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Citation: Leite, H., Bateman, N. & Radnor, Z. (2016). A classification model of the lean barriers and enablers: a case from Brazilian healthcare. Paper presented at the 23rd EurOMA Conference, 17-22 Jun 2016, Trondheim, Norway.

This is the accepted version of the paper.

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A classification model of the lean barriers and enablers: a case from Brazilian healthcare

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Abstract:

Lean is widely known as an approach to improve the process, reducing wastes and adding value to the customer. However, around 70% of the lean projects fail during its journey, this situation is related to barriers and enablers to implement lean projects. Thus, this paper aims to analyse and classify lean barriers and enablers into an organizational model. The methodology is based on systematic literature review as well as a case study. The paper presents a classification model into seven organizational aspects as well as propositions related to patient's behaviour and the public healthcare system.

Keywords: Lean barriers and enablers, organizational aspects, healthcare.

Introduction

Toyota started their production system philosophy in the mid 50's and lean became popularised with the book 'The Machine that Changed the World', and lean has been implemented in a great number of companies. The benefits of lean in manufacturing companies influenced the possibility to spread the philosophy in different sectors, principally across the services areas (Bowen and Youngdahl, 1998). These areas have implemented lean in different ways, and most of them have witnessed its benefits.

Regardless of the popularity and benefits of lean, there is a part of the literature that reports about the unsuccessful lean initiatives. Schipper and Swets (2010) present results from practitioners in their book confirming that the success rate of the lean implementation is around 30%. This low rate in successful lean implementations can be related to several hurdles faced during the lean journey, but also with the lack of some enablers to enhance the chances of succeed in terms of implementation and sustainability. Thus, some scholars have identified the barriers as well as the enablers which can help companies to understand the situation and overcome such difficulties (Bateman and Rich, 2003; Bhasin, 2012c; Radnor *et al.*, 2006).

The lean barriers and enablers have been studied for different researchers in diverse areas such as manufacturing, public service, healthcare, construction and education.

Analyzing outcomes from these research it is possible to find a common trend in generating lists of lean barriers and enablers (Hilton and Sohal 2012; Mostafa *et al.* 2013), which can be helpful for companies who want to embark into the lean journey.

Nevertheless, there is a relevant step in this process, which is to understand the routes and concentration of these barriers and enablers within the organizational structure. Thus, a classification of these barriers and enablers can bring an understanding about which area experiences the most impact during the lean journey. Understanding the impact of barriers and enablers within the organizational structure can support the senior leadership to dedicate the right resources and provide support for this areas in terms of ease these hinders.

This paper aims to undertake a comprehensive analysis of the barriers and enablers to implement lean, providing a classification of these barriers enablers considering elements of the organizational structure. The methodology carried out to achieve the paper's aim was a systematic literature review in academic articles as well as a case study in emergency areas to investigate new barriers.

Methodology

The methodology of this paper is based on a systematic literature review and case study, about the barriers and enablers to implement and sustained lean projects across the manufacturing and services areas. To access this secondary data, the researchers explored more than 115 academic and professional articles published from 1996 to 2015 in several databases, such as Science Direct, Emerald, Springer Link, Google Scholar and Taylor Francis Online, including others.

To access primary data, a case study within the emergency areas of the Brazilian healthcare system was undertaken. The data was based on 40 interviews with staff members and lean practitioners as well as 10 observations of the patient's pathway. Thematic analysis was carried out to analyze the data. This approach based on combination of primary and secondary data, support an understanding of the situation under investigation from theoretical and practical point of view.

Barriers and Enablers

There is no a unique recipe to implement lean and succeed, indeed every organization is different in terms of sector, product and service. Thus, a replication of another organization's lean process is a mistake, since lean is context dependent, and the cultures, organisational pressures and supporting infrastructures vary between companies (Bhasin, 2012b; Radnor and Osborne, 2012).

Understanding the hurdles to implement lean and identify the strengths to sustain the lean journey is crucial in order to succeed. The barriers and enablers to implement lean, which can constraint or support the philosophy to become a strong process improvement technique across the organization, were identified in different areas, such as public services (Radnor *et al.*, 2006), healthcare system (Brandao de Souza and Pidd, 2011), manufacturing (Bhasin, 2012a) and IT service sector (Kundu and Manohar, 2012), among others.

The barriers act inhibiting the lean journey across the organization, some examples are lack of communication, leadership resistance and resources shortage (Jadhav *et al.* 2014a; Radnor *et al.*, 2006). On the other hand, enablers act to support the implementation and sustaining the long-term process, some examples are strong organizational culture, management commitment and understanding as well as effective communication (Bateman and Rich, 2003; Malmbrandt and Ahlstrom, 2013). These barriers and enablers are often associated with specific functions within the

organization, for example, lack of training (human resources) or scarce budget (finance). Thus, a classification of those barriers and enablers can bring an understanding about their impact in cultural and technical aspects, supporting top managers to make the right decision during lean implementation.

Organizational Elements

There are a considerable number of barriers and enablers reported by different authors (Hilton and Sohal 2012; Mostafa *et al.* 2013), it consolidates into a large list from different areas but without a classification in terms of organizational aspects.

As a tentative approach to bring a new understanding about the classification of lean barriers and enablers within the organization, this paper adapts the 'Lean Iceberg Model' (Figure 1) developed by Hines *et al.* (2008). It addresses the five original elements presented by the authors' model, but also it includes two new elements that will support this classification. The elements are classified in technical and cultural aspects, where strategy and alignment, leadership and behavior are defined as cultural aspects; and processes, technology, training and resources are related to technical aspects. The elements training and resources are not part of the original model, but they were included to reflect findings from the literature and provide a broad classification of the lean barriers and enablers.

In the original model Hines *et al.* (2008) present the technical and cultural aspects with focus on enablers for lean implementation, however the literature reviewed (Bateman and Rich, 2003; Brandao de Souza and Pidd, 2011; Radnor and Walley, 2008) showed that these aspects are also related to barriers. Thus, it is relevant an analysis and classification of the lean enablers and barriers considering those elements first proposed by Hines *et al.* (2008), but also including the two new elements, training and resources as part of a comprehensive model. The adoption of this model to classify the barriers and enablers is justified due the ability of these elements in covering the technical and cultural aspects of the organization.

Each of the elements within the organizational aspects, will be explained and justified in order to provide a suitable understanding of their relevance for this classification model of barriers and enablers to implement and sustain lean.

Technical Aspects

Technical aspects are less related to human aspects, and rely on support for the organization during the lean implementation. This support can be in terms of lean tools, technology to facilitate process or overcome barriers and performance control, among others. There are four technical organization elements to be addressed in terms of technical aspects, they are processes, technology and tools, training as well as resources.

Processes

Process is about the company's core activities, how they perform them and manage the relationship with their partners. Aspects that are important to consider when looking to a business process, is to understand what process is the key for the business and how to design and improve the key processes to delivery value to the customer (Hines *et al.* 2008).

There are a variety of barriers and enablers encountered within the processes, some examples are related to lack of focus on customer and process (Radnor, 2010a) or establishment of a strong supplier partnership (Bortolotti *et al.*, 2015).

Technology and Tools

Lean implementation is not only the application of a set of tools and techniques, and approaches that have this view are misunderstanding the nature of the philosophy (Boyer and Sovilla, 2003). However, the lean implementation is dependent of specific tools and technologies in order to achieve sustainable implementation.

In terms of technology and tools acting as barriers and enablers, the literature revealed several of them, such as adequate IT support, lack of methodology and technological challenges (Bhasin, 2012c).

New Elements Within the Classification Model

The original model designed by Hines *et al.* (2008) does not consider the elements training and resources as part of the model (Figure 2). However, the majority of the literature in this field depicts about barriers and enablers connected with those elements (Bateman and Rich, 2003; Bhasin, 2012a; Marodin and Saurin (2015). Adding such elements will provide a comprehensive classification model from barriers and enablers.

Training

During the process of literature review, several papers indicated hinders related to lack of technical knowledge and skills to guide lean implementation (Lean Enterprise Institute, 2007; Marodin and Saurin, 2015). This situation has a relevant impact in the lean journey, mainly because organizations that do not know how to use the lean concept will face constraints to implement and sustain the lean system (Wendel and Abdulhalim, 2014). There are relevant enablers related to training elements, for example, but not limited to, training culture, multitasking and self development (Radnor, 2010a).

Resources

The lean journey is dependent of resources, these are basically related to human and financial resources. To promote the lean implementation and achieve the benefits that lean can bring, it is necessary to provide the right resources, such as financial investment, material, training, human resources, such as people's time.

To provide an example of the barriers related to resources, the Canadian Manufactures and Exporters (2006) carried out a survey with manufacturing companies and it showed that lack of time for human resource and finance are obstacles to effective lean implementation. In other words, if these resources are available during the lean transformation they will have an opposite effect acting as enablers.

Cultural aspects

After years of lean implementations in different areas, there is an understanding that lean is a journey that takes time and requires change in behaviour. People need time to engage with and embed ideas (Radnor, 2010b; Radnor and Walley, 2008). In this lean journey, the human aspects play essential role and it has high dependent of the cultural aspects such as strategy, leadership and behaviour.

Strategy and Alignment

All elements are important, but strategy and alignment of the organization can be considered crucial for a successful lean implementation and sustainability. It is the foundation of the organization, and a well-defined vision and purpose are part of a strong strategy and alignment, thus failures in provide the correct strategy and alignment will rely in barriers that will hinder lean implementation, such as lack of understanding about lean as a direction (Karlsson and Åhlström, 1996).

Leadership

The leadership is the organizational aspect that leads the lean transformation across the organization. Hines *et al.* (2008) argue that many organizations possess managers and supervisors but do not have leaders who have a guiding vision, passion and integrity to lead changes and focus on people.

In order to achieve successful lean implementation and avoid pitfalls, the leadership team that includes executives, middle managers and shop floor leaders have to be consistent with the lean values, keeping the long-term vision. The literature reveals that leadership can be the strength of the lean journeys, but also the reason of its failure (Bhasin, 2012a; Brandao de Souza and Pidd, 2011; Radnor *et al.*, 2006).

Behaviour and Engagement

This element addresses the people's behaviour and company's culture, which will rely on the organization engagement. It is essential to have people and company's engagement, as this can help to anticipate problems as well as create enablers for success (Hines *et al.*, 2008).

The strong part of this element relies on aspects related to culture which will influence people's behaviour. Some barriers, found about this element, are related to backsliding to old ways of doing and convincing staff that lean can work, for example in healthcare (Canadian Manufactures and Exporters, 2006; Kim *et al.* 2007). The enablers are related to a culture that creates the involvement of everyone in the organization (Radnor and Walley, 2008).

Results

The literature reviewed shows that there are several types of barriers and enablers to implement and sustain lean. Most of the authors have presented similar lists of these barriers and enablers, however synthesizing a classification of those barriers and enablers within the organizational literature is still a challenge.

In this paper 115 articles were analyzed, generating considerable data, in the form of long lists of barriers and enablers, many of which had a considerable overlap. Thereby, as an attempt to classify this information and provide an example of how this can be part of a model, table 1 depicts these barriers and enablers organized within organizational elements. It is important to highlight that due table size constraints, only three examples per element were presented.

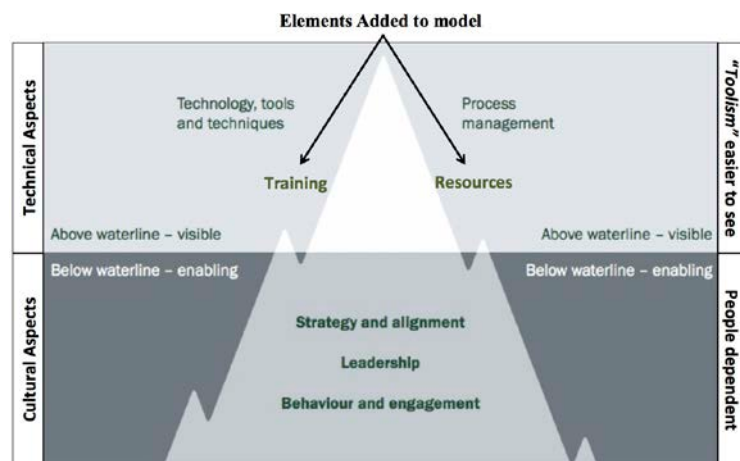


Figure 1. Lean Iceberg Model (Adapted from Hines *et al.*, 2008)

After an analysis of the papers content a list with more than 650 enablers and barriers has been created, most of them similar with slight differences in definition. An analysis within this list has revealed that 31% of the findings were related to enablers and 69% to barriers. These findings are classified in cultural and technical aspects. The cultural aspects have the major impact within the literature reviewed, representing 64% of the barriers and 62% of the enablers found. On the other hand, technical aspects are less representative, with 38% of the barriers and 36% of the enablers found.

This concentration of barriers and enablers in cultural aspects can be justified analyzing the adapted lean iceberg model (Figure 1). It shows that cultural aspects are difficult to see as they are above the waterline, these are issues that people have difficult to understand and see, especially because the intangibility of this aspect. On the other hand, the technical aspects can be considered easier to deal with, they are more related to visible and tangible issues that are above the waterline. This can be defined as a trend of “*toolism*” during the lean journey, where it is easier to tackle problems related to technical aspects, as they are visible and less difficult to solve.

Table 1 – Organizational Barriers and Enablers

Organizational Elements	Barriers	Enablers	Sources	
Technical Aspects	Processes	Demand uncertainty	Infrastructural elements	Doolen and Hacker (2005); Malmbrandt and Ahlstrom (2013)
		Supply chain characteristics	Matching demand and capacity levels	Al-Balushi (2014); Portioli-Staudacher and Tantardini (2012)
		Weak supplier performance	Continuous improvement	Bortolotti <i>et al.</i> (2015); Zimmermann and Bollbach (2015)
	Technology and Tools	Lack of lean experience	Visual information management system	Marodin and Saurin (2015); Wahab <i>et al.</i> 2013
		Lean terminology	Measures and measurement systems	Bateman and Rich (2003); Brandao de Souza and Pidd (2011)
		Lack of consultants in the field	Process investigation VSM	Andersen and Røvik (2015); Mostafa <i>et al.</i> (2013)
	Training	Lack of lean understanding	Training culture	Hilton and Sohal (2012); Bhasin (2013)
		Lack of people development	Personnel training and involvement in lean principles and methods	Al-Balushi (2014); Poksinska (2010)
		Insufficient workforce implementation skills	Understanding of the lean tools	Bhasin (2012a); Mostafa <i>et al.</i> (2013)
	Resources	Lack of human resources	Dedicates full time resources for lean	Marodin and Saurin (2015); Sisson and Elshennawy (2015)
		Financial resources constraints	Availability of resources	Bateman and Rich (2003); Radnor <i>et al.</i> (2006)
		Lack of time	Resources and capabilities	Mirzaei (2011); Pedersen and Rahbek (2011)
Cultural Aspects	Strategy and Alignment	Poor Communication	Clear communication	Lucey <i>et al.</i> (2005); Radnor <i>et al.</i> (2006)
		Lack of strategy perspective	Clarity of vision	Bhasin (2013); Hines <i>et al.</i> (2008)
		Lean viewed as a Fad	Involvement of all parties (ownership)	Bhasin (2012c); Lean Enterprise Institute (2007)
	Leadership	The lack of leadership team involvement	Top management support	Emiliani and Stec (2005); Massey and Williams (2005)
		lack of employees empowerment	Leadership empowering the workforce	Dickson <i>et al.</i> (2009); Papadopoulou and Ozbayrak (2005)
		Managerial Style	Management commitment (buy-in)	Portioli-Staudacher and Tantardini (2012); Radnor <i>et al.</i> (2006)
	Behaviour and Engagement	Lack of engagement	A culture that creates people involvement	Radnor and Walley (2008); Sisson and Elshennawy (2015)
		Resistance to change	Improvement Culture	Albliwi <i>et al.</i> (2014); Dombrowski and Mielke (2014)
		Organizational Culture and structure	Employee commitment (buy-in)	Malmbrandt and Ahlstrom (2013); Radnor and Boaden (2008)

Within the cultural and technical aspects, seven organizational elements, which impact the lean journey were identified. According to results from the papers reviewed (Figure 2), the concentration of lean barriers and enablers within the cultural aspects is

associated with strategy and alignment elements with 27% and 31%, followed by behaviour and engagement with 24% and 18%. On the other hand, the lean barriers and enablers within the technical aspects have concentration in processes elements with 15% and 8%, followed by training and technology.

These findings can be connected to the iceberg model and the “*toolism*” tendency, as the majority of barriers and enablers identified are below the waterline. This represents relevant intangible barriers and enablers related to cultural aspects with people dependent. This situation is more difficult to manage and overcome, mainly because is something that cannot be easily seen. Regardless of the concentration of barriers and enablers in cultural aspects, all elements are relevant, there is no element that has a lower priority. It is important to highlight that training and resources were added to the original iceberg model, because their addition provides a more comprehensive classification model of barriers and enablers.

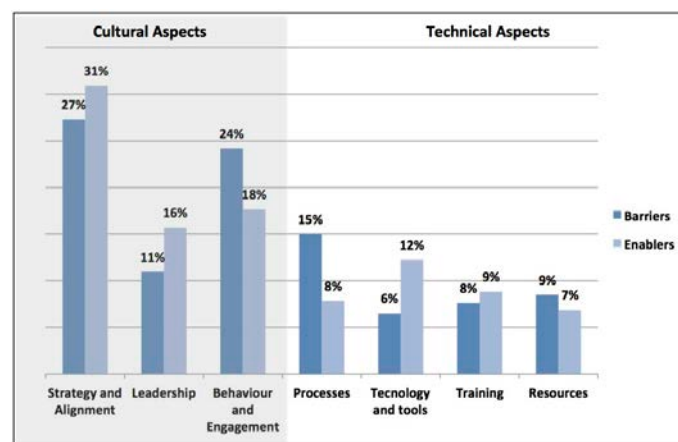


Figure 2 – Frequency From Literature for Each Type of Barriers and Enablers

In terms of areas that concentrate the barriers and enablers, the analysis revealed that 56% come from the manufacturing area, where lean was first implemented. The services area represents 44% of the barriers and enablers encountered.

Case Study Results

Over two months the authors investigated the main barriers to implement lean within the emergency areas of the Brazilian public healthcare system. In order to identify causes for the main problems and possible hurdles for the lean implementation, interviews with staff members and patients were carried out in an emergency care unit (ECU) and an emergency department (ED), in addition patients were observed during their journey in these emergency facilities. Moreover, five well-known practitioners in the lean healthcare field were interviewed to access their point of view about the challenges in this area.

The results from the data collected revealed two different situations about barriers to implement lean. Firstly, was the confirmation of the barriers that are already well known in the literature, such lack of leadership, resources, training, direction and strategy, among others. These and other barriers were classified as cultural and technical aspects within the iceberg model (Figure 1). Secondly, was about new barriers that have not been entirely discussed within the related literature. These barriers are related to patients' behavior and public healthcare system model.

The barriers related to patients' behavior are related to the presence of non-urgent patients in emergency areas, which creates a massive demand for assistance and bottlenecks in parts of the patient pathway. One of the patients said '*why do I have to go to my basic healthcare unit (similar to GP) if I will not see the doctor today? I know that I will have to wait 5 hours in the ECU, but at least I will see the doctor today*'. During the interview with doctors and nurses they said that almost 80% of the patients in the ECU are not urgent and should go to basic healthcare units. Furthermore, there is a cultural misunderstanding that these units can issue sick notes to justify work absence for everyone, no matter how meagre the cause. A doctor has reported that on Monday and Tuesday the ECUs and EDs are overcrowded, and sometimes 80% of the cases are minor situations such as headaches, sore throats or even nothing. According to the doctor interviewed, the problem to improve the service is related to these people's behavior, because they create increased demand and increase the waiting times in the queue for people that really need care assistance.

The model that the public healthcare system operates also creates problems that constrain attempts to standardize and improve the process, for example, but not limited to, difficulties to access basic units. Such difficulty can be understood, as people that have to wait days or weeks to see a GP, as a consequence, patients just try to find healthcare assistance more immediately in ECUs or EDs, creating an unpredictable demand and long waiting times. There are situations where the patient does not know the difference between basic units and emergency areas, and just choose the one that is more convenient. Nurses and doctors suggested that the communication process with population has failed and it is important to act to educate people to use the right service, otherwise improvements in this system will never work.

It is important to highlight that these barriers related to the patients' behavior and the model that the healthcare system operates can be classified as cultural aspects in the iceberg model (Figure 1).

Closing Remarks

The lean thinking had become popular across both manufacturing and service areas and its benefits can be substantial. Paradoxically the success rates of lean implementation are notably low, nearly two-thirds of the lean implementations results in failures and less than one-fifth of those implemented have sustained results (Bhasin and Bucher, 2006). This issue might be associated to some hurdles faced during the lean journey, but also the lack of some enablers. Thus, understand the barriers and enablers in the organizational context becomes crucial to increase the success rates of lean initiatives.

This paper addressed the organizational classification of lean barriers and enablers in cultural and technical aspects. These barriers and enablers constraint or support the philosophy to become a strong process improvement technique across the organization. In order to provide a suitable understanding about these barriers and enablers, they were classified in seven organizational elements in terms of cultural and technical aspects, using an adaptation of the 'lean iceberg model' first developed by Hines *et al.* (2008). The three cultural aspects are behaviour and engagement, strategy and alignment and leadership, and the four technical aspects are training, resources, process and technology and tools (Table 1).

According to Hines *et al.* (2008) the elements in the iceberg model are all interdependent, thereby addressing all of these elements is essential in order to deliver a successful, sustainable lean transformation. Whilst adding the two new elements training and resources generated a comprehensive model, tackling different enablers as well as barriers to implement lean.

The barriers and enablers related to cultural aspects are demonstrated to be the most influential during the lean journey, organizational elements, such as strategy and alignment followed by behaviour and engagement have a relevant function during the lean journey. These aspects are related to people dependency and are more difficult to be identified and overcome. On the other hand, the technical aspects follow the 'toolism' trend, where it is easier to identify and tackle problems related to process, tools, training and resources. However organizations that rely only in 'toolism' practices to implement lean will find difficult to sustain the improvement, because lean is a long-term philosophy and the engagement with cultural aspects is crucial for its success.

Within the literature in most of the cases there is no clear separation from barriers and enablers in lean implementation, some authors address both simultaneously in their papers. However the logical explanation for this situation relies in the relationship of these two elements. One is pointed as cause of problems (barriers) and the other (enablers) is indicated as countermeasure in terms of how to overcome these hurdles. This emerges in a logical way, for example, the lack of training is a barrier, and thereby providing an effective training programme is an enabler to implement lean.

The case study outcomes confirmed established barriers that constraint the lean implementation, such as lack of leadership, resources, training, direction and strategy, these barriers are well stated for different authors (Bateman and Rich, 2003; Radnor, *et al.* 2006; Bhasin, 2013). However, the major contribution of this empirical study relies in two new barriers from patient's behaviour and public health system. These results show that there is a high influence in the patients' behaviour, which might constraint initiatives of improvements across the system. A related situation is about the way that the public system operates, encouraging the demand for one area to move to another without a suitable solution, creating long waiting time and poor service.

Overall, the paper's outcomes highlight relevant propositions to be investigated in the future:

Proposition 1: Sustainability can be achieved by overcoming the 'toolism' trend, instead focusing on both cultural and technical aspects during the lean implementation, rather than only on areas that lean tools are more 'easily' implemented.

Proposition 2: there is need to further understand how to overcome the barriers related to patients' behavior and the public healthcare system. There are cases in the literature about how staff members can affect the lean implementation, however approaches that analyze how patients influence the improvement of process still scarce. Difficulties to implement lean in public systems have been discussed by some scholars, however further analysis of this issue in developing countries is needed.

The understanding of organizational barriers and enablers to implement lean in different areas, might contribute to increase success rates in the lean journey.

References

- Andersen, H., Røvik, K. A., & Ingebrigtsen, T. (2014). Lean thinking in hospitals: is there a cure for the absence of evidence? A systematic review of reviews. *BMJ open*, 4(1), e003873.
- Andersen, H., & Røvik, K. A. (2015). Lost in translation: a case-study of the travel of lean thinking in a hospital. *BMC health services research*, 15(1), 401.
- Bateman, N. and Rich, N. (2003). Companies' perceptions of inhibitors and enablers for process improvement activities. *International Journal of Operations & Production Management*, 23(2).
- Bateman, N., Hines, P., & Davidson, P. (2014). Wider applications for Lean: An examination of the fundamental principles within public sector organisations. *International Journal of Productivity and Performance Management*, 63(5), 550-568.
- Bhasin, S. (2012c). An appropriate change strategy for lean success. *Management Decision*, 50(3), 439
- Bhasin, S. (2012b). Performance of Lean in large organisations. *Journal of Manufacturing Systems*,

- Bhasin, S. (2012a). Prominent obstacles to lean. *International Journal of Productivity and Performance Management*, 61(4), 403-425.
- Boyer, M., & Sovilla, L. (2003). How to identify and remove the barriers for a successful lean implementation. *Journal of Ship Production*, 19(2), 116-120.
- Bhasin, S. (2013). Analysis of whether Lean is viewed as an ideology by British organizations. *Journal of Manufacturing Technology Management*, 24(4), 536-554.
- Bhasin, S., & Burcher, P. (2006). Lean viewed as a philosophy. *Journal of manufacturing technology management*, 17(1), 56-72.
- Bortolotti, T., Boscari, S., & Danese, P. (2015). Successful lean implementation: Organizational culture and soft lean practices. *International Journal of Production Economics*, 160, 182-201.
- Bowen, D.E., Youngdahl, W. E. (1998), "Lean" Service: in defense of a production-line approach", *International Journal of Service Industry Management*, Vol. 9 No 3, 1998, pp 207-225.
- Brandao de Souza, L. and Pidd, M. 2011. Exploring the Barriers to Lean Healthcare Implementation. *Public Money and Management*, 31:1, 59-66.
- Canadian Manufactures and exporters (2006) accessed in 10/10/15 <http://www.grantthornton.ca>
- Doolen, T. L., & Hacker, M. E. (2005). A review of lean assessment in organizations: an exploratory study of lean practices by electronics manufacturers. *Journal of Manufacturing systems*, 24(1), 55-67.
- Dombrowski, U., & Mielke, T. (2014). Lean Leadership—15 Rules for a Sustainable Lean Implementation. *Procedia CIRP*, 17, 565-570.
- Hilton, R. J., & Sohal, A. (2012). A conceptual model for the successful deployment of Lean Six Sigma. *International Journal of Quality & Reliability Management*, 29(1), 54-70.
- Hines, P., Found, P., Griffiths, G., & Harrison, R. (2008). *Staying Lean: thriving, not just surviving*. CRC
- Jadhav, J. R, Mantha, S. S., & Rane, S. B (2014). Exploring barriers in lean implementation. *International Journal of Lean Six Sigma*, 5(2), 122-148.
- Karlsson, C., & Åhlström, P. (1996). Assessing changes towards lean production. *International Journal of Operations & Production Management*, 16(2), 24-41.
- Kundu, G., & Manohar, B. M. (2012). Critical success factors for implementing lean practices in it support services. *International Journal for Quality research*, 6(4), 301-312.
- Lean Enterprise Institute (2007). Middle Managers are Biggest Obstacle to Lean Enterprise. <http://www.lean.org/WhoWeAre/NewsArticleDocuments> (accessed at 10 February 2015).
- Lucey, J., Bateman, N., & Hines, P. (2005). Why major lean transitions have not been sustained. *Management Services*, 49(2), 9-13.
- Malmbrandt, M., & Åhlström, P. (2013). An instrument for assessing lean service adoption. *International Journal of Operations & Production Management*, 33(9), 1131-1165.
- Marodin, G. A., & Saurin, T. A. (2015). Classification and relationships between risks that affect lean production implementation: a study in Southern Brazil. *Journal of Manufacturing Technology Management*, 26(1).
- Massey, L., & Williams, S. (2005). CANDO: implementing change in an NHS Trust. *International Journal of Public Sector Management*, 18(4), 330-349.
- Mirzaei, P. (2011). Lean production: introduction and implementation barriers with SMEs in Sweden.
- Mostafa, S., Dumrak, J., & Soltan, H. (2013). A framework for lean manufacturing implementation. *Production & Manufacturing Research*, 1(1), 44-64.
- Portioli-Staudacher, A., & Tantardini, M. (2012). Investigating the main problems in implementing Lean in supply chains of service companies. *International Journal of Services and Operations Management*, 11(1), 87-106.
- Radnor, Z. J., Walley, P., Stephens, A. and Bucci, G. (2006), Evaluation of the Lean Approach to Business Management and its Use in the Public Sector, Government Social Research, Edinburgh.
- Radnor, Z. and Walley, P. (2006), Lean on me... *Public Finance* (28 July–3 August), pp. 16–19.
- Radnor, Z., & Walley, P. (2008). Learning to walk before we try to run: adapting lean for the public sector. *Public money and management*, 28(1), 13-20.
- Radnor, Z., & Boaden, R. (2008). Editorial: Lean in public services—panacea or paradox?.
- Radnor, Z. J. (2010a). *Review of business process improvement methodologies in public services*. AIM
- Radnor, Z. (2010b). Transferring lean into government. *Journal of Manufacturing Technology Management*, 21(3), 411-428.
- Radnor, Z. J., Osborne, S. (2012), Lean: A Failed Theory for Public Services?, *Public Management Review*, DOI 10.1080/14719037.2012.748820.
- Sisson, J., & Elshennawy, A. (2015). Achieving success with Lean: an analysis of key factors in Lean transformation at Toyota and beyond. *International Journal of Lean Six Sigma*, 6(3), 263-280.
- Schipper, T., & Swets, M. (2012). *Innovative lean development: how to create, implement and maintain a learning culture using fast learning cycles*. CRC Press.