Towards a Theory of Continuous Improvement

Andrew Lahy & Pauline Found

University of Buckingham

Andylahy@gmail.com

Abstract

The term continuous improvement has been widely applied to OM but the meaning is ill defined and is used as a desired goal or as a means to achieve a goal. The purpose of this paper is to review the term continuous improvement with the aim of clarifying its meaning

Keywords: Continuous Improvement, Theory

Introduction

This paper forms part of a wider research project looking into how for-profit and not-for profit organisations can improve performance, innovate and learn from each other, by using a unified theory of continuous improvement.

The initial spark for this research came from two related projects with organisations operating in differing sectors. The first project, for a for-profit organisation, had the stated aim of "introducing a culture of continuous improvement" into the organisation. The second, for a not-for-profit organisation, was less well-defined, but essentially aimed to improve the performance of a charity store, by increasing revenue (proceeds) to support the charity.

These two related projects, led the author to the question of whether "continuous improvement" could be applied in the not-for-profit organisation, in the same way as it was being applied in the for-profit sector.

This simple question then led the researcher into some broader research questions. The first was around the term continuous improvement itself, what is it, where did it come from, where and why is it done? This led the research into an investigation into the origins and development of continuous improvement and a search for an underlying theory of continuous improvement that could be applied to the profit and not-for-profit sector.

As the research progressed, the questions were refined and revised, and eventually led to the questions defined below:

a) Is there a single theory of continuous improvement that can be applied across the for-profit and not for profit sector?
b) Would such a theory assist profit and not-for-profit organisations to share knowledge and ideas across the two sectors and mutually improve their continuous improvement efforts?

The research into these questions has found that there is an abundance of information on continuous improvement, and a growing amount of research into continuous improvement for the not-for-profit sector. However, it appears there is limited research on whether one single continuous improvement approach could be developed for both types of organisations, and whether this would assist with the generation of ideas and knowledge sharing between different organisation types.

The research suggests that there is a flow of ideas and information from the for-profit to the not-for-profit organisations, but there is very limited knowledge and ideas sharing in the opposite direction. For those practitioners working in the for-profit world, this is a missed opportunity. We propose that there is significant untapped opportunity to share ideas across the two sectors.

The objective of this paper is to review existing literature on the topic of continuous improvement with the aim of establishing if a theory of continuous improvement already exists that would help profit and not-for-profit organisations to improve organisational performance through learning and innovation

What is continuous improvement?

Research info the topic of continuous improvement is not new. Papers by Locke & Jain (1995), Bond (1999), Caffyn (1999), Savolainen (1999), Terziovski & Sohal (1999), Bessant and Francis (1999), Bessant, Caffyn & Gallagher (2001), Jorgensen et al (2003), Bhuiyan and Baghel (2005), Marin-Garcia et al (2008), Putnik (2012), Colledania et al (2010), Maletic et al (2012) among other have addressed the subject in detail.

Caffyn (1999) noted the increasing popularity of the term Continuous Improvement and states that the term has become associated with a variety of organisational developments including the adoption of "lean manufacturing" techniques, total quality management (TQM), employee involvement programmes, customer service initiatives and waste reduction campaigns.

Despite, or perhaps because of the breadth of research on the topic, the systematic literature review found many different definitions of the term "continuous improvement" and also found a number of academics who criticise the existing definitions used. Zangwill and Kantor (1998) for example, indicate that the concepts of continuous improvement are "abstract and imprecise" and Bessant et al (1999) point out that confusion remains around the term continuous improvement, as it "refers not only to the outcomes but also to the process through which these can be achieved". (Bessant et al 1999).

In terms of the definitions used, the literature review found a number of examples, including Bhuiyan and Baghel (2005) who define continuous improvement as a "culture of sustained improvements", Locke and Jain (1995) who define continuous improvement as "any and all organisational efforts designed to inculcate a culture of continuous improvement and change, which fosters continual learning and innovation within the organisation" and (Bessant et al 1999) who define continuous improvement "as an evolution of and aggravation of a set of key behavioural routines within the firm"

Other authors focus more on the practical use of continuous improvement. Marin-Garcia et al (2007) for example refer to continuous improvement as a "weapon for maintaining and improving competitiveness", which is similar to authors such as Bacdayan 2001 and Grutter et al 2002 who refer to the more practical use of

continuous improvement and see it as "tool for implementing wider systems of production such as TQM or Lean" (Marin Garcia et al, 2008)

The above definitions highlight the first point of ambiguity around the term "continuous improvement". Is it a concept, philosophy and set of behaviours or is it a collection of tools and techniques? Or is it both? This ambiguity is addressed later in this paper, but first a number of other ambiguities around the term continuous improvement are explored.

The second point of ambiguity around the term continuous improvement is related to whether continuous improvement is limited to improving what is already done, or also includes doing new things and innovating. Bessant et al (2001) indicate that continuous improvement is a "set of routines for doing what we already do better", but goes on to say that "there is emerging evidence that this capability (of continuous improvement routines), once established can also contribute to doing new things – to innovation routines. (Bessant et al 2001).

A third point of ambiguity is related to whether continuous improvement is an organisational, team or individual level phenomenon. Bessant et al 1996 imply that continuous improvement is organisation wide, specifically defining continuous improvement as "an organisation-wide process of sustained incremental innovations" (1996). This implies that continuous improvement is something that must be carried across the entire organisation. In contrast, Imai (1997), states that continuous improvement is a more "personal and individual philosophy that can be applied in working life, social life or home". Imai uses the term Kaizen in this reference, but also states that Kaizen is synonymous with term continuous improvement

A fourth point of ambiguity is related to the scale and size of change that continuous improvement refers to. For authors such as Imai (1997), continuous improvement only refers to small, incremental changes, and it specifically does not include radical or quantum leap change approaches. Singh and Singh (2013) appear to agree with this limitation, stating that "continuous improvement strategies are the recognised way of reducing waste by focusing on small incremental changes" as do (Bhuiyan and Baghel, 2005) who state that CI generally relates to small incremental improvements without the need for huge capital investments. Although these authors agree that continuous improvement is only related to small improvements, the ambiguity around what defines small still remains, and how and why should practitioners identify and use different approaches for different size projects.

A fifth point of ambiguity is whether learning is a separate topic from continuous improvement or if the two are inextricably linked. Locke and Jain (1995) emphasise the close link between the two and state that it is often impossible to distinguish one from the other. Bessant (2001) also indicates a strong link between continuous improvement and learning, where he argues that achieving the highest level of his model of continuous improvement maturity is equivalent to becoming a "learning organisation".

A sixth point of ambiguity is identified by Bessant et al (2001) who state that "there is considerable confusion in the way the term continuous improvement is used, since it is deployed as a verb - the process whereby a continuous stream of innovations emerge – and also as a noun, referring to the outcome of that process". The ambiguity here relates to whether continuous improvement is a means to an end, or whether it is the outcome of the means, or both.

As continuous improvement has become such a wide ranging term, with a number of ambiguities as defined above, it is perhaps not surprising that some authors abandoned attempts to create a definitive view of continuous improvement, with Michela et al stating

> "Because a shift to continuous improvement as a way of working has implications for so many aspects of the organisation (strategy, operations, human resource policies and practices etc.) it is impractical to provide a complete or definitive list of activities entailed by CI or conditions for its success". Michela, et al (1996)

For such a widely used term, it is perhaps surprising that the term "continuous improvement" is not specifically recognised or documented in the Oxford English Dictionary, particularly when one considers that other less widely used terms such as continuous assessment, continuous-flow and continuous process do appear in the OED. (OED Online, 2015). This lack of an OED definition is perhaps a reflection of the ambiguity that remains around this common term.

Does a theory of continuous improvement exist?

A number of authors have highlighted the lack of theory in the field of continuous improvement. Savolainen (1999) found that no theoretical basis exists for continuous improvement, and (Zangwill and Kantor, 1998) state that no scientific theory exists to guide the application of continuous improvement or to systematically improve the concepts of CI themselves. Lastly, Noori and Michela (1996) in their systematic literature review of CI conclude that "there is also little theory that gives specific guidance about how to conduct rigorous research or practice"

This paper proposes a more systematic and rigorous assessment of the theoretical underpinning of continuous improvement, to identify the existing gaps and facilitate the development of a theory that addresses the existing gaps

The term "continuous improvement" is reviewed against Schmenner and Swink's (1997) five criteria for a good theory. The first criteria states that

1) *The phenomenon for which explanation is sought should be clearly defined. This clarity is enhanced by unambiguous measures.*

As indicated in the previous section, it is argued that the term continuous improvement is not clearly defined, and seven areas of ambiguity were identified as part of the systematic literature review.

Arguably, if the term is poorly defined from the outset, all subsequent elements of the theory will be imbued with ambiguity. One cannot expect unambiguous measures for something which is ambiguously defined. We therefore propose the following definition for continuous improvement, adapted from Locke & Jain (1995)

"Any and all co-ordinated efforts designed to accelerate the achievement of specified organisational objectives through change, learning and innovation"

With this definition, we look to address the ambiguities defined in the earlier section. More specifically, we propose that continuous improvement is more a framework and mind-set than a specific set of tools or techniques (ambiguity 1). Continuous improvement is not separate from learning and innovation, learning and innovation are part of continuous improvement (ambiguity 2 and 5). We reject the idea that continuous improvement has to be organisation wide (ambiguity 3), as it is the authors view that continuous improvement can be done a team level, with any small group of individuals (with or without support from senior level management). We include the word "co-ordinated" into our definition, to distinguish it from individual continuous improvement philosophies.

This distinction between "enterprise-wide continuous improvement" (continuous improvement that aims to work all across the organisation and which many authors implicitly refer to in their research) and "co-ordinated continuous improvement" which we refer to here and can be done with any small group of individuals, is an important distinction.

It is the author's view that researchers are causing a barrier to organisations doing continuous improvement, with the statement that continuous improvement needs senior level commitment. Enterprise-wide continuous improvement does indeed need senior level commitment; however we propose that any group of individuals can do continuous improvement within their sphere of influence (whether or not it is supported at senior levels)

We reject the idea the continuous improvement is limited only to small, incremental, low cost improvements (ambiguity 4). It is our view that radical change and innovation, when reviewed in detail is often the culmination of lots of small ideas, and also that complex, long term improvements are types of continuous improvement, but just done over a longer time scale

We reject the idea that continuous improvement or achieving a culture of continuous improvement is an objective in itself (ambiguity 6). It is our belief that continuous improvement is the means, and not the end.

It is also worth highlighting that the use of the term organisation for us includes for-profit and not-for-profit organisations. In fact, we use the term as defined by the Oxford English Dictionary:

> "An organized body of people with a particular purpose, such as business, government department, charity etc". OED Online (2015).

So, from the start, our definition of continuous improvement specifically includes not-for-profit and for-profit organisations

With this new definition of continuous improvement, we can then proceed to introduce some measures.

As we have already specified that we do not believe continuous improvement to be the end state, but rather a means to an end, we propose that the effective measure for our theory should not be "how well is the organisation doing continuous improvement", but rather "how well is our continuous improvement approach delivering the organisational objectives it set out to achieve"

It is the authors belief that there is no one measure that would suit for-profit and not-for-profit organisations, but rather believe that for an organisation to measure the success of their continuous improvement approach, they must define **specified organisational objectives,** and it is against these objectives that the success of the continuous improvement approach should be measured.

2) *The description of the phenomenon will likely centre on some observed regularities that have been derived either logically or empirically*

Despite the lack of an agreed definition of continuous improvement, a number of articles have observed regularities and common themes in the area of continuous improvement. Research by Kaye & Anderson (1999) identified ten essential criteria for continuous improvement. Others, such as Caffyn (1999) have sought to unify the common phenomenon of continuous improvement under the umbrella of a self-assessment tool. Bessant et al (1999, 2001) have also sought to pull together common observed regularities of continuous

improvement, resulting in the creation of five levels of continuous improvement. Fryer et al (2012) building on the work of Bessant, identify 8 indicators of continuous improvement and classify the indicators along three levels of maturity. Interestingly, Fryer et al indicate that their model is developed for use in the public sector, but arguably the indicators and criteria are suitable for the private sector. This is a good example of where ideas are being defined as sector specific, when in fact, could possibly be applied to all sectors. It is also worth noting that the indicators identified by Fryer et al have not yet been put to the test in practice.

In fact, there has been considerable research into identifying common practices and regularities of continuous improvement. In some cases, the practices have been observed in specific organisations; the collection and practices used by Toyota for example, form the foundations for a grouping of continuous improvement ideas which can be broadly classified under the term "lean". Similarly, the improvement practices observed and developed by Motorola can be broadly classified as "6-sigma".

Other observed regularities or phenomenon of continuous improvement have been grouped under different titles, such as "TQM", "Agile" or "Systems Thinking".

It is perhaps a reflection of the number of different groupings of continuous improvement ideas, that there has also been research into comparing the differences, similarities and interconnectivity between the groupings. See Bendell (2006) and Dahlgaard (2006) for examples.

In summary, it can be argued that some observed regularities around continuous improvement have been derived, however it does appear that the regularities have already started to be fragmented under different headers (e.g lean, 6-sigma) and even when grouped under the wider term "continuous improvement", authors have already began to identify differences in certain sectors (e.g public or private) rather than looking for commonality across all sectors.

Also, the above table reflects the issue mentioned earlier in this paper, in that many researchers implicitly apply an "enterprise-wide" view of continuous improvement, and not, as proposed in this research, a theory of "co-ordinated continuous improvement" that can be applied with any small group of individuals.

3) *There should be one or more precise statements of these regularities (laws). Mathematical statements of the laws will naturally help the precision*

Schmenner and Swink (1997) state that "as hypotheses are supported by more and more evidence, especially evidence of different kinds, they can often be organised into laws".

As yet, it appears that no authors have appeared to specifically define any laws of continuous improvement. That is not to say they do not exist, it may be, as Schmenner and Swink (1997) identified in their research on the theory of operations, that the laws exist, but they have not yet been labelled as such by researchers.

In the below section, we propose some initial laws of continuous that can be used as a basis for further research.

Law of organisational focus: Organisations (note again, that our definition of organisation includes any small group of individuals) that focus on a limited set of objectives will have more success to achieve these objectives than an organisation with a wide range of objectives. This law is a key factor in our theory, in that for continuous improvement to be successful it must be aimed at achieving these **specified organisational objectives.** This law indicates that continuous improvement must not be done for the sake of doing continuous improvement, but it must be done with the aim of achieving specified organisational objectives. The fewer

focus areas, the more likely that they will be understood by the organisational members. The more likely the objectives are understood, the more likely continuous improvement plans can be tailored to meet them

Law of quality: Performance (as defined by the ability of meeting the organisational objectives) will be improved as quality is improved and waste declines. This law is adapted from Schmenner and Swink (1997) theory of operations.

Law of the experience curve: This law states that over time, a process involving people will naturally improve as individuals become more experienced at carrying out the process. This law has been researched in more detail, by Zangwill & Kantor (1998) who propose a mathematical statement around this law, the Continuous Improvement Differential Equation (CIDE).

The authors began by identifying the learning curve, which they describe as the historical predecessor of continuous improvement. The learning curve is described as a simple mathematical relationship between some metric or performance measure (and in our theory, this is the specified organisational objectives) and a firm's experience of delivering those objectives

Although distinctions have been made between the learning curve and the experience curve, the underlying concept is the same – in that performance (output) will improve over time as the individuals gain experience or learn from performing the input. Zangwill proposes that the purpose of continuous improvement is to increase the speed of learning, to increase performance at a faster rate.

Law of contiguity and cumulative capabilities. This law indicates that the more skills and ideas from different sources are brought together, the higher potential there is for new ideas for continuous improvement. This links the theory to learning, in that the more learning and knowledge is co-ordinated within the organisation, the more likely the improvements will be successful at achieving the specified objectives

Law of diminishing returns
This law indicates that continuous improvement focus areas will follow a typical S-curve shape. That is to say that initially improvement may initially have a big impact on performance, but eventually as the performance is improved, it will become increasingly difficult to maintain the same rate of improvement over time. This law is important as it indicates that the impact of continuous improvement will not be linear, and organisations must understand that at some point, new ideas and new approaches must be taken to start a new s-curve improvement. This links the theory to innovation, as this is the element that can trigger the start of a new s-curve of continuous improvement.

4) *The theory should indicate a mechanism….that explains why the laws work as they do and how, and in which ways, the laws may be subject to limitations*

The closest mechanism we find for continuous improvement is in the more established methodologies such as lean and 6-sigma. However, these methodologies often do not explain how nor why the mechanisms work, nor are they underpinned with laws. The mechanism below is proposed as an initial basis for the development of a mechanism for continuous improvement. Further work is required to review if the proposed laws exist and, or if additional laws should be added. Once all laws have been defined, it will then be possible to review their to further develop the mechanism and understand its limitations

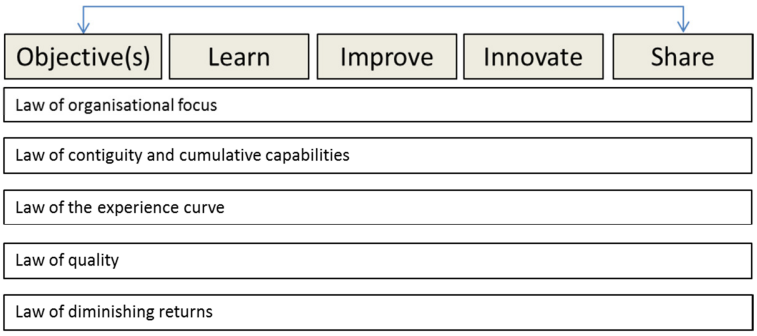

Figure 1 : Proposed mechanism for the theory of continuous improvement

5) *The more powerful the theory, the more likely it will unify various laws and also generate predictions or implications that can be tested with data.*

If anything, over time, continuous improvement has become less unified, leading to a wide range of different definitions, methodologies and implementation approaches. Although some researchers have attempted to measure (with data) the impact of continuous improvement, until the underlying laws can be unified, the debate will remain on what to measure, before the discussion moves on to how best to measure and test it. Only once the theory and laws are more established and understood, will it be possible to mathematically test the laws and use them to generate predictions

Conclusions

The review above indicates that there is currently no underlying theory of continuous improvement that meets the criteria for a good theory as defined by Schmenner and Swink (1998). In particular, the research finds considerable ambiguities with the term continuous improvement and a lack of underpinning laws.

The literature review also finds that research into the area of continuous improvement across the profit and not-for-profit sector is still in its early stages and certain specific research topics, such as learning and sharing continuous improvement ideas from the not-for-profit to the profit sector, have not been the subject of serious academic research.

This paper has made some preliminary attempts to address the gaps found, but further research is required to develop a more robust theory of continuous improvement that will serve to facilitate learning and innovation between the for-profit and the not-for-profit sectors.

Further research

The research carried out so far has generated ideas for a number of further research areas. In particular, further study is required to identify research that has been carried out that has tested the laws proposed here. Although no papers were found that specifically tested the laws, a more detailed review of the literature may identify papers that have reviewed the laws, perhaps using a different definition.

It is also believed that the development of a theory of continuous improvement cannot be created from a literature review only. Ideas and input from practitioners, particularly those in the not-for-profit sector, whose voice is less well represented in research so far, is required to develop the theory and underpinning laws.

°

References

Al-Tabbaa, O., Gadd, K., & Ankrah, S. (2013). Excellence models in the non-profit context: Strategies for Continuous Improvement. *International Journal of Quality & Reliability Management*, 30(5), 590-612.

Bacdayan, P. (2001). Quality improvement teams that stall due to poor project selection: an exploration of contributing factors. *Total Quality Management*

Bendell, T. (2006). A review and comparison of six sigma and the lean organisations. *The TQM magazine*, 18(3), 255-262.

Bessant, J., & Francis, D. (1999). Developing strategic continuous improvement capability. *International Journal of Operations & Production Management,* 19(11), 1106-1119.

Bessant, J., Caffyn, S., & Gallagher, M. (2001). An evolutionary model of continuous improvement behaviour. *Technovation*, 21(2), 67-77.

Bhuiyan, N., & Baghel, A. (2005). An overview of continuous improvement: from the past to the present. *Management Decision*, 43(5), 761-771.

Bond, T. C. (1999). The role of performance measurement in continuous improvement. *International Journal of Operations & Production Management,* 19(12), 1318-1334.

Bryson, J., Pajo, K., Ward, R., & Mallon, M. (2006). Learning at work: organisational affordances and individual engagement. *Journal of Workplace Learning*, 18(5), 279-297.

Caffyn, S. (1999). Development of a continuous improvement self-assessment tool. *International Journal of Operations & Production Management,* 19(11), 1138-1153.

Colledani, M., Ekvall, M., Lundholm, T., Moriggi, P., Polato, A., & Tolio, T. (2010). Analytical methods to support continuous improvements at Scania. *International Journal of Production Research*, 48(7), 1913-1945.

Dahlgaard, J. J., & Dahlgaard-Park, S. M. (2006). Lean production, six sigma quality, TQM and company culture. *The TQM magazine*, 18(3), 263-281.

Dahlgaard-Park, S. M. (2006). Learning from east to west and west to east. *The TQM Magazine*, 18(3), 216-237.

Deming Institute (2015). The Plan, Do, Study, Act (PDSA) Cycle. Retrieved (Jan 2015). https://www.deming.org/theman/theories/pdsacycle

Deming, W. E. (2000). The New Economics: For Industry, Government, Education. 2nd Edition. Cambridge, Mass. MIT press.

Fryer, K. J., Antony, J., & Douglas, A. (2007). Critical success factors of continuous improvement in the public sector: a literature review and some key findings. *The TQM Magazine*, 19(5), 497-517.

Fryer, K. J., Ogden, S., & Antony, J. (2013). Bessant's continuous improvement model: revisiting and revising. *International Journal of Public Sector Management*, 26(6), 4-4.

Fryer, K.J (2009) Continuous Improvement in the Public Sector. Published doctoral dissertation, Retrieved from Ethos, 12 Jan 2015, Order number : THESIS00988349

Grütter, A. W., Field, J. M., & Faull, N. H. (2002). Work team performance over time: three case studies of South African manufacturers. *Journal of Operations Management,* 20(5), 641-657.

Gupta, M. C., & Boyd, L. H. (2008). Theory of constraints: a theory for operations management. *International Journal of Operations & Production Management*, 28(10), 991-1012.

Holweg, M. (2007). The genealogy of lean production. *Journal of operations management*, 25(2), 420-437.

Imai Masaaki (1986). Kaizen: The key to Japan's competitive success. New York, ltd: McGraw-Hill.

Jørgensen, F., Boer, H., & Gertsen, F. (2003). Jump-starting continuous improvement through self-assessment. *International Journal of Operations & Production Management*, 23(10), 1260-1278.

Juran, J. M., & Riley, J. F. (1999). The quality improvement process. New York, NY: McGraw Hill.

Juran, J.M, & Godfrey, A. B. (1999). Quality Handbook. 5th Edition. New York. McGraw-Hill.

Kaye, M., & Anderson, R. (1999). Continuous improvement: the ten essential criteria. *International Journal of Quality & Reliability Management,* 16(5), 485-509.

Kim, S., & Nakhai, B. (2008). The dynamics of quality costs in continuous improvement. *International Journal of Quality & Reliability Management,* 25(8), 842-859.

Locke, E. A. (1976). The nature and causes of job satisfaction. *In Handbook of industrial and organizational psychology* (1990) Dunnette, MD; Hough, LM. Palo Alto, CA: Consulting Psychologists Press. (pp. 1319-1328).

Locke, E. A., & Jain, V. K. (1995). Organizational learning and continuous improvement. *International Journal of Organizational Analysis,* 3(1), 45-68.

Locke, L. F., Silverman, S. J., & Spirduso, W. W. (2009). *Reading and understanding research.* Sage.

Maletic, D., Maletic, M., & Gomišcek, B. (2012). The relationship between continuous improvement and maintenance performance. *Journal of Quality in Maintenance Engineering*, 18(1), 30-41.

Marin-Garcia, J. A., del Val, M. P., & Martín, T. B. (2008). Longitudinal study of the results of continuous improvement in an industrial company. *Team Performance Management*, 14(1/2), 56-69.

Mason-Jones, R., Naylor, B., & Towill, D. R. (2000). Lean, agile or leagile? Matching your supply chain to the marketplace. *International Journal of Production Research*, 38(17), 4061-4070.

Michela, J. L., Noori, H., & Jha, S. (1996). The dynamics of continuous improvement. *International Journal of Quality Science*, 1(1), 19-47.

Murray, P., & Chapman, R. (2003). From continuous improvement to organisational learning: developmental theory. *Learning Organization, The*, 10(5), 272-282.

Oakley, J. (1996). Communicating for competitive advantage: A continuous improvement model. *Journal of Communication Management,* 1(2), 169-173.

OED Online (2015). Oxford University Press, December 2014. Web. 2 January 2015. http://www.oed.com/

Putnik, G. D. (2012). Lean vs agile from an organizational sustainability, complexity and learning perspective. *Learning Organization*, *The*, 19(3), 176-182.

Savolainen, T. I. (1999). Cycles of continuous improvement: realizing competitive advantages through quality. *International Journal of Operations & Production Management*, 19(11), 1203-1222.

Schmenner, R. W., & Swink, M. L. (1998). On theory in operations management. *Journal of Operations Management*, 17(1), 97-113.

Singh, J., & Singh, H. (2013). Continuous Improvement Strategies: An Overview. *The IUP Journal of Operations Management*, 12(1), 32-57

Stone, K. B. (2012). Four decades of lean: a systematic literature review. *International Journal of Lean Six Sigma*, 3(2), 112-132.

Terziovski, M., & Sohal, A. S. (2000). The adoption of continuous improvement and innovation strategies in Australian manufacturing firms. *Technovation,* 20(10), 539-550.

Webster, A. (1999). Continuous improvement improved. *Work Study,* 48(4), 142-146.

Womack, J. P., Jones, D. T., & Roos, D. (1990). *The Machine that changed the world.*

Zangwill, W. I., & Kantor, P. B. (1998). Toward a theory of continuous improvement and the learning curve. *Management Science*, 44(7), 910-920.