Decision Making Through Fuzzy Linear Programming Approach

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Abstract

In this study a real world industrial MPS problem is addressed using the SMF approach. A decision maker, analyst and implementer, all play significant roles in making judgements in an uncertain environment, which is where this difficulty arises in the chocolate manufacturing business. As analysts our goal is to identify a solution with a higher LOS that will enable the decision maker to reach a conclusion. Because all the coefficients including the goals, technical and resource factors are well defined. The MPS problem is taken into consideration. With 24 constraints and 6 variables, this is regarded as one of the sufficiently large problem, which LOV is appropriate for getting satisfactory OR can be determined by a decision maker. To increase the satisfactory income, the decision maker can also advice to the analyst some feasible modification to FI. This collaborative process between the analyst, decision maker and implementer must continue until the best possible solution is found and put into action.

Keywords: Linear Programming problem, S-curve membership function, Uncertainty, Mix-Product selection, Decision maker.

Abbreviations

MPS	:	mix-product selection
FLP	:	fuzzy linear programming
MF	:	membership function
SMF	:	s-curve membership function
FO	:	fuzzy outcome
FS	:	fuzzy system
FI	:	fuzzy interval
UOP	:	units of product
LOS	:	level of satisfaction

LOV	:	level of vagueness
OR	:	optimal revenue
OF	:	objective function

1. Introduction

A non-linear MF, referred to as the SMF has been used in problems involving interactive FS. The modified SMF can be applied and tested for its suitability through an applied problem. In this problem, the SMF was applied to reach a decision, when all three coefficients such as OF, technical coefficients and resources of MPS were fuzzy. The solution thus obtained is suitable to be given to decision maker and implementer for final implementation. The problem illustrated in this paper is only one of six cases of MPS problems which occur in real life applications. It will be interesting to investigate the fuzzy solution patterns of these above MPS problem. Non-SMF conversion function is used for problems related to FLP. The function S can be applied and tested for its effectiveness by applied pressure. In this example, the S function is applied to make a decision after binary, such as the number of technologies and equipment, of which MPS is complex. Solutions thus obtained can provide the decision maker and the coordinator for the final implementation. The wording described in this article is just one of the three FPS words that actually have an application. The above FPS term is considered to be the real-life situation when it comes to making chocolate. Data for this problem are provided in the database of Choco man Inc, USA. Choco man manufactures chocolate bars, candies and wafer using a variety of ingredients and formulas. The goal is to use the modified S-function as a system to get the best UOP through the FLP system [1-3]. Compared with this FLP system. The recommended method is based on its relationship with the decision maker, developer and researcher to find satisfactory solutions for the FLP problem. In the decision-making process using the FLP model, modifications and source software can be complex, rather than providing exact numbers as in the net LP model. For example, machine hours, work, requirements, etc. and manufacturing, which is not always good, due to insufficient information and uncertainty among potential importers in the environment. Therefore, they should be considered as non-essential components and the FLP problem can be solved by using the FLP method. The problem of non-compliant MPS has been described. The aim of this article is to find the best UOP with high satisfaction and nonsense as the main thing. This problem is considered because all the parameters such as technology and hardware changes are uncertain. This is considered to be a major overall problem that includes 29 barriers and 8 barriers. Since there are so many decisions to make, the best UOP table is described for uncertainty and satisfaction to find a solution. with the highest UOP level and the highest satisfaction. It should be borne in mind that a high UOP does not mean it will lead to a high level of satisfaction. The best UOP was calculated at the satisfaction level using the FLP method. OF indicates that a high UOP will not lead to a high level of satisfaction. The results of this work suggest that the best decision is based on the negative impact on the FS of the MPS. In addition, high levels of UOP are obtained when blur is low in the system [4-25].

2. FLP Model

A general model of classical LP is formulated as,

$Max(w) = dy$; The standard formulation subject to

$$B \leq c; y \geq 0 \tag{2.1}$$

Where d and y are the m-part vector, B is $n \times m$ matrix. Since we live in an uncertain environment, the number of objective functions (d), the number of matrix technologies (B) and the variability of assets (d) are complex. Therefore, an infinite number can be displayed, so that the problem can be solved by the FLP system. FLP problems are designed as follows:

$$Max(w) = d^* y \text{ ; The fuzzy formulation subject to} \quad B^* y \le c^* ; y \ge 0 \tag{2.2}$$

Where w is the vector of the decision change, $B^*, c^* \,\&\, d^*$ are zero numbers. The function of addition and multiplication is explained by fact that in-depth numbers are derived from the extension principles of Li [26]. Njikọ Inequalities are provided by some relationship and work objectives, w, must take into account the given LP problem. The approach of Mohammed [27] is being considered to solve the problem of FLP 2 depletion., which means that the solution will probably be to some satisfaction. First, design the team function for the zero parameter of $B^*, c^* \,\&\, d^*$. Here, non-existent team functions, such as logic, are used. Here vb_{kl} represents the work of members; $vc_k \,\&\, vd_l$ are the numerical functions for matrix B for $k = 1,2,3...n \,\&\, l = 1,2,3,...m$. c_k is the numerical variable for $k = 1,2,3...n$ and d_l are the integers of purpose point w for $l = 1,2,3,...m$.

Then, with the appropriate change in the concept of agreement between the non- $b^* k_l$ numbers; $c^* k$ and $d^* k_l$ & l, words for $b^* k_l$, $c^* k$ and $d^* l$ will be obtained. When an agreement between $b^* k_l$; The solution $c^* k$ and $d^* l$ will be [28];

$$V = v_{dl} = vb_{kl} = vc_k \text{ for all} \quad k = 1,2,3...n \,\&\, l = 1,2,3,...m \tag{2.3}$$

Therefore, we can obtain,

$$D = pd(v); B = pb(v) \,\&\, C = pc(v) \tag{2.4}$$

Where $v \in [0,1]$ in $pd, pb \,\&\, pc$ are distinct functions [29], of $vd, vB \,\&\, vc$ resp. Equation (2.2) would be;

$$Max(w) = [pd(v)]y \text{ ; fuzzy formulation subject to} \quad [pb(v)]y \le pc(v); y \ge 0 \tag{2.5}$$

First, create a group function for the complex part of $B^* \,\&\, c^*$. Here, non-uniform functions are used as S-curve function [30]. vb_{kl} represents the work of members; where b_{kl} is the coefficient of matrix B for $k = 1,2,3...,29$ and $l = 1,2,3,...8$, c_k is the material variable for $k = 1,2,3...,29$. Group function is also obtained for b_k and beard time, $c_{kb} \,\&\, c_{kc}$ for c_k^*. Similarly, we can create team work for a number of non-core technologies and their production [31]. Due to the high cost of production and the need to meet certain production and demand conditions, the problem of inefficiency arises in the manufacturing process. This problem also arises in the production of chocolate when deciding on the combination of ingredients to create different types of products. This is called here the choice of product mix [32].

3. The Fuzzy MPS

There are products that can be made by mixing different ingredients and using k type processing. It is expected that the infrastructure will be massive. There are also some restrictions by the retail department, such as the requirement for the product mix, the requirement of the main product line, as well as the minimum and maximum query for each product. Not everything that is needed in these circumstances is obvious. It is important to achieve maximum UOP and satisfaction using the FLP method. Since the number of technologies and equipment changes is running high, the results of the UOP would be foolish. FLP problem, customized in size. 2 can be written:

$Max(w) = \sum_{l=1}^{8} y_l$, subject to

$$\sum_{l=1}^{8} b_{kl}^{*} y_l \le c_k^{*}, \text{ where } y_l \ge 0, l = 1,2,\ldots 8. \qquad (3.1)$$

where b_{kl}^{*} & c_k^{*} are fuzzy parameters.

3.1 Fuzzy Resource Variable vc_k

For an interval $c_k^b \le c_k \le c_k^c$,

$$b_{c_k} = \frac{c}{1 + De^{b\left(c_k - c_k^b / c_k^c - c_k^b\right)}}$$

$$\frac{\beta\left(c_k - c_k^b\right)}{e\left(c_c^k - c_k^b\right)} = \frac{1}{D}\left(\frac{c}{\theta_{c_k}} - 1\right) \qquad (3.1.1)$$

$$\frac{\beta\left(c_k - c_k^b\right)}{\left(c_c^k - c_k^b\right)} = \ln\left(\frac{1}{D}\left(\frac{c}{\theta_{c_k}} - 1\right)\right)$$

$$c_k = c_k^a + \frac{1}{D}\left(\frac{\left(c_c^k - c_k^b\right)}{\beta}\right)\ln\left(\frac{1}{D}\left(\frac{c}{\theta_{c_k}} - 1\right)\right)$$

Since c_k is a non-trivial material change therefore, from (3.2)

$$cc_k^{*} = c_k^b + \left(\frac{\left(c_c^k - c_k^b\right)}{\beta}\right)\ln\left(\frac{1}{D}\left(\frac{c}{\theta_{c_k}} - 1\right)\right) \qquad (3.1.2)$$

3.2 Fuzzy Constraints

The products, materials and equipment requirements are shown in Tables 1 as well as 2, respectively. Tables 3 as well as 4 provide the mix size and use the required material to make each product.

Table 1: *Product's Demand*.

Item	Fuzzy Interval $(\times 1000 units)$
Milk Chocolate, (200 gram)	[450-575) Gram
Milk Chocolate, (50 gram)	[750-950) Gram
Crunchy Chocolate, (200 gram)	[350-450) Gram
Crunchy Chocolate, (50 gram)	[550-700) Gram
Chocolate with Nuts (200 gram)	[250-325) Gram
Chocolate with Nuts (50 gram)	[450-575) Gram
Chocolate Candy	[150-200) Gram
Wafer	[350-450) Gram

Table 2: *Material and Ease of Access*

Raw Material	Fuzzy Interval (x1000 units)
Coco (Kilo Gram)	[75-125) Kilo Gram
Milk (Kilo Gram)	[90-150) Kilo Gram
Nuts (Kilo Gram)	[45-75) Kilo Gram
Sugar (Kilo Gram)	[150-450) Kilo Gram
Flour (Kilo Gram)	[15-25) Kilo Gram
Aluminum Foil (Kilo Gram)	[375-625) Kilo Gram
Paper (Per Feet Square)	[375-625) Per Feet Square
Plastic (Per Feet Square)	[375-625) Per Feet Square
Cooking (Ton per H)	[750-1250) Ton Per H
Mixing (Ton per H)	[150-250) Ton Per H
Forming (Ton per H)	[1125-1875) Ton Per H
Grinding (Ton per H)	[150-250) Ton Per H
Wafer Making (Ton per H)	[75-125) Ton Per H
Cutting (H)	[300-350) H
Packaging 1 (H)	[300-500) H
Packaging 2 (H)	[900-1500) H
Labor (H)	[750-1250) H

There are two unclear barriers such as access to the equipment and restrictions on the capacity of the equipment. These barriers are inevitable for any object and property depending on the consumption of the property, to trade and acquire property. These selections are based on the FLP resolution of Chocoman Inc. Decision changes for the FPSP are defined as:

$y_1 =$ 250 grams of chocolate milk to be produced (in 1000)

$y_2 =$ 100 grams of chocolate milk to be produced (per 1000)

$y_3 =$ Chocolate Crispy of 250 grams to be produced (in 1000)

$y_4 =$ 100 grams of Chocolate Crispy to be produced (in 1000)

$y_5 =$ Chocolate with 250 grams of fruit to produce (en1000)

$y_6 =$ Chocolate contains 100 grams per gram to produce (in 1000)

$y_7 =$ Chocolate candies will be produced (in 1000 packages)

$y_8 =$ Chocolate wafer production (in 1000 packages)

The Chocoman Marketing Department has issued the following restrictions:
Product mix required. Large product (250 grams) of any kind should not exceed 60% (uncertain value) of small product (100 grams)

$$y_1 \leq 0.6 y_2 \tag{3.2.1}$$

$$y_3 \leq 0.6 y_4 \tag{3.2.2}$$

$$y_5 \leq 0.6 y_6 \tag{3.2.3}$$

The required product line is key. Total sales of confectionery products and wafers should not exceed 15% (uncertain value) of total confectionery product.

Table 3: *Mixing Proportions*

Materials Required Per 1000 Units	Product types (fuzzy interval)							
	AMC 150	AMC 50	ACC 150	ACC 50	ACN 150	ACN 50	Candy	Wafer
Coco (Kilo Gram)	[60-90)	[20-45)	[105-130)	[25-60)	[150-250)	[0-0)	[1200-1400)	[150-300)
Milk (Kilo Gram)	[0-0)	[0-0)	[60-90)	[0-0)	[78-101)	[35-80)	[230-500)	[0-0)
Nuts (Kilo Gram)	[325-456)	[78-105)	[230-280)	[34-87)	[0-0)	[0-0)	[110-230)	[73-130)
Sugar (Kilo Gram)	[172-201)	[0-0)	[78-99)	[0-0)	[321-436)	[103-120)	[0-0)	[54-90)
Flour (Kilo Gram)	[0-0)	[0-0)	[120-150)	[0-0)	[450-487)	[245-298)	[1001-1200)	[540-670)
Aluminum Foil (Kilo Gram)	[110-165)	[78-95)	[0-0)	[0-0)	[330-420)	[110-154)	[0-0)	[0-0)
Paper (Per Feet Square)	[156-185)	[0-0)	[190-245)	[0-0)	[100-150)	[56-89)	[0-0)	[0-0)
Plastic (Per Feet Square)	[0-0)	[0-0)	[170-240)	[40-82)	[510-725)	[120-179)	[0-0)	[0-0)

Table 4: *Facility Usage*

Facility Usage Required Per 1000 Units	Product types (fuzzy interval)							
	AMC 150	AMC 50	ACC 150	ACC 50	ACN 150	ACN 50	Candy	Wafer
Cooking (Ton per H)	[0.60-0.90)	[0.20-0.45)	[0.105-0.130)	[0.25-0.60)	[0.150-0.250)	[0-0)	[0.1200-0.1400)	[0.150-0.300)
Mixing (Ton per H)	[0-0)	[0-0)	[0.60-0.90)	[0-0)	[0.78-0.101)	[0.35-0.80)	[0.230-0.500)	[0-0)
Forming (Ton per H)	[0.325-0.456)	[0.78-0.105)	[0.230-0.280)	[0.34-0.87)	[0-0)	[0-0)	[0.110-0.230)	[0.73-0.130)
Grinding (Ton per H)	[0.172-0.201)	[0-0)	[0.78-0.99)	[0-0)	[0.321-0.436)	[0.103-0.120)	[0-0)	[0.54-0.90)
Wafer Making (Ton per H)	[0-0)	[0-0)	[0.120-0.150)	[0-0)	[0.450-0.487)	[0.245-0.298)	[0.1001-0.1200)	[0.540-0.670)
Cutting (H)	[0.110-0.165)	[0.78-0.95)	[0-0)	[0-0)	[0.330-0.420)	[0.110-0.154)	[0-0)	[0-0)
Packaging 1 (H)	[0.156-0.185)	[0-0)	[0.190-0.245)	[0-0)	[0.100-0.150)	[0.56-0.89)	[0-0)	[0-0)
Packaging 2 (H)	[0-0)	[0-0)	[0.170-0.240)	[0.40-0.82)	[0.510-725)	[0.120-0.179)	[0-0)	[0-0)
Labor (H)	[0.325-0.456)	[0.78-0.105)	[0.230-0.280)	[0.34-0.87)	[0-0)	[0-0)	[0.110-0.230)	[0.73-0.130)

Table 5: *OS with S-curve MF for* $\theta = 14.120$.

Number	Satisfaction degree ($\boldsymbol{\theta}$)	Optimal UOP (w*)	Number	Satisfaction degree ($\boldsymbol{\theta}$)	Optimal UOP (w*)
1	7.562	2438.54	11	50.0115	2965.11
2	14.076	2500.51	12	52.1911	3001.89
3	15.2145	2615.83	13	52.8741	3057.48
4	16.1148	2651.25	14	59.6383	3152.55
5	18.057	2701.67	15	63.3374	3160.55
6	24.8497	2845.48	16	63.538	3180.37
7	28.9782	2848.79	17	64.8241	3204.67
8	30.3968	2889.39	18	70.4424	3250.39
9	31.7572	2923.44	19	85.5813	3277.92
10	42.6513	2955.9	20	95.4286	3344.58

4. Results

The FPS problem is solved by using MATLAB and its LP application. It provides complexity and a degree of satisfaction. The LP application has two extras in addition to the non-existent. There is an output w *, the best UOP.

Table 6: *The Vagueness* β *as well as objective value* w^* *with* $\theta = 50\%$

Vagueness β	UOP w*	Vagueness β	UOP w*
1	2465.54	21	3037.45
3	2533.72	23	3080.78
5	2568.99	25	3223.61
7	2631.09	27	3239.79
9	2730.54	29	3282.03
11	2740.35	31	3352.45
13	2778.95	33	3368.74
15	2784.04	35	3438.1
17	2833.00	37	3446.69
19	3011.15		

Table 7: *Optimal UOP* w^*

w^*	Vagueness β				w^*	Vagueness β			
θ	1	3	5	7	θ	1	3	5	7
7.562	2421.27	2478.47	2594.46	2488.84	42.6513	2957.06	2847.5	3230.2	2810.63
14.076	2514.88	2502.54	2673.13	2509.44	50.0115	2960.57	3010.7	3234.95	2838.32
15.2145	2638.86	2623.91	2765.32	2574.27	52.1911	2981.24	3017.36	3248.8	2843.2
16.1148	2639.8	2632.57	2780.56	2604.7	52.8741	3078.7	3080.9	3297.06	3039.16
18.057	2668.82	2675.98	2797.33	2618.06	59.6383	3079.57	3086.95	3298.37	3157.71
24.8497	2686.3	2680.99	2919.95	2621.45	63.3374	3132.07	3162.39	3334.88	3206.49
28.9782	2753.94	2747.67	2930.67	2652.31	63.538	3273.09	3202.78	3415.55	3315.88
30.3968	2827.54	2773.03	3028.05	2723.29	64.8241	3443.79	3348.41	3426.19	3411.56

31.7572	2870.88	2807.2	3189.58	2753.75	70.4424	3479.39	3434.25	3470.15	3476.37

Different standards of Chocolate production are transferred to the toolbox. The answer can be listed in the following tables. From Table 5, it can be seen that a high level of satisfaction provides a high UOP. But the best solution to the above problem is at a satisfaction rate of 50%, or 2833 minutes. From the tables below, we conclude that within the objective, w^* is an ever-increasing function [33].

Table 8: *Optimal UOP* w^*

w^*	Vagueness β				w^*	Vagueness β			
θ	9	11	13	15	θ	9	11	13	15
7.562	2517.93	2511.75	2700.82	2626.7	42.6513	3006.57	3238.42	3211.28	3082.57
14.076	2555.17	2562	2817.03	2713.6	50.0115	3106.2	3252.29	3236.27	3155.49
15.2145	2610.27	2712.45	2818.6	2730.28	52.1911	3110.49	3312.54	3276.6	3166.6
16.1148	2694.71	2735.65	2917.06	2735.94	52.8741	3155.25	3326.07	3285.56	3215.15
18.057	2704.95	2778.61	3015.94	2814.01	59.6383	3206.75	3341.22	3292.6	3306.44
24.8497	2768.05	2785.92	3017.65	2843.42	63.3374	3367.82	3383.69	3312.35	3339.97
28.9782	2803.52	2982.47	3019.4	2857.43	63.538	3432.71	3393.02	3319.99	3353.86
30.3968	2912.9	3162.64	3200.54	2919.49	64.8241	3461.5	3394.43	3341.83	3462.87
31.7572	2959.22	3205.75	3210.48	2936.06	70.4424	3478.85	3435.72	3421.66	3493.17

Table 9: *Optimal UOP* w^*

w^*	Vagueness β				w^*	Vagueness β			
θ	17	19	21	23	θ	17	19	21	23
7.562	2560.71	2591.74	2598.75	2569.53	42.6513	3279.76	3093.95	3025.39	3012.8
14.076	2577.5	2681.47	2671.48	2712.04	50.0115	3289.08	3100.34	3089.09	3119.28
15.2145	2827.45	2695.28	2725.3	2774.99	52.1911	3329.94	3206.97	3105.94	3133.89
16.1148	2857.61	2745.12	2898.84	2857.97	52.8741	3339.61	3249.02	3118.94	3212.27
18.057	2877.99	2760.14	2919.28	2910.07	59.6383	3343.42	3287.02	3159.21	3267.98
24.8497	3081.74	2770.16	2962.64	2962.97	63.3374	3362.92	3361.71	3185.11	3331.74
28.9782	3093.67	2858.84	2989.96	2977.2	63.538	3373.1	3417.77	3275.53	3457.72
30.3968	3157.45	3063.62	3018.63	2983.99	64.8241	3440.06	3434.14	3397.49	3486.65
31.7572	3202.92	3087.9	3020.53	2988.83	70.4424	3492.01	3471.26	3495.27	3498.94

Table 10: *Optimal UOP* w^*

w^*	Vagueness β				w^*	Vagueness β			
θ	23	25	27	29	θ	23	25	27	29
7.562	2557.26	2509.77	2624.58	2522.45	42.6513	3110.12	2866.61	3012.12	3001.32
14.076	2639.95	2531.72	2637.73	2547.82	50.0115	3128.99	2880.25	3060.57	3044.8
15.2145	2727.12	2561.53	2645.54	2584.66	52.1911	3139.91	2957.15	3075.73	3135.83
16.1148	2785.23	2610.31	2745.36	2750.06	52.8741	3240.09	3012.5	3126.45	3297.11
18.057	2845.05	2680.12	2766.93	2756.62	59.6383	3259.24	3066.82	3170.93	3305.56
24.8497	2879.51	2758.1	2778.77	2762.94	63.3374	3263.83	3118.69	3292.42	3313.34
28.9782	2937.4	2800.6	2817.91	2832.69	63.538	3378.55	3132.87	3296.45	3384.03
30.3968	2967.17	2840.55	2893.03	2886.01	64.8241	3422.86	3324.07	3375.38	3404.9
31.7572	3057.98	2846.94	2961.62	2938.18	70.4424	3483.18	3350.47	3470.84	3428.67

Table 11: *Optimal UOP* w^*

w^*	Vagueness β				w^*	Vagueness β			
θ	31	33	35	37	θ	31	33	35	37
7.562	2522.48	2523.96	2533.43	2519.95	42.6513	3144.28	2901.63	3220.44	3041.08
14.076	2532.12	2608.62	2618.64	2611.46	50.0115	3183.95	2934.68	3236.11	3068.4
15.2145	2571.52	2618.64	2717.62	2615.81	52.1911	3202.9	3052.3	3264.69	3102
16.1148	2712.13	2739.13	2749.95	2652.37	52.8741	3213.79	3204.34	3330.91	3109.29
18.057	2916.79	2771.39	2778.74	2857.52	59.6383	3342.85	3264.08	3393.05	3214.24
24.8497	2943.77	2797.06	2979.54	2891.37	63.3374	3361.04	3270.6	3426.9	3242.07
28.9782	3088.17	2828.98	3023.91	2963.05	63.538	3403.39	3377.37	3432.62	3352.56
30.3968	3126.97	2886.21	3082.34	3010.27	64.8241	3406.28	3467.32	3455.09	3392.32
31.7572	3130.92	2887.8	3171.68	3020.85	70.4424	3435.75	3483.32	3461.04	3459.68

4.1 UOP of w^* for different vagueness values

Reasonable solutions and some uncertainties in the zero parameter of the technical rate and the hardware change are equal to 50%. Thus, the result of the 50% satisfaction level for $1 \le \beta \le 37$ and the principle corresponding to w^* are shown in Table 6. OF's of UOP reduce β imprecision and increase of the non-linear parameter of the number of technologies and asset exchange. This is clearly shown in Table 6. Table 6 is very important for the decision maker when choosing UOP, so that the result is at perfect level.

4.2 Output for $\theta, \beta \,\&\, w^*$

The result in the table below shows that when the inaccuracy of the increase results in a small UOP.

Table 12: *w^* with resp. to $\beta \,\&\, \theta$*

Satisfaction Degree (θ)	Vagueness (β)	Optimal UOP (w^*)	Satisfaction Degree (θ)	Vagueness (β)	Optimal UOP (w^*)
7.562	1	2500.51	50.0115	21	3001.89
14.076	3	2615.83	52.1911	23	3057.48
15.2145	5	2651.25	52.8741	25	3152.55
16.1148	7	2701.67	59.6383	27	3180.37
18.057	9	2845.48	63.3374	29	3204.67
24.8497	11	2848.79	63.538	31	3250.39
28.9782	13	2889.39	64.8241	33	3277.92
30.3968	15	2923.44	70.4424	35	3338.54
31.7572	17	2955.9	83.3374	37	3344.58
42.6513	19	2965.11			

It is also seen that SMF has a variety of standards that provide possible solutions with some satisfaction. Also, the link between $w^* \,\&\, \theta$ is provided in Tables 7, 8, 9, 10 and 11. This is clearly shown in Table 6. Table 6 is very important for the decision maker when choosing UOP, so that the result is a perfect level. From Tables 7, 8, 9, 10 and 11, we find that for each type of satisfaction θ, the optimal UOP w^* decreases as the endpoint increases between 1 and 37. Similarly, with any positive value, the optimal UOP increases as the degree of satisfaction increases. Table 12 is the result of the diagonal pattern of w^* in Table 6. This result shows that, when the inaccuracies are low at $\beta = 1,3 \,\&\, 5$, UOP w * is best and reached the lowest satisfaction level, $\theta = 7.5\%, 14.1\% \,\&\, 15.2\%$. When the odds are high at $\beta = 33,35 \,\&\, 37$, UOP w^* is best reached with high satisfaction level, i.e., $\theta = 64.8\%, 70.4\% \,\&\, 83.3\%$.

5. Selection of Parameter β and Decision Making

In order for the decision maker to get the best results for the UOP w^*, the researcher creates a production table. From the table above, the decision maker can select the negative value according to his preference. Hair volume is divided into w^* in three parts, namely short, medium and high. It can be slightly modified if the input data for the number of technologies and hardware changes. It can be called a bunch of empty vanities. The decision can be made by the decision maker by choosing the best UOP for w^* and providing solutions for its implementation.

5.1 Discussion

The results show that the UOP minimum is 2,755.4 with a maximum of 3,034.9. It can be seen that when the understanding is between 0 and 1, the maximum value of w^* 3 034.9 is obtained by the minimum value. Similarly, when over 39, the minimum gain of w^* 2,755.4 and the maximum gain are obtained. Since the solution for MPS nonsense is the most satisfying solution with a high satisfaction degree, it is important to choose a blur between the minimum value and the maximum value of w^*.

6. Conclusion

The purpose of this research project was to find the most effective POU for MPS problems that have not been identified. SMF was recently developed as a framework for the task of solving the above problems effectively. The decision-making process and its implementation will be easier if the decision maker and consultant can work with the analyst to get the best and most satisfactory results. There are two more cases to consider in future work of the running technology that is not negative and that the dynamic assets are running and not complicated. FS mathematical relationships can be developed for MPS problems to find satisfying solutions. The decision maker, researcher and practitioner can apply their knowledge and experience to get the best results.

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