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Framework to select the most suitable production line in an apparel firm in Sri Lanka: use of Analytical Hierarchical Process

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The apparel industry is considered as one of the most labour-intensive industries in the world despite the technological advancements and the amount of automation. Line planning in the garment industry is the process of scheduling and allocating production orders to production lines according to the product setting and due dates of manufacturing completion. Most of the apparel manufacturers in Sri Lanka have switched to lean model production, in which large sewing departments are split into smaller, self-balancing sewing lines. The decisions that address the production line selection process for a particular production order still heavily rely on production planners, based on their experience. These decisions tend to be neither consistent nor scientific because of the lack of interdepartmental connectivity. Little emphasis has been placed on the impact of the planning considerations and ways to apportion certain production orders to the appropriate production system with specific characteristics. This problem is addressed in the research through the development of a multi criteria decision making framework to enable the incorporation of all the parameters to select the best production line for a particular sales order using Analytical Hierarchical Process (AHP). AHP method is adopted for decision making which models multiple, possibly conflicting factors dependent on each other and it makes appropriate trade-offs to recommend well-balanced solutions to different stakeholders. The production line selection criteria identified through expert opinions and literature review were applied in the AHP conceptual model. 23 factors were identified and they were categorized under 5 areas which are characteristics of the product, characteristics of the production order, characteristics of the production line, technical support and quality parameters. In order to build the AHP model, 4 manufacturing firms and 4 senior and middle level managerial industrial experts from each firm were selected and interviewed through AHP questionnaires. After the pairwise comparisons, each criterion was weighted and prioritized. Most of the interviews resulted in high priority for delivery date, technical infrastructure, skills inventory of the line, the efficiency of the line, and cadre requirement while the ability to adopt changeovers, prioritization of machine service, and infrastructure support by the technicians were given low priorities. This interprets that, for any kind of a production order the mostly prioritized criteria are important to be considered. Therefore, focusing on them in line selection would lead to improved planning efficiency. After the criteria comparison, each alternative production line was given a score against the planning criteria and the production lines were ranked in order to select the best production line. Through data analysis, it was found out that the results obtained from different industrial experts representing different apparel manufacturing firms vary from each other depending on individual perspective and policies inherent to the manufacturing firm. However, the framework can relate to any apparel manufacturing firm by allowing Decision Makers to select the valid criteria depending on the Production Order and its related parameters. Also, the framework can be used for other manufacturing industries with few modifications and assumptions. In order to avoid the subjectivity in AHP method, a Linear Programming model can be developed as a future improvement and optimize the production lines selected through AHP ranking.

Keywords: Apparel manufacturing, Production planning, MCDM methods, AHP method