Vol. 1(4), pp. 154-158, 1 MAR, 2016
ISSN Print : 2454-1435 © 2015 IJRMMAE
ISSN Online : 2454-1443 © 2015 IJRMMAE
http://www.ijrmmae.in

International Journal of Research in Mechanical, Mechatronics and Automobile Engineering

Analysis of Significant Issues in Green Lean System in Small and Medium Scale Enterprises

S. Bharadwaj [a,*], S. Sundar [b]

[a] PG Scholar, [b] Associate Professor, Department of Mechanical Engineering,

Dr. M.G.R. Educational and Research Institute, Chennai-600 095, Tamilnadu, India [a, *] e-mail: bharaths92@gmail.com , [b] e-mail: sundarshob@yahoo.co.in

Received 04, January 2016 | Accepted 01, March 2016

Abstract:

Lean philosophy of manufacturing focuses on waste reduction. Lean identifies some wastes namely over production, equipment breakdown, material shortages, yield loss, rework and scrap, non-optimal performance, changeover, material transport, material storage, inspection, delays, walking, idle time or waiting and excess inventory. Green manufacturing is an emerging philosophy of manufacturing aims to reduce the impact on environment. By using materials that are eco-friendly and by avoiding or reducing pollution to the maximum extent green manufacturing can be ensured and wherever possible the electric power can be produced with this renewable energy sources. Sustainable practices combine Lean Green methodologies. Green lean practices are successfully applied in large scale industries in India compared to small and medium scale industries. In this article the significant issues for green lean system execution in Small and Medium Scale Enterprises (SMSEs) in India were studied using Customized Interpretive Structural Modeling and the necessary suggestions were made.

Keywords: Environment Issues, Lean and Green Manufacturing, SMSE, ISM

Introduction

In manufacturing lean philosophy is mainly focuses on waste reduction. Nowadays, several manufacturing companies must follow the all new technology and tools for efficiently and effectively to present themselves a good competitor in the global economy. Lean manufacturing is the basic techniques for improve the production rate with the minimum available resources. Toyota Production System is the inventor of lean production techniques. Lean identifies some wastes namely Excess Inventory , Over Production, Equipment breakdown, Material shortages, Yield loss, Rework, and Scrap, Non-optimal performance, Changeover, Material transport, Material storage, Inspection, Delays, Walking and Idle time. Green manufacturing is an up-and-coming philosophy of manufacturing aims to reduce the impact on environment. By using materials that are eco-friendly and by avoiding or reducing pollution to the maximum extent Green Manufacturing can be ensured and wherever possible the electric power can be produced with this renewable energy sources. Sustainable practices combine Lean Green (LG) methodologies. LG practices are successfully applied in large industries. In India small scale industries are more compared to the medium and large scale industries. Now a days due to increase in cost of energy, increase in pollution, global warming, rules and

regulation regarding green manufacturing, cheaper prize of competitors, so to sustain in this environment company should adopt lean and green concept. Hence the possibility of application of lean green techniques in small scale industries is to be studied and identified.

Literature Review

Lean manufacturing is nothing but lean and manufacturing. Simply we can say that it is the lean value for industry and customer [1]. Subha [2] and Zhu, Q.H [3] aims to evolve sector-specific Lean Manufacturing Practices (LMP) with special reference to engineering goods manufacturing industries. They are duly validated to show how they would lead to higher volumes of production through minimum use of resources and thus achieve competitive advantage through operational benefits. Manoj Ade [4] suggests that Productivity improvement through Lean manufacturing means optimization and co-ordination of the input resources to minimize the wastes to reduce total production cost. Ramamoorthy [5] suggests implementing the lean manufacturing tools and techniques in the pump manufacturing premises for taking necessary steps to fulfill the customer demand and expectations. Hudli Mohd [6] describes the development of key areas which will be used to assess the adoption and execution of lean manufacturing practices. Ramesh V [7] discusses the simulation study carried out for proposing one-piece lean line layout with features of Lean Manufacturing. The lean initiatives that can be addressed are, introducing Kanban replenishment system, better work-in-process, changing the layout, visual management techniques, standardized work for the reduction of cycle time, number of workers and number of setups. Indian manufacturing industries are facing problem with less resources and this can be overcome by implementing lean manufacturing [8]. Now a day due to increasing pollution levels, energy consumption rate and waste generation, the pressure from government to become green is increasing and also there are some strict international rules and regulations regarding green supply chain management so rather than option it is mandatory to implement green technology in industries [9]. This analysis starts with the finding the important issues for lean and green execution in small and medium scale enterprises. From the pointed out issues, the new idea of Customized Interpretive Structural Modeling will be used for find out the significance of issues and stages of issues.

Issues in Lean and Green Execution

By means of the existing study and specialist recommendation significant issues for green lean execution have been finalised. The major ten significant issues has been finalised for this study on green lean execution in small and medium scale enterprises.

Healthy Management (HM): In successful execution of green lean in industries the stability in management assurance is very vital element. Correct resolutions at the right time must be taken by management which is essential for green lean manufacturing.

Development of Thoughts (DT): Development of thoughts is necessity for motivation of the industry to execute green lean concept in the premises. It needs long term move towards as ecological impact created by industries has been for many years.

Expectation of Customer (EC): In order to increase the market share and to sustain long term connection with consumers, industries are to meet the consumer anticipation. Consumer is very vital for industries since lack of consumer demand regarding eco-friendly product will resist the producer to execute green lean

technology.

Talent and Knowledge (TK): Higher level of execution of green lean manufacturing lead by elevated talent and knowledge. Talent and knowledge is one of the fences for small and medium scale enterprises for execution of new idea in industry.

Monetary Abilities (MA): One of the significant issues for successful execution of green lean is the monetary abilities of the industries. The most important problem for applying new idea is economic insufficiency which is desirable for worker training programs, outside consultancies charges, etc.

Teaching and Guidance (TG): To study the recent technology teaching and guidance helps the employees to develop their efficiency of the process. To execute green lean production concept teaching the people is always better.

Illumination Effectiveness (IE): Lightening in organizations use to take around sixty percent of electricity, for using day light changing normal and fluorescent bulbs with recent energy saver bulbs then around seventy five percent of electricity can be saved.

Choice of Material (CM): The very important footstep for green lean design is chosen of material since a product consists of numerous materials which have various level of impact on environment.

Participation of Dealer (PD): Participation of dealer is very necessary for green lean execution because dealer alliance will give better prizes to consumer and maintaining long term liaison with an industry and also it is more important for high-quality with timely deliverance.

Assistance by Government (AG): To defeat lack of news and major speculation government can assist by educating the people for minimizing the barriers in execution of green lean manufacturing.

Revised Interpretive Structural Modeling

Revised Interpretive Structural Modeling method by initiating two more new constraints E and F were suggested earlier. In this article A, B, C, D, E, F symbols have been used to indicate the direction of relationship between k^{th} row issues with respect to m^{th} column issues are as follows.

Issue k may be influencing issue m majorly	-A
Issue m may be influencing issue k majorly	-B
Issues k and m may help to attain each other	-C
Issues k and m are unrelated	-D
Issue k may be influencing issue m	-E
Issue m may be influencing issue k	-F

In methodology the steps are involved like describe problem and its objective, select issues for described problem; create a Structural Self-Interaction Matrix (SSIM) of issues by showing the pair-wise relations between the elements and level division of issues.

Structural Self-Interaction Matrix

A SSIM is created by correlating k^{th} row with respect to m^{th} column issue and thus their pairwise relationships have been converted into A, B, C, D, E, F symbols which gives the results like, when (k, m) entry in SSIM is A, then (m, k) entry may comes as B, if (k, m) entry in SSIM is B, then (m, k) entry may comes as A, if (k, m) entry in SSIM is C, then (m, k) entry may comes as C, if (k, m) entry in SSIM is D, then (m, k) entry may comes as D, if (k, m) entry in SSIM is E, then (m, k) entry may comes as F and while (k, m) entry in SSIM is F, then (m, k) entry may comes as E

Reachability Matrix (RM)

The SSIM has been converted into reachability matrix by assigning numerical values to SSIM. In reachability matrix A, B, C, D, E and F have been substituted by 4, 3, 2, 1 and 0 as per the given case which gives the results as follows. When (k, m) entry in SSIM is A means its entry in RM becomes 0 and (m, k) entry becomes 1, if (k, m) entry in SSIM is B means its entry in RM becomes 1 and (m, k) entry becomes 0, if (k, m) entry in the SSIM is C means its entry in RM becomes 2 and (m, k) entry also becomes 2, if (k, m) entry in SSIM is D means its entry in the RM becomes 4 and (m, k) entry becomes 1 and if (k, m) entry in SSIM is E means its entry in RM becomes 3 and (m, k) entry becomes 4. Similarly if (k, m) entry in SSIM is F means its entry in RM becomes 0 and (m, k) entry may becomes 3.

Division Rank

Reachability and precursor set for each issue was found using reachability matrix. It consists of other issues which are driven by these issues, which may help to attain that issue, are listed in a precursor set. The connection of precursor and reachability sets is resultant for all issues. First level was allocated to the issues for which the reachability, precursor and the connection sets were the same. Issues which are coming under first level helped by issues of other level to attain and would not help any other issues to attain above their own level. After the identification top-level issues it has been removed from the remaining variables sets. From the analysis it was seen that Development of Thoughts (DT), Talent and Knowledge (TK), Illumination Effectiveness (IE) are found in the top level which was obtained by Customized Interpretive Structural Modeling.

Results and Discussion

The customized Hierarchy Model using ISM is shown in the following figure. Based on this method the analysis was done and the results were obtained.

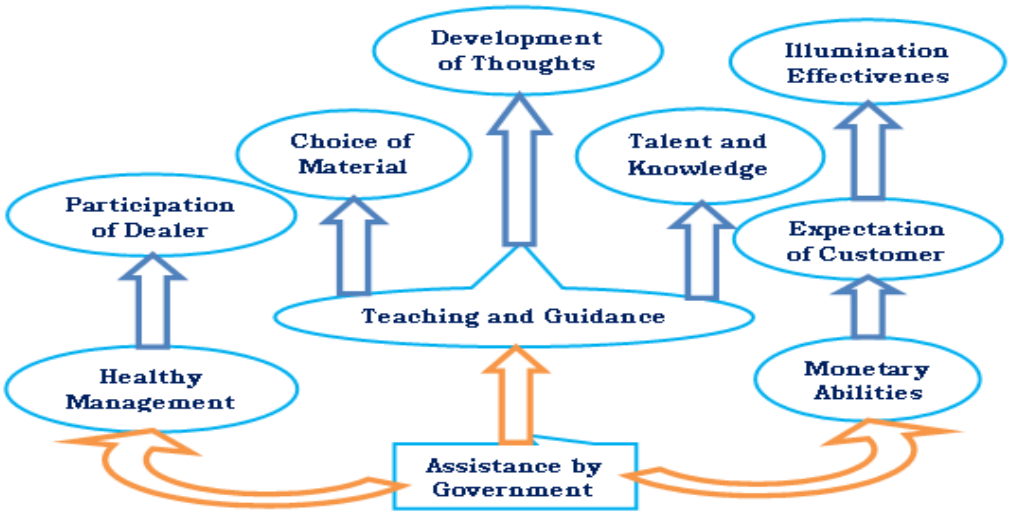

Fig. 1. Customized Hierarchy Model using ISM

To explore the level of issues after deciding the significant accomplishment issues for execution of green lean idea, Customized Interpretive Structural Modelling was implemented which states that the government assistance is most vital for execution of green lean manufacturing. And also it's clear that the government assistance must facilitate to accomplish other issues and thus lend a hand in easy execution of green lean more over another significant issues are financial ability and well management with good leadership.

Conclusions

Based on the above study and analysis the following conclusions were made.

1. Lean execution is the main tool to prolong in the competitive market for reducing the cost, producing quality of product and reducing time to market.
2. The significant success issues for execution of green lean system in small and medium scale enterprises. The main barrier for green lean execution is lack of government assistant.
3. If the people are not familiar with green lean manufacturing then teaching them by the government as it gives results into easy execution of both lean and green manufacturing.
4. Mainly lean and green are needed for high investment to establish, so that if the government will helps by means of funding then automatically lean and green idea may be executed in all small and medium scale enterprises.

This research may further extended in many industries in dissimilar areas of manufacturing for getting more examinations for green lean execution.

References

1. Rakesh Kumar and Vikas Kumar, (2012), "Lean Manufacturing System: An Overview", Proceedings of the National Conference on Trends and Advances in Mechanical Engineering, YMCA University of Science & Technology, Faridabad, Haryana, Oct 19-20, pp. 742-747
2. Subha M. V. and S. Jaisankar, (2012), "Balanced Adoption of Lean Manufacturing Practices in Engineering Goods Manufacturing Firms", European Journal of Social Sciences, Vol.28 (2), pp.271-277.
3. Zhu, Q.H, Sarkis, J and Lai K.H, (2007), "Initiatives and outcomes of green SCM execution by Chinese manufacturers", Journal of Env.Mgt., Vol. 85(1), pp. 179–189
4. Manoj Ade and V.S.Deshpande, (2012), "Lean Manufacturing and Productivity Improvement in Coal Mining Industry", Int. Journal of Engineering Research and Development, Vol. 2, Issue 10, PP. 35-43.
5. Ramamoorthy and Dr.V.Selladurai, (2011), "Economical Growth in pump manufacturing industries through lean manufacturing system using Brainstorming technique: A case study", International journal of advanced economics and business management, Vol No. 2(1), pp. 001 – 008
6. Hudli Mohd. Rameez and K.H.Inamdar, (2010), "Areas of Lean Manufacturing for Productivity Improvement in a Manufacturing Unit", World Academy of Science, Engg. and Tech., Vol: 4, pp. 09-20
7. Ramesh V, Sreenivasa Prasad K. V. and T. R. Srinivas, (2009), "Study on execution of one-piece lean line design using simulation techniques: A practical approach", Journal of Industrial Engineering, Vol. 5, No. 8, pp.20-36.
8. S. Luthra, D. Garg and H. Haleem, (2013), "Identifying and ranking of strategies to implement green SCM in Indian manufacturing industry using analytical hierarchy process", J. Industrial Engineering and Management, Vol. 6(4), Pp. 930-962
9. J. Sarkis, Q.H. Zhu and K.H. Lai, (2011), "An organizational theoretic review of green SCM literature", Int. J. Production Economics, Vol. 130(1), Pp. 1-15