean Six Sigma Black Belt training sessions. A one-hour focus group session was arranged at the ISSP. A summary of the participants is detailed in Table III.

**Insert Here -** **Table III. Focus Group Participants**

Overall, the recruitment was successful in identifying people suitable to meet the research’s aim and of similar ‘status’. This aided the level of interaction achieved.

The focus group involved the Black Belts being firstly introduced to the background of the research and then provided an overview description of each layer of the final conceptual framework. A series of open questions were then used to prompt responses from the group (Appendix D). Each participant was provided with an A3 paper copy of the framework at the beginning of the session. The framework was also projected onto a screen in the room to enable a shared discussion of any specific points raised.

***7.1 Focus Group Feedback***

The initial feedback on the framework was that it was ‘easy on the eye’ and easy to pick up on. It was also felt to be positive that different levels of detail were provided on each layer for different user groups. Participant E did, however, question why the themes of Culture and Pilot did not progress through all the phases of the framework like most others. In relation to Culture, it was felt that this was the wrong message as it is such a critical theme within the implementation. Participant B suggested that the expected achievement of the desired Culture change through the subsequent activities in the other themes could perhaps be better illustrated and linked to the framework. Another point raised was to have the labelling and theme titles more consistent between layers. Participant A commented that addressing this would prevent the need to flick between the layers as often.

The group also demonstrated a desire for further detail to be available. Participant C felt that as practitioners there would be a desire to look at each of the areas and have guidance on how to complete the activities with the detail provided on what tools to use. As people who would be using the framework without experience of ‘how’ to carry out the activities, it was felt that this guidance could be supplied in further layers or a reference document.

The shared consensus was that the framework was useful and that it could be used as a guide and a reference tool. Participant D made the suggestion that the framework could be used as a method for tracking progress through a CI programme implementation and that it could be easily adapted into a tracker.

It was commented by Participant A that the whole thread across leadership would be particularly challenging. Specifically, it was felt that getting genuine buy-in from the middle layer of management would be particularly difficult. Participant D stated that the person at the top of the organisation would typically kick off the implementation but those working under would not necessarily know or understand what that meant. It was also felt that the people operating at a middle level were typically measured on quite a short term horizon and hence it was not in their interests ‘to take a hit today to be better tomorrow’.

Overall, the group agreed that they would use the framework and would find it useful to measure themselves against. There was discussion about being able to evaluate their own company roadmap against the final framework to establish if there had been anything overlooked and to ensure that there was evidence that each had been completed satisfactorily. The use of the different phases chunks the process up to make it more manageable. It would be a useful point of reference.

**8. Discussion**

The critical literature review completed in Phase 3 of this research identified a research gap, i.e. the absence of a robust Continuous Improvement implementation framework. This was addressed for the particular context of the manufacturing industry. The conceptual framework derived from the existing literature differs from the final framework in some key aspects. The most notable of these was the addition of extra feedback loops. A strong consensus was found during the survey in favour of this change. The two separate loops now represent the need for both regular ongoing evaluation and re-alignment, as well as a less regular but more formal re-design, of the initiative. This finding aligns well with the theory of Argyris (1977) who promotes the concept of double-loop learning to enhance organisational learning.

From the framework reviewed during Phase 3 of the research, those presented by Baidoun (2004) and Jeyaraman and Teo (2010) were identified as the most complete in terms of addressing the eight main failure themes. These frameworks were also intended to guide a site-wide implementation. The frameworks, however, were not specifically tailored to the manufacturing industry. In terms of content, both fail to present it in a cohesive manner that could be easily followed. The user-friendly element found to be important during the interview was lacking. The finalised framework presented from this research has, therefore, ensured that the visual management element received focus to ensure the information was clearly presented and easily followed. In terms of promoting practical application, this was found to be critical.

Of the remaining frameworks, those developed by Mostafa *et al.* (2013), Nordin *et al.* (2012) and Thomas *et al.* (2009) were the only current offerings specific to the manufacturing industry. Mostafa *et al.* (2013) however failed to incorporate all of the key information from their paper in the framework and did not provide a deeper level of detail on the content to allow it to be clearly followed. Unlike the panel size used for this study, Nordin *et al.* (2012) only based their framework on an expert panel of 3 people. The content was also considered to be lacking the depth required to be comprehensive. Finally, Thomas *et al.* (2009) did not pitch the content at the organisational level. There was, therefore, a failure to cover the two most vital topics of Leadership and Culture. The final framework addresses these shortcomings through the use of different layers to provide different levels of detail, the use of a 20-person expert panel to ensure robust findings and the tailoring of the content to reflect a site or organisational implementation.

Finally, the framework developed by Kumar *et al.* (2011) was intended to be specific to SMEs. There would have to be further research as to whether this was necessary. Given the wide range of company sizes involved in this research, it would pose the question of whether an SME specific solution is, in fact, required when developing implementation guides. Both SMEs and non-SMEs contributed to this research with consensus found on how to implement Continuous Improvement when region and industry are considered.

**9. Managerial and theoretical implications**

The finalised conceptual framework may support managers in the implementation of Continuous Improvement. The framework can provide a clear guide to reference and benchmark against. Applied correctly, the approach detailed in the framework should help to avoid failure; the most likely outcome when implementing Continuous Improvement initiatives. This should aid the avoidance of frustration, allowing companies to benefit from their efforts earlier and, therefore, build the necessary momentum for successful change. More manufacturing companies should, accordingly, realise a positive return on their investment from their Continuous Improvement efforts. From a managerial perspective, the vital role to be played by leaders within the organisation is made clearer. The core strength is also the adaptability of the framework. Whilst providing clear guidance is not prescriptive, allowing users to tailor the approach to their specific circumstances. Prior to entering the world of work, this is also a tool which could be valuable in teaching students about Continuous Improvement and its implementation, ensuring they are more capable exponents once employed. Continuous Improvement is a key area of operations management as it strives to improve all aspects of an organisation’s operations. The framework builds on prior Continuous Improvement literature and details the practical application of a change in the form of a Continuous Improvement implementation. A new refined methodology for successful implementation within a specific industry is provided.

**10. Conclusion and directions for future research**

As a model or framework is a simplified representation of reality (Ackoff and Sasieni, 1968) and essentially, all are wrong, but some are useful (Box and Draper, 1987) it cannot be expected that uniform agreement on the content, layout or level of detail will be achieved. With this in mind, it has been demonstrated that a high level of consensus exists amongst the expert panel. Manufacturing companies of differing sizes and from multiple industries have been involved in a two-stage Delphi study. The panel is, therefore, an accurate representation of the overall target audience.

Through the rigorous application of several quantitative and qualitative methods, a finalised Continuous Improvement implementation framework has been validated for its application in the manufacturing industry. Depending on user preference and role within the implementation, three layers of guidance have been developed. The first layer identifies the main themes that must be addressed. This is then built upon with an overview of the areas to tackle within each. Finally, a much more detailed bottom layer is provided. It details the specific actions required in order to successfully implement Continuous Improvement initiatives. The importance of presenting the information in a user-friendly format is clear and should be given consideration where the aim is to have academic findings translated into a practical application. This is a key element of good theory building (Wacker, 1998).

The research, to date, shows limitations which warrant further research activities. First, the framework has not yet been tested through its practical application in a manufacturing company. The use of action research would be a natural final step in order to fully test the validity of the framework. This action research would ideally be completed in multiple companies of various sizes, industries and locations. Second, whilst the compilation of the expert panel achieved a cross-section of job roles and Continuous Improvement experience, the results are still based purely on the feedback of 20 individuals. In order to further validate the framework, the Delphi survey tool could be replicated with a separate panel to ensure the consistency of findings. Third, the findings are specific to the manufacturing sector. Although companies of differing sizes and industries input the research, the findings are based on only 15 companies. An opportunity, therefore, exists to not only apply this framework within the manufacturing industry but also to use it in other sectors to establish any changes required due to culture or sector practice. The panel participants were also all based in the UK. Whilst this was essential to allow access for the completion of face-to-face interviews, it does mean that the research findings are potentially region-specific rather than broadly applicable to all manufacturing companies as intended. It is expected that the overall structure would likely remain unchanged but that some of the content or terminology may require slight modifications. Finally, the interviews conducted during the Delphi study and the focus group highlighted a desire amongst some respondents for an even more detailed fourth layer to be developed for the framework. This would provide a detailed explanation of each point within the framework, with the opportunity to also incorporate a measure of maturity level into this new layer of the framework.

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