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Research Paper on Design and Manufacturing

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Abstract: *Angle grinder use in grinding a product and for high performances application, like deburring in foundries and construction. Consequently, this study investigates about the sustainability design of angle grinder with integration of Design for Manufacturing and Assembly (DFMA) analysis. Design for Manufacturing and Assembly (DFMA) is a process that produce a good product which is minimize complexity and number of part that lead to time and cost reduction in development. Sustainability design means a design solution that are advantageous to both human and nature in a complete and combined way. Sustainability design in this research include the production and assembly part which is analysis using DFMA method. The design solutions are minimizing the part number and assembly time problem regardless the costs, materials issues and selection of manufacturing process. Using the DFE method combined with Boothroyd and Geoffrey DFMA principle, the analysis on angle grinder by using the 3D scanning method in drawing some part using the Catia software and the sustainability analysis using Solidwork software is done. The result for current product efficiency is 21.3% with 15.34 KgCO2, 2.10×10-2 KgPO4, 15.5 KgSO2, 1.95 MJ produce in producing one angle grinder. Through this study, expecting 25% of reduction in all criteria study.*

Keywords: Design for manufacture, concurrent engineering, life cycle considerations, assembly

I. INTRODUCTION

In product development process, it is needing to include the sustainable design that have relationship with environment, social, economic impact indicators and product features from first stage which related to manufacturing process. DFMA is one of the processes that create the good product and can be related to sustainability design that minimize the number of part by decrease the product complexity and economic and thus reduce the sustainability indicator which is energy consumption, carbon footprint, number of parts, required amount of material, assembly time and manufacturing costs [1]. Sustainability design is a stage where the investigation about the life cycle of the product that include the raw material consumption, service, maintenance, upgrading end life time (EOL). The comparison will take to show the reducing of sustainability indicator in comparison of the redesign product and existing product [1]. The environment problem such as consumption, population, resource depletion and pollution is a main environment problem that lead to the important of the sustainability concept as it is involve a life cycle of a product which is the first activities that associated with measurement, evaluation, and improvement of environmental, economic and social [2].

Developing successful new products requires the ability to predict, early in the product development process, the life cycle impact of design decisions. Downstream life cycle issues include considerations of how the product will be made, shipped, installed, used, serviced, and retired or recycled. Ignoring downstream issues (or producing poor estimates) leads to poor product designs that may cause unforeseen problems and excessive costs downstream. Sometimes, when problems are uncovered during design verification or testing, the problems can be corrected by redesign, but the cost of redesign at this late stage can be prohibitive. Sometimes companies must simply accept higher manufacturing costs and reduced product effectiveness resulting from early design errors. If accurate predictions of life cycle needs can be made early in the design cycle, it allows product development teams to create superior designs. This not only reduces the number of redesign iterations, the time-to-market, and the development and manufacturing costs but also improves the customer's experience. Unfortunately, downstream life cycle needs are difficult to predict accurately during early design phases for many reasons. First, during the early stages of design, when the geometry and specifications of the

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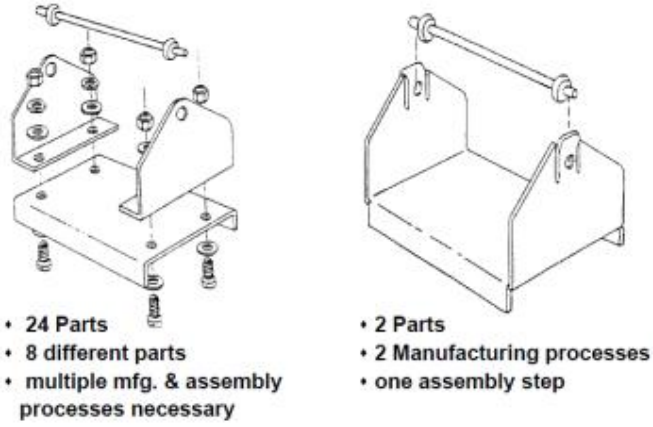
product are not yet complete, the manufacturing details and potential problems are very hard to predict. Until the details of the product are completely specified, a complete assessment of the product's

Design for Assembly (DFA)



II. CONCLUSION

The scope of DFM tools has expanded in many ways: to applications for different phases of design, to manufacturing system performance, to platform design and system quality, andto life cycle cost and environmental considerations. Though this variety is tremendous, there are some general guidelines that suggest how manufacturing firms can gain from DFM tools. Useful, effective DFM tools are based on the specific products and performance measures of interest and are used in the design phases that have the most impact on performance. Creating DFM tools should take into account the information available, the effort involved in making that information accessible, the information needed to evaluate the product and make a decision, and the time constraints for using the tool. Certainly, a product development team should consider the product's entire life cycle. Different techniques consider different phases of the life cycle and may make contradictory design improvement suggestions. Therefore, successfully employing techniques such as DFM requires using them in a coordinated way to design a more profitable product

REFERENCES

[1] Akao, Y., Quality Function Deployment; Integrating Customer Requirements Into Product Design, Booknews, Inc., 1990.
[2] Anderson, D. M., Design for Manufacturability, CIM Press, Lafayette, CA, 1990
[3] Ashby, M.F., and A. M. Esawi, "Cost estimation for process selection," Proceedings of ASME Design for Manufacture Conference, Las Vegas, Nevada, September, 1999.
[4] Boothroyd, Geoffrey, Peter Dewhurst, Winston Knight, Product Design for Manufacture and Assembly, Second Edition, Marcel Dekker, New York, 2002
[5] Bralla, James, Design for Excellence, McGraw-Hill, New York, 1996
[6] Chao, Lawrence P., and Kosuke Ishii, "Design Process Error-Proofing: Failure Modes and Effects Analysis of The Design Process," in Proceedings of the ASME 2003 International Design Engineering Technical Conferences and Computers and Information In Engineering Conference, Chicago, Illinois, September 2-6, 2003.
[7] Chen, Wei, Linda Schmidt, and Kemper Lewis, "Decision Based Design Open Workshop," http://dbd.eng.buffalo.edu/, accessed May 24, 2003
[8] Chincholkar, Mandar M., Jeffrey W. Herrmann, and Yu-Feng Wei, "Applying design for production methods for improved product development," DETC2003/DFM-48133, Proceedings of the ASME 2003 International Design Engineering Technical Conferences and Computers and Information In Engineering Conference, Chicago, Illinois, September 2-6, 2003

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[9] Corbett, J., M. Dooner, J. Meleka, and C. Pym, Design for Manufacture, Strategies, Principles and Techniques, Addison-Wesley, Workingham, England, 1991
[10]Dong, H., and W. H. Wood, "Issues in integration of design and manufacturing for mechatronics," DETC2003/DFM-48134, Proceedings of the ASME 2003 International Design Engineering Technical Conferences and Computers and Information In Engineering Conference, Chicago, Illinois, September 2-6, 2003.
[11]Fagade, Adekunle and David Kazmer, "Economic Design of Injection Molded Parts Using DFM Guidelines - A Review of Two Methods for Tooling Cost Estimation," Annual
[12]. J. Mesa, H. Maury, R. Arrieta, L. Corredor and Jorge Bris., Res. Eng. Des., 29, 227 (2017).
[13]. M. C.Chiu and C. H. Chu, Int. J. Precis. Eng. Man., 13, 1259–1272 (2012).
[14]. M. D. Eastwood and K. R. A. Haapala, J. Clean Prod., 108, 54–64 (2015).
[15]. M. Borchardt, M. H. Wendt, G. M. Pereira and M. A. Sellitto, J. Clean Prod., 19, 49–57 (2011).
[16]. G. Boothroyd and P. Dewhurst, "Product Design for Manufacture and Assembly" (M. D. Inc., Ed. 2nd ed.). New York, 2002)
[17]. G. E. Kremer, K. Haapala, A. Murat, R. B. Chinnam, K. Kim, L. Monplaisir and T. Lei, J. Clean Prod., 112, 2066–2078 (2016).
[18]. P. Suresh, S. Ramabalan and U. Natarajan, International Journal of Sustainable Engineering, 9, 107–118 (2016).
[19]. Karl T. Ulrich and Steven D. Eppinger, "Product Design and Development" (McGraw-Hill Higher Education, Fifth, 2012)
[20]. Design for sustainability: Embedding life cycle thinking, Strategic Direction, 25, 52–55 (2009).
[21]. E. Lawless and K. Medvedev, International Journal of Fashion Design, Technology and Education, 9, 41–50 (2016)