

Awareness, Implementation, Effectiveness and Future Adoption of Operational Improvement Initiatives: Survey Results

Musli Mohammad, Noor Hamizah Yaakub, Mohd Shahir Yahya
Department of Manufacturing and Industrial Engineering,
Faculty of Mechanical and Manufacturing Engineering,
Universiti Tun Hussein Onn Malaysia (UTHM), Batu Pahat, Johor
mmusli@uthm.edu.my, noorhamizahyaakub@gmail.com, shahir@uthm.edu.my

Nor Aziati Abdul Hamid
Department of Production and Operations Management,
Faculty of Technology Management and Business,
Universiti Tun Hussein Onn Malaysia (UTHM), Batu Pahat, Johor
aziati@uthm.edu.my

Abstract — This paper presents results from a survey on awareness, implementation, perceived effectiveness, and potential future adoption of seven operational improvement initiatives based on Malaysia context. Seven improvement initiatives being studied include: Lean, Organizational Assessment based on Business Excellence Model, Quality Management System, Improvement Team, Outsourcing, Business Continuity Management and Six Sigma. This study was conducted due to lack of existing studies on current status of awareness, implementation, effectiveness, and future adoption of improvement initiatives in Malaysia. Questionnaires were distributed to 107 practitioners, managers, executives, consultants and/or academicians who have been involved in the selection and/or implementation of improvement initiatives, which resulted in a response rate of 37.4%. Subsequently, the data were analyzed using the IBM SPSS software package. The findings of study indicated that Quality Management System has been the most popular initiative in term of awareness and implementation. Lean has been ranked as the most effective initiative. Meanwhile, improvement team has been ranked as the most wanted initiative for future adoption. The findings of study have also shown that there are no significant differences between manufacturing and service organizations with regard to the awareness, implementation, effectiveness, and future adoption for the majority of improvement initiatives.

Keywords - Operational improvement initiatives; Malaysia organizations; Lean; Quality Management System, Business Excellence Model; Improvement Team; Outsourcing; Business Continuity Management; Six Sigma.

I. INTRODUCTION

There are numerous operational improvement initiatives currently available in the market and the numbers of initiatives are increasing year by year [1, 2]. The “operational improvement initiatives” include the approaches, management systems, tools and techniques such as Lean, Organizational Assessment Based on Business Excellence Model (BEM), Improvement Team, Business Continuity Management, Quality Management System, Outsourcing, and Six Sigma. The adoption of improvement initiatives requires time, financial, resources, information, knowledge and support from top management [2]. Each improvement initiative has its own purpose, strengths and limitations [2, 3]. In order to reap the benefit of implementing improvement initiatives, it is important for organizations to understand when, where and how to implement the initiative [2]. There have been several studies carried out to investigate the trend, awareness, implementation, effectiveness, and/or future adoption of improvement initiatives, which include Mann, Abbas and Kohl [4]; Tickle, Adebajo, Mann and Ojadi [5]; Rigby and Bilodeau [6]; Rigby and Bilodeau [7]; and Cullen, O'Connor and Mangan [8]. Mann, Abbas and Kohl [4] and Tickle, Adebajo, Mann and Ojadi [5] reported the findings from a global survey on business improvement tools conducted in year 2008 involving 44 different countries. Rigby and Bilodeau [6] and Rigby and Bilodeau [7] discussed the management tools and techniques trends based on global survey conducted in year 2011 and 2007. Cullen, O'Connor and Mangan [8] explained

The authors would like to thank Universiti Tun Hussein Onn Malaysia (UTHM) for funding this project under Multi Disciplinary Research Grant (Vot. U092).

the study on management tools and techniques conducted in Ireland. Unfortunately, very limited studies have been found focusing on Malaysia context. In order to assist organizations in selecting appropriate improvement initiative, this study aims to investigate current status of awareness, implementation, effectiveness, and future adoption of seven main operational improvement initiatives, as well as compare the differences between manufacturing and service organizations.

II. OPERATIONAL IMPROVEMENT INITIATIVES

Operations can be defined as “the activity of managing the resources and processes that produce products and services” [9]. ‘Operations’ is one of the main categories of Baldrige Excellence Framework [10]. The Baldrige Excellence Framework is one of the most prominent and widely used Business Excellence Framework worldwide [11]. ‘Operations’ category under Baldrige Excellence Framework addresses how the organization designs, manages, improves and innovates the products and the work processes and improves operational effectiveness to deliver customer value and achieve ongoing organizational success [10].

‘Operational improvement initiatives’ in the present context refer to approaches, management systems, techniques or tools that can be used to improve operations and processes. Mohammad [2] listed 28 improvement initiatives that can be used to improve operations and processes based on a global survey and interviews conducted in New Zealand, Singapore and Malaysia. Meanwhile, Lily [12] listed 21 operational improvement initiatives based on her study in Malaysia. Referring to operational improvement initiatives proposed by Mohammad [2] and Lily [12], a pilot study had been conducted involving Malaysia Productivity Corporation (MPC) consultants in year 2015. Based on the pilot study, seven main operational improvement initiatives have been identified, which include: (1) Lean, (2) Organizational Assessment based on Business Excellence Model, (3) Quality Management System, (4) Improvement Team, (5) Outsourcing, (6) Business Continuity Management and (7) Six Sigma. Table I presents brief description of the seven main operational improvement initiatives.

TABLE I. BRIEF DESCRIPTION OF THE MAIN OPERATIONAL IMPROVEMENT INITIATIVES

No	Operational improvement initiatives	Brief description
1	Lean	Improvement approach that focuses on removing waste and improving flow [13]. It requires a very clear focus on the value element of all products and services and a thorough understanding of the detailed operations of the business processes [14]. The example of tools and techniques used are Kanban, Value Stream Mapping, Takt Time, and visual control [15].
2	Improvement Team (including Innovative and Creative Circle)	A team that is forms to make improvement on the workplace and/or process. It can comprise members of a single department, be cross-functional, and include representatives of either or both customers and supplier. Membership can be voluntary or mandatory [16].
3	Business Continuity Management (BCM)	An initiative that provides the availability of processes and resources in order to ensure the continued achievement of critical objectives as well as prevent an emerging crisis from becoming an organizational and personal disaster. It involves risk identification and assessment, business impact assessment and analysis, development of business continuity plan, training and testing of business continuity plan [17].
4	Quality Management System (QMS)	A management system to direct and control an organization with regard to quality [18]. It includes a quality policy, quality manual, quality objectives, procedures, records and/or compliance to quality standards, such as ISO9000, ISO/TS16949, ISO 13485 and ISO/TS 29001 [19].
5	Organizational Assessment based on Business Excellence Model	A comprehensive, systematic and regular review of an organization’s activities and results referenced against the Business Excellence Model, such as Malaysia Business Excellence Framework, Baldrige Excellence Framework and EFQM Excellence Award [20]. Organizational assessment can be conducted internally (self-assessment) or by external parties (e.g. for quality/ Business Excellence Award etc.). Business Excellence Model is a Total

		Quality Management Model [11].
6	Six Sigma	A business improvement approach that seeks to reduce variation and eliminate causes of defects / errors in processes by focusing on outputs that are critical to customers and a clear financial return for the organization [21]. Examples of tools and techniques used are Measurement System Analysis, Design of Experiments, Kano Analysis, Process Mapping, Failure Mode and Effect Analysis, and Robust Design [15, 22].
7	Outsourcing	A company uses third parties to perform noncore business processes and activities. Contracting third parties enables a company to focus its efforts on its core competencies. Many companies find that outsourcing reduces cost and improves performance of the activity [23].

III. RESEARCH DESIGN AND METHODOLOGY

Survey was used to collect data for this research. The objectives of the survey are to investigate the level of awareness, implementation, effectiveness and future adoption of seven main operational improvement initiatives, as well as to compare the differences between manufacturing and service organizations. The overall research procedures involved the following activities: conducting an extensive literature review; developing the draft of the questionnaire; conducting pilot study; conducting full survey; and analyzing data based on feedback from the survey.

Self-administered questionnaire was selected as the survey instrument. The questionnaire was adapted from Mann [24]. The questionnaire consists of two sections which are demographic of respondents and opinions on the level of awareness, implementation, effectiveness, and future adoption of the seven main operational improvement initiatives. Table II summarizes the details of all sections in the questionnaire.

TABLE II. DETAILS OF SECTIONS IN THE QUESTIONNAIRE

Section	Content	Data Categories
1	Duration of years the respondents have been involved in the area related to quality, productivity and/or operational improvement.	Nominal
	Position of respondents in the organization	Nominal
	Major business activity of the respondents' organization	Nominal
	Whether the respondents' organization had won any BE / quality award(s)	Multiple choice (Yes/ No)
2	Level of awareness of seven main operational improvement initiatives	Likert Scale (0 = Don't Know, 1 = Very Low, 2 = Low, 3 = Moderate, 4 = High, 5 = Very High)
	Implementation of seven main operational improvement initiatives	Multiple choice (Yes/ No)
	Level of effectiveness of seven main operational improvement initiatives	Likert Scale (0 = Don't Know, 1 = Very Low, 2 = Low, 3 = Moderate, 4 = High, 5 = Very High)
	Future adoption of the seven main operational improvement initiatives	Multiple choice (Yes/ No)

Questionnaires were distributed to 107 practitioners, managers, executives, consultants and/or academicians who have been involved in the selection and/or implementation of improvement initiatives. The questionnaires were distributed using

hardcopy and Google form. Initially, three questionnaires (hardcopy) were distributed during Business Excellence CEO Forum on 8th of September 2015. This forum was organized by Malaysian Productivity Corporation. Subsequently, the questionnaires were sent as on-line survey using Google form. On-line survey is more user friendly as the respondents could use their computer or smart phone at their convenient time to answer the questionnaire.

For reliability analysis, Cronbach's alpha model that measure internal consistency was performed using Statistical Package for Social Science (SPSS) software version 22. An internal consistency analysis was used to assess the reliability of questionnaire. The measurement of internal consistency involves the calculation of Cronbach's coefficient alpha [25]. The values of alpha range from 0 to 1, where the values close to 1 indicate higher reliability. Meanwhile, alpha values greater than 0.7 are considered acceptable for testing the reliability of factors [26]. The alpha value of this instrument is 0.848. Since the alpha value is greater than 0.7, therefore all scale are acceptable. From this result, it can be concluded that this instrument is reliable.

IV. RESULTS AND DISCUSSION

This section presents the overall result of this study. It begins with explanation on the profile of the respondents. Then it is followed with the status of the seven main operational improvement initiatives in terms of the level of awareness, implementation, effectiveness and future adoption. This section also discusses comparisons between manufacturing and service organizations.

A. *Profile of the Respondents*

Based on the total of 107 respondents, 40 respondents have completed the questionnaire, which represent 37.4 % response rate. Most of the respondents have 7 years or more experience related to the quality, productivity or operational improvement initiatives which yielded 80% from the total respondents and followed by 5 to 6 years experiences (12.5 %). Meanwhile, 3 to 4 years of experience and 1 to 2 years is 5% and 2.5% respectively. In term of position in the organization, half of the respondents are General Manager, Senior Manager, Manager, or Assistant Manager, which comprises of 52% from the total respondents. The rest of them are the Chief Executive Officer, Director, President or Vice President (18 %); Executive or Engineer (15%); Supervisor or Team Leader (5%); Specialist or Consultant (5%) and others (5 %). Majority of the respondents worked with the service sector (57.5% from the total respondents). Respondents from manufacturing sector are only 42.5%. Half of the respondents stated that their company has won business excellence / quality award.

B. *Status of Operational Improvement Initiatives in terms of Level of Awareness, Implementation, Perceived Effectiveness and Potential Future Adoption*

In the questionnaire, respondents were asked to rate their level of awareness and perceived effectiveness for operational improvement initiatives on a scale of don't know (0), very low (1), low (2), moderate (3), high (4) and very high (5). Respondents were also asked to answer 'Yes' or 'No' to indicate the status of the implementation and potential future adoption of the operational improvement initiatives. Level of the awareness, implementation, perceived effectiveness and potential future adoption of seven improvement initiatives were analyzed and the initiatives are ranked based on the mean value or percentage of 'Yes'. Figure 1 shows the awareness level of operational improvement initiatives based from Malaysia perspective. Quality Management System has reported being the highest ranking with mean score 3.90. The second rank is Lean (3.82) and followed by Improvement Team (3.72), Organizational Assessment based on Business Excellence Model (3.44), Outsourcing (3.26), Six Sigma (3.21) and Business Continuity Management (2.76).

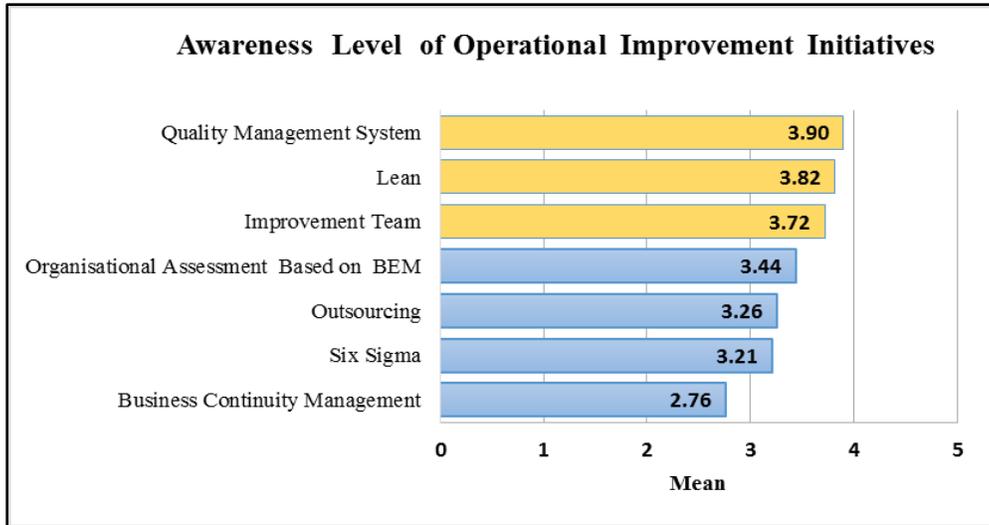


Fig. 1. Awareness level of operational improvement initiatives in Malaysia

Figure 2 shows the implementation status of seven main operational improvement initiatives in Malaysia. The first ranking is Quality Management System with the percentage of ‘Yes’ 85% and the second rank is Improvement Team (82%). It is followed by Lean (74%), Organizational Assessment based on Business Excellence Model (70%), Outsourcing (66%), Business Continuity Management (57%) and Six Sigma (50%). As shown in Figure 1 and 2, Quality Management System has been ranked first for awareness and implementation. The implementation status usually follows the same trend as awareness. Organizations tend to implement initiative that they are aware and understand [4].

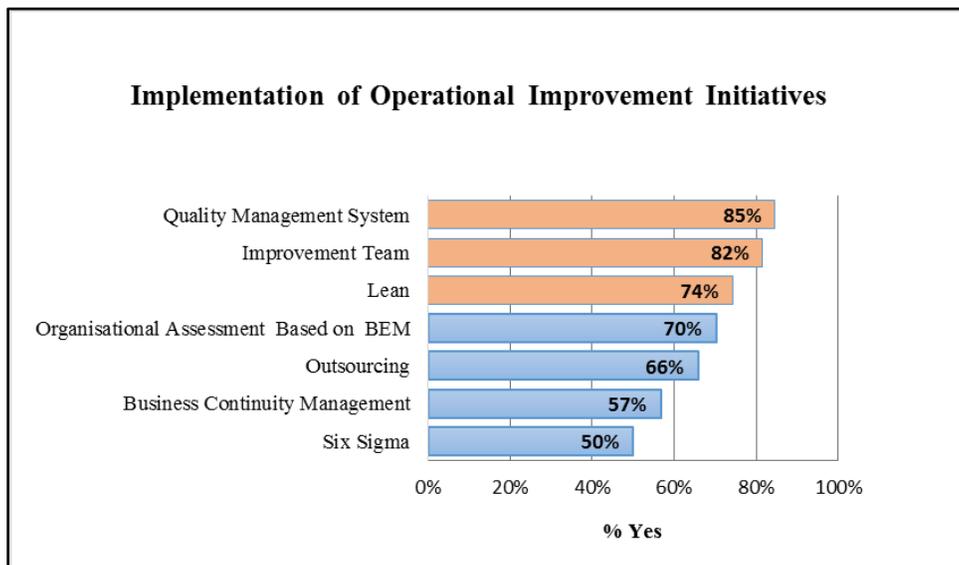


Fig. 2. Implementation status of operational improvement initiatives in Malaysia

Figure 3 shows the perceived effectiveness of seven main operational improvement initiatives. The first rank is dominated by Lean with the mean score 3.81. It is followed by Quality Management System (3.71), Improvement Team (3.63), Six Sigma

(3.20), Organizational Assessment based on Business Excellence Model (3.16), Outsourcing (3.03), and Business Continuity Management (2.79).

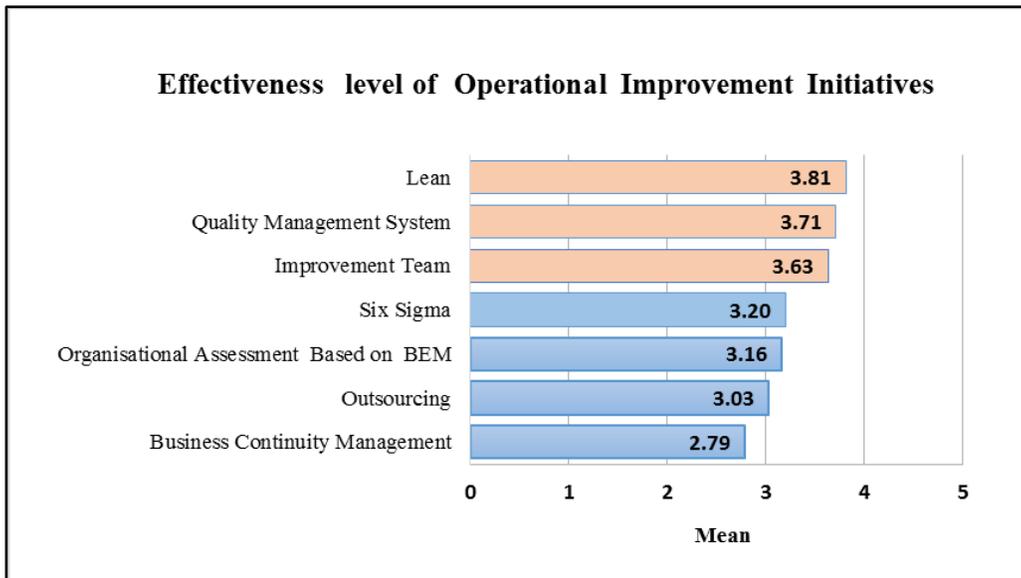


Fig. 3. Effectiveness level of operational improvement initiatives in Malaysia

Figure 4 shows the most wanted initiative for future adoption is Improvement Team with the percentage of 'Yes' 97%. It is followed by Quality Management System and Lean (92% respectively), Organizational Assessment based on Business Excellence Model (91%), Business Continuity Management (82%), Outsourcing (77%), and Six Sigma (69%).

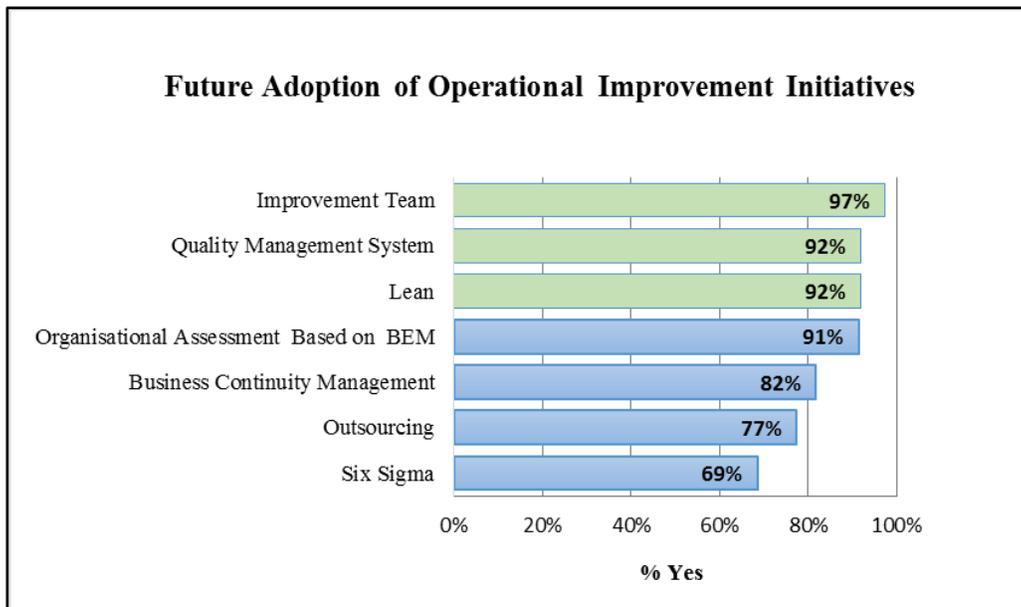


Fig. 4. Potential future adoption of operational improvement initiatives in Malaysia

C. Comparisons of Awareness, Implementation, Effectiveness and Future Adoption between Manufacturing and Service Organizations

This study has employed two different tests to compare the awareness, implementation, perceived effectiveness and potential future adoption of operational improvement initiatives between manufacturing and service organizations. The statistics tests involved are Mann-Whitney test for the Likert Scale and Chi-Square test for the multiple choices. Mann-Whitney test explores the differences between manufacturing and service organizations in terms of their awareness and effectiveness of the operational improvement initiatives. The respondents were asked to rate their level of awareness and perceived effectiveness for operational improvement initiatives on a scale of don't know (0), very low (1), low (2), moderate (3), high (4) and very high (5). The results of Mann-Whitney are shown in Table III for the level of awareness and Table IV for the perceived effectiveness of the operational improvement initiatives.

The results shown in Table III indicated that there are no significant differences between both organizations ($P > 0.05$). Based on the mean value, service organizations are more aware on the operational improvement initiatives such as Business Continuity Management, Six Sigma, and Improvement Team. Meanwhile, the manufacturing organizations show high level of awareness on Lean, Quality Management System and Outsourcing. This result is concurrent with Tickle, Adebajo, Mann and Ojadi [5] which stated that manufacturing sector is more aware about Lean and Quality Management System due to a number of reasons, such as these improvement initiatives being introduced into manufacturing sector first and the customers are demanding the use of these initiatives to improve their operations and products.

TABLE III. RESULTS OF MANN-WHITNEY U TEST ON AWARENESS OF THE OPERATIONAL IMPROVEMENT INITIATIVES BETWEEN MANUFACTURING AND SERVICE ORGANIZATIONS

Improvement Initiatives	Manufacturing		Service		Significance P
	N	Mean rank	N	Mean rank	
Lean	17	<u>20.09</u>	22	19.93	.964
Organizational Assessment Based On BEM	15	18.50	21	18.50	1.000
Quality Management System	16	<u>21.38</u>	23	19.04	.507
Improvement Team	16	19.38	23	<u>20.43</u>	.765
Outsourcing	16	<u>19.75</u>	23	20.17	.906
Business Continuity Management	15	16.17	23	<u>21.67</u>	.112
Six Sigma	17	18.18	21	<u>20.57</u>	.494

* $P < 0.05$ -significant / * $P > 0.05$ -insignificant

Table IV shows the results of a Mann-Whitney U test between manufacturing and service organizations in terms of effectiveness of the operational improvement initiatives. The results show that there are no significant differences ($P > 0.05$) between both organizations. Quality Management System, Improvement Team and Outsourcing are more effective for manufacturing organizations as compared to the service organizations. Meanwhile, the Organizational Assessment based on BEM is more effective in the service organizations. Quality Management System indicated higher mean for manufacturing organizations probably due to the nature of manufacturing processes that tend to have more repetitive processes that can be standardized as compared to service organizations.

TABLE IV. RESULTS OF MANN-WHITNEY U TEST ON EFFECTIVENESS OF THE OPERATIONAL IMPROVEMENT INITIATIVES BETWEEN MANUFACTURING AND SERVICE ORGANIZATIONS

Improvement Initiatives	Manufacturing		Service		Significance P
	N	Mean rank	N	Mean rank	
Lean	13	17.88	18	14.64	.279
Organizational Assessment Based On BEM	12	14.83	19	<u>16.74</u>	.544
Quality Management System	13	<u>19.96</u>	21	<u>15.98</u>	.221
Improvement Team	12	<u>18.46</u>	20	15.33	.319
Outsourcing	11	<u>18.41</u>	20	14.68	.248
Business Continuity Management	9	13.39	19	15.03	.606
Six Sigma	9	13.72	16	12.59	.703

* $P < 0.05$ -significant / * $P > 0.05$ -insignificant

The Chi-Square test has been used to determine the level of the implementation and potential future adoption of the operational improvement initiatives based on Malaysia context. Respondents were asked to answer Yes or No to whether or not they were currently implementing the improvement initiatives and/or thinking of using it in the future. The results in Table V show the implementation and results in Table VI show the potential future adoption of the improvement initiatives.

Results in Table V indicated that there are no significant differences ($P > 0.05$) between manufacturing and service organizations in term of implementation of operational improvement initiatives. The results also show that manufacturing organizations are more likely to implement Quality Management System, Lean and Organizational Assessment based on BEM, while service organizations are more likely to implement Improvement Team, Quality Management System and Lean.

TABLE V. RESULTS OF CHI-SQUARE TEST ON IMPLEMENTATION OF OPERATIONAL IMPROVEMENT INITIATIVES BETWEEN MANUFACTURING AND SERVICE ORGANIZATIONS

Improvement Initiatives	Manufacturing		Services		Significance P
	Count	%	Count	%	
	Yes	Yes	Yes	Yes	
Lean	13	<u>76.50</u>	17	<u>77.30</u>	1.000
Organizational Assessment Based On BEM	12	<u>75.00</u>	14	66.70	.723
Quality Management System	15	<u>93.80</u>	18	<u>78.30</u>	.370
Improvement Team	11	73.30	20	<u>87.00</u>	.401
Outsourcing	10	66.70	15	65.20	1.000
Business Continuity Management	8	57.10	14	60.90	1.000
Six Sigma	7	43.80	11	55.00	.738

* $P < 0.05$ -significant / * $P > 0.05$ -insignificant

Finally, Table VI displays the results of a Chi-Square test exploring the differences on whether or not an organization intends to use the operational improvement initiatives in the future. The results show that there are also no significant differences ($P > 0.05$) between both organizations. For manufacturing organizations, Quality Management System, Improvement Team, Business Continuity Management, and Six Sigma have higher percentage, which show that the respondents intend to use these improvement initiatives in the future. Meanwhile in the service organizations, Improvement Teams, Organizational Assessment based on BEM and Quality Management System have the higher percentage for the future adoption.

TABLE VI. RESULTS OF CHI-SQUARE TEST ON POTENTIAL FUTURE ADOPTION OF OPERATIONAL IMPROVEMENT INITIATIVES BETWEEN MANUFACTURING AND SERVICE ORGANIZATIONS

Improvement Initiatives	Manufacturing		Services		Significance P
	Count	%	Count	%	
	Yes	Yes	Yes	Yes	
Lean	15	88.2	17	85.0	1.000
Organizational Assessment Based On BEM	14	87.5	18	<u>94.7</u>	.582
Quality Management System	16	<u>100</u>	18	<u>85.7</u>	.243
Improvement Team	14	<u>93.3</u>	22	<u>100</u>	.405
Outsourcing	9	64.3	15	71.4	.721
Business Continuity Management	12	<u>92.3</u>	15	75.0	.364
Six Sigma	12	<u>92.3</u>	12	66.7	.194

* $P < 0.05$ -significant / * $P > 0.05$ -insignificant

V. CONCLUSION

This study has identified the level of awareness, implementation, perceived effectiveness and potential future adoption of the seven operational improvement initiatives in Malaysia. Based on analysis, it can be concluded that the top three initiatives in term of awareness are: (1) Quality Management System, (2) Lean, and (3) Improvement Team. Top three initiatives in term of implementation are: (1) Quality Management System, (2) Improvement Team, and (3) Lean. In relation to perceived effectiveness, top three initiatives are: (1) Lean, (2) Quality Management System, and (3) Improvement Team. Meanwhile, top three initiatives in term of potential future adoption are: (1) Improvement Team, (2) Quality Management System, and (3) Lean. This study has also compared the awareness, implementation, perceived effectiveness and potential future adoption between manufacturing and service organizations in Malaysia. In overall, there are no significant differences between manufacturing and service organizations with regard to the awareness, implementation, perceived effectiveness, and potential future adoption for the majority of improvement initiatives. This research finding is similar to the global study reported by Tickle, Adebajo, Mann and Ojadi [5], which contradict the conventional perception that improvement initiatives are more dominantly being implemented by manufacturing organizations.

The findings of this study have several important practical and academic implications. For managers, executives, consultants and academicians, it is important for them to know the current status of awareness, implementation, perceived effectiveness, and potential future adoption of operational improvement initiatives in Malaysia so that they can make an informed decision when selecting and implementing appropriate operational improvement initiatives. They also need to ensure all the related staff aware and understand the initiatives, as the findings of this study and Tickle, Adebajo, Mann and Ojadi [5] indicated that initiatives that had higher levels of awareness were more likely to be implemented. This study is probably one of first in Malaysia that focuses on the current status of awareness, implementation, perceived effectiveness, and potential future adoption of seven operational improvement initiatives, as well as compares the differences between manufacturing and service organizations.

ACKNOWLEDGMENT

The authors would like to thank Universiti Tun Hussein Onn Malaysia (UTHM) for funding this project under Multi Disciplinary Research Grant (Vot. U092).

REFERENCES

- [1] N. Thawesaengskulthai, "Selecting quality management and improvement initiatives: Case studies of industries in Thailand," Unpublished PhD thesis, University of Nottingham, 2007.
- [2] M. Mohammad, "Development of a guidance model for the selection of organizational improvement initiatives," Unpublished PhD thesis, Massey University, New Zealand, 2012.
- [3] B.P. Wieleman, "Selecting business improvement methods: towards a techniques for consultants to support the selection of methods in an improvement project," Unpublished Master Thesis, Eindhoven University of Technology, 2011.
- [4] R. Mann, A. Abbas, and H. Kohl, *Global survey on business improvement and benchmarking*. Berlin: Global Benchmarking Network, 2010.
- [5] M. Tickle, D. Adebajo, R. Mann, and F. Ojadi, "Business improvement tools and techniques: a comparison across sectors and industries," *Int. J. Prod. Res.*, vol. 53, no. 2, pp. 354–370, 2014.
- [6] D. Rigby, and B. Bilodeau, *Management tools & trends 2011*. Boston, MA: Bain & Company, 2011.
- [7] D. Rigby, and B. Bilodeau, "Bain's global 2007 management tools and trends survey," *Strateg. Leadersh.*, vol. 35, pp. 9-16, 2007.
- [8] J. Cullen, M. O'Connor, and J. Mangan, "Matching management tools and techniques with management challenges," *Strateg. Leadersh.*, vol. 32, no. 3, pp. 27–30, 2004.
- [9] N. Slack, and M. Lewis, *Operations strategy*, 2nd ed. Harlow: Financial Times Prentice Hall, 2008.
- [10] Baldrige Performance Excellence Program. *2015–2016 Baldrige excellence framework: a systems approach to improving your organization's performance*, Gaithersburg, MD: National Institute of Standards and Technology, 2015.
- [11] M. Mohammad, R. Mann, N. Grigg, and J. P. Wagner, "Business excellence model: An overarching framework for managing and aligning multiple organizational improvement initiatives.," *Total Qual. Manag. Bus. Excell.*, vol. 22, no. 11, pp. 1213–1236, 2011.
- [12] T. Lily, "Development of a computer aided guidance application (m-GUIDE) for selecting organizational improvement initiatives," Unpublished Bachelor Degree Project Report, Universiti Tun Hussein Onn Malaysia, 2013.
- [13] D. Nave, "How to compare six sigma, lean and the theory of constraints: a framework for choosing what's best for your organization". *Quality Progress*, vol. 35, no. 3, 2002.

- [14] T. Bendell, "Structuring business process improvement methodologies", *Total Qual. Manag. Bus. Excell.*, vol. 16, no. 8-9, pp. 969-978, 2005.
- [15] I. Ricondo and E. Viles, "Six Sigma and its link to TQM, BPR, Lean and the Learning Organization," *International Journal of Six Sigma and Competitive Advantage*, vol. 1, no. 3, pp. 323-354, 2005.
- [16] B. G. Dale, A. Van der Wiele, and J. D. Van Iwaarden, "Teams and Teamwork," in *Managing Quality*, B. G. Dale, et al., Eds., Malden, MA: Blackwell Publishing, 2007, pp. 510-530.
- [17] Standards Australia / New Zealand, *Handbook: Business Continuity Management - HB 221:2004*, 2 ed. Sydney and Wellington: Standards Australia / New Zealand, 2004.
- [18] International Organization for Standardization (ISO), *ISO 9000: Quality management systems - Fundamentals and vocabulary*, 2nd ed. Geneva: ISO, 2000.
- [19] D. L. Goetsch and S. B. Davis, *Quality Management*, 5th ed. New Jersey: Prentice Hall, 2006.
- [20] European Foundation for Quality Management (EFQM), *Introducing excellence*, Brussels: EFQM, 2003.
- [21] J. R. Evans, *Quality and Performance Excellence: Management, Organization, and Strategy*, 5th ed. Mason, OH: Thomson South-Western, 2008.
- [22] C. C. Yang, "An integrated model of TQM and GE-Six-Sigma," *International Journal of Six Sigma and Competitive Advantage*, vol. 1, no. 1, pp. 97-111, 2004.
- [23] D. K. Rigby, *Management tools 2011: An executive's guide*. Boston, MA: Bain & Company, 2011.
- [24] R. S. Mann, "Global survey on business improvement and benchmarking", Unpublished Questionnaire, Global Benchmarking Network, 2010.
- [25] M.S. Litwin, *How to assess and interpret survey psychometrics*, 2nd ed. California: Sage Publications, 2003.
- [26] D. George, and P. Mallery, *SPSS for windows step by step: a simple guide and reference*, 3rd ed. USA: Allyn & Bacon, 2001.

BIOGRAPHY

Dr. Musli Mohammad is a Senior Lecturer in Industrial Engineering at the Department of Manufacturing and Industrial Engineering, Universiti Tun Hussein Onn Malaysia (UTHM). Before joining UTHM in 2003, he worked as a Total Quality Management Executive at the UMW Toyota Motor Sdn. Bhd. Musli graduated with a Bachelor of Engineering in Mechanical (Industrial), a Master of Science in Industrial and Systems Engineering, and a Doctor of Philosophy in Engineering and Industrial Management. He has served as an Expert for Asian Productivity Organization project to develop a toolkit on Business Excellence for Asian SMEs. He has also involved as a researcher in a global study on quality / business excellence awards, which was commissioned by the Baldrige Performance Excellence Program, National Institute of Standards and Technology (NIST), USA. His research interests include Total Quality Management, Lean Production and Operations Management.

Ms. Noor Hamizah Yaakub is a bachelor degree student at the Department of Manufacturing and Industrial Engineering, Universiti Tun Hussein Onn Malaysia (UTHM). Hamizah holds a Diploma of Mechanical Engineering from Politeknik Sultan Mizan Zainal Abidin and a Certificate of Mechanical Engineering from Politeknik Kota Bharu.

Mr. Mohd Shahir Yahya is currently a PhD student at Faculty of Mechanical and Manufacturing Engineering. Mr. Shahir holds a Bachelor of Engineering in Mechanical (Industrial) degree from Universiti Teknologi Malaysia and a Master of Manufacturing System Engineering degree from Universiti Putra Malaysia. He had also served as lecturer in Industrial Engineering at the Department of Manufacturing and Industrial Engineering, Universiti Tun Hussein Onn Malaysia (UTHM). He has taught courses in industrial engineering, production planning and control and entrepreneurship. His research interests include ergonomics product design, lean production, and production planning and control.

Dr. Nor Aziati Abdul Hamid is currently a fulltime senior lecturer and Head of Department of Production and Operation Management in Faculty of Technology Management and Business, Universiti Tun Hussein Onn Malaysia. Dr. Nor Aziati holds a Phd in Information System from Universiti Kebangsaan Malaysia and a Master of Science in Information technology from Universiti Teknologi Mara, Shah Alam. She has published journal and conference papers. She has teaching experience with over 10 years beside a head of several external research grants. Her research interests include manufacturing, ISO, business excellence, manufacturing, and lean. She has taught courses in Research Methodology, Quality Control, Project Management, Management Information System, Computer Application in Business, to name a few. Dr. Nor Aziati served as member of the various association and also the journal editor for the faculty. She is actively involved as technical committees for various international conferences locally and internationally.