

# The Role of APQP and QFD in Production

Dr. Kamaladdin Rahmani, Tajaddin Eram

**Abstract**—The world economy in the twenty-first century will be faced with profound transformation. These developments are going to affect most countries that rely on single-product economy (such as oil) have had. Because the oil in the global economy and the authority of his past into the "black gold" is lost. In fact, growth and economic development in the next century will depend on the volume of production and added value that is created in those countries. This fact added to the effort of governments in creating new competitive advantages. In today's knowledge era and the post-industrial age, rapid changes, technological developments resulted in global organizations think and to deal with the unpredictable competition to prepare. In a world where change occurs at extremely high speeds, organizations are threatened with destruction. The emergence of competitors in the competitive provision of services and production of goods with high quality and reasonable price is a threat to organizations. In today's competitive world, all organizations have found that customer satisfaction is dependent on increasing the quality of goods and services. No matter which product you sell or fantastic ideas, success depends on the quality of the final product. What is that your business is not important. To be successful you need to have the quality of goods produced in the first place. Finally, growth in sales of more sustainable business and sustainable business that its structure is relatively large. No doubt we do not live in a perfect world, people are wrong and the car broke down, the objective is to minimize these problems so that customers are impressed again and again to come straight. Access to this goal by focusing on quality is possible. Enhance quality, thus preserving the capital, and in this case no further action is to compensate for past mistakes. Staff is also working more efficiently because people are interested in the company and working in groups. How can the uniqueness of the quality of your business make sure, this article reviews the advanced product quality planning APQP in the design and manufacture of new products, goals, benefits and implementation steps it has stated. The results of the findings based on the one-sample t test showed Advanced product quality planning in industrial products, at 95 percent in terms of quality, customer satisfaction, costs and affect their quality there. Also to QFD, Houses of Quality (HOQ), and attitudes the quality are mentioned.

**Index Terms**— APQP (QFD) (HOQ, Quality approach

Dr. Kamaladdin Rahmani, Department of Industrial Management, Tabriz Branch, Islamic Azad University, Tabriz, Iran

Tajaddin Eram, Department of Management, Maku Branch, Islamic Azad University, Maku, Iran

## I. INTRODUCTION

In recent years, attention to customer needs and respond to their demands, both in manufacturing and services is one of the most important and most urgent tasks or goals of the organization. Quality as one of the most important evaluation criteria is a broad concept that different parts of the organization are committed to it. Its aim is to increase the efficiency of the entire organization with minimal cost to enhance competitiveness. So that the entire range of features needed to accommodate customer (Fiegenbaum, 1991).

Successful companies are trying to balance between organizational strategies and needs of our customers and the convergence of communication and design process and provide products and services to ensure maximum customer satisfaction what are the basic pay. (Ehsani & Shamsipour, 2004).

Society of America quality control, the quality is defined as the sum of the features and characteristics of a product or service that will meet customer needs. The so-called customer-centric, indicates that the company can only reach the full quality of the products and services you offer is appropriate or exceeding customer expectations. (Kotler, & Armstrong, 1999). It seems that customer satisfaction is a feeling that the outcome of these services is achieved. Basis of the consent of both customer expectations and his understanding of the services provided to each client expects to provide services if his understanding of the services provided is below expectations, resulting in his dissatisfaction (Zaboyar, Ziyadeh, & Nargesian, 2012).

Customers more satisfied customers who are not satisfied with the services, they tend to use more services and plans to repurchase and other acquaintances often eager to introduce the service or product (Kim, j.j, & Swinney, 2009). So in order to maintain the functionality and achieve the organization's objectives, level of customer satisfaction should always be promoted (Hamidzadeh, Jazani, Hajikarimi, & Ebrahimi, 2012). Customer satisfaction is a key factor in shaping the future customer is willing to buy higher levels of customer satisfaction and customer loyalty leads (Mortazavi, Rahinniya & Gholami, 2012).

Advanced product quality planning in the design and manufacture of new products and crops caused by a change in primary products or products that are reproducible in the hands of the most widely used.

## 2. Problem Statement:

The rating is based on market competition and the lifeblood and anything that hinders the attainment of market competition, gradually makes the economic inefficiency of the system .

Due to the above, increase prosperity and business service organizations of interaction satisfaction and loyalty is

achieved. Thus, managers of manufacturing centers for the maintenance and survival of your organization should periodically or continuously, product quality and customer satisfaction and loyalty of our customers to measure the strengths and weaknesses of the organization to identify and to address weaknesses, adopt the necessary decisions and develop their strengths (Maasumi, 2008).

The price and quality of important competitive advantages in the industry are considered. Thus, the relationship between the two leading industry and competitive advantage in recent years, especially in industrialized countries has been much discussed. The bad impact on prices will be subsequently revenue and also how much we need to achieve optimum quality. Costing the quality has a special place (Sakharkar BM, 1998).

In fact, "In today's world it is very difficult and tough competition between companies and there are companies every day less and less sustainable recovery is critical for companies. This means that should one of the key features of our business is continuous improvement. » (Strickland & Herriot, 1997, 607)« In this era of continuous improvement in all aspects of the business necessary to overcome the challenged by due to turbulent business environment has become. but very few companies, the strength that comes from having staff who are always and at any time to think about improving things have understood (MILLER, JON, 2003).

The APQP and QFD techniques to achieve total quality in the design and manufacture of new products and by doing the service that customers have the most carbide.

APQP (Advanced Product Quality Planning) 75% planning and 25% implementation through production to customer satisfaction and continuous improvement are.

APQP relationship between the seller and Customers facilitate communication between them through the translation of expectations on both sides and features partial measure makes clear.

- Improved working relationships
- Increasing safety in products

Advanced product quality planning in the design and manufacture of new products and products that are created by a change in primary products or products that are reproducible in the hands of the most widely used.

The question that arises from this is still industrial companies, producers of traditional and not standards that if the trend continues, the increased cost of quality, reducing the quality of the product, timely delivery and as a result of They will increase customer satisfaction and reduce complaints. The only solution is the establishment of the project's advanced product quality planning and design relevant policies and procedures needed and the use of software is integrated so that goals are realized.

3. The importance and necessity of research:

The importance of advanced planning, production and product quality at competitive institutions consent of manufacturing companies and service organizations, both public and private can be changed and the changes that have occurred in recent years at the international level checked and for more efficient use of the mentioned institutions and to gain the necessary result.

Ensure product quality and reduce production costs, optimize the use of these techniques in the form of advanced product quality planning and the planning Timken are very useful in the context of total quality management. Technology advanced product quality planning systematically and comprehensively first by three named America's automotive giant Ford, GM and Chrysler developed and approved by the International Standard Organization (ISO) was named QS9000.

Effective product quality planning depends on the commitment of the top management of the company's effort to achieve customer satisfaction. Some of the benefits include:

- Directing resources for customer satisfaction
- Improve early detection of changes

In other words, the way of formal structure that customer satisfaction at the heart of the design and production guarantees (Mehraban, 14, 1998).

And QFD and organized group refer to a process for the planning and design of new products or improve existing products according to the following are used:

- Requirements of our customers
- The information requirements of our customer's competitive environment
  - Plan flexible use of teamwork
  - become non-functional requirements to goals Snjz (Mottaghi, 2006, 87).

Advanced production planning techniques, product quality is an integral part of the six international standard QS. The six components are:

- Statistical Process Control (SPC)
- Production Parts Approval Process (PPAP)
- Measurement Systems Analysis (MSA)
- Quality System Assessment (QSA)
- Advanced product quality planning AOQP
- Analysis of failure and its consequences FMEA

So planning Advanced international standard of product quality is one of the six components of the first American companies to implement design processes and manufacturing techniques were used auto parts suppliers.

Therefore, the use of advanced product quality planning by production units following in its effects both within the organization and outside the organization pursue that appears.

- Reduce design and production time
- Reduce the cost of design and production
- To ensure high quality in the context of design and production
- Reduce design and production time
- The avoidance of past changes
- Product quality, timely and cost

4- Hypothesis:

There is a significant relationship between quality costs with APQP and QFD

There is a significant relationship between the quality of products with APQP and QFD

There is a significant relationship between customer satisfaction with APQP and QFD

5. The definitions of advanced product quality planning APQP

- APQP advanced product quality planning as a means rather than product quality control in product design.

- APQP process of defining a system to improve product
- APQP method that uses different techniques to gain legitimacy in the process of design and manufacturing quality.
- APQP official way to create customer satisfaction at the heart of the design and production stages guarantees.
- APQP is an attempt to ensure communication within the company and between the company and customers

Aims to facilitate communication - people involved and ensure that all required steps are completed on time.  
APQP effectiveness depends on the commitment and support of senior management to ensure that customer satisfaction is provided.

#### 6- Benefits of APQP

1. Ensure quick planning.
2. Directing resources to the client.
3. Identify required changes in the process in less time.
4. To provide a quality product on time and lowest cost.
5. Addressing potential problems in the design and manufacture fast.
6. Reduce the cost of design and production.
7. Reduce the time to design and manufacture.
8. Increasing safety in products.
9. Meet the conditions and criteria.
10. Ensure high quality in design and production.

#### 7- Goals APQP

1. The customer's voice turned to a plan that not only satisfies their current needs but also their satisfaction is exceeded.
2. The creation of the tools and processes that is capable of producing such a product.
- 3- APQP products and services in the shortest time should be able to obtain the consent of customers.
- 4- APQP manufacturer must provide benefits and increase profitability and competitiveness.

#### 8- Steps to achieve APQP

1. The guidance personnel for customer satisfaction
2. Encourage the identification and timely changes
3. Ensure accurate and timely steps
4. Establishing communication facilities to improve quality at the lowest cost

#### 9. The results of the lack of APQP

1. The poor performance of the product
  2. The increase of product development and marketing
  3. Increase the cost of design and production
  4. Increasing unexpected changes
- #### 10. The stages or phases of the APQP

1- The first phase of the project and set the agenda PLAN and define program

Voice of the customer

Business plan / marketing strategy

Product / process benchmark data

Product / process assumptions

Product reliability studie

Design goals

Reliability and quality goals

Preliminary bill of material

Preliminary process flow chart

Preliminary listing of special

Product and process characteristics

Product assurance plan

Management support

Second phase design and product development PRODUCT DESIGN AND DEVELOPMENT

Failure analysis and its impact on the design of D-FMEA

Design and assembly (D.F.A & D.F.M)

Design Reviews

Prototype build - Control plan

Engineering Drawings

Specifications Engineering

Material Specifications

Drawing and Specifications

New Equipment, Tooling and Facilities Requirements

special product and process characteristics

gages / testing equipment requirements

team feasibility commitent and mangement support

phase iii of the development process process design and development

packaging standards

Product / process quality system review

Process flow chart

Floor plan layout

Characteristics

Failure analysis and its impact on the p-fmea

Pre - launch control plan

Procedure (production and control) process instructions

Measurement systems analysis plan

Preliminary process capbility study olan

packaging specifications

management support

the fourth phase of product and process validation product and process validation

-do mass production production trial run

-measurement systems evaluation

-preliminary process capability study

-production part approval

-production testing

-packaging evaluation

-production control plan

- quality planning sign- off and management support

phase v: launch ,feedback, assessment & corrective action

- reduced variation

- customer satisfaction

- delivery and service (<http://iso9000isots.iranblog.com>).

#### 11 -Quality Function Deployment (QFD)

QFD to batch process and regularly refers to the planning and design of new products or improve existing products according to the following items used

1- Customer requirements

2- Details the competitive environment

3- To use teamwork

4- Plan in a flexible

5- Conversion needs. Measurable quality goals(Mottaghi, 2006, 87).

So we can say is QFD an effective TQM customer asked to design and make special signs

QFD refers to:

1- To determine what customer satisfaction leads

2- Turns customer demands to design the instruments House of Quality (HOQ) and the voice of the customer Table (VOCT) is quality tools.

12- House of Quality (HOQ)

Quality home or HOQ a graphical technique to define relationships between customer demands and product or service is one of the tools TQM is so because HOQ one of the tools QFD and QFD is one of the tools TQM

To make quality homes have 6 basic steps taken this step include

- 1- Identify customer demands
- 2- Identify the characteristics of a product or service
- 3-Linking customer demands with the product
- 4- Competitive product evaluations
- 5-Development of performance specifications for the product or service
- 6-Provided the appropriate place in the process of transformation(Jaffarnezhad & basmeng, 2009, 33-35).

13- Quality approach

1-Necessary quality: It is quality that reduces the cost by reducing the amount of waste product or service, reduce duplication and minimize customer complaints

2-Basic quality: Substantial or critical needs of customers in the quality characteristics of the product or service that is part of the fulfillment negligible effect on customer satisfaction will be fully satisfied if the client will not be provoked strong protests, for example, when you into the classroom, we expect there will be a place to sit if there is such a place would be very unhappy if the place had not objected to it because they are a class as possible

A: Satisfy the need for high levels of customer satisfaction is a slight increase

B: Failure to satisfy the needs of customer dissatisfaction is caused

C: Customer surveys and in the case of failure to fulfill these needs do not report it to raise complaints

D; Public expectations of product requires a fundamental role in the formation.

E: The numbers of competitors to divide these requirements affect the basic needs of the Kano model similar to Maslow's physiological needs are not satisfied, go to the upper level.

3- Performance: Linear behavior is generally satisfy these performance requirements that satisfy these needs by increasing the level of customer satisfaction increases linearly characteristics it can be mentioned the following

A: More satisfy increasing customer satisfaction is linear.

B: Steep increase customer dissatisfaction due to the non-satisfaction of basic needs less functional requirements

C: Much of the information that the customer's voice called functional needs of the customer survey

D: Much of the competition on the improvement of functional requirements

E: Operational needs over time become the basic needs

4- Attractive quality: The revenue and profit increase customer satisfaction and discover hidden customer complaints indirectly.

5 Excitement quality: Excite the customer to happen because he designs and characteristics of the product or service plan sees not expected or even thought such as: the possibility of ordering through the Internet and order merchandise sums deducted automatically from customer's account

It can be characterized as follows:

A: Satisfaction of these needs is to increase customer satisfaction

B: Not included in the survey

C: Way over rivals and dominate the market to satisfy this need is

D: Failure to satisfy it does not upset

E: Much of the advertising is on stimulating demand (Feghhi-farahmand, 2003, 53).

II. TEST OF THE HYPOTHESES

A.Hypothesis 1

H o:  $\mu \leq 15$  or Ho: there is a no significant relationship between quality costs with APQP and QFD

H1:  $\mu > 15$  or H1: there is a significant relationship between quality costs with APQP and QFD

**Table (1): Descriptive statistics, hypothesis testing results quality costs with APQP and QFD**

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
quality costs	30	18.6667	1.86313	.34016

**Table(2): Inferential statistics, One sample t test results assuming quality costs with APQP and QFD**

One-Sample Test						
	Test Value = 15					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
quality costs	10.779	29	.000	3.66667	2.9710	4.3624

According to the results table (1) and (2), the one-sample t test, test average of 18.67 and a significance level is 0.0000. Since the average is more than 15 and a significance level is no less than .05 null hypotheses is rejected. As a result, there is a significant relationship between quality costs with APQP and QFD Therefore The implementation of the APQP and QFD has an impact on the cost of quality.

Also, the value of the test statistic is 10.77 with 29 degrees of freedom and because a significance level is no less than .05, it can be said that the average of the variable with the number 15 is significant. that is the mean difference of equal to 3.6 . So the show output results there is a significant relationship between quality costs with APQP and QFD Therefore The implementation of the APQP and QFD has an impact on the cost of quality.

B.Hypothesis 2

H o:  $\mu \leq 15$  Ho: there is a no significant relationship between the quality of products with APQP and QFD

H1:  $\mu > 15$  H1: there is a significant relationship between the quality of products with APQP and QFD

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Quality Production	30	19.6333	1.21721	.22223

Table (4): Inferential statistics, one sample t test results assuming the quality of products with APQP and QFD

One-Sample Test

	Test Value = 15					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Quality Production	20.849	29	.000	4.63333	4.1788	5.0878

According to the results table (3) and (4), the one-sample t test, test average of 19.63 and a significance level is 0.0000. Since the average is more than 15 and a significance level is no less than .05 null hypotheses is rejected. As a result, there is a significant relationship between the quality of products with APQP and QFD Therefore The implementation of the APQP and QFD have an impact on the quality of products.

Also, the value of the test statistic is 20.849 with 29 degrees of freedom and because a significance level is no less than .05, it can be said that the average of the variable with the number 15 is significant. That is the mean difference of equal to 4.63. So the show output results there is a significant relationship between the quality of products with APQP and QFD Therefore The implementation of the APQP and QFD has an impact on the quality of products.

C.Hypothesis 3

**H<sub>0</sub>:**  $\mu \leq 12$  Ho: there is a no significant relationship between customer satisfaction with APQP and QFD

**H<sub>1</sub>:**  $\mu > 12$  H1: there is a significant relationship between customer satisfaction with APQP and QFD

Table (5): Descriptive statistics, hypothesis testing results customer satisfaction with APQP and QFD

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
satisfaction2	30	15.3000	1.31700	.24045

Table (6): Inferential statistics, One sample t test results assuming customer satisfaction with APQP and QFD

One-Sample Test

	Test Value = 12					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Satisfaction	13.724	29	.000	3.30000	2.8082	3.7918

According to the results table (5) and (6), the one-sample t test, test average of 15.30 and a significance level is 0.0000. Since the average is more than 12 and a significance level is no less than .05 null hypotheses is rejected. As a result, there is a significant relationship between customer satisfaction with APQP and QFD Therefore The implementation of the APQP and QFD have an impact on the customer satisfaction.

Also, the value of the test statistic is 13.724 with 29 degrees of freedom and because a significance level is no less than .05 it can be said that the average of the variable with the number 12 is significant. that is the mean difference of equal to 3.3 . So the show output results there is a significant relationship between customer satisfaction with APQP and QFD Therefore The implementation of the APQP and QFD has an impact on the customer satisfaction.

Prioritizing the variables relationship with APQP and QFD

**H<sub>0</sub>:** Prioritizing the variables, are the same

**H<sub>1</sub>:** Prioritizing the variables, are not the same

Friedman Test

Table(7): Friedman test for ranking variables relationship with APQP

Ranks

	Mean Rank
QUALITYPRODUCTION	2.60
satisfaction	1.07
Quality Costs	2.33

Table(8): Inferential statistics Friedman test

Test Statistics<sup>a</sup>

N	30
Chi-Square	43.927
df	2
Asymp. Sig.	.000

a. Friedman Test

According to the results table (8), the amount of Chi-Square equal 43.927 with 2 degrees of freedom and a significance level is 0.0000. Because a significance level is no less than .05 null hypothesis is rejected. Therefore, there is a significant difference between the mean values

According to the results table (7), the relationship variables With APQP QFD in order of importance are as follows:

Customer satisfaction ranks first with an average of 1.07

Quality costs in second place with an average of 2.33

And product quality ranks three with an average of 2.60.

### III. CONCLUSION

Today, many organizations have realized that they must change their management approach works because customers have changed practices On the other hand, survival and development companies with foreign customers, due to the correct customer interaction and attention to quality in recent years, quality and quality management for our industry have become familiar words, but in many whatever industry claims the practice is utilizing the principles of this method claim, but the deep, broad scientific and away the most effective measures for the industry and protect the interests of consumers in real productivity and achieve export markets The national interests to take advantage of scientific principles to improve quality control and quality management depends on a process that started but did not finish

On the one hand, organizations must respond to changing customer needs and expectations and on the other hand the implementation of processes and systems in constant interaction and dynamic, so always can be found opportunities to improve processes and systems to the efforts and actions of an organization meet customer needs and expectations of internal and external then internal customers (employees and managers) passion and creativity and their talents to track performance and more efficient systems and processes and find better ways to employ and on the other hand the opening of a dialogue with foreign customers continuous quality improvement of services leads to anything regardless of customer needs and expectations of internal and external managers, however, may be a useful thing, and no violation, but in fact without Value is

organizations present for their survival on the quality of

their products and services so that they can focus on their current customers happy and attract new customers and boost your income sources and to achieve this important guarantee by applying the Management also needs proper management to improve the quality of the various tools that one of the tools to implement the APQP and QFD.

So production units should have paid more attention to the APQP, Why it makes quality products produced according to the result of increased customer satisfaction, increased profitability, increased productivity, exports and competitiveness will result in the sale of products.

The results of this study based on the findings from the questionnaire information and test hypotheses, showed that Advanced Production Quality Planning in the manufacture of industrial products In terms of quality, customer satisfaction, quality costs are related and affect them.

The advanced product quality planning based on test results assume the first, second and third at 95 percent on the cost of quality, customer satisfaction and affect product quality

Advanced product quality planning and product development, and to ensure that all customer needs are met is considered to be the goal of providing a quality product at the right time to achieve the necessary improvements project goals and channels of communication between Know parties (customers, suppliers, subcontractors), according to the results obtained from the theoretical foundations:

- Reduce design and production time
- Reduce the cost of design and production

### REFERENCES

- [1] Feghhi-farahmand, N., "Reliable management organization", publications froozesh, Tabriz, 2003, first edition, pp. 91 to 136.
- [2] Mehraban, R., "Application of advanced product quality planning (APQP)", 1998, Tehran: Publication Pykan H. Poor, *An Introduction to Signal Detection and Estimation*. New York: Springer-Verlag, 1985, ch. 4.
- [3] Ehsani, M., & Shamsipour, S. "The study of customers ideas and opinions in Esfahan women body building halls". *Journal of Harekat*, 2004,25, 135-145.
- [4] Fiegenbaum, A.V. "Total quality Control", 3rd Edition, New York, 1991, MC Grave-Hill.
- [5] Hamidzadeh, M., Jazani, N., Hajikarimi, A., & Ebrahimi, "A. Designing a multidimensional model for measuring customer satisfaction in the banking industry in Iran". 2012, *Outlook Business administration*,9, 99-116.
- [6] Herriot, Peter & Stick land, Rob . "The Management of Careers", 1997, Psychology Press
- [7] Kotler, P., & Armstrong, G. "Principles of Marketing". Translated by parsian, Ali. Eighth Edition. 1999, New World Press, 23.
- [8] Mortazavi, S., Rahimniya, F., & Gholami, S. "Imagine the impact of satisfaction on loyalty customer service attitude and behavior". *Management Agricultural Development*, 2012, 15,23-37. in Esfahan,3, 73-81.
- [9] Sakharkar BM., "Principles of Hospital Administration & Planning". Jaypee Brothess Medical Publishers (p) ,1998, Ltd. New Dehi. India.
- [10] . Zaboyar, F., Ziyae, M. S., & Nargesian, J. "Factors affecting customer satisfaction using SERVQUAL model". *Journal of the New Marketing Research*, 2012,3, 186-173.