A STUDY ON COMPLEXITY MANAGEMENT METHODS AND TECHNIQUES FOR GREEN BUSINESS PRACTICES IN COMMERCIAL VEHICLE MANUFACTURING INDUSTRY

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Abstract

Complexity exists in commercial vehicle manufacturing industry in various forms. By nature of the product design, commercial vehicle construes thousands of parts aggregated into sub-assemblies, finally to finished product and in the process leaves behind a plethora of complex, interconnected, duplicated organizational challenges leading to non-green business practices. This paper focuses on the different approaches and methods towards identification of complexities in commercial vehicle manufacturing industry at a gross level and possible reduction towards attaining a greener business practicing environment thereby leading to better business profitability. Typical examples and considerations on cost and management level impacts are also showcased.

Keywords: Complexity identification tools and techniques, organization complexity, process complexity, duplication, differentiated processes, complexity handling methods, etc.

1. Introduction

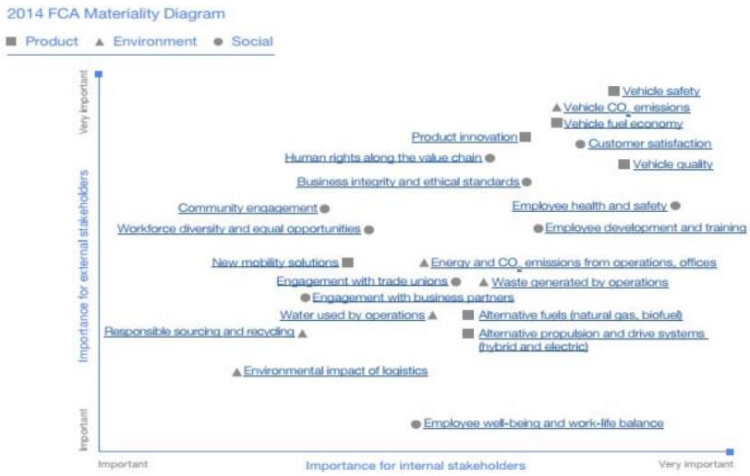
Commercial vehicle is defined as “vehicles which are used for goods and paying people” as per European Union, EC Council Directive 68/297. Complexity is defined as “the state of having many parts and being difficult to understand” as per Cambridge dictionary. Complexity as applicable for a commercial vehicle industry is the state of product families with inter-related/unique parts leading to a variety of manufacturing, operational, organizational & eco system challenges for CV industry. This paper discusses about complexity associated at every level of the organization starting from design of a product, manufacturing process, operational process & impact on the organizational eco system within the commercial vehicle industry and methods to handle them from a green business perspective.

2. Sustainability issues for Fiat

Oana Apostol describes the various sustainability issues while dealing with best practices at Fiat in Figure 1, however does not cover the impact at the cost level and methods of handling the complexities.

FIGURE 1

Significant Sustainability Issues for Fiat



Source: Fiat 2014 Sustainability Report

3. Design level complexity

By inherent nature of the commercial vehicle construing typically about 3100 parts and more than 3300 product models, it becomes very challenging to check the proliferation of design at part level. However, it is simplified to filter out the outliers based on purchase price of parts using the ECRSO method of managing part level complexity briefed as per below process in Figure 2.

FIGURE 2
Product Design Complexity Management Methodology

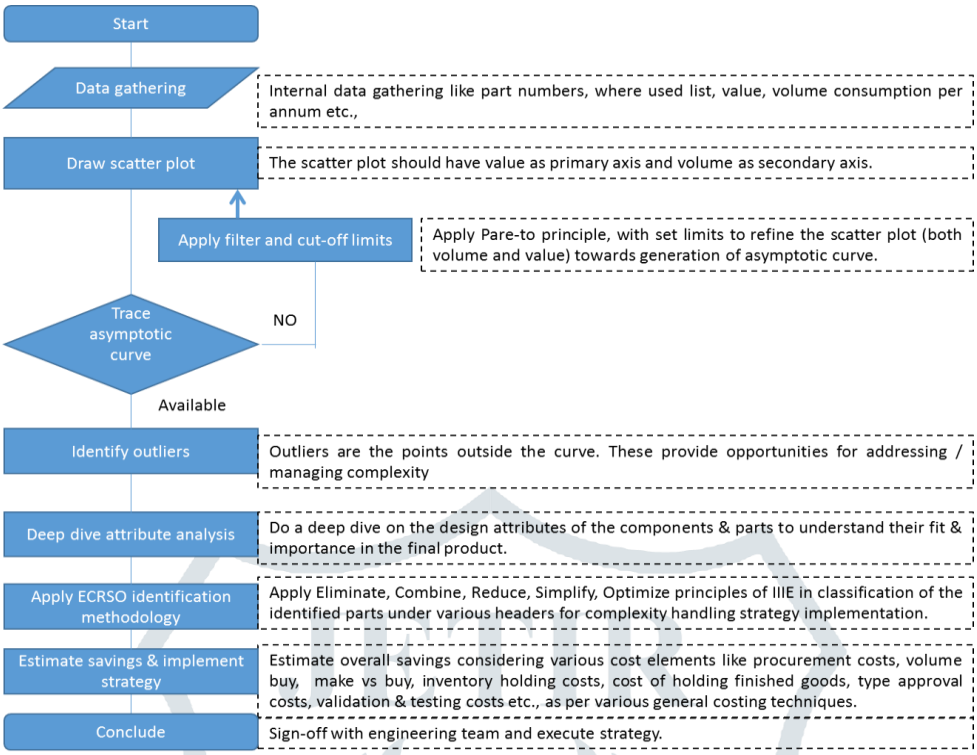
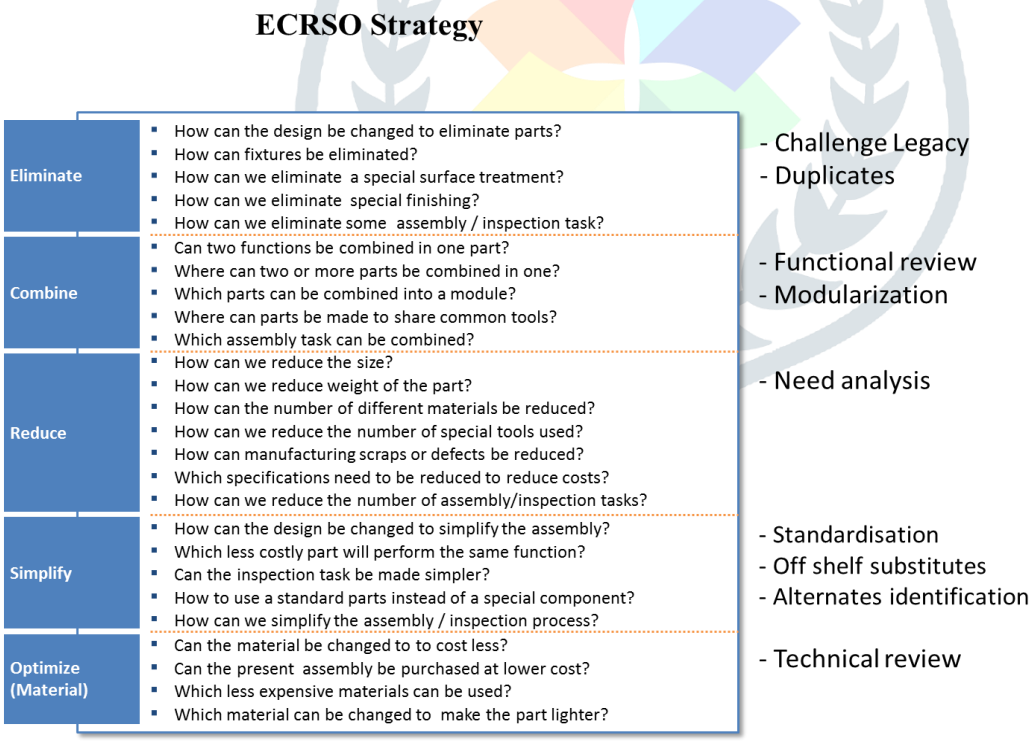


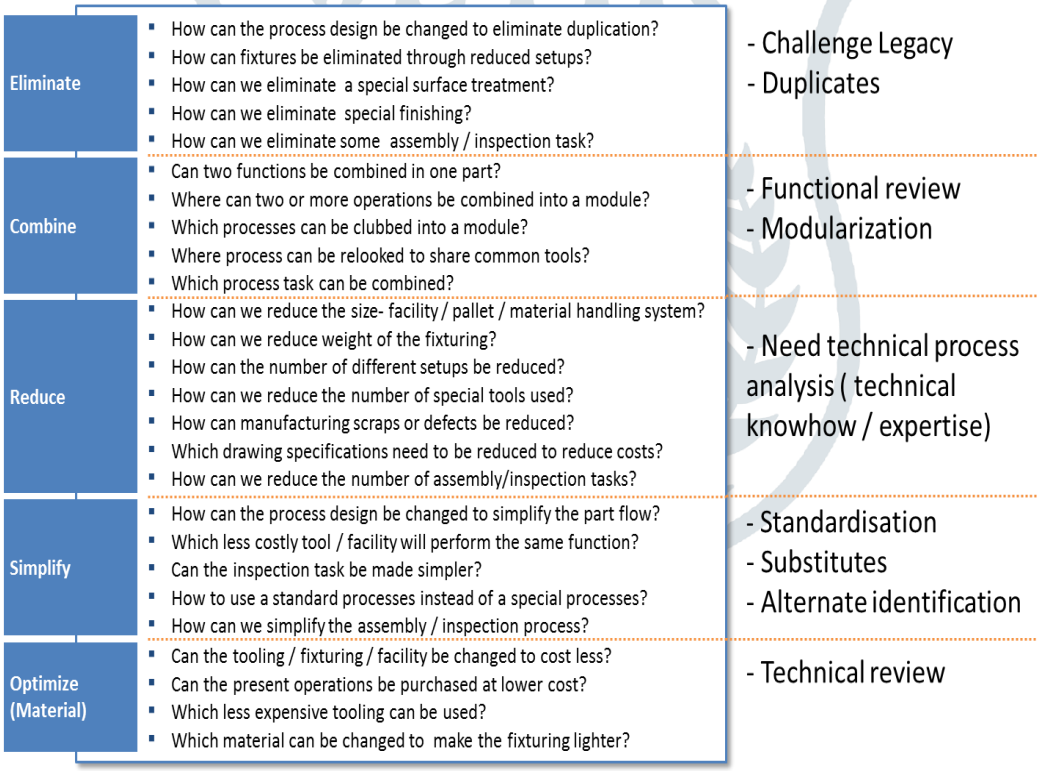
FIGURE 3
ECRSO Strategy for Part Level Complexity Management



4. Manufacturing process complexity

Different manufacturing processes are adopted in a commercial vehicle manufacturing industry starting with machining of engine components like cylinder block, head, crankshaft, camshaft, flywheel, housings, transmission elements, axles etc., static members like frame punching which are typically material removal process followed by welding for cabins, frames, cross members which are typically material additive process. In addition to the same there are fitment processes leading to final assembly of aggregates like engines, transmission, vehicle and testing processes to ensure quality assurance. Complexity exists in each of the manufacturing processes leading to organizational efficiency challenges. Typical method of overcoming the manufacturing process level challenges are explained in brief using the ECRSO method for machining process complexity handling in Figure 4:

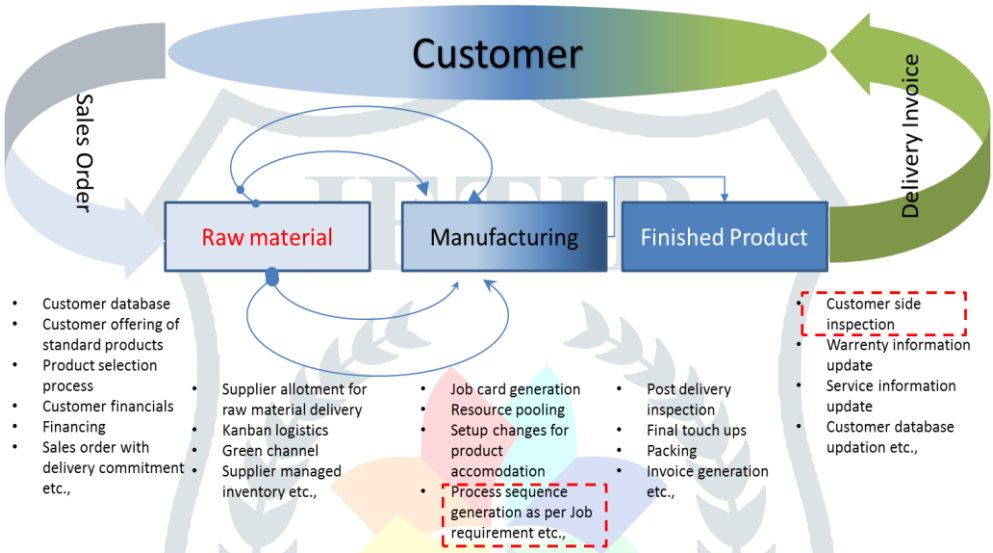
FIGURE 4
Machining Process Complexity Reduction using ECRO Method



5. Organizational process complexity

Commercial vehicle manufacturing industries are typically large sized organization spanning thousands of personnel working round the clock starting from design, testing &validation, manufacturing, procurement, finance, logistics etc. The various organization processes and a typical case of existence of complexity are represented in Figure 5.

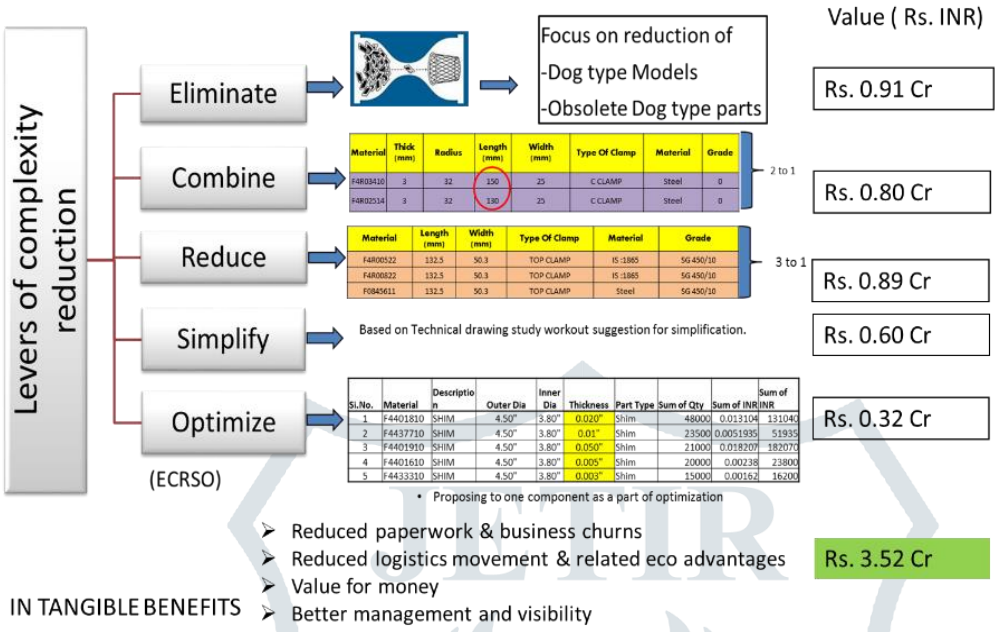
FIGURE 5
Example of Organizational Process Complexity



It can be noted of multiple duplication of processes related to product specific manufacturing requirements like process sequence generation based on product model which can be overcome with online display and tagging of models, checking of the processes and product itself through inspection methods which are a non-value add from an end customers perspective, records updating at the end of the process, goods receipt note against a firm purchase order, duplication of resources for handling these complexities, etc.

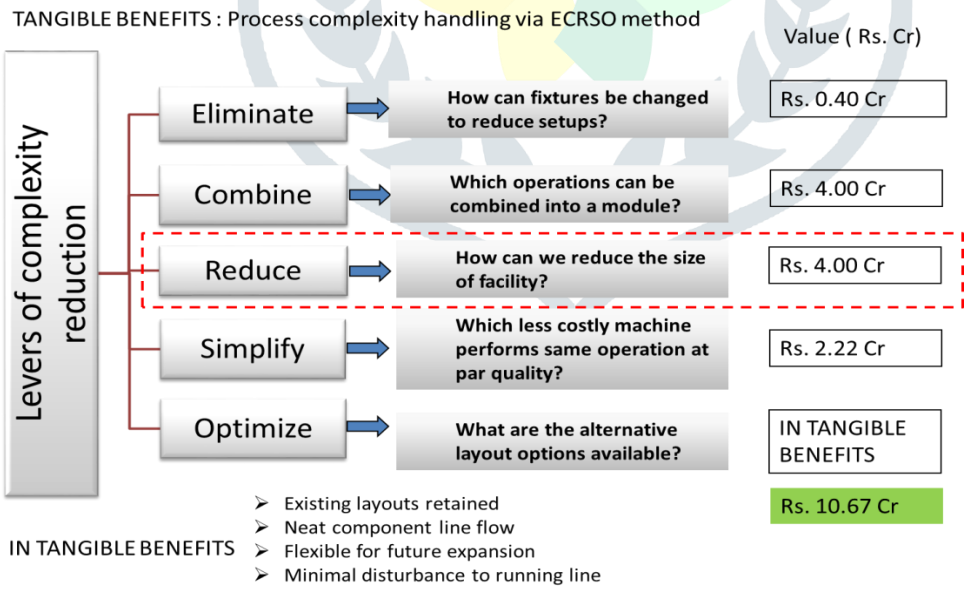
6. Part level complexity handling

FIGURE 6
Cost Benefit for Part Level Complexity Handling



7. Process level complexity handling

FIGURE 7
Cost Benefit for Process Level Complexity Handling



These benefits when viewed from a macro economic perspective yields a lot of return for running green commercial vehicle industry which also impacts the eco system surrounding the organization like roads, traffic density, better yield per logistic run and thereby paving a way to a greener economy.

8. Conclusion

The complexity observed across the organization needs to be managed strategically using the tools cited in the paper as a start point in reaping the benefits of running a greener business. In the present competitive scenario various cost saving measures need to be managed without compromise in quality to ensure business sustenance and longevity. This study is limited to commercial vehicle industry and paves way for future research applicable for other industries as well leading to global business green practices.

9. Reference

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