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Duration of Outfit Layout using Fuzzy Critical Path Analysis

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Abstract*: For trendy garment new designs and technologies are used. In this current study, fuzzy logic is used to compute the duration to design the new garments no restriction in using the needed products is considered for planning. The article is on women kurti producer. The existing style was studied and the time taken to design is analyzed and finally the product time for designing the kurti was calculated with the tool fuzzy critical path technique. Finally, it was analyzed that the normal time 620 seconds to design was reduced to around 22% of normal time after applying the tool.

***Keywords:* Apparel, Fuzzy critical path method, Manufacturing, Process layout, Designing.**

I. INTRODUCTION

In this century trendy kurti is the one among the traditional dress which is very comfortable, economical and popular garment for all categories of ladies. Costume designers design different style and fit size as per the expectation of the ladies. In this busy and changing taste in costumes, expectations changes within a short term. So, a manufacture with the help of the stylist and designers is in an urgent to launch their new design as early as possible to with stand their name and economy. Regarding this purpose and to hold the name in the ladies word the technology applied for computing the completion time for designing layout of kurti, fuzzy critical path analysis is used.

In early 19th centuries Critical path analysis technique was established. The particular order for designing and launching the new designed product with limited and earlier time than the current style and time usually expected for completing the designing the product [1].

Fuzzy set theory [2] was the new technique applied to analyze and predict whether to bring to the market the new product. Nasution [3] in his research analyzed that any real physical situations can be analyzed using fuzzy critical path method only when the fuzzy substation results are positive. Chanas and Zielinski [4] in their results in the manuscript has discussed critical path analysis of the ordered sequence flow with fuzzy task duration [5] to the basic notion treating it mapping of task completion duration in the sequence of work. Slyeptsov and Tyshchuk [6] designed a tool fuzzy time for start and finish duration in the fuzzy problems.

Fuzzy set theory is one of the best theories which is used when exact value for the event cannot be predicted. The non identical terms can also be represented by the reasoning of fuzzy set theory [7]. Liang and Han [8] in their article have given and proved an algorithm to estimate the duration.

Fashion is one which is changing without any fixed duration, the current style of processing and designing the outfit of a garment depended on the garments. Fuzzy critical path technique is one among the tool which is applied to save the money and time for designing and processing the technology. This tool is an ordered sequencing of work in designing the outfit. Each work in the sequence is processed only after finishing the predecessor work.

Researchers with the help of the data collected during the survey have analyzed that right activity at right time was always economical and time saving. The study and research on the current market need is the only way for the growth of any business [9]. Experts have no second thought for best output of any product the maker should understand the need of his product user [10].

II. LITERATURE SURVEY

Author (s) can UM Takebira and ATM Mohibullah [11] has researched on men's T- shirt designers that is, a ready wear factory. In their research they have analyzed the current state of the shirt designing and output of the product. Finally they have organized and given an algorithm for designing the output with the help of the technical tool critical path method. To prove and give a theoretical duration before experimenting is using the tool critical path method to know the shortest duration in completing the product than the traditional process used in designing the product. As an end conclusion, using of the critical path method in garment designing and producing minimizes the time of production.

T Thulasimani [12] reviewed on kurti using critical path method.

III. HYPOTHESIS

If we apply garment (Kurti) parts assembling, using stitching machines the complete design flow with minimum designing time will be calculated.

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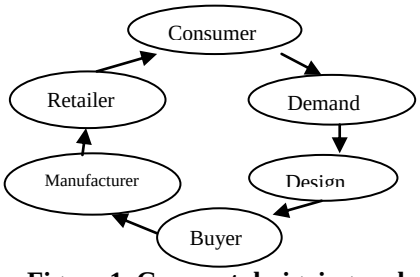

Figure 1. Garment designing cycle

IV. PROCEDURE FOR COMPUTING FUZZY CRITICAL PATH

A. Description of case study

620 seconds are taken to design a kurti by conventional method. To reduce the stitching time of the outfit the tool fuzzy critical path is applied. The analysis on the design was a real case was experimented on knit garment plant. The entrepreneur characteristic is to design new product, according to his users demand. In particular, the current research was on planning and observing the production process layout of trendy outfit. The expected activities, in the research, and their approximate completion as per the scheduled time are tabulated

Table 1. Activities with Durations

ID	Task	Previous activity	Fuzzy task time(Seconds) *FATij*
A12	Cup sleeve hemming	-	Approximately 61 (60,61,61,62)
A23	Neck design	A12	Approximately between 122 and 123 (120, 122, 123, 125)
A24	Neck hemming	A12	Approximately between 96 and 97 (95, 96,97,98)
A35	Shoulder joining	A23, A24	Approximately between 51 and 52 (50, 51, 52, 53)
A56	Attaching the brand label	A35, A24	Approximately 13 (10, 13, 13, 15)
A57	Attaching the size label	A35, A24	Approximately 11 (10, 11,11,12)
A47	Joining the sleeves	A24	Approximately 11 (10, 11,11,12)
A78	Sleeve attachment	A47, A57, A67	Approximately 87 (85, 87, 87, 89)
A89	Bottom hemming	A78	Approximately between 56 and 57 (55, 56, 57, 58)
A910	Side joining	A89	Approximately 91 (90, 91, 91, 92)

B. Fuzzy activity time computation

In this current work, the fuzzy task time, denoted by FATij, of activity Pij for the designing sequence of task by using trapezoidal number FATij = (gij, eij, fij, hij) where gij, hij are least and highest values of computed activity time for Pij, whereas eij and fij are the first quartile and third quartile of task duration for Pij. The greatest and least value can be predicted with four data gij, eij,fij and hij. Conversely, the fuzzy task time is computed with the help of the user's knowledge and previous experience when the tasks information is not clear.

With the help of the extension principle studies in [6], the FATij of any two tasks are computed with the help of two operations: 1. Addition 2. Subtraction

Addition $\oplus$:

$$FAT1 \oplus FAT2 = (g1, e1, f1, h1) \oplus (g2, e2, f2, h2) = (g1 + g2, e1 + e2, f1 + f2, h1 + h2)$$

Subtraction Θ

$$FAT1 \,\Theta\, FAT2 = (g1, e1, f1, h1) \,\Theta\, (g2, e2, f2, h2) = (g1 - h2, e1 - f2, f1 - e2, h1 - g2)$$

C. The Trapezoidal fuzzy number ranking

Fuzzy critical path method needs the ranking technique. Fuzzy number ranking is computed using different technique by different authors. Among them the technique developed by Park [13] has some accurate analysis of the reports. But the ranking method analyzed and implemented by Han [8] is applied is used in recent studies. In the current analysis on trendy kurti production also the method implemented by Han[8] is only applied .

Let *FATij* = (g*ij*, e*ij*, f*ij*, h*ij*) be the fuzzy activity time of activity *Aij*. The decision maker's risk attitude index α can be obtained by

$$\alpha = \left[\sum_i \sum_j \frac{f_{ij} - e_{ij}}{(f_{ij} - e_{ij}) + (h_{ij} - g_{ij})} \right] \div t \quad \text{----- (1)}$$

$$R(\breve{A}_i) = \alpha \left[\frac{(h_i - a_1)}{(a_2 - a_1 - g_i + h_i)} \right] + (1-\alpha) \left[\frac{1-(a_2 - e_i)}{(a_2 - a_1 + f_i - e_i)} \right]$$

a_1 = Infimum of D,

a_2 = Supremum of D

D. Notation

N = Set of all end points in the complete project

Pij = the work between nodes i and j.
FATij = work time of Aij.
FASj = beginning time of node j.
LFj = ending time of node j.
TSij = total slack time of Aij.
SA(j) = The set of all upcoming work of node j.
NCS(j) = The set of all nodes connected to all upcoming work of node j
FP(j) = The set of all previous work of node j.

Before applying the procedure to find the duration the beginning edge is assumed with zero time, FAS1 = (0, 0, 0, 0). Then,

$$FASj = \max\{FASi \oplus FATij \mid i \in NP(j), j \neq 1, j \in N\} \quad (2)$$

$$LFj = \min\{LF_k \,\Theta\, FA_{jk} \mid k \in NS(j), j \neq n, j \in N\} \quad (3)$$

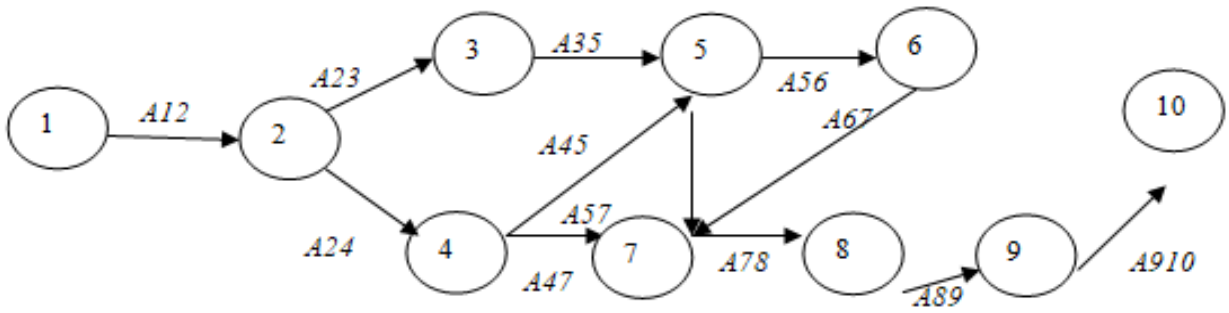

Figure 2. Network Diagram

V. RESULT AND DISCUSSION

The By considering (1) the total risk index α = 0.51.
Set *FAS*1 = (0, 0, 0, 0) and
Computing *FASj*, *j* = 2, 3, 4, 5, 6, 7, 8, 9, 10 using (2).

FAS2 = (60, 61, 61, 62);
FAS3 = (180, 183, 184, 187);
FAS4 = (135, 157, 158, 160);
FAS5 = (230, 234, 236, 240);
FAS6 = (240, 247, 249, 255);
FAS7 = (240, 247, 249, 255);
FAS8 = (325, 334, 336, 344);
FAS9 = (380, 390, 393, 402);
FAS10= (470, 481, 484, 494)

Set *LF10* = (470, 481, 484, 494) and
calculate *LFj*, *j* = 9, 8..2, 1 using (3) .

LF9 = (378, 397,396,404);
LF8 = (320, 340, 340, 349);
LF7 = (231, 253, 253, 264)
LF6 = (231, 253, 253, 264);
LF5 = (216, 240, 240, 254) ;
LF4 = (216, 240, 240, 254)
LF3 = (163, 188, 189, 204);
LF2 = (38, 65, 67, 84);
LF1 = (-24, 4, 6, 24)

The paths are

P ={(1,2,3,5,6,7,8,9,10), (1,2,4,5,6,7,8,9,10), (1,2,4,7,8,9,10),(1,2,4,5,7,8,9,10)}

By ranking the paths the critical path is (1, 2, 3, 5, 6, 7, 8, 9, 10) and the completion time is approximately between 481 to 484.

VI. CONCLUSION

By applying the technique 22% time in designing the trendy outfit has been reduced. Actually the time take to design a trendy kurti was about 620 seconds , but after applying this tool the entrepreneur was able to know that the designing period for the outfit has been approximated around an average period of 483 seconds which usually by previous technique take 620 seconds. The reduction rate was around 137 seconds to complete the design and production process of a trendy kurti. By applying this technique a time minimisation of around 137 seconds will really result in the entrepreneur's recourse power which would reduce their budget in planning the new trendy kurti.

REFERENCES

1. Christopher, "The agile supply chain: competing in volatile markets," Industrial Marketing Management, vol. 29 (1), 2000, pp. 37-44.
2. Zadeh, L.A., "Fuzzy Sets," Information and Control, Vol. 8, 1965, pp. 138-353 .
3. Nasution, S.H., "Fuzzy Critical Path Method," IEEE Transportation Systems Man Cybernet, Vol. 24, 1994, pp. 48-57.
4. Chanas, S. and Zielinski, P., "Critical Path Analysis in the Network with Fuzzy Activity Times," Fuzzy Sets and Systems, Vol. 122, 2001, pp. 195-204 .
5. Mohleji, S.C., "A Route-Oriented Planning and Con- trol Concept for Efficient Flight Operations at Busy Airports," Control Engineering Practice, Vol. 4, No. 8, 1996, pp. 1143-1151 .
6. Slyeptsov, A.I. and Tyshchuk, T.A., "A Method of Computation of Characteristics of Operations in a Prob- lem of Fuzzy Network," Cybernetics and Planning and Management System Analysis, Vol. 39, No. 3, 2003, pp. 367-378.
7. Zadeh, L.A., "The Concept of a Linguistic Variable and Its Application to Approximate Reasoning I, II, III," Information Sciences, Vol. 8, pp. 199-249, pp. 301-357; Vol. 9, 1975, pp. 43-80.
8. Liang, G.S. and Han, T.C., "Critical Path Analysis Based on Fuzzy Concept," International Journal of Informa- tion and Management Sciences, Vol. 15, No. 4, 2004, pp. 29-40.
9. M Kielmas, "History of the Critical Path Method," Chron Com Demand Media.1, **2015**.
10. CF Gray, EW Larson, "Project management: The managerial process," Asia: McGraw-Hill, (**2010**).
11. UM Takebira and ATM Mohibullah, "Using Critical Path Method for Making Process Layout of a T-Shirt within Earliest Finish Time," Journal of Textile Science & Engineering, vol. 7, 2017, pp. 1-5.
12. Thulasimani T, Arasu K and Yazharasu A, "Scheduling manufacturing process layout of a kurti applying critical path method", AIP Conference Proceedings 2128, 030014, 2019.
13. Kim, K. and Park, K.S., "Ranking Fuzzy Numbers with Index of Optimism," Fuzzy Sets and Systems, Vol. 35, 1990, pp. 143-150.