Agric. Sci. Digest., 37(3) 2017: 209-215
Print ISSN:0253-150X / Online ISSN:0976-0547

AGRICULTURAL RESEARCH COMMUNICATION CENTRE
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Critical success factors and organizational performance: A study on citrus industry

U.T. Sunil Kumar* and R.L. Shrivastava

Department of Mechanical Engineering,Yeshwantrao Chavan College of Engineering,
Hingna Road, Wanadongri, Nagpur- 441110, India.
Received: 26-09-2016 Accepted: 01-06-2017 DOI:10.18805/asd.v37i03.8994

ABSTRACT

Quality management of citrus fruits is the top priority as the demand for the fruits is increasing tremendously. In order to investigate the effect of critical success factors (CSF,s) or predictors on the performance measurement factors of citrus industry, an exploratory type of study was conducted with 100 valid responses collected from citrus stake holders. Specially prepared questionnaire consisted of 102 items clubbed in to ten groups for performance improvement Input factors and 24 items clubbed in to four groups for performance measures. The questionnaire is prepared in consultation with experts of industry and 1-5 Likert scale is being used for data collection. The data obtained is tested for normality, validity and reliability then, ANOVA and multiple regression analysis is performed. The ANOVA test revealed that the perceptions associated with the findings were in conformity with the hypothesis. Quality improvement frame work or model is derived from the current study. The study revealed that business environment and resources leads to Economic, Quality, Non-financial and Innovation/ technology performance of the citrus industry. Post harvest process control and post harvest pest and disease control measures improved economic performance and technology and innovation performance. Critical factors like marketing and distribution contributed to non-financial performance. It is further seen that socio economic aspects lead to innovation and technology performance.

Key words: Citrus, CSF's, Model, Post harvest processing, Quality management, Storage.

INTRODUCTION

Citrus industry in India is the third largest fruit industry of the ranking ninth among top orange producing countries contributing 3% of the world's total orange production (Khedkar, 2015). In India, post-harvest losses of citrus fruits are in the range of 25-30% as against 5-10% in developed countries like Brazil, USA, Australia, Spain, Italy and Israel (Sonkar *et al.* 2008). Optimum cultural practices to be followed in the field, otherwise pre-harvest stress can profoundly affect post-harvest fruit quality and shelf life (El-Otmani and Ait-Oubahou 1996). The resource required to conserve the harvested fruits are much less than to produce same quantity, about 15-20% produce can be made available for consumption at less input cost (Ladaniya and Singh 2006). Oranges constitute approximately 65% of the world's citrus production followed by mandarin 19%, lemon and limes 11% and grapefruits 5% (Ismail and Zhang 2004).

Significance of post harvest quality management: Consumers generally assess the fruit's quality based on taste, freshness, ripeness, colour and appearance. Post harvest practices include the management and control of variables such as temperature and relative humidity (Sundaram, 2016) the selection and use of packaging and the application of such supplementary treatments as fungicides (Santacoloma *et al.* 2015, Zenga *et al.* 2012). Bio-fungicides and a plant extracts to control postharvest disease (Reddy *et al.*2008) was investigated as an alternative to chemical control (Palou *et al.* 2014, Sukorini *et al.* 2013 and Regnier *et al.* 2014). Rind quality is a critical factor affecting the external appearance and marketability of citrus fruit (Khalid *et al.* 2012). The time when fruits were harvested influenced the internal quality prior to storage, decreasing juice sugar percent and acidity content (Pailly 2004). Fig.1 indicates the channels involved in citrus industry processing value chain. In recent decades, food safety has become a significant issue. International quality standards for citrus fruits and products are normally set in Codex Alimentarius, a joint commission of WHO and FAO.

Critical success factors (CSF's): Daniel (1961) first introduced the concept of key factors. Critical success factors have been used significantly to present or identify a few key factors that organizations should focus on to be successful. Rockhart (1979) described CSFs as the limited number of areas in which results, if they are satisfactory, will ensure successful competitive performance for the organization. Frameworks for attaining competitive advantages through quality management have been developed *via* Crosby's 14 steps (Crosby, 1979), Deming's

*Corresponding author's e-mail: sunil_ut2004@yahoo.co.in

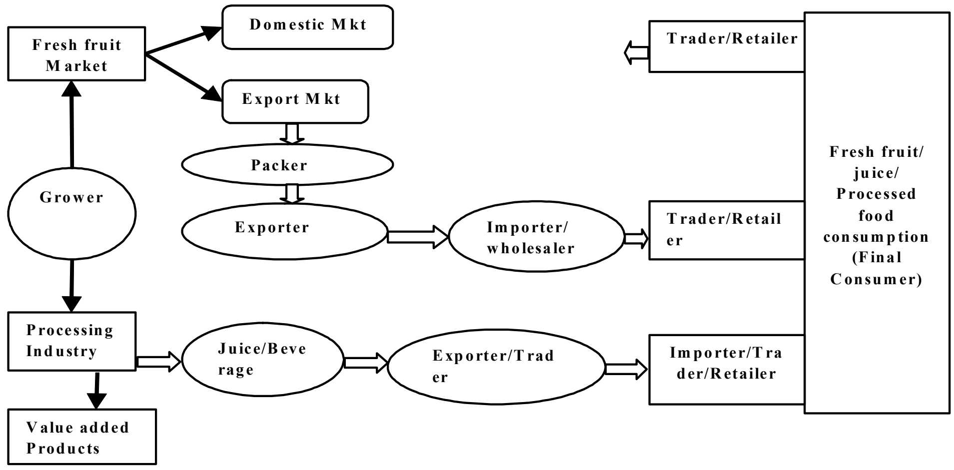

Fig-1: Channels involved in citrus industry processing value chain(Source: UNCTAD Secretariat)

14 prescriptive points (Deming, 1982), and Juran's trilogy (Juran and Gryna 1980). Each of these gurus identified a "set of key variables" that they claim are essential to achieving superior quality outcomes. Jaideep Motwani (2001) emphasized the top management commitment to TQM as the base or foundation.

Hence, this study is aimed to identification of the factors responsible for quality management in post harvest processing of citrus fruits followed by integrating the critical success factors for formulating a performance improvement model. The model, can be validated further.

MATERIALS AND METHODS

Data collection: A questionnaire is an instrument means to collect quantitative primary data from respondents in a standardized way, so that the data are internally consistent and coherent for analysis.

Continuous follow up and interaction with respondents resulted in obtaining 100 valid responses and the profile of respondents is presented in Table 1. Survey has considered all the relevant stake holders of citrus industry for the present study.

Table 1: Respondent details

Respondents	No. of responses	Percentage (%)
Citrus growers/orchard owners	20	20.00
Contractors/Traders	15	15.00
Experts	30	30.00
Exporters	08	08.00
Retailers/local vendors	07	07.00
Support Service providers/ VC promoters /consultants	08	08.00
Consumers	12	12.00
Total	100	100

The questionnaire has been handed over personally and through Email to different stake holders in the post harvest value chain. Data collected after observing production and marketing practices, storage conditions and other market infrastructures and by interviewing value chain actors.

For the field survey major citrus growing area of Nagpur and surrounding was selected. Apart from farmers, local fruit vendors, traders in auction yard, exporters and other relevant stakeholders providing support to the citrus sub-sector were also interviewed and also requested to indicate their responses to each statement in the questionnaire by ticking the categories of agreement or disagreement using a 5 points likert scale using Very low importance, Low importance, Medium importance, High importance, Very high importance, i.e. score 1 to 5.

Data testing and analysis of data: Data testing and statistical analysis have been done using SPSS-16 software are as follows.

A lot of statistical tests (e.g. t-test) require that data are normally distributed and therefore we should always check if this assumption is satisfied. It is necessary that data follows normal distribution i.e the data should lie within the inverted bell shaped curve, with a clearance of 2.5% on either side as we are analyzing the data at a confidence level of 95% (Fig.2 a & 2 b).

The test of normality for input factors obtained a collective value of 0.058, 0.482 for Kolmogorov-Smirnov and Shapiro-Wilk test respectively. The mean, skewness, kurtosis and Standard error values found to be 3.550, -.0263, 0.042 and 0.0716 respectively. The test of normality for Output factors obtained a collective value of 0.153, 0.734 for Kolmogorov-Smirnov and Shapiro-Wilk test respectively.

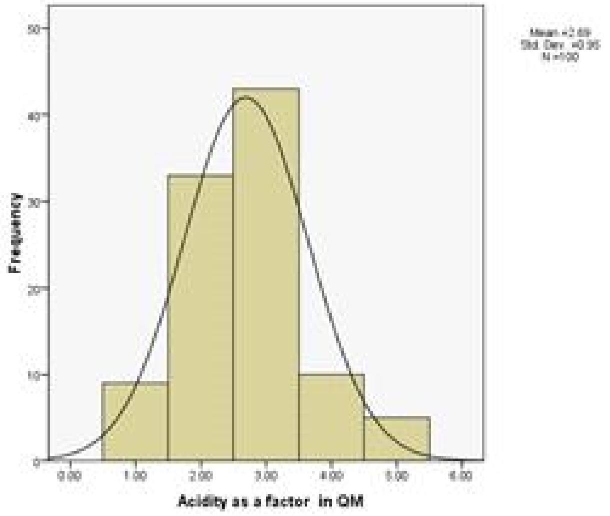

Fig. 2(a): Normality check for input data

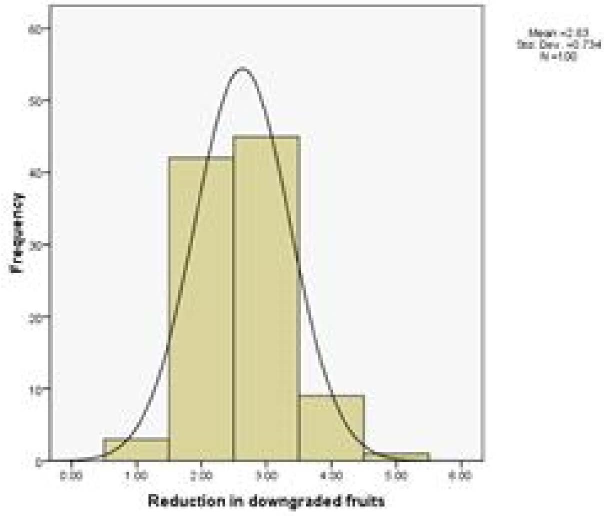

Fig-2(b): Normality check for output data

The mean, skewness, kurtosis and Standard error values found to be 2.630, -0.198, 0.008 and 0.073 respectively.

The Kolmogorove-Smirrnov and Shapiro-Wilk test value for both input and output items indicated that the test is not significant as data is presumed to be normally distributed. The Kolmogorov-Smirnov (K-S) and Shapiro-Wilk (S-W) test are designed to test normality by comparing your data to a normal distribution with the same mean and standard deviation of your sample. Descriptive testing also revealed that perfect symmetry (skewness) and perfect peakedness (kurtosis) is nearer to zero and Similarly the test were repeated for remaining input items and output items. . "Normal Q-Q Plot" was also explored, which provides a graphical way to determine the level of normality.

The reliability specifies the accuracy of the measurement. The information extracted from these correlations is vast; hence we want a single summery statistics that reveal how reliable the survey is. One of the common methods of doing it is by Cronbach's alpha. Cronbach's (Cronbach 1951) is thus the measure of reliability and reliability coefficient of 0.70 or higher is 'acceptable'. The reliability factors thus determined in Table 2 and Table 3 indicate that the reliability for input and output parameters obtained more than 0.7; hence reliability of instrument is confirmed.

Table 2: Reliability of input data

Cronbach's alpha	Cronbach's alpha based on standardized items	No of items
0.977	0.982	102

Table 3: Reliability of output data

Cronbach's alpha	Cronbach's alpha based on standardized items	No of items
0.967	0.971	24

Kaiser-Meyer-Olkin (KMO) measures sample adequacy. A value close to one indicates that patterns of correlations are relatively compact and so factor analysis should yield distinct and reliable factors. Factor analysis is a statistical method used to study the dimensionality of a set of variables. The Kaiser-Meyer-Olkin indicates the proportion of variance in variables that might be caused by underlying factors. High values (close to 1.0) generally indicate that a factor analysis may be useful with data. If the value is less than 0.50, the results of the factor analysis probably won't be very useful. Bartlett's test of sphericity tests the hypothesis that correlation matrix is an identity matrix, which would indicate that variables are unrelated and therefore unsuitable for structure detection. Small values (less than 0.05) of the significance level indicate that a factor analysis may be useful with collected data. As we observed in the Table 4 and Table 5, the value of KMO is greater than 0.5 for all input and output factors, the data are adequate.

Validity is the most important criteria for the quality of a test and represents that the correct variable is measured. The variable or factor name in the instruments used for this study is being given in Table 4 and Table 5.

RESULTS AND DISCUSSION

In order to investigate the effect of critical success factors (CSF's) or predictors on the performance measurement factors of citrus industry, multiple regression analysis is performed.

Analysis of Variance (ANOVA): The analysis of variance is used when multiple sample cases are involved. Using the technique, one can draw inferences about whether the

Table 4: Results of KMO and Bartlett's test of input factors

Input factors	KMO	Barlett's test of Sphericity		
		Approx. Ch-i Square	df	Sig.
Pre-harvest factors	0.742	276.978	6	0.000
Intrinsic and physical condition	0.847	1.027E3	21	0.000
Business environment and resources	0.858	347.215	36	0.000
Post harvest pest & disease control measures	0.751	320.651	10	0.000
Post harvest process control	0.859	443.584	28	0.000
Transportation and storage	0.836	839.943	45	0.000
Evaluation/Testing/ Documentation/ auditing factors	0.845	347.124	21	0.000
Marketing and Distribution	0.726	200.671	15	0.000
Post-harvest techniques for Maintaining Quality	0.783	316.835	15	0.000
Socio Economic aspects on quality	0.658	141.887	21	0.000

Table 5: Results of KMO and Bartlett's test of Output factors

Output factors	KMO	Barlett's test of Sphericity		
		Approx. Ch-i Square	df	Sig.
Economic performance	0.730	1.010E3	15	0.000
Quality performance	0.804	591.399	10	0.000
Non- financial performance	0.811	303.198	21	0.000
Innovation and Technology performance	0.727	533.391	10	0.000

samples have been drawn from populations having the same mean (level of significance = 0.05) i.e 5 % level of significance.

Null hypothesis: H0: i.e. there is no correlation between the performance improvement factors and respondent (there is no significant difference between mean factor score of performance improvement factors and respondents perception).

Alternate hypothesis: H1: i.e. there is correlation between performance improvement factors and respondents (there is significant difference between mean factor score of performance improvement factors and respondents perception). The salient findings, reason and significance of the ANOVA is discussed in Table 6.

Regression Analysis (RA): The regression analysis performed for determining the relationship between input and output variables is presented below for deriving the impact of input and output variables. In RA the relationship is expressed as an equation that predicts a response variable also called a dependent variable or criterion from a function of regress or variable also called independent variables, predictors, explanatory variables, factors or carriers and parameters .The parameters are adjusted so that a measure of fit is optimized.

In order to investigate the effect of critical success factors (CSF's) or predictors on the performance measurement factors of citrus industry, multiple regression analysis was performed.

A ENTER and STEP regression method is being used to find out the comparative importance of the independent variables to the dependent variables. The independent variables (Input Factor 1 to 10) regressed against the sub factors of dependent variables (Output Factor 1 to 4). The mathematical equation / model can be written as:

$$Y=a+bX1+cX2+dX3+eX4+fX5+gX6+hX7+IX8+JX9+KX10$$

The model summary for the Economic performance indicated that the R^2 value of 0.798 and standard error of the estimate was 0.325. ANOVA test obtained a F value of 98.442 and the significant value was less than 0.05. The test of coefficients obtained 0.223(for un-standardized coefficient for the constant) and 0.360, 0.264, 0.305 for standardized coefficient for independent variables IF5, IF3 and IF4 respectively. Thus the regression equation or mathematical model can be written as

Y1 (Economic Performance)= .223 + 0.360 (Post harvest Process control)+ 0.264 (Business environment and resources) + 0.305 (Post harvest pest & disease control measures)

Similarly the Regression analysis for Quality performance, Non-financial performance and Innovation and technology performance were performed and determined its significance which are presented below.

The R^2 values obtained were 0.952 0.878 and 0.894 respectively for other models i.e. Quality performance, Non-Financial performance and Innovation and Technology performance.

Table 6: Findings of the ANOVA

Findings	Reason
Better position associated with rise in perception about competitive advantage to the citrus industry	Better agro techniques and cultural practices
Better position associated with rise in perception about contribution and nation	Sustainable local, regional and global growth and to society strengthening of local industry
Higher perception at quality management culture in organization	Focus on quality and less rejects of fruits
Higher perception associated with rise in shelf life of citrus	More exposure of modern technologies
Higher perception associated with stake holders enrichment	Severe need felt at customer level
Decrease in perception with increase in experience/ skill improvement about contribution to society and nation	Better awareness of citrus industry problems.
Higher perception associated about relationship within various stake holders in the citrus industry	Better working condition and social recognition
Citrus productivity perception higher at processing facilities	Organizations more concerned about productivity
Better position associated with rise in perception about pest/ disease management	Better recognition of pest/ disease management
Better position associated with rise in perception about post harvest process control in the citrus industry	Processing facilities more concerned about quality and safety
Higher perception associated with rise in perception about improvement in capacity utilization and value creation due to adoption of new technologies	Selection of appropriate technologies and adoption of innovative technology
Citrus perception higher at processing facilities about Transportation/ storage	Organizations more concerned about transportation, storage
Better management associated with rise in perception about evaluation/ testing / documentation and marketing management	Control of raw materials, inspection, documentation, testing and distribution

The standard error of the estimate obtained was 0.407, 0.429 and 0.244 respectively for three dependent variables. The value indicates the more precise measurement of the data.

F value obtained for the models are 126.726, 63.211 and 173.604 respectively and the level of significance is found to be less than 0.05 for all models.

The resulting mathematical model obtained for other dependent variables are

Y2 (Quality performance) = -1.914 + 0.359 Post harvest Process control + 0.375 Pre-harvest factors+ 0.248 Business environment and resources

Y3 (Non-Financial performance) = -0.471 + 0.418 Post harvest pest & disease control measures + 0.253 Business environment and resources + 0.224 Marketing and Distribution

Y4 (Innovation & Technology performance) = -0.811 + 0.430 (Post harvest process control)+ 0.197 (Business environment and resources) + 0.170 (Socio Economic

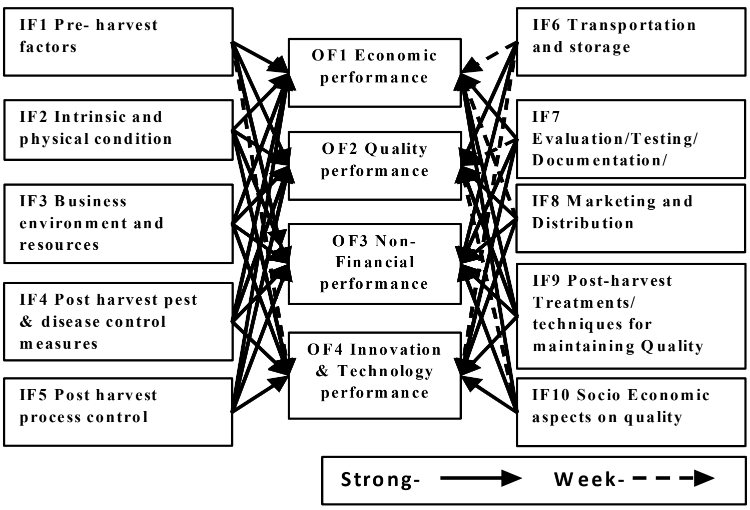

Fig-3: The post harvest processing and quality improvement model for citrus industry aspects on quality) + 0.239 (Post harvest pest & disease control measures)

The frame work or model derived is presented in Fig. 3 and the mathematical model obtained is discussed in previous paragraphs.

The results obtained from regression analysis proved that the relationship exists between critical input and output variables. These critical input factors (CSF's) contributing in performance of the system and in practical terms the model obtained will be useful in post harvest quality management of citrus fruits.

CONCLUSION

The study is an attempt to identify the critical success factors (CSF's) in post harvest processing of citrus fruits. Management of CSF's will in turn improve performance of the citrus entity. ANOVA test revealed that perception associated improved specialization or experience of the stake holders , better management culture, increase in shelf life, citrus productivity, better disease control, process control, transportation and storage and marketing etc will leads improved quality and Economic performance. Regression models obtained with R^2 value ranges from 0.798, 0.952, 0.878, and 0.894 respectively for Economic, Quality, Non-financial and Innovation and technology performance respectively. Significance of each factor is determined statistically. Analysis concluded that business environment and resources leads to Economic, Quality, Non-financial and Innovation/ technology performance of the citrus Industry. Post harvest Process control and post harvest pest and disease control measures improved economic performance and Technology and innovation performance. Critical factors like marketing and distribution contributed to non-financial performance like reputation of the facility, increase in healthy competition among other units, better satisfaction to stake holders. It is further seen that Socio economic aspects, improved specialization of suppliers and service providers, value creation due to better technologies leads to innovation and technology performance. Generalized performance improvement model or frame work is used to depict the week and strong relationship of critical input factors (independent variables) with output variables (dependent variables).

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