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Original Article

Implementation of Lean Manufacturing Using MCDM-TOPSIS Approach in Switch Gear Manufacturing Industry

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Abstract - *Lean manufacturing is an assessment method that assesses productivity and eliminates inefficiency. Manufacturers employ lean manufacturing to maintain the pinnacle of competition by improving the efficiency of their industrial technologies and increasing product reliability. In this work, it was attempted to enhance the operational process of the company that manufactures various features for Medium Voltage (MV) Switchgear manufacturing lines of AEGIS 24 KV by minimizing waste and non-value added process variations using Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) approach and L8 Orthogonal Array (OA). Initially, various factors were considered. Then, combinations of the factors were experimentally arranged as per the L8 OA. Thereafter, the optimal combination is arrived at using the TOPSIS approach, considering the lead time for various combinations.*

Keywords - *Lean Manufacturing, TOPSIS, Switchgear, Orthogonal array.*

1. Introduction

Lean Manufacturing is a waste minimization technique that also increases the product value by reducing waste. In Lean principles, the product/service value is defined as recognition given by the customer. Thereafter, the product is made in a flow in line with the customer requirement and strives for perfection with continuous enhancement to minimize waste by sorting out Value Added Activity (VA) and Non-Value Added Activity (NVA) (Sundar et al, 2014). The NVA activity waste sources include motion waiting, overproduction, transportation, inventory overprocessing, and defects. Switchgear is a critical procurement item as its on-time delivery and predetermined cost determine whether an electrical contractor gets the contract (Alsumaidaee et al, 2022). Based on the methodology, switchgear/control gear manufacturing consists of cutting and bending, welding, pretreatment, undercoating, finish-coating, and assembly. Few researchers have analyzed the lead time reduction using different processes in the literature. Elfving et al (2002) have highlighted certain key problems in minimizing lead times for electrical switchgear (Elfving et al, 2002). Gawande et al (2018) developed a strategy for a kanban system in an electrical manufacturing company to reduce the inventory cost (Gawande et al, 2018). Sancheti et al (2018) observed that the robotic work stations showed the maximum defects using root cause analysis. Further, at the welding work station, it was observed that the existing method used to weld the tank was inappropriate because the operator had to take a new reference point for each new tank. Therefore, they suggested poke yoke and waste elimination to increase productivity (Sancheti et al, 2018). From the literature, it was observed that a few bottlenecks caused waste during lead time. However, a combination of multiple factors was not considered for reducing the lead time, as the switch gear manufacturing has many processes, including cutting, bending, welding, assembly, coating, etc. The Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) approach is a multi-criteria decision-making approach. Many researchers have used this approach for various decision-making tasks in many industrial processes. Tiwari et al. (2017) used the TOPSIS approach to select gear manufacturing processes (Tiwari et al., 2017). Bertolini et al (2020) employed the TOPSIS approach to obtain the optimal match between the manufacturing technologies and the product specifications (Bertolini et al, 2020). Ersoy (2020) conducted a green manufacturing selection using the TOPSIS method [Ersoy et al, 2020]. Gadakh (2012) selected the best parameters for the wire-electrical Discharge Machining process using the TOPSIS approach (Gadakh et al, 2012). Potdar et al (2018) used TOPSIS to select a suitable manufacturer industry (Potdar et al, 2018). Mahopatra et al (2018) used the TOPSIS in the optimization of gear cutting in Wire-Electrical Discharge Machining (WEDM) in Inconel 718 (Mohopatra et al, 2018). Sardar et al (2016) conducted a simulation study to optimize the layout in the gear manufacturing industry and presented the results (Sardar et al,2016). Stoidner et al (2024) analyzed the Time Data Management (TDM) in switchgear and control cabinet manufacturing, where several sectors integrate into industrial automation. It also provides empirical data for practical assesment to overcome the difficulties such as process measurement and reliability on expert time estimation (Stoidner et al, 2024).

The literature shows that multi-criteria decision-making of the factors of consideration with lean manufacturing in the switch gear manufacturing process is essential to minimize the lead time and increase production. In the previous literature, multiple criteria optimization with lean manufacturing was not done to identify the suitable factors for switch gear manufacturing.

Therefore, seven factors of consideration were chosen in this work, various combinations were obtained using an L8 Orthogonal array, and the lead time was measured experimentally. Thereafter, using the TOPSIS approach in lean manufacturing, the best combination of the factors is obtained via experimental results.

2. Switchgear Manufacturing Process

The switch gear manufacturing includes housing, support systems, busbars, switchgear, equipment, and cabling material (Zhou et al, 2023). Then, they are plugged together using connectors and the insertion of the flange bars. The bush bars, mounting plates, and other parts are mounted thereafter. Then the switchgear is installed and wall-mounted. Finally, the switchgear is cabled. The switch gear manufacturing process consists of the following processes: (1) Cutting and bending; (2) Welding; (3) Pretreatment; (4) Electrode deposition coating process; (5) Solvent based coating process; (6) Powder based coating process; (7) water-based coating process; (8) Assembly; (9) Bonding; (10) Touch up coating process. They are briefly explained below.

2.1. Cutting and Bending

The first processes in switchgear manufacturing are cutting and bending (Feng et al, 2023). During these processes, the production team cuts and builds the stainless steel body of the switch gear based on the product design. The thickness is generally 1.5 mm to 2.5 mm. However, dimensions vary based on the application. The preliminary work is carried out with utmost care, as the accuracy and sensitivity increase the quality of the electrical panel in sensitive machines. In this work, two sets of cutting and bending tools are compared. The second set consists of special bending tools for manufacturing switch gears.

2.2. Welding

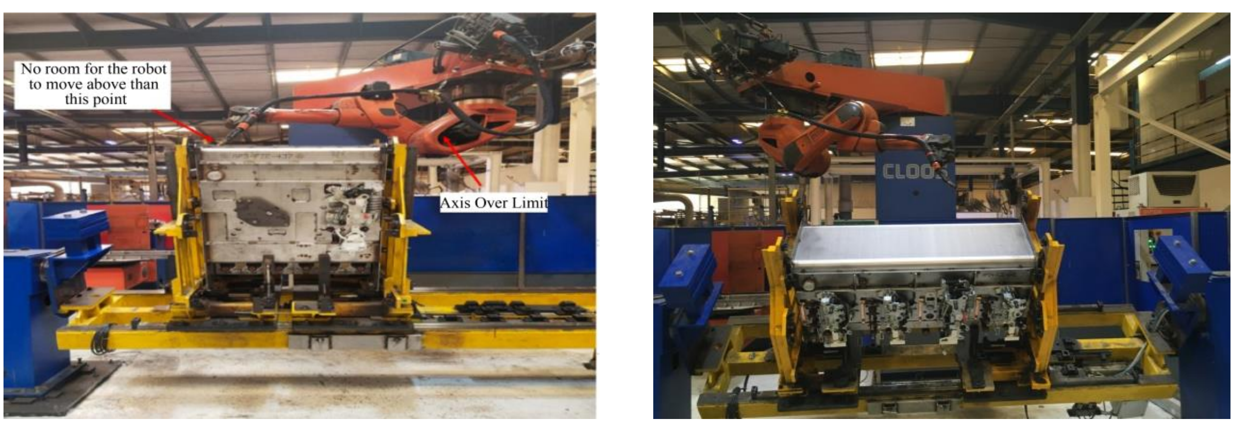
The next process is the welding process. In this process, the metal material is butted and bonded with welding rods or filler wires using electrical arc welding or gas heating. This work uses two different setups of Metal Inert Gas welding (MIG) and laser welding as shown in Figure 1. Setup 1 has only one welding point, and the extension of the welding arm is limited. Setup 2 has two welding points, and the welding arm extension is longer than that of Setup 1. These two methods' outcomes are compared.

2.3. Coating Process

After the metals are welded, they are coated with powder and solvents for better durability. The coating process is divided into pretreatment, undercoating, and finish coating. The undercoating is further divided into electrode deposition and solvent-based coating. The finish coating is further divided into solvent-based coating, powder-based coating, and water-based coating.

2.4. Assembly and Bonding Process

After the manufacturing of various parts of the switchgear, they are assembled. The wires and the control gear assemblies in the switch gears are soldered. Thereafter, the rubber materials are bonded into the switchgear and control assembly. Finally, they are touched up with a final layer of coating.



(a) **(b)**

Fig. 1 Welding stations (a) Setup 1, and (b) Setup 2.

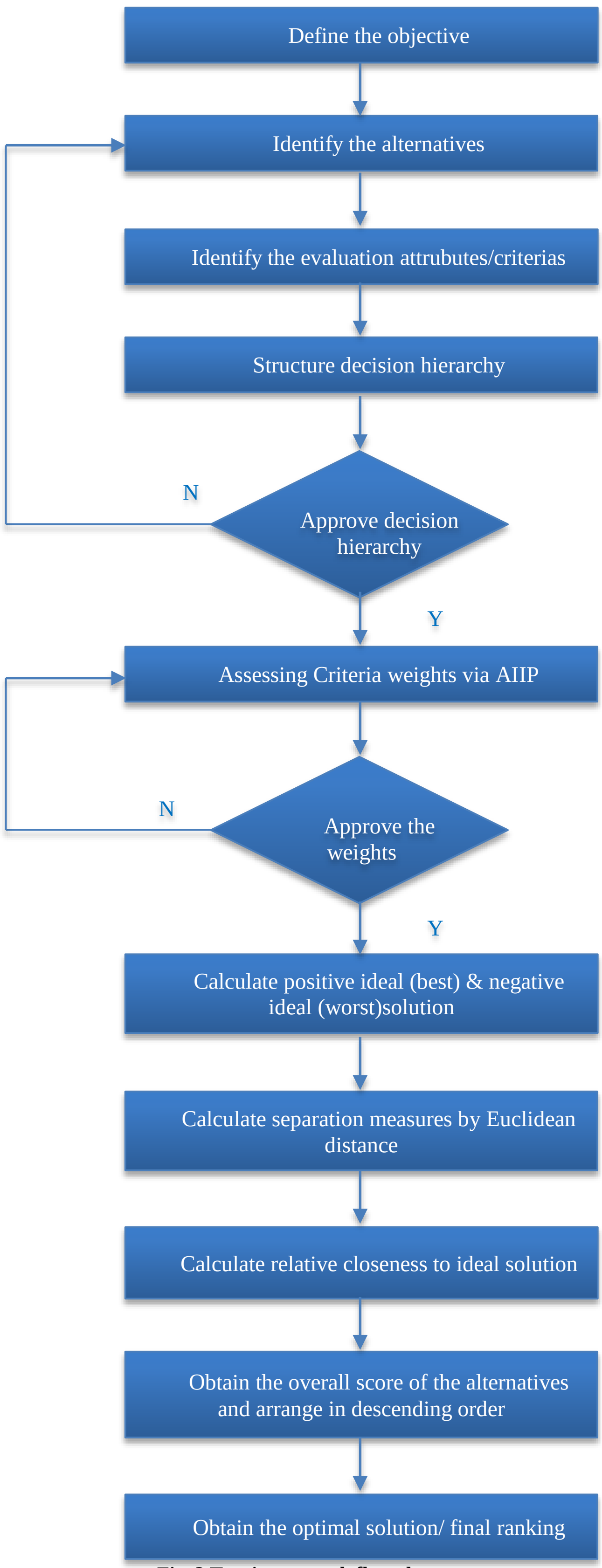


Fig. 2 Topsis approach flow chart

2.5. Existing Production Process

The current state of the mapping function is higher than the end of the good products from the raw materials.CSM is mainly used to analyze more time-consuming and non-value-added activities.CSM's Inquiry shows that 98% of non-value-added time accounts for information product distribution. Some interruptions may be unavoidable; however, it is surprisingly significant that time is spent waiting or on non-value-adding operations during delivery. Excess is a major hurdle in the current process, contributing to the long wait time and resulting in longer delivery times. Therefore, multi-criteria optimization is required for enhancing the productivity and lead time.

3. Topsis Approach

Multi-Criteria Decision-Making (MCDM) is a method for selecting the suitable option from a set of decision alternatives. The key steps in multi-criteria decision-making are the following: (a) to determine criteria for system evaluation that is related to system capabilities and goals, (b) alternatives generation, (c) alternatives evaluation in terms of criteria, (d) applying the methods of normative multiple criteria analysis, (e) finalizing one of the alternatives as the best solution. However, group decision-making is even more complicated than individual decision-making as it includes many controversial factors, like goals that are conflicting individually, inefficient knowledge, information validity, etc. In Multi-Criteria Decision-Making (MCDM) and Group Decision-Making (GDM), the two predominant steps are aggregation and exploitation. In GDM, appropriate operators aggregate a set of parameters. The multi-criteria method is applied to these sets, and the obtained solution implies group preference. The TOPSIS approach (Figure 2) has the following steps: (1) Formation of the decision matrix and determining the weight of criteria; (2) Evaluation of the normalized decision matrix. (3) Evaluation of the weighted normalized decision matrix; (4) Obtaining the positive and negative ideal solutions; (5) Evaluation of the separation measures from the positive ideal solution; (6) Evaluation of the relative closeness to the positive ideal solution; (7) Ranking of the preference order or select the option closest to 1.

4. Selection of Factors

In the switch gear manufacturing of AEGIS 24 KV medium voltage switches, the important factors to be considered are shown in Table 1. These factors are considered based on the existing switch gear manufacturing process and equipment. The batch size considered is 25, with 100 parts for each batch. The factors considered are the type of welding technology, layout of the production process, Implementation of special bending tools, Usage of new technology robots, high voltage and partial discharge, and operation training on multi-skilling. In welding technology, MIG welding is used in the current state, and Laser welding is used in the modified state. Further, the current state layout is shown in Figure 3. The modified layout is shown in Figure 4. The schematic representation of the path of the process in the current and modified states is shown in Figure 5. Figure 5(a) shows that the material movement is high, which may lead to more production time. However, Figure 5(b) shows that the zigzag product movement is avoided, decreasing production time. Further, the space is well utilized under one roof.

Special bending tools are not utilized in the current state, whereas special bending tools are used in the modified state. Further, in the modified state, new technology robots are also used. Considering the number of welding stations, the current state has only one welding station, whereas the modified state has two welding stations. Moreover, high voltage and partial discharge techniques were employed in the modified state, and operation training in multi-skilling was also provided to the laborers. Once the factors of consideration were selected, the suitable combinations were considered as per the L8 Orthogonal Array (OA) (Table 2). L8 orthogonal array is used for seven two-level factors. Since our work has seven two-level factors, L8 was used.

Table 1. Factors of consideration for AEGIS switch gear manufacturing

S. No	Factors of consideration	Current state (1)	Modified State (2)
1	Welding Technology	MIG	Laser Welding
2	Layout of the production process	Layout 1	Layout 2
3	Implementation of special bending tools	No	Yes
4	Including New Technology Robots	No	Yes
5	No. of Welding stations	1	2
6	High Voltage and Partial Discharge	No	Yes
7	Operation Training on multi-skilling	No	Yes

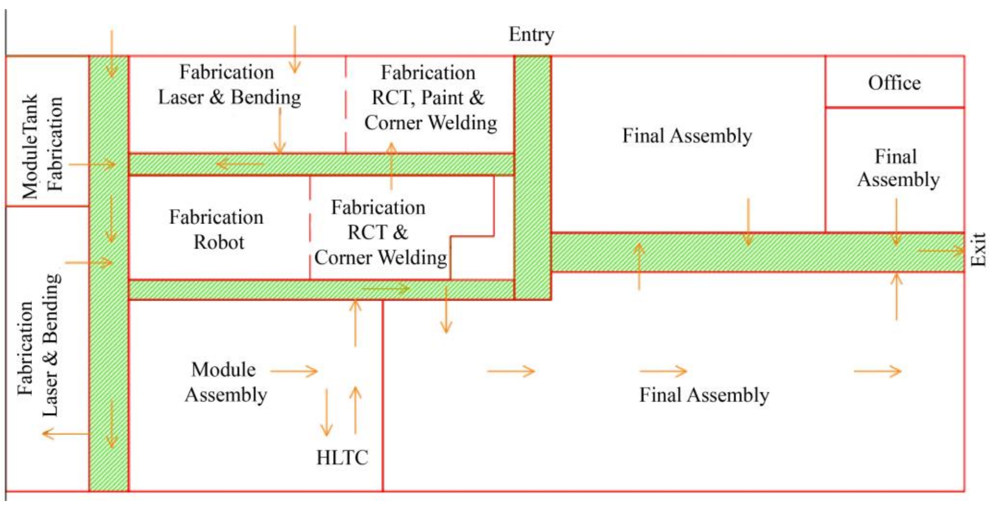


Fig. 3 Schematic representation of the modified state layout 2

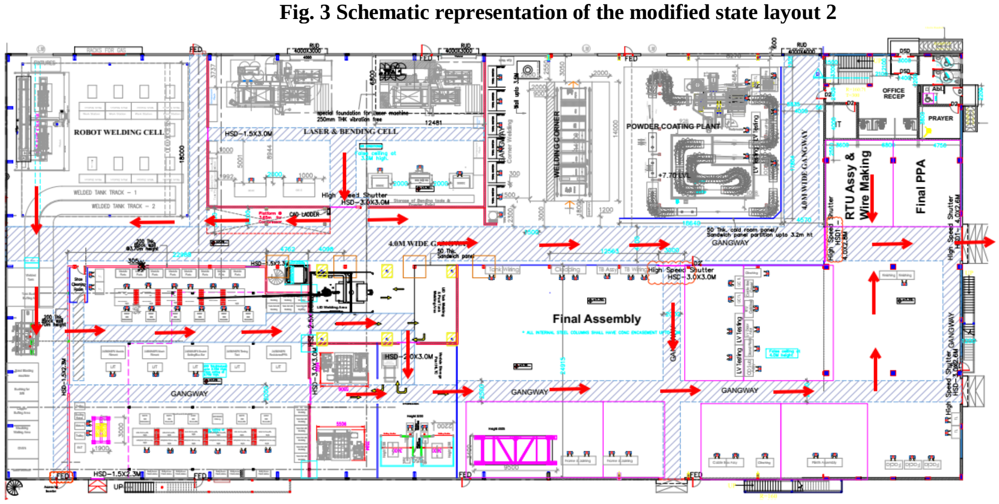


Fig. 4 Schematic representation of the state layout 1

(a) (b)

Fig. 5 Schematic representation of movement in the current layout and modified layout

Table 2. Combination of factors using L8 orthogonal array

Exp No.	Factors of Consideration						
	1	2	3	4	5	6	7
1	1	1	1	1	1	1	1
2	1	1	1	2	2	2	2
3	1	2	2	1	1	2	2
4	1	2	2	2	2	1	1
5	2	1	2	1	2	1	2
6	2	1	2	2	1	2	1
7	2	2	1	1	2	2	1
8	2	2	1	2	1	1	2

5. Results and Discussions

5.1. Results of Experimental Evaluation of the Factor Combinations

The combinations of factors were implemented experimentally at the switch gear manufacturing company, and the outputs were processed. The processed outputs include Laser cutting operation time, Punching time, Bending operation time, Robot welding time, Corner welding time, Reactive Chromium Treatment RCT, Powder coating time, and Assembly time.

Further, for the assembly process, tank washing and DU bush fitting, bush assembly, switch and Circuit Breaker CB sub-assembly, switch and CB cassette assembly, mechanism fitment and interlock fixing, snatch setting, endurance and timing, contact resistance and lid closing, busting disc assembly and Helium Leak Testing ChamberHLTC, and High Voltage/Partial Discharge HV/PD testing. During the finishing assembly, the processes considered were base and stand assembly, tank assembly, tank wiring, cladding, relay wiring, Low Voltage LV testing, finishing, final inspection, and palleting.

The lead time is calculated by considering both the machining time and the man-hours of the process. The total lead time for the above-mentioned processes is experimentally recorded for each combination of the consideration factors in L8 OA. The results for combination 1 are shown in Tables 3, 4, and 5. Similar results were obtained for all eight combinations, and the overall time taken is obtained by adding the fabrication processes time, module assembly time, and finishing assembly time. The results obtained are tabulated in Table 6.

5.2. Results of Topsis Analysis

The steps involved in the TOPSIS evaluation are followed as discussed in Section 2. The following steps were carried out to determine the optimal solution.

5.2.1. Formation of the Decision Matrix and Normalized Matrix

The matrix values were normalized using Equation (1). The decision matrix is formed, and the weight criteria are determined as shown in Table 7. Table 7 shows that all the factors are non-beneficial, i.e., the lower the better. Therefore, the weights are taken as non-beneficial. Then the decision matrix was normalized using standard formulae shown in Equations (1)-(3). and tabulated in Table 8.

$$n_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}}\ , \tag{1}$$

$$n_{ij} = \frac{x_{ij}}{\max_i x_{ij}}\ , \tag{2}$$

$$n_{ij} = \begin{cases} \dfrac{x_{ij} - \min_i x_{ij}}{\max_i x_{ij} - \min_i x_{ij}} \text{if} C_i \text{ is a benefit criterion} \\ \dfrac{\max_i x_{ij} - x_{ij}}{\max_i x_{ij} - \min_i x_{ij}} \text{if} C_i \text{ is a cost criterion} \end{cases} \tag{3}$$

for $i = 1, \ldots\ldots, m; j = 1, \ldots\ldots, n.$

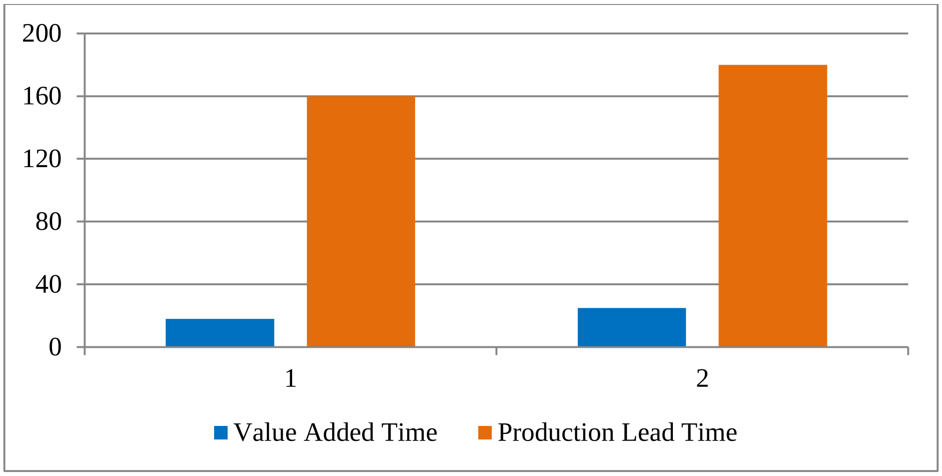


Fig. 6 Comparison of production lead time and value added time in previous and proposed manufacturing factors

5.2.2. Formation of the Weighted Normalized Matrix and Ideal Positive and Negative Solutions

From the normalized matrix in Table 8, the weighted normalized matrix is obtained using Equation (4)-(5)

$$n_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}} , \quad (4)$$

$$n_{ij} = \frac{x_{ij}}{\max_i x_{ij}} , \quad (5)$$

$$v_{ij} = w_j n_{ij} \; for \; i = 1, \dots \dots, m: j = 1, \dots \dots \dots, n.$$

Where w_j is the weight of the j-th criterion, $\sum_{j=1}^{n} w_j = 1$.

Then the ideal positive and negative and relative closeness were determined as shown in the Equations (6)-(11). The positive ideal option is the extreme performance on each criterion, and the negative ideal option, the reverse extreme performance on each criterion, are identified. The ideal positive solution is the solution that maximizes the benefit criteria and minimizes the cost criteria. In contrast, the negative ideal solution maximizes the cost criteria and minimizes the benefit criteria.

Positive ideal solution A^+has the form:

$$A^+ = (v_1^+, v_2^+, \dots \dots, v_n^+) = \left[\left[\max_i v_{ij} \backslash j \in I\right], \left[\min_i v_{ij} \backslash j \in J\right]\right] \quad (6)$$

Negative ideal solution A^- has the form:

$$A^- = (v_1^-, v_2^-, \dots \dots, v_n^-) = \left[\left[\min_i v_{ij} \backslash j \in I\right], \left[\max_i v_{ij} \backslash j \in J\right]\right] \quad (7)$$

Where I is associated with benefit criteria and J with the cost criteria, $i = 1, \dots \dots, m: j = 1, \dots \dots \dots, n.$

The separation of each alternative from the positive ideal solution is obtained using.

$$d_i^+ = \left[\sum_{j=1}^{n} \left(v_{ij} - v_j^+\right)^p\right]^{1/p}, i = 1, 2, \dots \dots, m. \quad (8)$$

The separation of each alternative from the negative ideal solution is obtained using

$$d_i^- = \left[\sum_{j=1}^{n} \left(v_{ij} - v_j^-\right)^p\right]^{1/p}, i = 1, 2, \dots \dots, m. \quad (9)$$

Where $p \geq 1$. For $p = 2$ we have the most used traditional n- dimensional Euclidean metric.

$$d_i^+ = \sqrt{\sum_{j=1}^{n} \left(v_{ij} - v_j^+\right)^2} \; , i = 1,2, \dots \dots \dots, m \quad (10)$$

$$d_i^- = \sqrt{\sum_{j=1}^{n} \left(v_{ij} - v_j^-\right)^2} \; , i = 1,2, \dots \dots \dots, m \quad (11)$$

The relative closeness of the i-th alternative A_j with respect to A^+ is defined as shown in Equation (12).

$$R_i = \frac{d_i^-}{d_i^- + d_i^+}, \quad (12)$$

Where $0 \leq R_i \leq 1, i = 1, 2, \dots \dots, m.$

5.2.3. Ranking of Combinations using TOPSIS

Finally, the combinations were ranked from closest to 1. The results are tabulated in Table 9. From the results, it is observed that the optimal combination of the factors is combination 7. In combination 7, the welding process is laser welding, and layout 2 is used. There is no requirement for special bending tools and new technology robots. The number of welding stations is 2, and high power and partial discharge are required. Operators' training on multi-skilling is not required. According to this TOPSIS analysis for implementing lean manufacturing in the switch gear manufacturing industry, the above factor combination is optimal. The results show that the optimal solution obtained using the TOPSIS method in the switch gear industry has enhanced the productivity and lead time compared to traditional layouts in switch gear manufacturing. Using the TOPSIS approach, an optimal combination of various selection criteria is selected, which enhances the lead time and productivity as shown in Figure 6.

6. Conclusion

In this work, an attempt was made to enhance the operational process of the company that manufactures various features for MV Switchgear manufacturing lines of AEGIS 24 KV by minimizing waste and non-value added process variations using Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) approach and L8 Orthogonal array (OA). Initially, various factors were considered. Then, combinations of the factors were experimentally arranged as per the L8 OA. Thereafter, the optimal combination is arrived at using the TOPSIS approach, considering the lead time for various combinations. From the results, it is observed that the optimal combination of the factors is combination 7. In combination 7, the welding process is laser welding, and layout 2 is used. There is no requirement for special bending tools and new technology robots. The number of welding stations is 2, and high power and partial discharge are required. Operators' training on multi-skilling is not required. According to this TOPSIS analysis for implementing lean manufacturing in the switch gear manufacturing industry, the above factor combination is optimal. The results were obtained by experimentally implementing the optimized combination in the switch gear manufacturing industry, and the productivity and lead time results are compared.

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Appendix

Table 3. Results of the combination 1 experiment for different fabrication processes

Product / Operation	Laser Cutting Operation			Punching (Only Embossing)			Bending Operation			Robot Welding			Corner Welding			RCT			Powder Coating/Zinc Spray			Total time
	M/C Time	Man hours	Total	M/C Time	Man hours	Total	M/C Time	Man hours	Total	M/C Time	Man hours	Total	M/C Time	Man hours	Total	M/C Time	Man hours	Total	M/C Time	Man hours	Total	
Ags 24kV 4W – Finishing Fabrication (THM0159651)	0.94	1.88	2.82	0.24	0.24	0.48	5.9	6.9	12.8	0	0	0	2.4	2.4	4.8	1.1	1.3	2.4	1.1	4.4	5.5	
Ags 24kV 4W Module Fabrication (THM0157121)	0.38	0.76	1.14	0	0	0	0.82	0.89	1.71	3	0.76	3.76	0	0	0	0	0	0	0	0	0	
Processing Time Fabrication			3.96			0.48			14.51			3.76			4.8			2.4			5.5	**35.41**

Table 4. Results of the combination 1 experiment for module assembly processes

Product / Operation	Tank Washing & DU bush fitting	Bushing Asslemby	Switch & CB Sub-Assembly	Switch & CB Cassette Assembly	Mechanism fitment & Interlock Fixing	Snatch setting, Endurance & Timing	Contact Resistance & Lid Closing	Busting disc assly + HLTC	HV/PD test	Total time
Ags 24kV 4W Module Assly (THM0157121)	0.4	0.73	2.3	2.59	3.86	4.45	1.3	1.96	0.31	**17.9**

Table 5. Results of the combination 1 experiment for finishing assembly processes

Product / Operation	Base & Stand Assly	Tank Assly	Tank Wiring	Cladding	Relay Wiring	LV Testing	Finishing	Final Inspection	Palleting	Total time
Ags 24kV 4W - Finishing Assembly (THM0159651)	0.75	1.05	2.8	1.75	2.75	3.11	3.45	1.85	0.8	**18.31**

Table 6. Results of the total process time of all combination experiments

Combination Experiment	Laser cutting operation	Punching time	Bending operation time	Robot welding time	Corner welding time	RCT	Powder coating time	Assembly time	Total Time
1	3.96	0.48	14.51	3.76	4.8	2.4	5.5	36.21	71.62
2	3.96	0.48	14.51	3.56	3.5	2.4	5.5	33.68	67.59
3	3.94	0.51	11.1	3.56	3.5	2.4	5.5	34.69	65.20
4	3.94	0.51	11.1	3.56	3.5	2.4	5.5	34.69	65.20
5	3.96	0.48	1105	3.76	3.8	2.4	5.5	35.16	66.11
6	3.96	0.48	10.85	2.55	2.2	2.4	5.5	35.16	63.10
7	3.96	0.48	13.42	2.44	2	2.4	5.5	35.16	65.36
8	3.96	0.48	13.11	2.44	2.4	2.4	5.5	35.16	65.45

Table 7. Decision matrix with weight criteria

Weight	**Non-Beneficial (NB) 0.125**	**NB 0.125**	**NB 0.125**	**NB 0.125**	**NB 0.125**	**NB 0.125**	**NB 0.125**	**NB 0.125**
Experiment	**Laser cutting operation**	**Punching time**	**Bending operation time**	**Robot welding time**	**Corner welding time**	**RCT**	**Powder coating time**	**Assembly time**
1	3.96	0.48	14.51	3.76	4.8	2.4	5.5	36.21
2	3.96	0.48	14.51	3.56	3.5	2.4	5.5	33.68
3	3.94	0.51	11.1	3.56	3.5	2.4	5.5	34.69
4	3.94	0.51	11.1	3.56	3.5	2.4	5.5	34.69
5	3.96	0.48	11.05	3.76	3.8	2.4	5.5	35.16
6	3.96	0.48	10.85	2.55	2.2	2.4	5.5	35.16
7	3.96	0.48	13.42	2.44	2	2.4	5.5	35.16
8	3.96	0.48	13.11	2.44	2.4	2.4	5.5	35.16

Table 8. Normalized Decision Matrix

Weight	**Non-Beneficial (NB) 0.125**	**NB 0.125**	**NB 0.125**	**NB 0.125**	**NB 0.125**	**NB 0.125**	**NB 0.125**	**NB 0.125**
Experiment	**Laser cutting operation**	**Punching time**	**Bending operation time**	**Robot welding time**	**Corner welding time**	**RCT**	**Powder coating time**	**Assembly time**
1	0.353999512	0.347990583	0.408887559	0.408537124	0.509285611	0.35355	0.353553391	0.365828481
2	0.353999512	0.347990583	0.408887559	0.386806426	0.371354092	0.35355	0.353553391	0.340267971
3	0.352211636	0.369739994	0.312794756	0.386806426	0.371354092	0.35355	0.353553391	0.350471969
4	0.352211636	0.369739994	0.312794756	0.386806426	0.371354092	0.35355	0.353553391	0.350471969
5	0.353999512	0.347990583	0.311385771	0.408537124	0.403184442	0.35355	0.353553391	0.355220364
6	0.353999512	0.347990583	0.305749829	0.2770664	0.233422572	0.35355	0.353553391	0.355220364
7	0.353999512	0.347990583	0.378171678	0.265114517	0.212202338	0.35355	0.353553391	0.355220364
8	0.353999512	0.347990583	0.369435969	0.265114517	0.254642806	0.35355	0.353553391	0.355220364

Table 9. Ranking of combinations using the TOPSIS method

Weight	**Non-beneficial (NB) 0.125**	**NB 0.125**	**NB 0.125**	**NB 0.125**	**NB 0.125**	**NB 0.125**	**NB 0.125**	**NB 0.125**	**Si+**	**Si-**	**Pi**	**Rank**
Experiment	**Laser cutting operation**	**Punching time**	**Bending operation time**	**Robot welding time**	**Corner welding time**	**RCT**	**Powder coating time**	**Assembly time**				
1	0.044249939	0.043498823	0.051110945	0.05106714	0.063660701	0.04419	0.044194174	0.04572856	0.043323356	0.002719	0.059048	**6**
2	0.044249939	0.043498823	0.051110945	0.048350803	0.046419261	0.04419	0.044194174	0.042533496	0.028167687	0.017951	0.389237	**4**
3	0.044026454	0.046217499	0.039099344	0.048350803	0.046419261	0.04419	0.044194174	0.043808996	0.025237927	0.021276	0.457409	**5**
4	0.044026454	0.046217499	0.039099344	0.048350803	0.046419261	0.04419	0.044194174	0.043808996	0.074579427	0.021276	0.221958	**7**
5	0.044249939	0.043498823	0.038923221	0.05106714	0.050398055	0.04419	0.044194174	0.044402546	0.029922489	0.018264	0.379032	**8**
6	0.044249939	0.043498823	0.038218729	0.0346333	0.029177821	0.04419	0.044194174	0.044402546	0.003579273	0.040429	0.918668	**2**
7	**0.044249939**	**0.043498823**	**0.04727146**	**0.033139315**	**0.026525292**	**0.04419**	**0.044194174**	**0.044402546**	**0.009246363**	**0.041525**	**0.817883**	**1**
8	0.044249939	0.043498823	0.046179496	0.033139315	0.031830351	0.04419	0.044194174	0.044402546	0.00974991	0.036987	0.791388	**3**