Relationship Analysis between Mass Customization and Rationalized Quality Costs

Khdier Salman Al-hamad Rajaa Rasheed Abdul-Sattar
Madenat Alelem University College \ Department Accounting
khdier.salman@yahoo.com rajaa.alsiraj@gmail.com

Abstract

Mass customization is one of the new models that lead to quick response to customer requests and participation in product or service design processes that meet their needs. This study aims to reduce the cost of quality in the economic units through mass customization and finish the external and internal failure costs.

The most important conclusion of the study is that the mass customization system of modern means will help the management of economic units to program their production according to the customer's desire. The most crucial conclusion, that study reached is the need to adopt high-tech systems and then eliminate all costs of external and internal failure.

Keywords: Cost of quality, Mass customizations

تحليل العلاقة بين الايصاء الواسع وترشيد تكاليف الجودة

خضير سلمان ذياب رجاء رشيد عبد الستار
كلية مدينة العلم الجامعة / قسم المحاسبة

الخلاصة

يعد الايصاء الواسع احد النماذج الجديدة التي تؤدي الى الاستجابة السريعة لطلبات الزبائن اي مشاركة الزبون في عمليات تصميم المنتج او الخدمة التي تلبي رغباتهم واحتياجاتهم، وتهدف هذه الدراسة إلى تخفيض تكاليف الجودة في الوحدات الاقتصادية من خلال الايصاء الواسع وإنهاء تكاليف الفشل الخارجي والداخلي.

اهم ما توصل اليه البحث هو ان نظام الايصاء الواسع من الوسائل الحديثة التي من شانها ان تساعد أدارة الوحدات الاقتصادية على برمجة انتاجها حسب رغبة الزبون واهم استنتاج توصلت اليه الدراسة هو ضرورة اعتماد الانظمة المؤتمتة وذات التقنيات العالية ومن ثم سيتم الغاء كل تكاليف الفشل الخارجي والداخلي.

الكلمات المفتاحية : تكاليف الجودة، الايصاء الواسع

Introduction

The customer is considered the most critical motive and concern in the economic units that seek to achieve his desires. It is no longer their responsibility to provide products but rather to satisfy the customer's desires and obtain satisfaction by taking advantage of technological development, rapid communications, and the information network. Gaining customer satisfaction and immediate response to his desires has become one of the most important goals of economic units. There is a wide range of modern methods that help the management of these units in this field.

The first topic: research methodology:

First: The research problem: - the failure of economic units to keep pace with the administrative and production methods in achieving customer satisfaction as a result of the continuous change in the tastes and desires of customers, including the mass customization that seeks to do so at a reasonable cost and appropriate quality.

Second: Research Objectives: The research aims to identify quality costs and reduce them through mass customization through analyzing the relationship between there.

Third: The importance of the research: The research derives its significance through the adoption of economic units, the participation of their customers in the design of their products, and attention to their requests, by following an approach that depends on an automated production system, which is the mass customization, and through this, customers preserve and even increased, and their satisfaction is gain by producing high-quality products at low cost.

Fourth: The research hypothesis: The research hypothesis between mass led to reduce the costs of quality and ending external and internal failure costs by relying on the mass customization system.

Fifth: Sources of data collection:

1- Arabic and foreign books, theses, and university thesis

2- Periodicals and published research

3- Information from the General Company for Leather Industries

The second topic: the costs of quality and mass customization

First: Cost of quality: Before we address quality costs, we must know what quality means. Quality means characteristics and qualities of a product or service provided to customers at the time of purchase or during its use. Costs of quality are expenses incurred by the company to prevent the production of poor quality products.[1]

Types of quality costs include the following:

1. Prevention costs lead to avoiding the production of products that do not conform to specifications, such as: (quality engineering and training, quality conformity audit, basic product design).
2. Evaluation costs: These are the costs through which the specifications, whether identical or not, are: (Inspection of finished or semi-finished goods and then verification).
3. Internal failure costs: repairing and correcting defects and errors in products that do not conform to specifications, such as: (remanufacturing, re-inspection, verification, and then better).
4. External failure costs: the costs incurred by the economic unit after delivering goods that do not conform to specifications or are defective to customers, such as: (reduced revenues, the cost of handling legal complaints, social responsibility of products).

Quality means conformity to specifications. This concept prevailed for a short time. When the product conforms to the pre-established specifications, it will meet the customer's satisfaction. The tremendous progress in technology, communications, the Internet and the change that occurred in the preferences of

customers and globalization all brought about a shift in consumer awareness. The customer became able to obtain his needs of products from all over the world, and thus he was able to compare those products. The concept of conformity and appropriateness did not achieve customer satisfaction because it means quality from the producers' point of view only, which does not lead to customer satisfaction.[2]

Second: The mass customization:

1) History of mass customization

The history of this term dates back to 1970, which was predicted by (Alvin Toffler) and mentioned in his book Future Shock [3]. Davis (1987) and Pine (1993) described mass customization as applied in industrial companies. That has modern technology and administrative methods, and it provides customized and diversified products depending on its flexibility and ability to respond quickly to supply products according to customer needs [4]. Production carried out in this way with different stages of development that will show in the following table:

Table (1) Stages of production models development [5]

Paradigm	Craft Production	Mass Production	Flexible Production	Mass Customization	Sustainable Production
Paradigm started	1850	1913	1980	2000	2020?
society needs	Customized products	Low-cost products	Variety of products	Customized products	Clean products
Marketing	Very small volume per product	Demand > supply steady demand	Supply> demand smaller volume per product	Globalization Fluctuating demand	Environment
Business model	Pull sell-design-make-assemble	Push design-make-assemble-sell	Push-Pull design-make-sell-assemble	Pull design-sell-make-assemble	Pull design for an environment–sell-make-assemble
Technology enabler	Electricity	Interchangeable parts	Computers	Information technology	Nano/Bio/Material technology
Process enabler	Machine tools	Moving assembly line and DML	FMS robots	RMS	Increasing manufacturing

The emergence of the wide-spectrum system led to the overcoming of the old methods of mass production. The weak response of the traditional techniques to unusual phenomena such as the diversity of products and the opportunity to enter electronic commerce.

This problem led to the emergence of a model that could face the new situation of diversity, customization, market heterogeneity, and shortening the product's life cycle through rapid response and providing The best services to reach the peak of rapid manufacturing.[6]

2) Definition of mass customization: - Mass customization is defined by many researchers as follows:

In 1993, Pine defined a mass customization system to increase customer participation and produce products at lower costs through changes in manufacturing systems.

As for (Kotha) in 1996, he defined it as the possibility of an economic unit to provide different products using flexibility and speed of industrial response.[7]

As for (Skjelestad), he defined it as fast production at a low cost according to customers' desire.[8]

And (Al-Tawil) defined it in 2009 as a production system whose goal is to adapt modern technologies with the ability of the economic unit to obtain a product that suits the desires of customers.[9]

As for (Krajewski) in 2010, he defined it as the production of goods and services by an economic unit at a low cost and the possibility of choosing products according to the customer's desire.[10]

And (Barman & Canizares) defined it as combining the rationalization of the cost of one unit with individual flexibility to produce products dedicated to the environment and according to the customer's desire.[11]

The researchers define it: - (as improving products according to customers' desires and at a reasonable cost by relying on modern technologies in the fields of manufacturing and information to provide a product with a quality suitable for use)

3) The importance of mass customization

(Kratoche) has identified the importance of the mass customization system [12], including:

1- Cost reduction: by eliminating unnecessary steps, production using just in time concept, and supply chain system.

2- Reducing resource depletion: by eliminating mismatches by using modern software.

3- Increasing customer loyalty due to good communication with him through managing customer relations.

4- Easier services within a short period and a quick response to customer needs.

4) Types of mass customization:[13][14]

1- Pure customization: It is the process of customers expressing their special needs beginning from design onwards, and the customer cooperates with the producer to get the best products, and here the process becomes (design - manufacture - assembly - distribution), such as clothing companies, contracting, blacksmithing and carpentry.

2- Manufacturing customization: - Here, the customer influences the transformational activities and does not interfere with the design process, and the modification is according to the customer's desires and preferences with a degree of flexibility, and the modification is secondary and not on the basic design, such as kitchen companies.

3- Assembly customization: - Here, the customer's influence is on the assembly activities only, and the customer has no role in the design or manufacturing modification process, such as furniture and computer companies.

4- Distribution customization: - Here, the customer influences the distribution process and has nothing to do with other operations, such as Amazon.

5- Diversified without customization: The effect of the customer is to choose between alternatives only through the offered products.

The third topic, the practical side:

The application of quality costs in one of the laboratories of the General Company for Leather Industries. The shoe model 70120 was chosen as a model for the study, and the selected data for 2014. The company's cost unit does not count the cost of quality by their types (prevention, evaluation, internal and external failure); for this reason, the researchers have calculated the costs.

1) Prevention costs (prevention): the company's cost to prevent defects from occurring during production or reduce them. The elements of prevention costs can be clarified as follows:

Table (2) Calculation the cost of research and development

Details	Amount
Salaries and wages	17686569
commodity supplies	106200
Services supplies	0
Depreciation	30000
Total\ Baghdad factory	177003769
Factory share	16091251

The cost of research and development: It is the search for the development of products and models and finding different alternatives for raw materials at a lower cost and with the same quality, including the following:

Product design cost: The product is design according to the customer's desire and expectations in terms of quality, composition, and price. By reviewing the records, we found the following:

Table (3) Product design cost

Details	Amount
Salaries and wages	781270140
commodity supplies	1820300
Services supplies	2404972
depreciation	976427
Total\ Baghdad factory	786471839
Factory share six models out of 49 models	96302674

Quality planning cost:- It is planning using unique quality plans and programs to maintain the required level of quality by ISO specifications, by setting objectives for specifications, the quality level of the product, and customer requirements as follows:

Table (4) Quality planning cost

Details	Amount
Salaries and wages	80023324
commodity supplies	16000
Services supplies	1260000
depreciation	502000
Total\ Baghdad factory	81801324
Factory 7 shares only	81801324

The cost of the preventive maintenance activity: Where the maintenance department in the company reduces or eliminates the breakdowns that may occur in the company as follows:

Table (5) Cost of preventive maintenance activity

Details	Amount
Salaries and wages	721180516
commodity supplies	104416520
Services supplies	3514300
Depreciation	22507830
Total\ Baghdad factory	851619166
Factory share (63) document out of (754) document	71156508

The cost of prevention (prevention) for the laboratory is shown in the following table:

Table (6) Total prevention cost

Elements of Quality Costs (Prevention)	Amount
Research and development cost	16091251
Product design cost	96302674
Quality planning cost	81801324
Preventive maintenance cost	71156508
Total	265351757

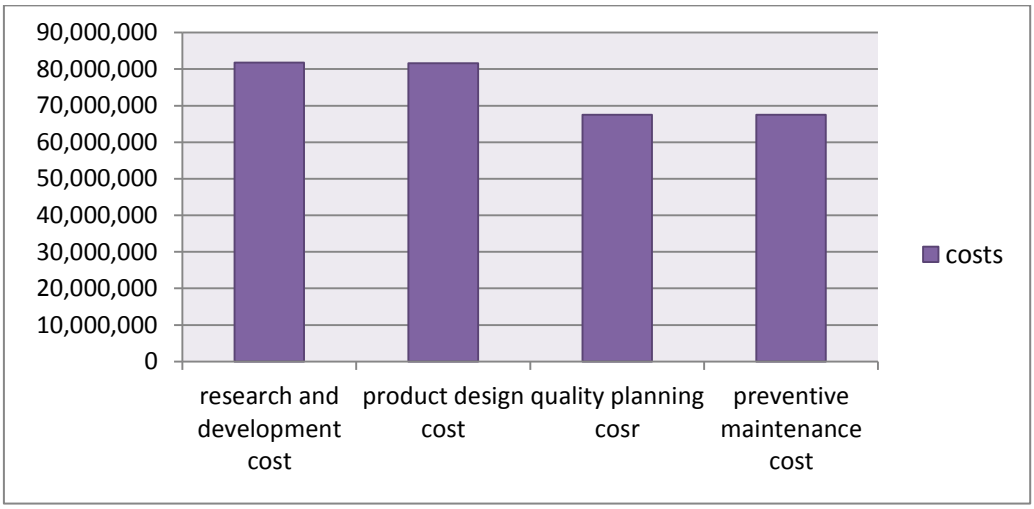

Figure (1) Prevention costs (based on table (6))

2- Evaluation cost: It is used to evaluate the product during the production process and after the completion of the process and includes the following:

Table (7) Examination costs

Details	Cost
Salaries and wages	52881504
commodity supplies	257650
Services supplies	416280
depreciation	29500
Total\ Factory	53584934

a. Raw materials inspection: Special tests are carried out on raw materials to ensure their conformity to specifications before entering the separation process. The test is carried out by a special committee, starting from before entering the examination to the first stage of production, separation. Table (10) shows its cost.

b. Examination of semi-finished products: - Inspection of products is the responsibility of the supervisors responsible for the production process, where the product is tested for each part separately, starting from the process of separation, sewing and traction. Because of its failure and thorough knowledge of field coexistence and consulting experts and technicians, it is devoted (80%) of its time to examination during production. In contrast, devoted the remaining time to the materials returned to the Factory.

c. Inspection of the final products: Where a specialized group of inspectors checks the products permanently after the completion of the last stage of production (the withdrawal process),

where they check the product entirely before the process of packaging it to ensure its suitability to the requirements and expectations of the customer.

d. Examination of the returned products: This is for the inspectors to re-examine the parts that do not conform to specifications and then return them to the production process and then re-examine 20% of the examination process again.

Table (8) The cost of the tests used in the laboratory

Statement	Number of Workers	Cost
Raw material inspection	1	6698117
Semi-finished products inspection	5	33490584
Finished products inspection	2	13396233
Total	8	53584934

Table (9) and Figure (2) show the total evaluation costs and their details

Table (9) Total evaluation cost

Cost of Quality Elements Evaluation	Cost
Raw material inspection	669811675
Semi-finished products inspection	26792467
Finished products inspection	133962335
Returned products inspection	669811675
Total	53584934

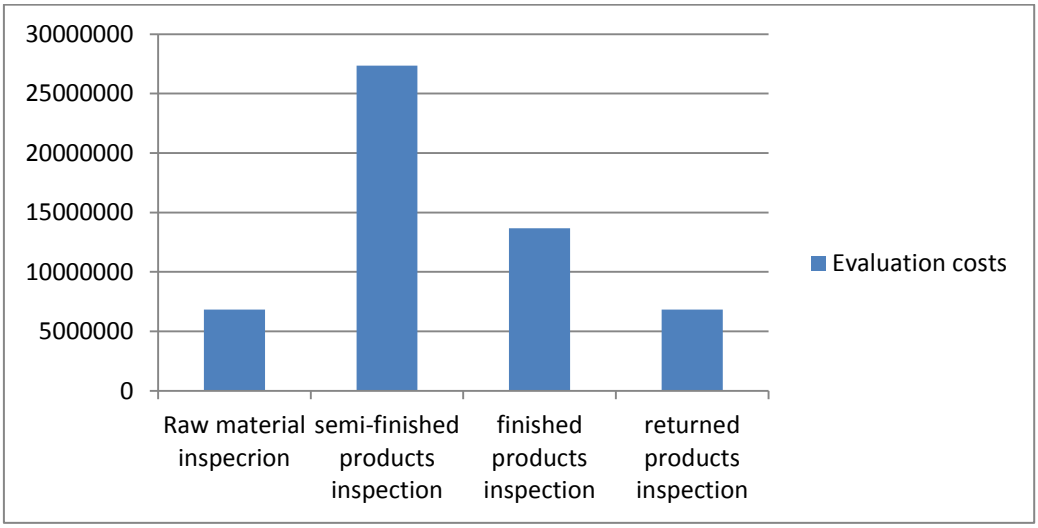

Figure (2) Evaluation costs

It is noted from Figure (2) that the inspection costs of semi-finished products are the highest part of the evaluation costs.

3- Internal failure:-

These are costs of the product that do not conform to the specifications, as the components and parts or damaged products cannot be repaired or even used. So they are considered damaged permanently. This failure occurs for various reasons, and through the method of field living in the laboratory and discussion with specialists in the laboratory, discovered:-the following reasons:

a. Defects in cutting and detailing the leather due to the knives being damaged

due to their frequent use in the repetition process.

b. Defects in the sewing process, such as breaking a sewing needle or using a color thread that is different from the exact color.

c. Defects in the process of traction and subtraction.

Where the costs of product damaged in the Factory represent 7% of the waste stores (119411103) and that is (8358777)

4- External failure:-

As for the external failure is the company's failure to provide poor quality products to the customer, which negatively affects sales and the customer's reluctance to buy the company's products. Defective and returned and because the General Company for Leather Industries does not have the costs of repairing damages and not filing lawsuits for inferior products, except for the discounts granted by the company to increase the number of sales. It was noted that there are no complaints, compensation, warranty, or discounts, so there are no costs of external failure.

Table (10) Total cost of quality

Cost of Quality Classification	Costs	Percentage
Prevention costs	265351707	%81,1
Evaluation costs	53584934	% 16,4
internal failure costs	8358777	% 2,5
External failure costs	0	0
Total	327395468	% 100

Table (10) represents the costs of a quality report for the Factory, where found that the total amounts of quality costs (327295468) as the amount spent aims to provide quality for the product and the process, where we note the high evaluation costs to prevent a defective occurrence in the production.

Table (11) explain the impact of the mass customization on those costs by using advanced technology in manufacturing and communications to produce products that meet the customers' desires and which are designed based on the customer's participation in that, as the production is for a particular order starting from the design and according to the customers' desire.

Table (11) The effect of mass customization on costs of quality

Cost Types	Cost Elements	Before Mass Customization	After Mass Customization	Notes
Prevention costs	Research and development cost	16091251	16091251	-
	Product design cost	96302674	96302674	-
	Quality planning cost	81801324	0	Based on the above, there is no need for ISO because the customer measures the quality through its suitability for its use
	Cost of preventive maintenance activity	71156508	0	Therefore high-tech and flexible factories are repaired on their own without the need for maintenance

Evaluation	Raw materials inspection	6698117	0	It is not needed because the economic unit deals with reliable suppliers, and it is in small quantities
	Inspection of semi-finished products	26792467	0	In the case of relying on factories with the same technology, there is no need for an examination of semi-finished products because the analysis is automatic
	Inspection of finished products	13672749	0	no need for an examination
	Inspection of returned products	669811675	0	No returned products
Internal failure	Damaged products	8358777	0	There are no damaged or defective products that do not meet customer specifications
External failure	none	0	0	There are no complaints or fines under mass customization because the products are made according to the customer's request

Conclusions and Recommendations

First: Conclusions

i. The General Company for Leather Industries, like any industrial company from the public sector companies, suffers from a decrease in sales, the failure to modernize the machines, the inability to use modern methods in the design, and the reliance on those old designs.

ii. The use of the mass customization system is considered one of the modern means of production that assists the management of the economic unit of output according to customers' desires.

iii. Production according to customers' wishes will lead to rationalization or ending the costs of prevention, evaluation, and failure.

Second: Recommendations

i. The company must keep up to date with recent developments in the fields of production and communications, as well as technology in the same global industries.

ii. Stimulating the management of economic units to rely on modern systems in production and marketing, including the mass customization system.

iii. Production according to customer specifications excludes evaluation costs.

iv. The necessity of relying on the automated production system and high-tech factories will eliminate all costs of internal and external failure.

References

1- Horngren, Charles T. & Datar, Srikant M. & Rajan, Madhav V. (2012),"Cost Accounting A Managerial Emphasis" Fourteenth Edition ,Prentice Hall.

2- Al-Saadi, Wessam Aziz Shanawa, (2016) "The Challenge of Cost Accounting (Appropriate for Use in the Light of Artificial Intelligence and its Role in Achieving Customer Satisfaction), Applied Research in the Electronic Industries Company, Ph.D. thesis submitted to the Higher Institute for Accounting and Financial Studies.

3- Chen ،Jue & Hao,Yunhong,(2010)," Mass customization in design of service delivery system: A review and

prospects", African Journal of Business Management Vol. 4(6), pp. 842-848 .

4- Harmsel ,Maarten ter , (2012)," Mass customization as a solution for the Service Industry "Master's thesis , Business Administration, Service Management, University of Twente.

5- Boer,Claudio R. and Dulio Sergio,(2007)," Mass Customization and Footwear Myth, Salvation or Reality?", Springer-Verlag London Limited.

6- Al-Lami, Ghassan Qassem, (2008), "Contemporary Techniques and Systems in Operations Management," Ithra for Publishing and Distribution, first edition, Sports City Circle.

7- Kotha , suresh, (1996) , " from mass production to mass customization : the case of national industrial bicycle company of japan ", Journal European Management Vol. 14 No 5 ,pp:544.

8- Skjelstad, Lars & Hagen,Ingvar & Alfnes, Erlend ,(2005)," GUIDELINES FOR ACHIEVING A PROPER MASS CUSTOMISATION System" , Sessio : Production and Manufacturing Management , EurOMA International Conference on Operations and Global Competitiveness .

9- Al-Taweel, Akram Ahmed, and Al-Kiki, Ghanem Mahmoud Ahmed (2009), "The possibility of adopting the entrances to the broad benediction system in the National Company for Home Furniture Industries in Mosul, an exploratory study," research published by the Tikrit Journal of Administrative and Economic Sciences, Volume (5), No. (20).

10- Krajewski , Lee J. & Ritzman , Larry P. & Malhotra , Manoj K. ,(2010) , "Operations Management – Processes and Supply Chains" , (ninth) Global Edition , Pearson Education, Inc., New Jersey.

11- Barman,Samir &Canizares, Alejandra E.,(2015)," A Survey of Mass Customization in Practice", International Journal Sup Chain. Mgt Vol. 4, No. 1.

12- Kratochvíl, Milan & Carson, Charles, (2005)," growing modular mass costomization of complex products, services and software", springer berlin Heidelberg, New York.

13- Coletti, Paolo & Aichner, Thomas, (2011)," Mass Customization an Exploration of European Characteristics", Paolo Coletti.

14- Forza, Cipriano & Salvador, Fabrizio, (2006)," Product Information Management for Mass Customization" First published, PALGRAVE MACMILLAN.