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Ranking Effective Quality Dimensions on Buyer's Behavior of Ethylene Nano-Absorbent Device (Case study: Middle-East Bio-Researchers Co.)

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ABSTRACT

The present research aims to investigate Ethylene Nano-absorbent device customers' behaviors towards this device quality and rank quality dimensions in order to help improve the quality of this technology. The present research classifies quality dimensions based on David Garvin (1984) study into: performance, perceived quality, attribute, concordance, durability, aesthetics, reliability and serving capability. The present research is an applied study in terms of its goal, and it is a descriptive sectional survey from methodology viewpoint. 37 purchase decision-making groups (including managers and technicians) were selected randomly out of population. Questionnaire was used as data collecting instrument. Variance analysis and t-student test were used to analyze data in SPSS software. Finally, importance degrees and ranks of quality dimensions were determined. According to the results, the most desirable dimensions of quality were aesthetic and performance dimensions. The most unwanted dimensions were durability and perceived quality dimensions. Purchasing groups' perceptions of the 8 dimensions quality were different and these differences were statistically significant. Results also showed that customers do not have the same perception of quality dimensions. Therefore, these differences should be considered in quality improvement programs of the device and ranks should be determined according to the differences.

KEYWORDS: quality, quality dimensions, purchaser group, Ethylene, Ethylene Nano-absorbent device

INTRODUCTION

Kanes and Houng contend that "product quality, production cost and production time" are three main factors in production system process in modern businesses (Murray, M.R and Wilemon, D., 2008). Therefore, improvement in product quality has been always an important attempt for achieving competitive advantage and it can be said that it is considered as the most important factor for competition in global environment (Zalim, S., Mehmet S, 2000). Over years, quality was regarded as meaning matching characteristics. Today, however, quality has correlated and also dissimilar dimensions and they must be considered as important (Jan.c.moven and Michel.s.minur, 2009). Increased demand of consumers for improving product quality has made companies to emphasize on their products quality in order to be able to confront with regional and international competitors threats. Therefore, they try to focus on satisfaction of consumers through development and improvement of product (Shen,X.X ., Tan.K.C. & M. Xie, 2000).

Research importance

Proper application of new technologies to inventory systems and transportation of fruits can influence development of production and export of horticultural products. It can meet internal needs and also play an important role in non-petroleum exports. Over 25 million tons of fruits and vegetables are produced in Iran, 7.6 million tons of which are ruined (an equivalent of 30.6%). This is while this value is about 7 to 10% (Omrani, 2005). Since this product is a new technology in Iranian market and it is in fact a new technology in storage and on the other hand, we cannot consider these device consumers' behaviors the same as other products consumers, the author would like to investigate product quality dimensions-presented by Garvin-which influence customers' behaviors. In internal and foreign studies, many studies have been conducted to investigate the quality of other products. However, the present research is the first study which investigates Ethylene Nano-absorbent device quality dimensions in Iran. This technology entered Iranian industry in 2005 and has played important role in reducing agricultural and horticultural products wastes. Results of the present research can improve users' familiarity with the device and helps managers of the producing company to improve this device quality. Some studies have been conducted on the efficiency and performance of the device which are reviewed in the following sentences.

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Theoretical background

Many studies have been conducted to investigate consumable and industrial products quality, but this is the first time Ethylene Nano-absorbent device quality is studied in Iran. The followings are examples of similar studies. Murray, M.R and Wilemon, D conducted a research titled "scientific study of product quality dimensions with presenting concepts for R & D management". They examined Garvin's the 8 quality dimensions presented in 1987. Results showed that at least two of these dimensions: reliability and product features dimensions were very effective on customers' behaviors. Further, product durability, performance and functionality, serving capability and aesthetic dimensions were key dimensions necessary for new products success and profitability (urray, M.R and Wilemon, 2008). In another research, researchers investigated the ideas of a group of quality managers in production companies in order to find whether there is a relationship between the 5 traditional definitions of quality (intuition-oriented, product-oriented, user-oriented, production-oriented and value-oriented) and the 8 quality dimensions presented by Garvin? Results showed that user-oriented definition had a significant relationship with aesthetics and perceived quality, and production-oriented definition had a significant relationship with concordance and product-oriented definition gt had a significant relationship with performance and attributes. Further, ranking of these dimensions showed that performance, concordance, perceived quality, reliability, aesthetics, attribute and serving dimensions were important to quality managers and these dimensions cover comprehensive quality) Sebastianelli, 2002 &Tamimi. Furthermore, the following studies concerning Ethylene Nano-absorbent device function can be mentioned: A research titled "influence of Nano-zeolite granules containing potassium permanganate on Ethylene Hormone absorption and storability lifetime and quality increase in Cherry fruit" was aimed to reduce wastes and increase cherrystorability lifetime. Results showed that Ethylene Nano-absorbent device use had significant influence on dependent variable. Reduction percentage of fruit weight, dissoluble solid material percentage and browning of fruits tips reduced significantly in the case of using the device. Data variance analysis supported the significant influence of using Ethylene Nano-absorbent device on titration able acidity and browning of fruits tips (RezaeeKalaj et al, 2008). Emadpour et al also conducted a research titled: "influence of Ethylene Hormone granules with zeolitic context on increasing storabilitylife and qualitative features of Kiwi Fruit Hayward type". Results of their test revealed that the highest level of flesh stiffness, the lowest level of white area in the core of the fruits, the lowest level of PH, soluble solid material percentage and weight reduction occurred when Ethylene Nano-absorbent device was used and conversely, the lowest level of flesh stiffness, the highest level of white area in the core of fruits, the highest level of PH and dissoluble solid material of juice and weight reduction occurred when the device was not used (Emadpour et al, 2008). RezaeeKalaj et al conducted a similar study. Their research involved testing two kinds of vegetables with a device containing Ethylene Nano-absorbent granules. The absorbent device was used for Chinese cabbage and salad lettuce. Experiment lasted 21 days and sampling was conducted at zero point and in 7-day periods. Results showed that application of the device had significant influence on qualitative characteristics of lettuce and cabbage. Comparison of means revealed that in Chinese cabbage, after 21 days of storability, the highest level of flesh stiffness, lowest level of weight reduction, the lowest PH, the highestcolor transparency, the lowest dye angle, the highest visible quality index and the lowest browning of vascular tissue at cutting point occurred at the presence of the device. Results showed that the presence of this device increased storability life of leaf vegatables (RezaeeKalaj et al, 2008).

Quality

Scientific and research associations have tried and try to define quality concept from different aspects. It can be said with certainty that there is no unique definition of quality and the reasons for this are the characteristics of quality which have been presented below:

- Quality is an objective and subjective concept at the same time and it can be slightly generalized.
- Some of quality characteristics are measurable and some of them are only evaluable and estimable.
- Quality can refer to a level of technical performance or deviation resulting from that.
- Quality can have understandable effects or effects that cannot be felt consciously by customers (Becser, 2007).

An important point regarding quality concept is the fact that it is a multi-faceted concept. In fact, there is no unique definition for quality which best suits management and relationship with customers (Garvin, 1984).

Product quality dimensions

David Garvin presented one of the most acceptable classifications for quality dimensions in Harvard Business School. Garvin found that most quality definitions are intuitive, production-oriented, product-oriented, value-oriented or user-oriented (Wurjaningru & Nugrahayu , 2010).

He presented a framework for thinking about product quality which is based upon 8 dimensions:

Performance, attributes, reliability, concordance, durability, usability, aesthetics and perceived quality. He, actually, aimed to provide companies with instruments to deal with strategic methods of competition. He proved that these 8 dimensions can be used to explain differences between 5 traditional approaches for defining quality.

Specifically, he assumed that product-oriented approach emphasize on performance, attributes and durability, user-oriented approach emphasizes on aesthetics and perceived quality and production-oriented approach emphasize on performance and reliability (Garvin, 1984). In the next sentences we deal with these dimensions:

Reliability

Companies pay more attention to establishment of long-term relationships with customers and suppliers in order to be able to confront with fiercely competitive business environmentresearchers believe that trust is the base of relationship and plays an important role in both theoretically and practically in marketing and has attracted many researchers' attention since 1950s (Liu &Ansary, 2008). Garvin defined trust as the possibility of a product performing flawlessly over a particular period of time (Sebastianelli & Tamimi, 2002).

Common qualitative criteria for this dimension include: "mean time of intervals between defects" and " mean time of the first defect". Low reliability results in absence of commitment. Therefore, reliability has a considerable effect on productivity (Arry Heither and Harnen, 2006). Further, trust is defined as tendency to rely on a business and refers to having positive anticipations from the other side in risky conditions (Das &Teng, 2001). Most studies concerning distribution channels communications define trust as the belief of a company in its commercial partner's honesty and its good will and similar points (Geyskens et al, 1998).

Presence of trust is followed by a number of advantages in business:

- It reduces deal complexity, consumers reduce their options and therefore the possibility of a transaction increases.
- It reduces transaction cost because it reduces companies' marketing costs.
- It results in cooperation persistency and can act like a cooperation facilitator.
- It results in long-term relationships which is an important factor in long-term profitability.
- It results in reduction of perceived risk.

Aesthetics

Many scientists and engineers believe that beautifully designed technical processes and products have better performance. Aesthetics is turning into an important element of marketing strategies (Weggeman et al, 2007). Aesthetic dimension is a subjective dimension and includes appearance, feeling, effect, taste and smell of a product. Personal preference and interests influence his or her judgment about aesthetic dimension (Arnheiter & Harren,2006). The appearance of a product or store, attractiveness of service-providing, desirable space of serving, product design attractiveness are all components of this dimension (Simon and Minor, 2009).

Perceived quality

Perception is a process in which an individual creates a meaningful image of the world through selection, organizing and information interpretation. Purchasers choose information, products, advertisements and messages which are closely matching their attitudes and interests (Kotler, 2006). Perceived quality is the interaction between a consumer's perception and his or her subjective evaluation of a product's quality (Hansen, 2005). This quality dimension is based upon image, brand or advertisements and concerns subjective evaluation of an individual (Sebastianelli & Tamimi, 2002). In general, it can be said that a comprehensive Catchall Categorization which includes brand image and other intangible factors and influences customers' perceptions of product quality (Simon and Minor, 2009). Most purchasers tend to pay higher prices in return for buying their products from a famous organization (Garvin, 1987).

Performance

Performance refers to a product's function in achieving a pre-determined goal and it can be said that better performance means better quality (Wurjaninger and Negrahayo, 2010). Carbonell Monira and Rogriguez found that high-performance products (products which satisfy anticipated performance) bring better financial and marketing performance and provide higher levels of customer satisfaction (Carbonell et al, 2004). Furthermore, performance refers to a product's ability to have operational characteristics and meeting performance requirements (Garvin, 1987).

Timeliness and convenience

This dimension is also called serving capability. It can not be measured by quantitative parameters and it is an intangible dimension. It refers to speed in receiving and if necessary, repairing a product. Most researchers consider serving as an additional service besides physical product. Serving include technical support, designing, teaching, financial services, employees teaching, supporting, information services and after-sale services. Moreover, it includes more intangible services like recommendation and evaluation (Persson, 2010). Speed in providing products and services, ease of purchase and serving process (service includes accepting credit cards, working hours and car parking) are also items which were proposed by John Mon and Michael Minor. Speed, ease of fixing or service experience is criteria for usability of products. The time and effort needed for fixing a

car brakes is an example of serving capability. Some of its aspects like competency of the mechanic who fixed the brakes are subjective (Arrenheither and Harnen, 2006).

Attribute

Attribute becomes usually important after the main performance of a product and it refers to secondary features of a product which are complimentary to the main functions (Jafari and Osuli, 2000). Jouran (1951) wrote: "you cannot have something you cannot measure it" (Carbonell and Rodriguez, 2004).

Durability

This dimension refers to tension or blow toleration degree of a product without stopping working. Garvin (1987) also defined durability as the time a product can be used before its replacement with a new one and before it stops working. A customer should assess replacement costs and repairmen costs. Reliability plays an important role in this decision-making because fixing times is an important factor which specifies operational cost. Making decisions for replacement time of a product is dependent on two factors:

1. Whether the product meets anticipated performance?
2. Whether malfunctioning and repairmen costs are justifiable? (Arren Heither and Harnen, 2006).

Research hypotheses

Research hypothesis: the main hypotheses of the research are based upon David Garvin's classification of quality dimensions in 1984:

First hypothesis: device performance dimension has a positive impact on Ethylene Nano-absorbent device purchasers group's behavior.

Second hypothesis: responsiveness dimension has a positive impact on Ethylene Nano-absorbent device purchasers group's behavior.

Third hypothesis: reliability dimension has a positive impact on Ethylene Nano-absorbent device purchasers group's behavior.

Fourth hypothesis: perceived quality dimension has a positive impact on Ethylene Nano-absorbent device purchasers group's behavior.

Fifth hypothesis: aesthetics dimension has a positive impact on Ethylene Nano-absorbent device purchasers group's behavior.

Sixth hypothesis: concordance dimension has a positive impact on Ethylene Nano-absorbent device purchasers group's behavior.

Seventh hypothesis: attribute dimension has a positive impact on Ethylene Nano-absorbent device purchasers group's behavior.

Eighth hypothesis: durability dimension has a positive impact on Ethylene Nano-absorbent device purchasers group's behavior.

RESEARCH METHODOLOGY

The present research is an applied study in terms of its goal and it is a descriptive study in terms of its methodology. It is a descriptive survey study in terms of data collection method and data analysis. Statistical population of the research included all customers of Middle-East Bio-researchers Company which had equipped their company with this technology. All population members (78 companies) were selected as sample members. 40 questionnaires were distributed in order to calculate reliability coefficient via Chronbach's alpha (0.84). SPSS (version 16) and Statistica (version 8) software were used for analysis. T-student test was used for investigation of the hypotheses. Then, One-way ANOVA was used for investigation of the impact of the dimensions and their differences. Finally, Friedman test was used for ranking of the dimensions.

Research data analyses

In order to investigate the hypothesis: "there is a significant difference between managers and technicians' viewpoints of the device purchasing companies on effectiveness of each of quality dimensions", we used t-student test. Results of this test have been summarized in table 1. We tried to compare the two groups' viewpoints.

Table 1.a comparison of managers and technicians' viewpoints means on Ethylene Nano-absorbent device quality dimensions

Quality dimensions	Purchasers groups	Descriptive indices			T-student statistic	df	p-value
		Sample size	mean	Standard deviation			
Performance	Managers	37	7.11	1.61	27.-0	72	0.789
	technicians	37	8.11	1.85			
Responsiveness	Managers	37	10.8	1.58	0.91-	72	0.364
	technicians	37	11.2	1.72			
Reliability	Managers	37	10.8	1.58	910.-	72	0.364
	technicians	37	11.2	1.72			
Perceived Quality	Managers	37	10.7	2.21	0.00	72	1.000
	technicians	37	10.7	2.25			
Aesthetics	Managers	37	12.2	1.33	0.35	72	0.729
	technicians	37	12.1	1.34			
Concordance	Managers	37	11.8	1.45	0.98	72	0.332
	technicians	37	11.5	1.41			
Usability	Managers	37	11.2	1.84	-0/78	72	0/437
	technicians	37	11.5	1.41			
Durability	Managers	37	10.1	2.08	-0/70	72	0/489
	technicians	37	9.8	2.27			

According to table 1, results show that "there is no significant difference between managers and technicians' viewpoints on quality dimensions of Ethylene Nano-absorbent device".

Hypotheses tests

T test was used for testing the hypotheses. Results of this test have been summarized in table 2. In the next sentences, research hypotheses are tested according to table 2 results.

Table 2.results of t test

Row	Variable	T value	Sample size	df	P-value
1	performance	13.90	74	73	0.000
2	responsiveness	10.64	74	73	0.000
3	trust	10.35	74	73	0.000
4	Perceived quality	6.62	74	73	0.000
5	aesthetics	20.32	74	73	0.000
6	concordance	15.96	74	73	0.000
7	attribute	12.32	74	73	0.000
8	durability	9.9	74	73	0.000

First hypothesis test

Results show that performance dimension mean value is equal to 11.8. Considering the calculated probability value (P-value=0.000), because it is smaller than significance level (0.05), H0 is rejected in significance level. Therefore, it can be said with 95% of certainty that performance dimension had positive influence on the behavior of purchasers of Ethylene Nano-absorbent device of middle-east bio-researchers company.

Second hypothesis test

Considering the calculated probability value (P-value=0.000), because it is smaller than significance level (0.05), H0 is rejected in significance level. Therefore, it can be said with 95% of certainty that responsiveness dimension had positive influence on the behavior of purchasers of Ethylene Nano-absorbent device of middle-east bio-researchers company.

Third hypothesis test

Considering the calculated probability value (P-value=0.000), because it is smaller than significance level (0.05), H0 is rejected in significance level. Therefore, it can be said with 95% of certainty that reliability dimension had positive influence on the behavior of purchasers of Ethylene Nano-absorbent device of middle-east bio-researchers company.

Fourth hypothesis test

Considering the calculated probability value (P-value=0.000), because it is smaller than significance level (0.05), H0 is rejected in significance level. Therefore, it can be said with 95% of certainty that perceived quality

dimension had positive influence on the behavior of purchasers of Ethylene Nano-absorbent device of middle-east bio-researchers company.

Fifth hypothesis test

Results show that aesthetics dimension mean value is equal to 12.1. Considering the calculated probability value (P-value=0.000), because it is smaller than significance level (0.05), H0 is rejected in significance level. Therefore, it can be said with 95% of certainty that aesthetics dimension had positive influence on the behavior of purchasers of Ethylene Nano-absorbent device of middle-east bio-researchers company.

Sixth hypothesis test

Results show that concordance dimension mean value is equal to 11.8 and its standard deviation is equal to 1.43 which is greater than evaluation standard (9)(????). Considering the calculated probability value (P-value=0.000) and because it is smaller than significance level (0.05), H0 is rejected in significance level. Therefore, it can be said with 95% of certainty that concordance dimension had positive influence on the behavior of purchasers of Ethylene Nano-absorbent device of middle-east bio-researchers company.

Seventh hypothesis test

Results show that attribute dimension mean value is equal to 11.3 and its standard deviation is equal to 1.63 .Considering the calculated probability value (P-value=0.000) and because it is smaller than significance level (0.05), H0 is rejected in significance level. Therefore, it can be said with 95% of certainty that attribute dimension had positive influence on the behavior of purchasers of Ethylene Nano-absorbent device of middle-east bio-researchers company.

Eighth hypothesis test

Results show that durability dimension mean value is equal to 9.9 .Considering the calculated probability value (P-value=0.000) and because it is smaller than significance level (0.05), H0 is rejected in significance level. Therefore, it can be said with 95% of certainty that durability dimension had positive influence on the behavior of purchasers of Ethylene Nano-absorbent device of middle-east bio-researchers company.

Friedman test results

As it was mentioned, Friedman test is used to rank the effectiveness of the dimensions. Results of Friedman test have been summarized in table 3.

Table 3. Ranking of the importance level of dimensions affecting behavior of Ethylene Nano-absorbent device purchasers

Quality dimensions	Mean value	rank
Performance	5.16	2
Responsiveness	4.86	4
Reliability	3.92	6
Perceived Quality	3.57	7
Aesthetics	6.05	1
Concordance	5.03	3
Attribute	4.49	5
Durability	2.90	8
Friedman Test Statistic	df	P-value
100.09	7	0.000

RESULTS

Creation of new markets and development of new products and accessing new markets involves application of marketing strategies and tactful identification of customers' needs in different markets.

The present research tried to identify the most important factors which influence on product quality from purchasers' viewpoints. Finally, we concluded that all dimensions of quality are important in group behavior. We also ranked the dimensions from purchasers' viewpoints as follows:

1. First rank: aesthetics dimension
2. Second rank: performance dimension
3. Third rank: concordance dimension
4. Fourth rank: responsiveness dimension
5. Fifth rank: attribute dimension
6. Sixth rank: reliability dimension
7. Seventh dimension: perceived quality

8. Eighth rank: durability dimension

It must be mentioned that as we go down the ranking, customers' satisfaction is decreased and we can conclude that these dimensions have not been included in product quality program or the dimensions have not been applied in spite of development of programs. Further:

51% of men were responsive and 4% of women were responsive. He remaining 45% was not responsive.

The smallest working experience was 1 year and the greatest working experience of companies was 28 years. Therefore, it can be said that the experts surveyed had relatively high executive experience and this is important in their viewpoints on product quality dimensions. This is because they have tested different devices and procedures for reducing Ethylene in their refrigerators.

Recommendations based on findings

1. appropriate and compatible material should be used in spaces the device is used in order to minimize the possibility of rusting in humid environments of refrigerators.
2. from purchasers' viewpoints, the device's consumable materials were not cost-effective. In order to dissolve this problem, the company should either replace the material with cheaper ones or try to reduce the materials prices.
3. the company should try to attract customers' satisfaction in order to increase their perceived perceptions of the product image and thereby facilitate product development and increase word of mouth advertisements and become popular.
4. most respondents were unfamiliar with Nano-technology used in the device because most of them chose "no idea" choice in answering the questions regarding Nano-technology used in the device. Since media can play important roles in advertising new technologies (Cobb &Macoubrie, 2004) proper advertisement plans should be in top priority of programs. Media are the main resources for familiarizing people with science and technology. In addition to increasing individuals' familiarity with scientific issues, their perceptions also are affected.
5. Holding seminars, conferences and educational plans will help familiarize users with the device and its advantages.
6. The company should offer discounts and facilitate payment conditions.

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