



# Implementation of Agile Manufacturing in industry: A Critical Review

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## Abstract

This paper deals with the concept of an agile manufacturing System (AMS) as an arising idea in industry that targets accomplishing adaptability and awareness to the changing business sector desires. Agile Manufacturing (AM) has developed as a progressive approach to products manufacturing also dealing with manufacturing product quality and so on beside the production association to execute the steadily escalating client significance and to boost the profit. It requires rousing client; helping out rivals; sorting out to manage change, dubiousness and intricacy; and utilizing individuals and data.

**Keywords:** Agile Manufacturing (AM), Customer requirements,

## 1. Introduction

Agile manufacturing can deliver what clients need, when and precisely the way in which they need it, at a practical cost. This way of manufacturing brought about resolute plants that couldn't be quickly reconfigured, and were related with enlarged unrefined components, work-in-process and completed products inventories.. These difficulties lead the associations for the progressions, for example, diminished item life cycle, least creation cost and answering different requirements of clients. To answer the client necessity and expanding consumer loyalty numerous associations embraced process further developing procedures *agile manufacturing etc.* Under such limitations, *agile manufacturing* frameworks are attractive. Agile Manufacturing utilizes present day data innovation to frame virtual endeavours, which dexterously answer the changing business sector requests. A virtual endeavour, unique in relation to a customary venture, is built by accomplices from various organizations, who team up with one another to plan and make top notch and redid items. It is item arranged, group coordinated effort styled, and highlighted as quick and adaptable. A fundamental structure block for a mechanized manufacturing framework is the hardware group or manufacturing cell. The machine instruments, robots, and PC equipment essential for agile manufacturing cell are for the most part that anyone could hope to find as stock things, the product expected for incorporated control of these gadgets should grow explicitly for each manufacturing cell.

Agile manufacturing (AM), answers rapidly to client needs for assortment in the eccentric climate by utilizing a manufacturing framework. Light-AMS gives fast reaction to new item



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advancement and dynamic limit designation to satisfy the capricious need [24;27]. Different empowering influences of agile manufacturing related with innovation, methodology, individuals, and framework featured by the majority of the specialists [29]. The administrations is additionally upgraded by seller overseen stock /VMI(vendor-managed inventory) on the lookout[15]. AM gives the upper hand of mass customization, new item developments, and adaptability in an eccentric market[21]. Agile manufacturing make an upper hand by utilizing quality, stock, cycle, and human abilities - at the same time [10]. Sustainable manufacturing consolidates every one of the four phases, i.e., pre- manufacturing, manufacturing, use, and post-utilization of item life-cycle with a 6R way to deal with accomplish the TBL(triple bottom line) objectives, i.e., social, natural, and financial element of manufacturing [5; 23;28]. A rising measure of administrative, manufacturing and innovation the executives research has inspected the arising circumstance, and reported the side effects of another modern age[46-47]. Over the entire course of time, ventures have consistently needed to manage persistent change in their functional climate to stay cutthroat. The argued that one of the main errands for associations is to oversee vulnerabilities[51]. Depicted the idea of enterprising undertaking as the quest for changes, reaction to changes, and taking advantage of changes as any open doors[50]. Turbulent times and vulnerability in the business climate have been perceived as the reason for most disappointments in manufacturing industry [40;54].

## **2. Basic Concept of Agile Manufacturing.**

Agile manufacturing (AM) gave adjoin agileness, however overall we can say agile is answering accessible difficulties in business climate that this challenge is through change and vulnerability to the business climate. A vital element of dexterity association is adaptability [20; 52].Confronting the serious market, modern makers are unable to take on clever methodologies and advancements to improve item quality, to reduce fabricating expense and to decrease item lead time. Agile Manufacturing, our point is to join our association, individuals and innovation into a coordinated and facilitated entirety. This is proficient by the organization having the option to react and adjust quickly [33]. The idea of an agile Manufacturing is worked around the blend of various endeavors that each have some center abilities or capabilities which they bring to a joint wandering activity, which depends on utilizing each accomplice's offices and assets [32]. Fundamental to the capacity to frame these joint endeavors is the sending of cutting edge data innovations and the advancement of profoundly deft authoritative designs to help exceptionally gifted, learned and engaged individuals.

The Agile arrangement here brings extra qualities like fast new item presentation, convenience to eccentric interest, longer gear appropriateness, and so forth. They are recon-"gurable, reusable, scalable [45].

## **3.The critical components of agile manufacturing**

The main parts of an AM incorporate client flourishing, individuals and data, co-activity inside what's more, among firms, and fitting an organization for change.

### **1. Modular Product Design**



2. Information Technology
3. Corporate Partners
4. Knowledge Culture

#### **4. Needs of AMS**

The way to agile in any case, lies in a few spots. A light-footed endeavor needs profoundly gifted and educated individuals who are adaptable, inspired and receptive to change. A agile venture additionally needs new types of authoritative designs which incite non-progressive administration styles and furthermore invigorate and uphold people as well as collaboration and group working. AM ventures likewise need progressed PC based advances to incorporate data and to share the information base [36]. To accomplish AM, undertakings should unite an extensive variety of information in the plan of an manufacturing framework that envelop providers, clients. It ought to likewise addresses all elements of the framework including association, individuals, innovation, the board bookkeeping rehearses, and so forth. In particular the between related nature of this large number of regions should be perceived and an interdisciplinary manufacturing frameworks plan technique embraced as standard practice[31]. These patterns lead away from the old thoughts of enormous industrial facilities making gigantic amounts of somewhat scarcely any standard items. Different ventures will require a couple of additional years prior to these progressions start to nibble, however currently the drug business, the metals enterprises, pieces of clothing, businesses supplies etc.

#### **5. Some Types Of Agile Manufacturing Systems**

- Agile Production Lines
- Virtual Enterprises
- Rapidly-Reconfigurable Assembly Systems
- Rapidly-Reconfigurable Manufacturing Systems

#### **6. Agile Manufacturing Literature Review**

New administration procedures have arrived in a manner to better figure out the various parts of manufacturing according to the viewpoint of human asset, providers/merchants, effect of stock administration, advertising, deals and so forth. The point of any business is to boost its benefits. This technique couldn't support for long as clients' inclinations were altering and producing with decreased number of units was not financially reasonable (Iacocca Institute, 1991)[47-48]. Adaptability to create various assortments of items is feasible somewhat provided that it is foreordained. Any unexpected changes in item assortments can't be executed and upheld by LM. In the compacted opportunity to-advertise climate, fabricating frameworks must give full-load creation limit basically "on-request," and produce at large scale



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manufacturing levels for somewhat short timeframes, for medium assortments or items. Since limit is now set up preceding item presentation, it very well may be gotten rapidly (e.g., through identification furthermore, shaping of organizations over the Internet), and on the grounds that every office might be associated with different organizations whenever, it isn't important to amortize the office over the existence of a specific arrangement of items. Such organizations are generally called virtual ventures [43].

AM was the way of thinking proposed by Iacocca Institute to defeat a portion of the short comings of lean way of thinking [47-48;54]. A large number, who were pushing the lean idea, needed to confront more up to date difficulties from the dubious and ever-changing client interest. The reason for the writing survey is to unite and dissect critical measure of data on a specific point. Nowadays, the most monetary and viable method for bringing out the exploration is using web and different insightful information bases. A portion of the papers were likewise prohibited which were viewed as from not so dependable diaries and gatherings. Digitally animated, intelligent work guidelines enjoy clear upper hands over conventional paper-based work directions. The equal utilization of computerized and paper-based work directions can't be suggested based on the exploratory outcomes. Organizations ought to in this way put more in computerized information move, while customary paper-based work directions ought to and will be transitioned away from here on out[7]. A portion of the potential region are Product and manufacturing frameworks configuration, Process arranging [33], Production arranging booking and control, Facilities plan, Facilities area, Material taking care of and stockpiling frameworks, Integrated data frameworks, Information frameworks intended for supporting explicit areas of Information trade, Supply chain Strategies, Partner choice Human variables[41,42; 53]. The association should know that change doesn't work out more or less by accident; the come about because of executing such a framework might come gradually. This paper assists with figuring out the essential idea of Lean and light-Agile manufacturing with their likenesses and contrasts and can direct the associations for choosing either to carry out Lean or agile manufacturing framework to tackle their current issues[16;52]. As an initial step, organizations need to figure out the essential thoughts and become canny respondents to the ideas. Deftness is a drawn out issue for organizations and accomplishing agile is an excursion, not a goal to be accomplished prior to continuing on toward something different. The execution of agileness is still a lot of a wilderness action, including profoundly new ideas concerning techniques, association, individuals and innovations. It brings organizations into a space where central and underestimated presumptions are tested. Readiness is a change in perspective and before one can move advances one needs to figure out the current worldview and to look up to the frequently excruciating errand of tolerating that ongoing practices and convictions are at this point not fitting or significant[17]. From the outcomes got, it very well may be presumed that the main UK producing organizations esteem the ten key empowering agents recognized in the proposed applied model and that these organizations are doing whatever it may take to become Agile Manufacturing associations. They are advancing at differing rates yet they are setting out the establishments to acquire an upper hand in their particular business sectors. It is likewise very certain that the model created



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by the creators can permit associations to evaluate their advancement towards becoming Agile manufacturing associations[44]. ARIAC 2021 outcome demonstrates the productivity of our framework[3]. AM has the ability to deal with steady and flighty changes from business sectors and internal frameworks to keep up with the seriousness of manufacturing ventures [8]. One of the main necessities of Agile Manufacturing frameworks is to plan an adaptable, versatile, open, adaptable and reconfigurable control framework [14;55], which is likewise trying for agile mechanical framework plan. The readiness of the robot in this paper is steady with [4], i.e., the capacity to think, learn and adjust to disappointments and eccentric changes. Specialist based innovation gives a characteristic method for resolving this issue and is described by decentralization, knowledge, independence, and variation [12]. A proposed exhibition estimation structure will give the way to the nonstop development and benchmarking rehearses for ISGLSMAS[1]. The paper recognizes, through a writing review, different drivers for the reception of an incorporated practical green lean six sigma AMS[19] .GM(Green manufacturing) centers around the decrease of the ecological effects of the manufacturing and utilization of labor and products[6]. For green item advancement, associations need to zero in on (i) total life cycle impact, (ii) recyclable, biodegradable, energy-efficient materials, (iii) extending the life of the product [9,13]. Many industries and markets are progressively requiring a lot more noteworthy adaptability and idealness from their makers. The actual organization should can impact change quickly, have profoundly adaptable administration designs, and exhaustive techniques for presenting change and succeeding from it. There must likewise be a component for promptly making casual coalitions with different organizations and associations even contenders to plan and deliver items and administrations that address the requirements of the clients and the arising commercial center. These progressions are occurring exceptionally quick in certain enterprises, and all the more leisurely in others. Yet, the organizations that will address the difficulties of the always changing worldwide commercial center of the twenty-first century are those that can become deft all around[25].

As obvious from the writing, to meet supportable market-centered manufacturing, ISGLSAMS gives a strong base to saving nature for people in the future and meeting the consistently changing client interest. The finding shows that the greater part of the Indian Competition, client interest, innovative changes, store network pressure, money saving advantages, impetuses, top administration responsibility and future regulation are the most grounded drivers for ISGLSAMS. Rivalry, the most noteworthy positioned driver, is viewed as driven by the accessibility of association assets for ISGLSAMS, client interest for ISGLSAMS, future regulation for manageability, motivations for ISGLSAMS, store network tension for ISGLSAMS and ISGLSA innovative turns of events. For regulating the opposition for ISGLSAMS in the market government and policymakers should zero in on these key aspects. Through this review, legislatures, partners and policymakers might choose an essential methodology for spurring the Indian manufacturing associations for the reception and effective execution of ISGLSAMS in the item, cycle, framework and production network. Further examination should be possible to investigate the coupling impacts of drivers on ISGLSAMS execution[2].



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Agile manufacturing frameworks are brought into the world as an answer for a general public with a capricious and dynamic interest. Most of these articles just makes sense of the nuts and bolts of light-Agile manufacturing however a couple have caused commitments that to give components to empower this new sort of big business. We proposed an order conspire with nine significant exploration regions: (I) item and manufacturing frameworks plan; (ii) process arranging; (iii) creation arranging, booking and control; (iv) offices plan and area; (v) material taking care of and stockpiling frameworks; (vi) data frameworks; (vii) production network; (viii) human elements; (ix) strategic policies and cycles[26].

- AM has developed as a progressive approach to manufacturing the products while dealing with advancement, prevalent quality etc. The motivation behind this paper is to fundamentally break down the writing connected with different components of AM and to report the discoveries[11]. This study arranges and dissects that the different revealed meanings of AM reflecting objectives, standards and degree. A characteristic AMC demonstrating is examined in view of item situated worldview. The unmistakable elements of proposed MEO displaying plan might be portrayed. MEO are a normalized portrayal, to exploit shell center construction which veils the exclusive idea of genuine manufacturing substances from different modules in a control climate[30].

## 7. Challenges of Agile Manufacturing

Interdisciplinary plan in any case, implies something beyond applying information from different areas, like brain research and authoritative science, to the plan of Agile Manufacturing frameworks. It likewise suggests investigating the neglected regions between these disciplines and the regions where they cross-over, to track down another experiences, new information, new and unique arrangements. This is quite possibly of the main test that chiefs and framework originators and integrators will look in the years to come. The interdisciplinary plan drives us to new methodologies and better approaches for working and of reasoning [41;53]. In any case, to effectively embrace an interdisciplinary plan strategy, we likewise need to: utilize the imaginative innovation such that makes human ability, information, and knowledge more viable and useful which permits businesses to take advantage of the imagination and ability surprisingly in an undertaking.

The provokes that face as for this multitude of issues are huge. In the realm of manufacturing the difficulties and issues are exceptionally mind boggling. There are countless interconnections between the different parts and components. A manufacturing manufacturing undertaking is perplexing to the point that, previously, it has been difficult to adapt to it in general, and it has been important to lessen it into sensible regions which have would in general be inspected independently. Scientists have moved toward the administration of Agile Manufacturing from various viewpoints, utilizing a large number of devices. The motivation



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behind this paper is to unite them for the plan and execution of Agile Manufacturing frameworks (AMS). The accompanying empowering agents of Agile manufacturing are examined in this segment: (i) virtual endeavor (VE) arrangement devices/measurements; (ii) genuinely disseminated groups and manufacturing ; (iii) quick organization development apparatuses/measurements; (iv) Concurrent Engineering (CE); (v) coordinated item/creation/business data framework; (vi) fast prototyping apparatuses; and (vii) Electronic Commerce (EC). Accordingly, the significant road obstructions of carrying out these frameworks in the any organizations appear to be "individuals" factor. Following information address the significant restrictions in execution of Agile Manufacturing in the association [22].

## **8. A framework for the design of AMS**

The framework engineering for AM may incorporate control, capability, process, data, correspondence, appropriation, improvement, and execution [38].

### **8.1. Strategies**

Coming up next are a portion of the essential choice regions that ought to be considered while creating AMSs: CE, quick organization development, key unions, virtual endeavor, truly circulated fabricating frameworks [31].

### **8.2. Technology**

As examined before, procedures of AM with reasonably upheld advancements would upgrade the progress of accomplishing/further developing agileness in associations. Subsequently, key advances to accomplish deftness in light of the techniques chose are featured here This enjoys an unmistakable upper hand over non-adaptable taking care of plans, for example, bowl feeders which require significant change in accordance with changeover starting with one section [39].

### **8.3. Systems**

The justification for why automated data frameworks are prescribed for AM is because of the qualities like VE, fast prototyping and truly circulated producing frameworks.

### **8.4. People**

The most basic issue in agile climate is the way to oversee and propel labor force to help the adaptability and responsiveness. Forsythe talks about the human elements in AM[34]. For the advancement of Agile strategic approaches, there should be thought of human elements influencing dynamic inside quick moving powerful conditions [49]. At the point when data doesn't presently, because of specialized or human issues, readiness is lost. Hence, disposal of human weak spots in framework support is fundamental [35].

## **9. Current Modeling Methodology**

Agile uses a bunch of tool stash principally taken from lean. Some lean apparatus being utilized in dexterous advancement are Visual management, Kanban; Multitasking[18],[22]. Most organizations have a lot more extensive item runs, are presenting all the more new items all the more rapidly, and are centering their promoting. We are on the cusp of the data age and these



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progressions are introducing very interesting difficulties for western makers. Two models for creation arranging and planning for a virtual organization. This paper thinks about that each virtual enterprise is shaped by various manufacturing organizations (fabricating focuses) and get together organizations (gathering focuses)[37; 56]. The creators expect that each term has an alternate creation capacity (every one can deliver various items). Also, they accept that accomplices are producing focuses or get together focuses, yet not both.

## 10. Conclusion

Agile Manufacturing System(AMS) is an arising idea in industry that targets accomplishing adaptability and awareness to the changing business sector desires. The motivation behind this paper is to fundamentally investigate the writing connected with different components of Agile Manufacturing (AM) and to report the discoveries. AMS frameworks are brought into the world as an answer for a general public with a flighty what's more, powerful interest, and with a serious level of accumulation customization in its products. AMS has developed as a progressive approach to products manufacturing with direct quick dealing with customers. It is the technique that many ventures are taking on as an answer for the new market potential open doors. Agile Manufacturing System more extensive assortment for the client to pick and answers rapidly to arising emergency. Agile Manufacturing System found some impediment like Insufficient consideration regarding inside elements, and nonappearance of execution technique.

## REFERENCES

1. Dharmendra Hariyani, Sanjeev Mishra(2022), “An analysis of drivers for the adoption of integrated sustainable-green-lean-six sigma-agile manufacturing system (ISGLSAMS) in Indian manufacturing industries”, Emerald Publishing Limited 1463-5771, DOI 10.1108/BIJ-08-2021-0488.
2. Dharmendra Hariyani, Sanjeev Mishra(2022), “ Drivers for the adoption of integrated sustainable green lean six sigma agile manufacturing system (ISGLSAMS) and research directions”, Cleaner Engineering and Technology 7 (2022) 100449.
3. Guangxi Wan, Xiaoting Dong, Qingwei Dong, Yunpeng He, Peng Zeng(2022), “Design and implementation of agent-based robotic system for agile manufacturing: A case study of ARIAC 2021”, Robotics and Computer–Integrated Manufacturing 77 (2022) 102349.





DOI : 10.5281/zenodo.6826959

4. A. Downs, Z. Kootbally, W. Harrison, P. Pilliptchak, B. Antonishek, M. Aksu, C. Schlenoff, S.K. Gupta, Assessing industrial robot agility through international competitions, *Robot. Comput.-Integr. Manuf.* 70 (2021) <http://dx.doi.org/10.1016/j.rcim.2020.102113>.
5. Hariyani, D., Mishra, S., 2021. Organizational enablers for sustainable manufacturing and industrial ecology. *Clean. Eng. Technol.* 6, 100375 <https://doi.org/10.1016/j.clet.2021.100375>
6. Karuppiyah, K., Sankaranarayanan, B., Ali, S.M., Chowdhury, P., Paul, S.K., 2020. An integrated approach to modeling the barriers in implementing green manufacturing practices in SMEs. *J. Clean. Prod.* 265, 121737 <https://doi.org/10.1016/j.jclepro.2020.121737>
7. Peter Letmathe, Marc Röbler(2020), “Should firms use digital work instructions?— Individual learning in an agile manufacturing setting”, Wiley, DOI: 10.1002/joom.1159.
8. A. Gunasekaran, Y.Y. Yusuf, E.O. Adeleye, T. Papadopoulos, D. Kovvuri, D.G. Geyi, Agile manufacturing: an evolutionary review of practices, *Int. J. Prod. Res.* 57 (15–16) (2019) 5154–5174, <http://dx.doi.org/10.1080/00207543.2018.1530478>.
9. Moktadir, M.A., Rahman, T., Rahman, M.H., Ali, S.M., Paul, S.K., 2018. Drivers to sustainable manufacturing practices and circular economy: a perspective of leather industries in Bangladesh. *J. Clean. Prod.* 174, 1366–1380. <https://doi.org/10.1016/j.jclepro.2017.11.063>
10. Eltawy, N., Galleary, D., 2017. Leanness and agility: a comparative theoretical view. *Ind. Manag. Data Syst.* 117, 149–165. <https://doi.org/10.1108/IMDS-01-2016-0032>.
11. Pavan Kumar Potdar, Srikanta Routroy, Astajyoti Behera(2017), “Agile Manufacturing: A Systematic Review of Literature and Implications for Future Research”, *Benchmarking: An International Journal*, Emerald is a global publisher, <https://doi.org/10.1108/BIJ-06-2016-0100>.
12. H. Zhang, D. Tang, T. Huang, C. Xu, An agent based intelligent distributed control paradigm for manufacturing systems, 49, (12) 2016, pp. 1549–1554, <http://dx.doi.org/10.1016/j.ifacol.2016.07.800>.



DOI : 10.5281/zenodo.6826959

13. Jawahir, I.S., Bradley, R., 2016. Technological elements of circular economy and the principles of 6R-based closed-loop material flow in sustainable manufacturing. *Procedia CIRP* 40, 103–108. <https://doi.org/10.1016/j.procir.2016.01.067>.
14. Z. Kootbally, Industrial robot capability models for agile manufacturing, *Ind. Robot* 43 (5) (2016) 481–494, <http://dx.doi.org/10.1108/IR-02-2016-0071>.
15. Dubey, R., Gunasekaran, A., 2015. Agile manufacturing: framework and its empirical validation. *Int. J. Adv. Manuf. Technol.* 76, 2147–2157. <https://doi.org/10.1007/s00170-014-6455-6>.
16. Javed G. Khan and Dr. R.S Dalu(2015), “Lean and Agile Manufacturing as productivity enhancement techniques - a comparative study”, *IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE)* e-ISSN: 2278-1684,p-ISSN: 2320-334X, Volume 12, Issue 1 Ver. IV (Jan- Feb. 2015), PP 52-56.
17. Manivelmuralidaran. V(2015), “Agile Manufacturing - An Overview”, *International Journal of Science and Engineering Applications* Volume 4 Issue 3, 2015, ISSN-2319-7560 (Online).
18. Richard Blockley and Wei Shyy, John Wiley & Sons, *Encyclopedia of Aerospace Engineering*, ISBN: 978-0-470-75440-5, 2010,
19. Moher, D., Liberati, A., Tetzlaff, J., Altman, D.G., 2009a. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *PLoS Med.* 6 <https://doi.org/10.1371/journal.pmed.1000097>.
20. Agarwal, A., Shankar, R., Tiwari, M. K. (2007). Modeling agility of supply chain. *Industrial Marketing, Management*, Vol.36 pp443-457
21. Adeleye, E.O., Yusuf, Y.Y., 2006. Towards agile manufacturing: models of competition and performance outcomes. *Int. J. Agil. Syst. Manag.* 1, 93–110. <https://doi.org/10.1504/IJASM.2006.008861>.
22. Dahlgaard J. J., Dahlgaard-Park S. M., Lean production six sigma quality TQM and company culture, *The TQM magazine*, 18, 263 – 281, 2006.
23. Jawahir, I.S., Dillon, O.W., Rouch, K.E., Joshi, K.J., Jaafar, I.H., 2006. Total life-cycle considerations in product design for sustainability : a framework for comprehensive evaluation. In: 10th International Research/Expert Conference “Trends in the



DOI : 10.5281/zenodo.6826959

Development of Machinery and Associated Technology. Barcelona-Lloret de Mar, Spain, pp. 11–15, 10.1.1.402.3563.

24. Elkins, D.A., Huang, N., Alden, J.M., 2004. Agile manufacturing systems in the automotive industry. *Int. J. Prod. Econ.* 91, 201–214. <https://doi.org/10.1016/j.ijpe.2003.07.006>.
25. Brian Maskell(2001), “**Insight from Industry** -The age of agile manufacturing” *Supply Chain Management: An International Journal* Volume 6 . Number 1 . 2001 . pp. 5-11, ISSN 1359-8546
26. Luis M. Sanchez & Rakesh Nagi (2001) A review of agile manufacturing systems, *International Journal of Production Research*, 39:16, 3561-3600, DOI:10.1080/00207540110068790
27. Sharifi, H., Zhang, Z., 2001. Agile manufacturing in practice - Application of a methodology. *Int. J. Oper. Prod. Manag.* 21, 772–794. <https://doi.org/10.1108/01443570110390462>.
28. Westkamper, E., Alting, Arndt, 2000. Life cycle management and assessment: approaches and visions towards sustainable manufacturing. *CIRP Ann* 49, 501–526. [https://doi.org/10.1016/S0007-8506\(07\)63453-2](https://doi.org/10.1016/S0007-8506(07)63453-2).
29. Gunasekaran, A., 1999. Agile manufacturing: a framework for research and development. *Int. J. Prod. Econ.* 62, 87–105. [https://doi.org/10.1016/S0925-5273\(98\)00222-9](https://doi.org/10.1016/S0925-5273(98)00222-9)
30. Jie Zhang, Jian Gu, Peigen Li, Zhengcheng Duan(1999), “Object-oriented modeling of control system for agile manufacturing cells”, *Int. J. Production Economics* 62 (1999) 145}153
31. Gunasekaran.A, Agile manufacturing :endblers and an implementation frame work, *International Journal of Production Research*, 1998, Vol 36, No.5,1223-1247.
32. He.D, Kusiak.A., Design for Agility: A Scheduling Perspective, *Robotics and Computer-Integrated Manufacturing Systems*, Vol. 14, No. 4, 1998, pp. 415-427.
33. Gupta.S, Herrmann.J.W., Lam.G, Minis.I, Automated high level process planning to aid design for agile manufacturing, *IERC Proceedings 1997, 6th Annual Industrial Engineering Research Conference, Norcross, GA, USA*, pp1-19



DOI : 10.5281/zenodo.6826959

34. S. Forsythe, Human factors in agile manufacturing: A brief overview with emphasis on communications and information infrastructure, *Human Factors and Ergonomics in Manufacturing* 7 (1) (1997) 3}10.
35. C. Forsythe, M.R. Ashby, Human factors in agile manufacturing, *Ergonomics in Design* 4 (1) (1996) 15}21.
36. Don-Taylor,G. and Nagi,R., Agile manufacturing in material handling and logistics:Implications and a research agenda. *Progress in Material Handling Research*, 1996, pp. 9±13.
37. He, D.W. and Kusiak, A., 1996, Production planning and scheduling in virtual manufacturing. *IERC Proceedings 1996, 5th Annual Industrial Engineering Research Conference*. pp.491-496.
38. M. Jung, M.K. Chung, H. Cho, Architectural requirements for rapid development of agile manufacturing systems,*Computers & Industrial Engineering* 31 (3}4) (1996) pp 551-554.
39. R.D. Quinn, G.C. Causey, F.L. Merat, D.M. Sargent, N.A. Barendt, W.S. Newman, V.B. Velasco Jr., A. Podgurski, J.Y. Jo, L.S. Sterling, Y. Kim, Design of an agile manufacturing workcell for light mechanical applications, *Proceedings IEEE International Conference on Robotics and Automation*, vol. 1, 1996, pp. 858-863.
40. Small, A.W. and Downey, A.E., (1996), ``Orchestrating multiple changes: a framework for managing concurrent changes of varied type and scope", *Proceedings of IEMC 1996 Conference on Managing Virtual Enterprise*, Canada, pp. 627-34.
41. Gupta.P., Nagi.R, Flexible optimization framework for partner selection in agile manufacturing. *IERC Proceedings 1995, 4th Annual Industrial Engineering Research Conference*, Norcross, GA, USA, pp 691-700
42. Gupta.P.,Nagi.R.(1995), Process partner selection in agile manufacturing using linguistic decision making. Department of Industrial Engineering, State University of Newyork
43. Goldman, S. L., Nagel, R.N., and Preiss, K. (1995) *Agile Competitors and Virtual Organizations*. Van Nostrand Reinhold, New York.
44. J.M. Sharp, Z. Irani, S. Desai (1995), “Working towards agile manufacturing in the UK industry” , *Int. J. Production Economics* 62 (1999) 155}169



DOI : 10.5281/zenodo.6826959

45. R. Dove, Agile cells and agile production, Production 10 (1995) 16}18.
46. Hamel, G. and Prahalad, C.K. (1994), ``Competing for the future", Harvard Business Review, July- August, pp. 122-8.
47. Iacocca Institute (1991), 21st Century Manufacturing Enterprise Strategy, An Industry-led View, Vol. 1, Lehigh University, Bethlehem, PA.
48. Iacocca Institute (1991) 21st Century Manufacturing Enterprise Strategy – An Industry-Led View (Vols. 1 and 2). Bethlehem, PA: Iacocca Institute.
49. K.M. Eisenhardt, Making fast strategic decisions in highvelocity environments, Academy of Management Journal 32 (3) (1989) 543-576.
50. Drucker, P.F. (1968), ``Comeback of the entrepreneur", Management Today, April, pp. 23-30.
51. Thompson, J. (1967), Organisation in Action, McGraw-Hill, New York, NY.
52. [www.iosrjournals.org](http://www.iosrjournals.org)
53. [www.researchgate.net](http://www.researchgate.net)
54. [www.emeraldinsight.com](http://www.emeraldinsight.com)
55. [liu.diva-portal.org](http://liu.diva-portal.org)
56. [www.tandfonline.com](http://www.tandfonline.com)