Cost-effectiveness of Using "Tyvek" in Wedding Dress

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Abstract: The wedding dress is the finest product made in the garment industry, because of the high prices of raw materials used, from fabrics to accessories, as well as the accuracy required in the sewing and finishing. In addition, the dress often features decoration such as embroidery or hand-drawing. All these factors make the wedding dress an expensive commodity on which thousands of Pounds are spent, although it is only used for few hours. Thus using inexpensive innovative raw materials to design wedding dresses and exploit the potential of such materials in the production of these dresses, without compromising on the high aesthetic value is an important target. The study entails the possibility of simulating three international designs of wedding dresses (after permission from the original designers of using simulators for scientific purposes) by using innovative raw materials as "Tyvek" and comparing cost-effectiveness and consumer opinions between the original designs and simulated designs. Questionnaires of Consumers; that consists of a sample of 20 girls and women aged between 20-40 years, they were about to marry and they were from different residential areas and economic levels, were done. The questionnaire included the following parameters: simulation of innovation, simulation of attractiveness, simulation of functional convenience and price; each girl or woman evaluated both the original and simulated wedding dress through specific evaluation expressions and gave score of 5 for each design of the three simulated designs. The study concluded that the idea of using economic raw material was accepted for the consumers as long as it is offered in an innovative pattern. It also demonstrated that using economic raw materials such as tyvek with other supplemented materials as synthetic leather for wedding dress design are effective.

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1. Introduction

Cost-effectiveness analysis is a decision-making assistance tool. It identifies the economically most efficient way to fulfill an objective. In evaluation, the tool can be used to discuss the economic efficiency of a program or a project (Black, William, 1990). Focused on the targeted major result of the activity – the number of jobs created – the tool estimates the cost of each job generated by a specific measure. The comparison of various programs with similar impacts enables the comparison of the costs generated by each job created and provides useful quantitative indicators for the selection of comparative methodologies (http://ec.europa.eu/europeaid/evaluation/methodology/examples/too_cef_res_en.pdf), steps involved in cost-effectiveness analysis are shown in figure (1).

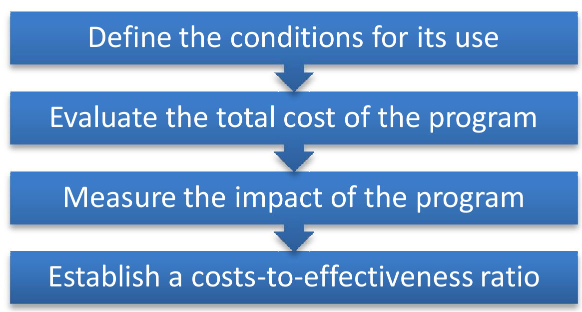

Figure 1: Steps involved in cost-effectiveness analysis

To evaluate the cost of a project, direct costs such as raw materials, accessories, operating steps costs and human resources costs, fixed costs such as rent, electricity, transportation and taxes, and indirect costs such as production losses and storage need to be calculated (http://www.signindustry.com/directtogarment/articles/2011-12-15-Pricing-Guidelines-Pricing-Strategy-for-Direct-Garment-Printing.php3). The wedding dress is the finest product made in the garment industry, because of the high prices of raw materials used, from fabrics to accessories, as well as the accuracy required in the sewing and finishing. In addition, the dress often features decoration such as embroidery or hand-drawing (http://pages.stolaf.edu/

cis-mwilm/files/2014/03/PART-I-History-of-the-Wedding-Dress.pdf). All these factors make the wedding dress an expensive commodity on which thousands of Pounds are spent, although it is only used for few hours (Shyenne Horras, 2013). Thus using inexpensive innovative raw materials to design wedding dresses and exploit the potential of such materials in the production of these dresses, without compromising on the high aesthetic value is an important target. The discovery of Tyvek was a chance occurrence by DuPont researcher Jim White, who in 1955 noticed white polyethylene fluff coming out of a pipe in a DuPont experimental lab. A program to develop the new material was set up, and a year later DuPont submitted a patent proposal for strong yarn linear polyethylene (www.Dupont.com). In 1965, the new engineered sheet structure was registered under the trademark name Tyvek, but it was not until April 1967 that commercial production of Tyvek started. Tyvek combines all the best physical properties and characteristics of paper, film, and fabric-in one exceptional material. While most products offer water resistance or breathability, Tyvek offers both. It is equally strong and protective in wet or dry conditions. Tyvek is lightweight, flexible, smooth, particulate free, opaque, and resistant to water, rot & mildew, chemicals, abrasion, and aging. It has a high strength-to-weight ratio and is pH 7(neutral). Made from 100% high-density polyethylene fibers, Tyvek is manufactured in a unique flash-spinning process without the use of binders, and Tyvek is recyclable. Tyvek protective apparel such as lab coats, jackets, suits, or aprons, and soft structure Tyvek, which is sometimes referred to as Tyvek fabric has a soft fabric-like hand, and becomes even softer and more pliable with use and wear, taking on a silky feel. Tyvek fabric has a unique balance of strength and softness. This soft Tyvek style is now being used to make apparel and promotional tote bags (www.dpp-europe.com/TyvekClassicXpert).

2. Material and Methods

The study entails the possibility of simulating three international designs of wedding dresses (after permission from the original designers of using simulators for scientific purposes) by using innovative raw materials as “Tyvek” and comparing cost-effectiveness and consumer opinions between the original designs and simulated designs.

To measure the cost of the final piece of product, the study followed the following approach: Studying the budgets of different Ateliers showed that the average monthly expenses of Atelier reaches up to 25,000EGP and by dividing it on the number of monthly working days (25 days) the cost per day nearly equals 1000EGP, by further dividing it on the number of daily working hours (8 hours) the cost per hour is approximately 125EGP (will be used later). By estimating the duration of each stage of the production, and calculating the number of working hours for the wedding dress production and multiplying them in the cost per hour we can get the operating cost price, by adding the raw materials consumption multiplied by the price per square meter, thus reaching a cost price which is added to the profit margin (was appreciated by about 30%, according to customs being in the market) to reach the cost of the final product (http://apparelscience.com/index.php/apparel-science/merchandising/86-apparel-science/merchandising/141-how-to-calculate-the-cm-cost-of-making-of-a-garment).

The first original design:

This design was created by Austrian designers Viktor Horsting, Rolf Snoeren (www.viktor-rolf.com), they used natural satin,it cost 3570€=30470EGP (figure2).

The first simulated design:

The used material is “Tyvek”, Steps for finishing the first dress included (figure 3); Making dress lining using “tyvek” and fixing ruffled layers on mannequin by draping.

Figure (2): First original design

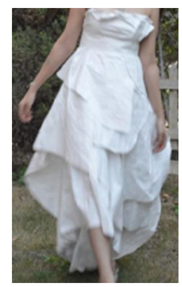

Figure (3): First simulated design

Calculating dress costs:

Design analysis: dress of composed ruffled multilayer of tyvek in vice-versa manner with different lengths with a broad belt in the middle as shown in figures (4, 5, 6).

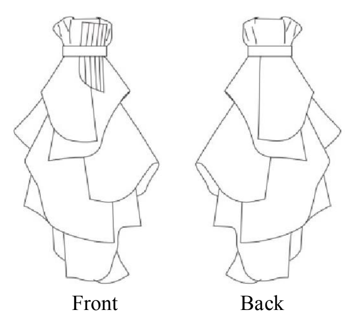

Figure (4): Technical drawing for the first simulated design

Figure (5): Analysis of composed layers on the lining of the dress

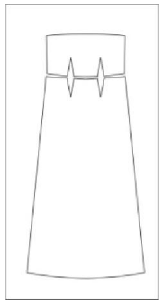

Figure (6): Dress lining

Table (1): Duration of first simulated dress assembly

Dress part	Stage	Time/ second
Lining	Closure of the first front dart	12
	Closure of the second front dart	12
	Composing of front inform	30
	Closure of the first front dart	12
	Closure of the second back dart	12
	Composing of Back inform	30
	Assembly of Right side skirt	8
	Assembly of Left side skirt	8
	Skirt assembly	28
Dress Layers	Fixation of piece no.1 on the dress lining	180
	Fixation of piece no.2 on the dress lining	200
	Fixation of piece no.3 on the dress lining	180
	Fixation of piece no.4 on the dress lining	200
	Fixation of piece no.5 on the dress lining	200
	Fixation of piece no.6 on the dress lining	180
	Fixation of piece no.8 on the dress lining	200
	Fixation of corresponding piece to piece no.8 from the back	200
	Bending of piece no.7 tucks	340
	Fixation of piece no.7 in its lining	15
	Eversion of piece no.7	60
	Fixation of piece no.7 on the dress lining	10
	Fixation of Zipper	23
	Assembly of the two layers of the belt	60
	Belt eversion	60
	Ironing	600
	Total	2860

Consumption of raw material:

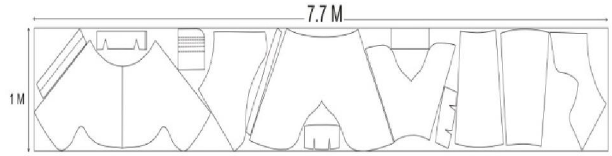

Figure (7): Consumption of raw material for the first simulated design

Calculation of Assembly stages cost:

- Raw material "Tyvek" cost = (consumption of Tyvek × price per meter) = 7.7m^2 ×10 EGP = 77 EGP
- Accessories costs (thread and zippers) = 7 EGP
- Total cost of raw material = 77+7 = 84 EGP
- Duration of cutting pattern lining: 1 hour
- Duration of dress draping on a mannequin: 9 hours
- Duration of assembly stages: 2860 seconds: 0.7hour
- Total production hours: 10.7 hours

Accordingly, the total cost of the dress becomes as follows: (total production hours × cost) + (raw material consumption × price per m^2) = (10.7 × 125 EGP) + 84 EGP = 1421 EGP

By adding 30% profit margin to the total cost; the final price of the first wedding dress becomes 1847 EGP

The second original design:

This design was created by American designer SHERRI HILL (www.sherrihill.com), she used special raw material supplemented with satin, fashioned into large floral detailing. It cost 3000$ = 22870 EGP (figure 8).

The second simulated design:

Figure (8): Second original design

Figure (9): Second simulated design

The basic material is "Tyvek", supplemented with nonwoven fusing (non adherent Vaseline), Steps for finishing the second dress included (figure 9); Making dress frame using "tyvek" and, design of roses using non adherent Vaseline by cutting of circles with different diameters used as rose background and fixing narrow strips (6mm) by hand sewing then fixing the prepared roses on the frame of the dress by adhesive substance.

Calculating dress cost:

Design analysis: circular skirt with back inverted pleat, covered with roses and a belt with a broad bow and two ribbons

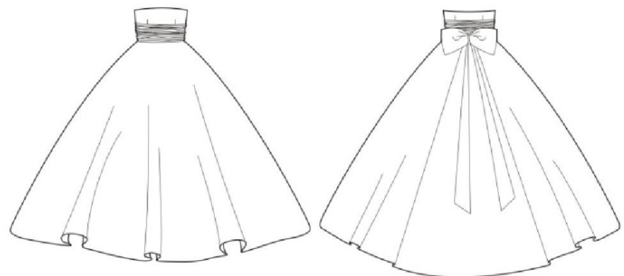

Figure (10): Technical drawing for the second simulated design

Raw material consumption:

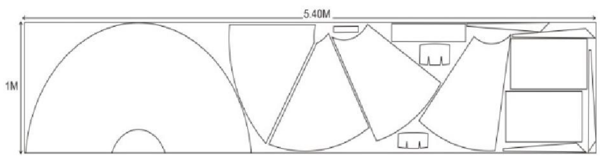

Figure (11): Consumption of raw material for the second simulated design

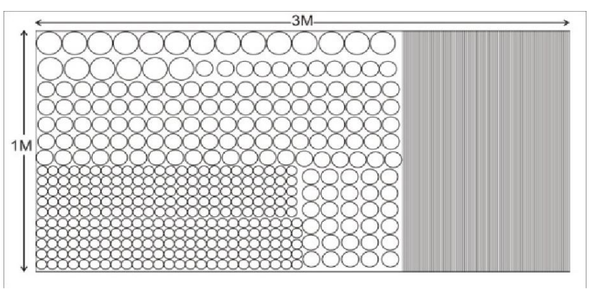

Figure (12): Consumption of circles and stripes used in making roses

Table (2): Consumption of raw material for the second simulated design:

Material	No. of meters	Meter price / EGP	Cost / EGP
Tyvek	5.40	10	54
Non-adherent Vaseline	4.5	3	13.5
Accessories (thread & zippers)			7
Total			74.5

Table (3): Duration of second simulated dress assembly

Dress part	Stage	Time / seconds
Dress	Closure of the first front dart	6
	Closure of the second front dart	6
	Composing of the front inform	30
	Closure of the first back dart	6
	Closure of the second back dart	6
	Composing of the back inform	30
	Assembly of flared skirt	5
	Fixation of the inverted pleat	36
	Fixation of the zipper	23
	Ruffle the belt	25
Bow	Sewing the Bow with its lining	22
	Bow eversion	26
	Sewing Bow loop	3
	Fixing the loop around the Bow	10
Belt	Fixation of the first belt ribbon with its lining	13
	Eversion of the ribbon	20
	Fixation of the second ribbon with its lining	13
	Eversion of the ribbon	20
	Fixation of ribbons to the Bow	60
	Fixation of belt hooks and eyes	5×60=300
	Ironing	300
	Total	**876**

Calculation of Assembly stages cost:

- Total cost of raw material = 74, 5 EGP
- Duration of cutting dress pattern: 1 hour
-Duration of preparation of dress roses:50hours
- Duration of fixation of dress roses: 2 hours
- Duration of assembly stages: 876 seconds= 0.2 hour
- Total production hours: 52.2 hours

Accordingly, the total cost of the dress becomes as follows: (total production hours × cost) + (raw material consumption × price per m^2) = (52.2 × 125 EGP) + 74,5 EGP= 6599,5 EGP

By adding 30% profit margin to the total cost; the final price of the second simulated wedding dress becomes 8579 EGP

The Third original design:

This design was created by the American designer Vera Wang. (www.verawang.com), she used natural satin supplemented with natural leather, It cost 3500$ = 26670 EGP (figure 13).

The Third simulated design:

Figure (13): Third original design

Figure (14): Third simulated design

The basic material is "Tyvek", supplemented with synthetic leather; Steps for finishing the second dress included (figure 14); Making dress frame using "tyvek" and, design of vest and long gloves using synthetic leather.

Calculating dress cost:

Design analysis: wedding dress in the form of figure (A) widened at the knee by inverted pleats, one on each side and one on the back (figure 15), over it leather vest with straps and pair of long leather gloves.

Figure (15) Technical drawing of the third simulated design

Consumption of raw materials:

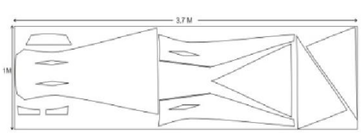

Figure (16): Consumption of raw material (Tyvek) for the third simulated design

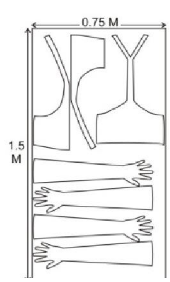

Figure (17) Consumption of synthetic leather for the third simulated design

Total cost of raw materials:

Table (4) total cost of raw materials for the third simulated design

Material	No. of meters	Meter price/ EGP	Cost/EGP
Tyvek	3.75	10	37,5 EGP
Synthetic leather	0.75	15	11.75EGP
Accessories (threads, zippers)			7 EGP
Total			56.25 EGP

Duration of third simulated dress assembly:

Table (5): Duration of third simulated dress assembly

Dress part	Stage	Time/ second
Dress	Closure of the first front dart	6
	Closure of the second front dart	6
	Composing of front inform	30
	Closure of the first back dart	6
	Closure of the second back dart	6
	Composing of right back inform	15
	Composing of left back inform	15
	Composing of back inverted pleat	20
	Assembly of the right inverted pleat with the back	10
	Assembly of the left inverted pleat with the back	10
	Assembly of the front with the back	30
	Fixation of the zipper	23
	Ironing	360
Vest	Assembly of the front with the back	20
Gloves	Assembly of front and back of the first glove	1800
	Fixation of the first glove zipper	600
	Assembly of front and back of the second glove	1800
	Fixation of the second glove zipper	600
	Total	**5357**

Calculation of Assembly stages cost:

- Total cost of raw material = 56.25 EGP.
- Duration of cutting pattern lining: 1 hour.
-Duration of assembly stages: 5357 seconds = 1.47 hour.
- Total production hours: 2.47 hours.

Accordingly, the total cost of the dress becomes as follows: (total production hours × cost) + (raw material consumption × price per m^2) = (2.47 × 125 EGP) + 56.25 EGP= 365 EGP

By adding 30% profit margin to the total cost; the final price of the third simulated wedding dress becomes 473 EGP.

3. Results

Questionnaires of Consumers; that consists of a sample of 20 girls and women aged between 20-

40 years, they were about to marry and they were from different residential areas and economic levels were done. The questionnaire included the following parameters: simulation of innovation, simulation of attractiveness, simulation of functional convenience and price; each girl or woman evaluated both the original and simulated wedding dress through specific evaluation expressions and gave score of 5 for each design of the three simulated designs. The detailed evaluations of the simulated designs were grouped, tabulated, and analyzed statistically. The detailed evaluations of the simulated designs by consumers are shown in table (6)

Table (6) the detailed evaluations of the simulated designs and its averages by consumers

parameters	**Evaluation expressions**	**First simulated design**	**Second simulated design**	**Third simulated design**	**Average**
Simulation of innovation	The simulated dress is similar in innovation to the original dress	65	70	46	60.3
	The simulated dress achieves the excellence and uniqueness of original design	49	64	40	51.0
	The simulated dress is similar in excellence to the original dress	25	73	24	40.7
Simulation of attractiveness	The overall shape of the simulated dress is similar in attractiveness to the original dress	40	66	48	51.3
	The raw material (tyvek) used in simulated dress is similar in attractiveness to the original dress	23	74	25	40.7
	The simulated dress is similar in preference to the original dress	22	57	21	33.3
Simulation of functional convenience	The simulated dress is appropriate for wedding as the original dress.	47	74	22	47.7
	The raw material (tyvek) used in simulated dress is appropriate for wedding as the original dress.	23	73	23	39.7
	The simulated dress techniques are appropriate for wedding as the original dress techniques.	30	68	38	45.3
Price	The economic price encourages me to buy the simulated dress.	52	91	30	57.7
	The simulated dress attracts me to buy it regardless of its price	24	67	22	37.7
	The economic price gives me an impression of low quality	67	90	74	77.0
	Average of total evaluation	38.9	72.3	34.4	

Table (6) illustrates that the averages of evaluation expressions for the simulated designs ranged between 39 to77 and the difference between them was very wide. Also, evaluation of each simulated design separately revealed that the second simulated design averages ranged between 57 to 90 and the difference between them again was very wide, but considered good averages. Whilst, the averages for the first simulated design ranged between 22 to 67 and that for third simulated design ranged between 21 to 74 and the differences between them were again very wide but lower than the second simulated design averages

Variance analysis for consumer's evaluation of simulated designs

Table (7): Variance analysis for consumer's evaluation of simulated designs

Groups	**No. of parameters**	**Sum of averages for parameters**	**Average**	**Variance**
First simulated design	4.0	155.7	38.9	91.6
Second simulated design	4.0	289.0	72.3	54.2
Third simulated design	4.0	137.7	34.4	39.2

Table (8) statistical analysis of variance for consumer's evaluation of simulated designs

Source of Variation	SS	DF	MS	F	P-value	F crit
Between Groups	3417.0	2.0	1708.5	27.7	0.0	4.3
Within Groups	555.1	9.0	61.7			
Total	3972.1	11.0				

Table (8) shows that there are significant differences between consumer's evaluation of simulated designs (p-value is 0.0)

Total parameter evaluation for simulated designs:

Table (9) the averages for each parameter for consumer's evaluation of simulated designs

Parameters	First simulated design	Second simulated design	Third simulated design
Simulation of innovation	46.3	69.0	36.7
simulation of attractiveness	28.3	65.7	31.3
simulation of functional convenience	33.3	71.7	27.7
price	47.7	82.7	42.0
Total evaluation average	38.9	72.3	34.4

Table (9) highlights the superiority of the second simulated design averages in all parameters whilst, the evaluation averages for the first and third simulated designs are approximate

Table (10) Consumer's evaluation averages for Simulation of innovation

Evaluation expressions	First simulated design	Second simulated design	Third simulated design
The simulated dress is similar in innovation to the original dress	65	70	46
The simulated dress achieves the excellence and uniqueness of original design	49	64	40
The simulated dress is similar in excellence to the original dress	25	73	24
Average	46.3	69	36.67
Variance	405.3	21	129.3

Table (11) statistical analysis of variance for consumer's evaluation of Simulation of innovation

Source of Variation	SS	DF	MS	F	P-value	F crit
Between Groups	1652.667	2	826.3333	4.461308	0.065001	5.143253
Within Groups	1111.333	6	185.2222			
Total	2764	8				

Table (11) revealed that the differences between consumer's evaluation of Simulation of innovation are statistically non significant (p-value greater than 0.05).

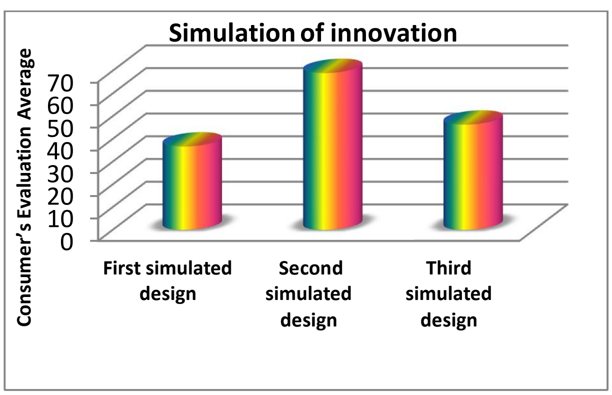

Figure (18) consumer's evaluation averages of Simulation of innovation

Figure (18) shows that the evaluation averages of Simulation of innovation are the highest for the second simulated design and the lowest for the third simulated design

Consumer's evaluation of Simulation of attractiveness:

Table (12) the consumer's evaluation averages for Simulation of attractiveness

Evaluation expressions	First simulated design	Second simulated design	Third simulated design
The overall shape of the simulated dress is similar in attractiveness to the original dress	40	66	48
The raw material (tyvek) used in simulated dress is similar in attractiveness to the original dress	23	74	25
The simulated dress is similar in preference to the original dress	22	57	21
Average	28.3	65.6	31.3
Variance	102.3	72.3	212.3

Table (13) statistical analysis of variance for consumer's evaluation of Simulation of attractiveness

Source of Variation	SS	DF	MS	F	P-value	F crit
Between Groups	2581.556	2	1290.778	10.00603	0.012272	5.143253
Within Groups	774	6	129			
Total	3355.55	8				

Table (13) revealed that the differences between consumer's evaluation of Simulation of attractiveness are statistically significant (p value is 0.012272)

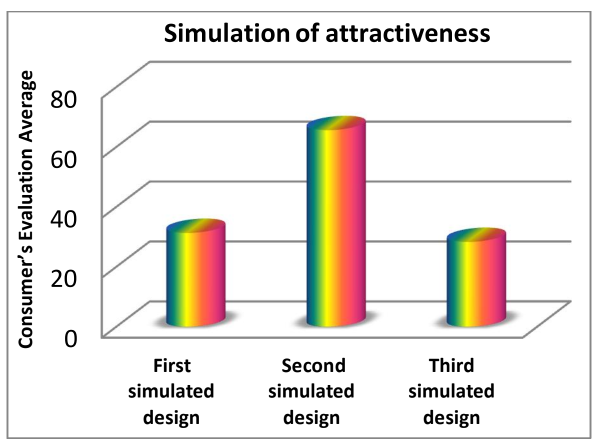

Figure (19) consumer's evaluation averages of Simulation of attractiveness

Figure (19) shows that the evaluation averages of Simulation of attractiveness are the highest for the second simulated design and the lowest for the first simulated design.

Consumer's evaluation of simulation of functional convenience:

Table (14) the consumer's evaluation averages for Simulation of functional convenience

Evaluation expressions	First simulated design	Second simulated design	Third simulated design
The simulated dress is appropriate for wedding as the original dress.	47	74	22
The raw material (tyvek) used in simulated dress is appropriate for wedding as the original dress.	23	73	23
The simulated dress techniques are appropriate for wedding as the original dress techniques.	30	68	38
Average	33.3	71.6	27.6
Variance	152.3	10.3	80.3

Table (15) statistical analysis of variance for consumer's evaluation of Simulation of functional convenience

Source of Variation	SS	DF	MS	F	P-value	F crit
Between Groups	3437.556	2	1718.778	21.21948	0.001901	5.143253
Within Groups	486	6	81			
Total	3923.556	8				

Table (15) revealed that the differences between consumer's evaluation of Simulation of attractiveness are statistically significant (p value is 0.001901)

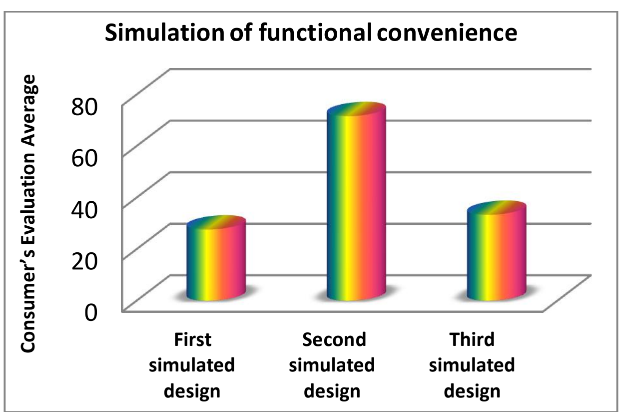

Figure (20) consumer's evaluation averages of Simulation of functional convenience

Figure (20) shows that the evaluation averages of Simulation of attractiveness are the highest for the second simulated design and the lowest for the third simulated design.

Consumer's evaluation of price:

Table (16) the consumer's evaluation averages for price:

Evaluation expressions	First simulated design	Second simulated design	Third simulated design
The economic price encourages me to buy the simulated dress.	52	91	30
The simulated dress attracts me to buy it regardless of its price	24	67	22
The economic price gives me an impression of low quality	67	90	74
Average	47.6	82.6	42
Variance	476.3	184.3	784

Table (17) statistical analysis of variance for consumer's evaluation of price

Source of Variation	SS	DF	MS	F	P-value	F crit
Between Groups	2910.889	2	1455.444	3.022381	0.123612	5.143253
Within Groups	2889.333	6	481.5556			
Total	5800.222	8				

Table (17) revealed that the differences between consumer's evaluation of price are statistically non significant (p value is greater than 0.05)

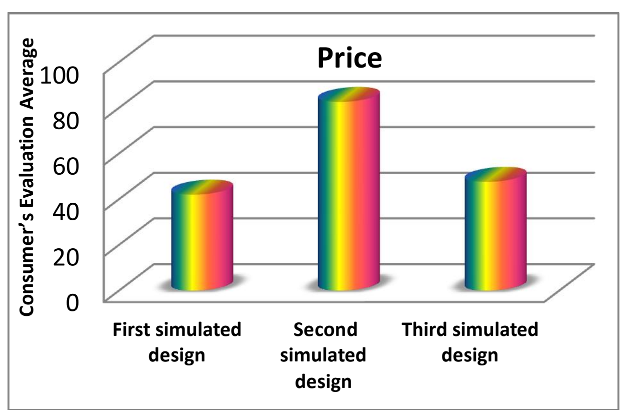

Figure (21) consumer's evaluation averages of price

Figure (21) shows that the evaluation averages of price are the highest for the second simulated design and the lowest for the third simulated design. In spite of the highest price for the second simulated design, the consumers accepted it due its near simulation to the original design and its comparable attractive price.

Consumer's total evaluation of simulated designs:

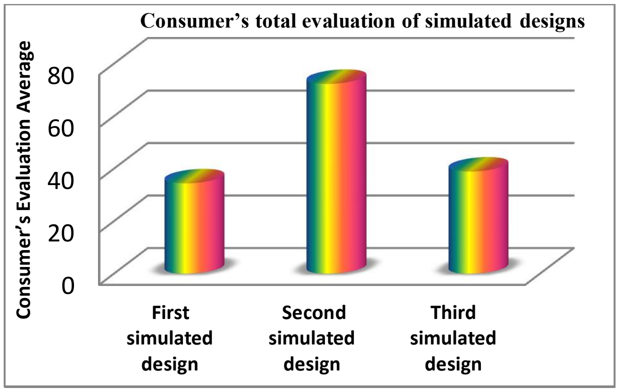

Figure (22) Consumer's total evaluation averages

Figure (22) shows (as been listed in table 6) that the total evaluation averages are the highest for the second simulated design and the lowest for the third simulated design.

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