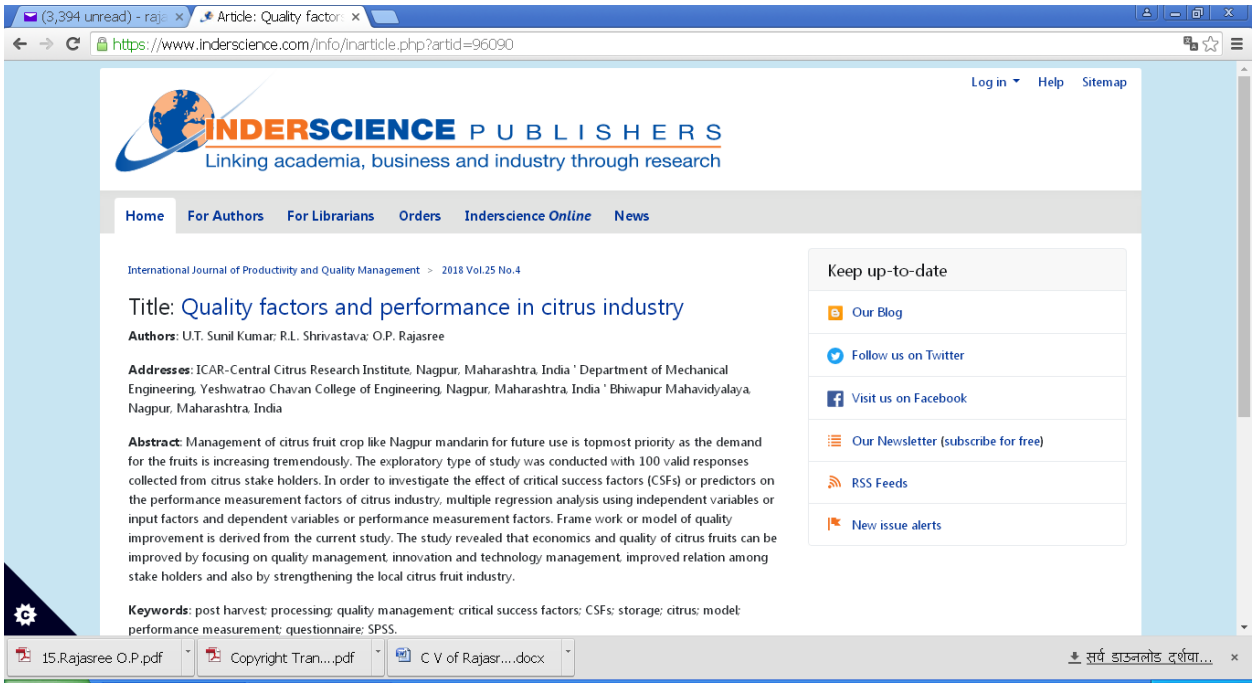

(3,394 unread) - raja
Article: Quality factor
https://www.inderscience.com/info/inarticle.php?artid=96090
Log in
Help
Sitemap
INDERSCIENCE PUBLISHERS
Linking academia, business and industry through research
Home
For Authors
For Librarians
Orders
Inderscience Online
News
International Journal of Productivity and Quality Management > 2018 Vol.25 No.4
Title: Quality factors and performance in citrus industry
Authors: U.T. Sunil Kumar; R.L. Shrivastava; O.P. Rajasree
Addresses: ICAR-Central Citrus Research Institute, Nagpur, Maharashtra, India ' Department of Mechanical Engineering, Yeshwatrao Chavan College of Engineering, Nagpur, Maharashtra, India ' Bhiwapur Mahavidyalaya, Nagpur, Maharashtra, India
Abstract: Management of citrus fruit crop like Nagpur mandarin for future use is topmost priority as the demand for the fruits is increasing tremendously. The exploratory type of study was conducted with 100 valid responses collected from citrus stake holders. In order to investigate the effect of critical success factors (CSFs) or predictors on the performance measurement factors of citrus industry, multiple regression analysis using independent variables or input factors and dependent variables or performance measurement factors. Frame work or model of quality improvement is derived from the current study. The study revealed that economics and quality of citrus fruits can be improved by focusing on quality management, innovation and technology management, improved relation among stake holders and also by strengthening the local citrus fruit industry.
Keywords: post harvest; processing; quality management; critical success factors; CSFs; storage; citrus; model; performance measurement; questionnaire; SPSS.
Keep up-to-date
Our Blog
Follow us on Twitter
Visit us on Facebook
Our Newsletter (subscribe for free)
RSS Feeds
New issue alerts
15.Rajasree O.P.pdf
Copyright Tran....pdf
C V of Rajasr....docx
सर्व डाऊनलोड दर्शवा...


(3,394 unread) - raja
International Journal
https://www.inderscience.com/info/inarticletoc.php?jcode=ijpqm&year=2018&vol=25&issue=4
Productivity and Quality Management
International Journal of Productivity and Quality Management
2018 Vol.25 No.4
Pages
Title and author(s)
417-443
Prioritisation of leader roles in several phases of innovation process to enhance productivity
Mojtaba Kiaei; Amir Hassan Zarei Rahro; Mona Shirkhorshidi
DOI: 10.1504/IJPQM.2018.096092
444-458
The impact of faculty member's communication behaviours on student satisfaction: the role of cognitive and affective learning and student's motivation
Smita Kulkarni; Nikhat Afshan; Jaideep Motwani
DOI: 10.1504/IJPQM.2018.096087
459-479
The improvement of thresher design by using the integration of TRIZ and QFD approach
Nilda Tri Putri; Agus Sutanto; Nafroh Bifadhlih
DOI: 10.1504/IJPQM.2018.096083
480-490
Quality factors and performance in citrus industry
U.T. Sunil Kumar; R.L. Shrivastava; O.P. Rajasree
DOI: 10.1504/IJPQM.2018.096090
View sample articles
Latest issue contents as RSS feed
Forthcoming articles
Journal information in easy print format (PDF)
Publishing with Inderscience: ethical guidelines (PDF)
Recommend to a librarian (PDF)
Feedback to Editor
Find related journals
Keep up-to-date
Our Blog
Follow us on Twitter
Visit us on Facebook
15.Rajasree O.P.pdf
Copyright Tran....pdf
C V of Rajasr....docx
सर्व डाऊनलोड दर्शवा...

Quality factors and performance in citrus industry

U.T. Sunil Kumar*

ICAR-Central Citrus Research Institute,
Nagpur, Maharashtra, India
Email: sunil_ut2004@yahoo.co.in
*Corresponding author

R.L. Shrivastava

Department of Mechanical Engineering,
Yeshwatrao Chavan College of Engineering,
Nagpur, Maharashtra, India
Email: rlshrivastava@gmail.com

O.P. Rajasree

Bhiwapur Mahavidyalaya,
Nagpur, Maharashtra, India
Email: rajasreesunil2011@yahoo.com

Abstract: Management of citrus fruit crop like Nagpur mandarin for future use is topmost priority as the demand for the fruits is increasing tremendously. The exploratory type of study was conducted with 100 valid responses collected from citrus stake holders. In order to investigate the effect of critical success factors (CSFs) or predictors on the performance measurement factors of citrus industry, multiple regression analysis using independent variables or input factors and dependent variables or performance measurement factors. Frame work or model of quality improvement is derived from the current study. The study revealed that economics and quality of citrus fruits can be improved by focusing on quality management, innovation and technology management, improved relation among stake holders and also by strengthening the local citrus fruit industry.

Keywords: post harvest; processing; quality management; critical success factors; CSFs; storage; citrus; model; performance measurement; questionnaire; SPSS.

Reference to this paper should be made as follows: Sunil Kumar, U.T., Shrivastava, R.L. and Rajasree, O.P. (2018) 'Quality factors and performance in citrus industry', *Int. J. Productivity and Quality Management*, Vol. 25, No. 4, pp.480–490.

Biographical notes: U.T. Sunil Kumar obtained his MTech with specialisation in Heat and Power Engineering. He is working as an Assistant Chief Tech Officer in ICAR-Central Citrus Research Institute, Nagpur, India and he is currently undertaking PhD from the RTM Nagpur University, Nagpur, India. He has more than 30 years work experience in mechanical engineering, citrus processing and quality management aspects. He has published more than 15 research articles in international, national journals and conferences.

Copyright © 2018 Inderscience Enterprises Ltd.

R.L. Shrivastava has more than 25 years rich experience in teaching and a renowned personality in quality management, TQM, Six Sigma aspects. He has published more than 50 papers in international and national journals.

O.P. Rajasree is a post-graduate in Library and Information Science, UGC-NET, and a computer expert. She is currently undertaking doctoral research in IPR related aspects from the RTM Nagpur University, Nagpur. She has published papers in national journals and conferences.

1 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). India, post-harvest losses of citrus fruits are in the range of 25%–30% as against 5%–10% in developed citrus growing countries like Brazil, USA, Australia, Spain, Italy and Israel (Sonkar et al., 2008). Good agricultural practices should be in the field during whole production cycle; otherwise pre harvest stress can profoundly affect post harvest fruit quality and shelf life (El-Otmani and Ait-Oubahou, 1996). About 15%–20% produce can be made available for consumption at much less input cost (Ladaniya and Singh, 2006). Oranges constitute 65% of the world's citrus production followed by mandarin 19%, lemon and limes 11% and grapefruits 5% (Ismail and Zhang, 2004).

Post harvest practices include the management and control of variables such as temperature and relative humidity, 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 post harvest disease was investigated as an alternative to chemical control (Palou et al., 2014; Sukorini et al., 2013; Regnier et al., 2014). Cruz-Valenzuela et al. (2013) studied potential of seed by-products rich in antioxidant and antimicrobial compounds that can be used to preserve quality of fresh-cut oranges. External appearance is a critical factor affecting the marketability of citrus fruit (Khalid et al., 2012). The market demand supply, the producer capacity limits and the food quality decrease during shipment, i.e., perish ability, limit the feasibility region. The time when fruit were harvested influenced their internal quality prior to storage, decreasing juice sugar percent and acidity content (Pailly et al., 2004).

The grower either hand over the produce to fresh fruit market or processing facility. Fruit quality is important to both as the quality of fruit is concerned to all considering the economics of wastage in citrus value chain due to improper handling, packaging, transportation, and storage techniques. Advanced processing techniques may also be adopted to reduce losses from grower to consumer.

Good quality fruits contribute to customer satisfaction and better return to citrus value chain players. Bortolini et al. (2016), studied multi-objective design of multi-modal fresh food distribution networks for quality maintenance of perishable varieties. In recent decades, food safety has become a significant issue. Fehr and Romao (2010), study developed a scoring guide in evaluating and mitigating the loss potential for fruit and vegetables within their operations. International quality standards for citrus fruits and

products are normally set in Codex Alimentarius, a joint commission of WHO and FAO. Minimally processed products have become more important in the marketing of fruits and vegetables due to increasing consumer demand for convenience and nutritional benefits (Gnas and Clemente, 2013).

Daneil (1961), Goharshenasan and Shahin (2017) and Rockhart (1979) described CSFs as the limited number of areas in which results, if they are satisfactory, will ensure successful competitive performance for the organisation. Performance evaluation of organisational units is one of the vital issues that have direct and indirect impacts on the organisation performance (Jafarpour et al., 2015). Frameworks for attaining competitive advantages through quality management have been developed via Crosby' (1979) 14 steps, Deming's (1982), 14 prescriptive points, and Juran's trilogy (Juran and Gryna, 1980). Each of these gurus identifies a 'set of key variables' that they claim are essential to achieving superior quality outcomes.

Motwani (2001) and Malik et al. (2013) emphasised the top management commitment to TQM as the base or foundation. The factors of human resources are directly linked to the company's performance in environmental management (Tanwer et al., 2015). Bhatia and Awasthi (2017) investigated the impact of quality management systems on business performance.

Mohapatra (2017) used an empirical study for finding factors that would optimise productivity and quality in IT business. Maurya et al. (2013) studied supplier selection in supply chain using analytical hierarchy process which is similar to the process required in citrus value chain.

Hence present study is aimed to identification of the factors responsible (Sunil Kumar and Shrivastava, 2012) for quality management in post harvest processing of Nagpur mandarin fruits, followed by integrating the critical success factors (CSFs) (Ullah et al. 2017; Bouranta et al., 2017) for formulating the model validating the model (Patyal and Koilakuntla, 2016). Ozturkoglu et al. (2016) in a study focused on the CSFs. In addition, they applied the factor analysis and regression analysis.

Suggesting new methods and process and will lead to enhancing the performance of the system as whole. The present study is exploratory in nature and further the result can be corroborated through case studies.

2 Materials and methods

2.1 Design of questionnaire

An instrument is a specially designed questionnaire for collecting quantitative primary data from stake holders in a standardised way, so that the data are internally consistent and coherent for analysis. One hundred two items clubbed in to ten groups for input and for output, 24 items were grouped in to four factors. The grouping and factor selection was supported by literature review. The language and the context used shall be familiar to respondents. Likert scale is one of the most widely used and easy scale is being used in this study to collect the response from the respondents to each of the statements. The five-point scale is marked such as very low important, low important, medium important, high important and very high important.

2.2 Profile of the respondents

Continuous persuasion and interaction with respondents resulted in obtaining 100 valid responses and the profile of respondents is being given in Table 1. The present study has considered all the relevant stake holders of citrus industry.

Table 1 Respondents details

Sl. no.	*Respondents*	*No. of responses*	*Percentage (%)*
1	Citrus growers/orchard owners	20	20.00
2	Contractors/traders	15	15.00
3	Experts	30	30.00
4	Exporters	08	08.00
5	Retailers/local vendors	07	07.00
6	Support service providers/VC promoters/consultants	08	08.00
7	Consumers	12	12.00
	Total	100	100

2.3 Data collection

The instrument has been handed over personally and through e-mail to different stake holders in the post harvest value chain during the fruit season of 2014–2015. The respondents were asked to familiarise enough to obtain correct feed back through the questionnaire. Data collected after observing people, by interviewing value chain actors (producers/groups, contractors/traders, experts, exporters, wholesalers, retailers, and support providers).

For the field survey almost all the major citrus growing area of Nagpur and surrounding areas were selected. In total, 100 respondents were surveyed along with the observation of citrus orchards, collection centres and market sheds. Farmers, local fruit vendors, traders in auction yard, exporters and other relevant stakeholders providing support to the citrus sub sector were also included.

3 Data testing and analysis of data

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

3.1 Normality

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 analysing the data at a confidence level of 95%. 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.

3.2 Reliability

The information extracted from these correlations is vast; hence we want a single summery statistics that tell us 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'. Table 2 indicates that reliability statistics for input and output parameters are within the limit.

Table 2 Reliability statistics of input and output data

	Cronbach's alpha	*Cronbach's alpha based on standardised items*	*No of items*
Input data	0.977	0.982	102
Output data	0.967	0.971	24

3.3 Adequacy

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 factor. As we observed in the Table 3 and Table 4, the value of KMO is greater than 0.5 for all input and output factors, the data are adequate.

The Bartlett's test compares the observed correlation matrix to the identity matrix. In other words, it checks if there is a certain redundancy between the variables that we can summarise with a few number of factors. If the variables are perfectly correlated, only one factor is sufficient. If they are orthogonal, we need as many factors as variables.

Table 3 Results of KMO and Bartlett's test of input factors

Sl no	*Input factors(IF)*	*KMO*	*Barlett's test of sphericity*		
			Approx. chi square	*df*	*Sig.*
1	Pre-harvest factors	0.742	276.978	6	0.000
2	Intrinsic and physical condition	0.847	1.027E3	21	0.000
3	Business environment and resources	0.858	347.215	36	0.000
4	Post harvest pest and disease control measures	0.751	320.651	10	0.000
5	Post harvest process control	0.859	443.584	28	0.000
6	Transportation and storage	0.836	839.943	45	0.000
7	Evaluation/testing/documentation/auditing factors	0.845	347.124	21	0.000
8	Marketing and distribution	0.726	200.671	15	0.000
9	Post harvest techniques for maintaining quality	0.783	316.835	15	0.000
10	Socio economic aspects on quality	0.658	141.887	21	0.000

Table 4 Results of KMO and Bartlett's test of output factors

Sl no.	*Output factors(OF)*	*KMO*	*Barlett's test of sphericity*		
			Approx. chi square	*df*	*Sig.*
1	Economic performance	0.730	1.010E3	15	0.000
2	Quality performance	0.804	591.399	10	0.000
3	Non-financial performance	0.811	303.198	21	0.000
4	Innovation and technology performance	0.727	533.391	10	0.000

3.4 Validity of instrument

Validity is the most important criteria for the quality of a test and represents that the correct variable is measured.

The variable or factor names in the instruments used for the research work are given in Table 3 and Table 4. Content validity is really how representative questions are the sampling adequacy of items. This is achieved when items are first selected: don not include items that are blatantly very similar to other items, and ensure that questions cover the full range of construct.

A high content validity question covers more of what is sought. A trick with all questions is to ensure that all of the target content is covered (preferably uniformly). It is not evaluated numerically but subjectively judged by the researchers. Since the selection of measurement items was based on exhaustive review of the literature and detailed evaluation by academicians, researchers and opinion of experts, content validity was ensured at the stage of questionnaire formation. Factor analysis has been performed for all input and output variables.

3.5 Factor analysis

It measures if the items belong to same group or not. If the item does not belong to that group, eliminate that or check the appropriate group. This is done with the help of principal component factor analysis. The factor matrices showed that they are uni-factorial with eigenvalues (eigenvalues represent the amount of variance explained by the factor, or relative importance of each factor in accounting for variance associated with the set of variables being analysed) greater than the accepted criterion.

4 Results and discussions

In order to investigate the effect of CSFs or predictors on the performance measurement factors of citrus industry, multiple regression analysis is performed.

The regression analysis is carried out with factor score of ten factors as independent variables. The four dependent variables are citrus industry performance measurement factors.

4.1 Analysis of variance

The analysis of variance (ANOVA) is used when multiple sample cases are involved. Using the technique, one can draw inferences about whether the 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 5.

Table 5 Results of the ANOVA

Sr. no.	*Findings*	*Reason*
1	Competitive advantage to the citrus industry	Better agro techniques and cultural practices
2	Perception about contribution to society and nation	Sustainable local, regional and global growth and strengthening of local industry
3	Higher quality management culture in organisation	Focus on quality and less rejects of fruits
4	Higher perception with rise in shelf life	More exposure of modern technologies
5	Higher perception associated with stake holders enrichment	Severe need felt at customer level
6	Increase in experience/skill improvement	Better awareness of citrus industry problems
7	Higher perception of relationship within various stake holders	Better working condition and social recognition
8	Higher productivity perception at processing facilities	Organisations more concerned about productivity
9	Rise in perception about pest/disease management	Better recognition of pest/disease management
10	Rise in perception about post harvest process control	Processing facilities more concerned about quality and safety
11	Improvement in capacity utilisation and value creation	Adoption of innovative technology
12	Higher perception at processing facilities	Organisations more concerned about transportation, storage
13	Rise in perception about evaluation/testing/documentation and marketing management	Control of raw materials, inspection, documentation, testing and distribution

4.2 Regression analysis

The regression analysis performed for determining the relationship between input and output variables is presented below for deriving the assessing impact of input and output variable on performance. In order to investigate the effect of CSFs 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 model summary for the economic performance indicated that the R^2 value of 0.798 and standard error of the estimate was 0.325. Similarly the regression analysis for quality performance, non-financial performance and innovation and technology performance were performed and determined its significance which is 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.

The standard error of the estimate obtained was 0.407, 0.429 and 0.244 respectively for three dependent variables. The mathematical model obtained for economic, quality, non-financial and innovation and technology performance is as follows:

$Y1$ (*Economic performance*) = .223 + 0.360 (post harvest process control)
+ 0.264 (business environment and resources)
+0.305 (post harvest pest and disease control measure)

$Y2$ (*Quality performance*) = −1.914 + 0.359 post harvest process control
+ 0.375 pre harvest factors + 0.248 business environment and resources

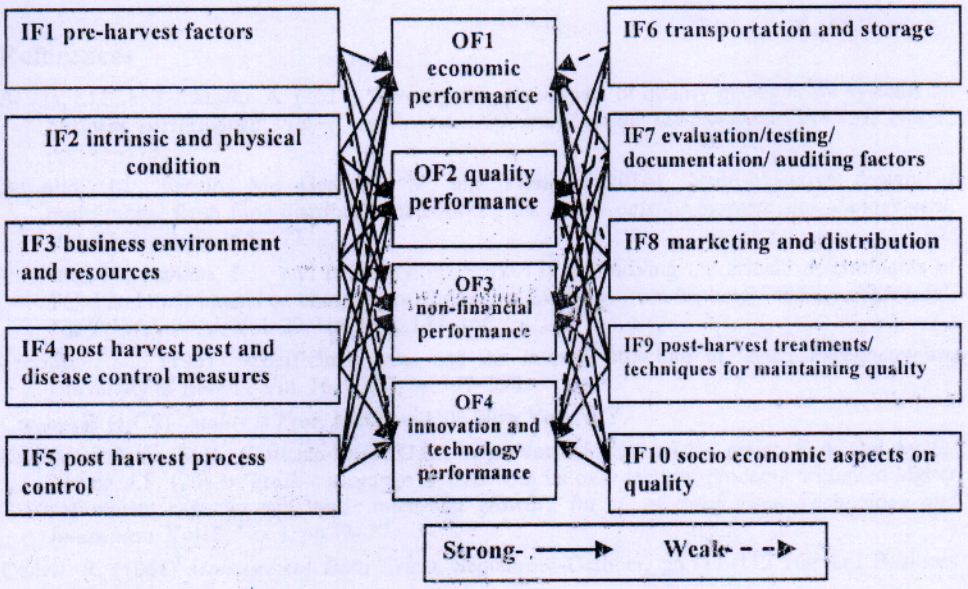
$Y3$ (*Non financial performance*) = −0.471 + 0.418 post harvest pest
and disease control measure + 0.253 business environment and resources
+ 0.224 marketing and distribution

$Y4$ (*Innovation and techonology performance*) = −0.811
+0.430 (post harvest process control)
+ 0.197 (business environment and resources)
+ 0.170 (socio economic aspects on quality)
+ 0.239 (post harvest pest and disease control measures)

The frame work or model derived from the analysis of mathematical model is presented in Figure 1. It is seen that, even though the relationship exists with input and output factors, some of the input factors are more relevant and strong enough to influence quality and financial performance.

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

Figure 1 The post harvest processing and quality improvement model for citrus industry



5 Conclusions

Management of CSFs will in turn improve performance of the citrus entity. ANOVA test revealed that perception associated improved specialisation 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.

Post harvest process and post harvest disease control measures improved quality management and economic performance. Post harvest process control, business environment and resources and post harvest pest and disease control measures leads to economic performance. Post harvest process control, pre harvest factors and business environment and resources leads to better quality performance.

Post harvest process control, business environment and resources, socio economic aspects on quality and post harvest pest and disease control measures helps in improving innovation and technology performance which in turn leads to improved specialisation of suppliers and service providers, value creation due to better technologies and leads to overall performance.

Quality can also be improved by focusing on improved relation among stake holders and also by strengthening the local fruit industry. The model obtained from the study can be utilised for different enterprises, in the service of quality management of citrus. The present study has focused on Nagpur mandarin fruits production areas in Nagpur with 100 respondents and study can be widened to cover more population with case studies for meaningful conclusion.

References

Bhatia, M.S. and Awasthi, A. (2017) 'Investigating the impact of quality management systems on business performance', *Int. J. of Productivity and Quality Management*, Vol. 21, No. 2, pp.143–173.

Bortolini, M., Faccio, M., Gamberi, M. and Pilati, F.(2016) 'Multi-objective design of multi-modal fresh food distribution networks', *Int. J. of Logistics Systems and Management*, Vol. 24, No.2, pp.155–177.

Bouranta, N., Psomas, E.L. and Pantouvakis, A. (2017) 'Identifying the critical determinants of TQM and their impact on company performance: Evidence from the hotel industry of Greece', *The TQM Journal*, Vol. 29, No. 1, pp.147–166.

Cronbach, L.J. (1951) 'Coefficient alpha and the internal structure of tests', *Psychometrika*, University of Illinois, Vol. 16, No. 3, pp.297–298.

Crosby, P. (1979) *Quality is Free*, McGraw-Hill, New York, NY.

Cruz-Valenzuela, M.R., Carrazco-Lugo, D.K., Vega-Vega,V., Gonzalez-Aguilar, G.A. and Ayala-Zavala, J.F. (2013) 'Fresh-cut orange treated with its own seed by-products presented higher antioxidant capacity and lower microbial growth', *Int. J. of Postharvest Technology and Innovation*, Vol. 3, No. 1, pp.13–27.

Daneil, R. (1961) *Management Data Crisis*, September–October, pp.111–112 Harvard Business Review, Massachusetts.

Deming, W.E. (1982) *Out of the Crisis*, Cambridge University Press, Cambridge, MA.

El-Otmani, M. and Ait-Oubahou, A. (1996) 'Prolonging citrus fruit shelf-life: recent development and future prospects', *Proc Int. Soc. Citri*, Vol. 12–17, pp.56–69, South Africa, May 1996.

Fehr, M. and Romao, D.C. (2010) 'Modeling the success of fruit and vegetable marketing', *Int. J. of Postharvest Technology and Innovation*, Vol. 2, No. 1, pp.4–12.

Gnas, B.B.B. and Clemente, E. (2013) 'Physicochemical monitoring of minimally processed pineapple with the use of edible films based on maltodextrin', *Int. J. of Postharvest Technology and Innovation*, Vol. 3, No.1, pp.73–82.

Goharshenasan, A. and Shahin, A. (2017) 'Prioritization of quality management principles based on critical success factors of TQM using integrated approach of MCDM and IPA – the case of Marjan Tile Company', *Int. J. of Productivity and Quality Management*, Vol. 21, No. 1, pp.112–128.

Ismail, M. and Zhang, J. (2004) 'Post-harvest diseases and their control', *Outlook Pest Management*, Vol. 1, No. 10, pp.29–35.

Jafarpour, E., Shafei, R., Sadeghani, M. and Moradi, M.(2015) 'Evaluation of the suggestions system performance using DEA, the case of Esfahan's steel company', *Int. J. of Productivity and Quality Management*, Vol. 15, No. 1, pp.20–35.

Juran, J. and Gryna, F. (1980) *Quality Planning and Analysis*, McGraw-Hill, New York, NY.

Khalid, S., Malik, A., Ullah., S., Basharat, A., Khan, A.S., Khalid, M.S. and Amin, M. (2012) 'Tree age and canopy position affect rind quality, fruit quality and rind nutrient content of 'Kinnow' mandarin (citrus nobilis lour × citrus deliciosa tenora)', *Scientia Horticulturae*, 24 February, Vol. 135, pp.137–144.

Khedkar, D.D. (2015) 'Minimal volume irrigation scheduling for citrus cultivation in Warud Tehsil, Maharashtra, India', *Agriculture and Agricultural Science Procedia*, pp.365–371.

Ladaniya, M.S. and Singh, S. (2006) 'Post-harvest technology of fresh citrus', *Souvenir, National Symp*, Citri-A Road Map, Umiam, Meghalaya, 22–24 February 2006, pp.271–292.

Malik, S.A., Nasim, K. and Iqbal, M.Z. (2013) 'TQM practices in electric fan manufacturing industry of Pakistan', *Int. J. of Productivity and Quality Management*, Vol. 12, No .4, pp.361–378.

Maurya, A.H., Narkhede, B.E., Raut, R.D. and Shrawge, A.S. (2013) 'Supplier selection in supply chain using analytical hierarchy process', *Int. J. of Productivity and Quality Management*, Vol. 11, No. 3, pp.357–369.

Mohapatra, S.(2017) 'An empirical study for finding factors that would optimize productivity and quality in IT business', *Int. J. of Productivity and Quality Management*, Vol. 20, No. 2, pp.169–196.

Motwani, J. (2001) 'Critical factors and performance measures of TQM', *The TQM Magazine*, Vol. 13, No. 4, pp.292–300.

Ozturkoglu, O., Saygılı, E. and Ozturkoglu, Y. (2016) 'A manufacturing-oriented model for evaluating the satisfaction of workers evidence from Turkey', *International Journal of Industrial Ergonomics*, Vol. 54, pp.73–82.

Pailly, O.A., Gilles, T.A. and Pailly, A.A.O. (2004) 'Harvest time and storage conditions of 'star ruby' grapefruit (citrus paradisi macf.) for short distance summer consumption', *Post Harvest Biology and Technology*, Vol. 34, No. 1, pp.65–73.

Palou, L., Pérez-Gago, M.B. and Valencia-Chamorro, S.A. (2014) 'Edible composite coatings formulated with antifungal GRAS compounds: a novel approach for post harvest preservation of fresh citrus fruit (conference paper)', *Int. Symposium on Discovery and Development of Innovative Strategies for Postharvest Disease Management*, ISHS, Acta Horticulturae, 20 October 2014, Vol. 1053, pp.143–150.

Patyal, V.S. and Koilakuntla, M. (2016) 'Relationship between organizational culture, quality practices and performance: conceptual framework', *Int. J. of Productivity and Quality Management*, Vol. 19, No. 3, pp.319–344.

Regnier, T., Combrinck, S., Veldman, W. and Du Plooy, W. (2014) 'Application of essential oils as multi-target fungicides for the control of Geotrichum citri-aurantii and other post harvest pathogens of citrus', *Industrial Crops and Products*, Vol. 61, pp.151–159.

Rockhart, J.F.(1979) 'Chief executives design their own data needs', *Harvard Business Review*, Vol. 57, No. 2, pp.238–241.

Santacoloma, P., Roettger, A. and Tartanac, F. (2015) 'Course on agribusiness management for producers' associations, module 4 – post-harvest and marketing-training materials for agricultural management, marketing and finance', *Sustainable Agriculture Reviews*, p.65, Springer, International Publishing Switzerland.

Sonkar, R.K., Sarnaik, D.A., Dikshit, S.N., Saroj P.L. and Huchche. A.D. (2008) 'Post-harvest management of citrus fruits: a review', *J. Food Sci. Technol.*, Vol. 45, No. 3, pp.199–208.

Sukorini, H., Sangchote, S. and Khewkhom, N. (2013) 'Control of postharvest green mold of citrus fruit with yeasts, medicinal plants, and their combination', *Postharvest Biology and Technology*, Vol. 79, pp.24–31.

Sunil Kumar, U.T and Shrivastava, R.L. (2012) 'Quality management of citrus fruits an approach by critical success factors', *MPGI National Multi Conference (MPGINMC2012), Recent Trends in Mechanical Engineering*, Proceeding Published by Indian Research Transaction (IRT), ISSN: 225008041.

Tanwer, A.K., Prajapati, D.R. and Singh, P.J. (2015) 'Effect of various factors for achieving environmental performance in manufacturing industry a review', *Int. J. Productivity and Quality Management*, Vol. 15, No. 1, pp.72–117.

Ullah, F., Thaheem, M.J., Siddiqui, S.Q. and Khurshid, M.B. (2017) 'Influence of six sigma on project success in construction industry of Pakistan', *The TQM Journal*, Vol. 29, No. 2, pp.276–309.

Zenga, R., Zhange, A., Chene, J. and Fue, Y. (2012) 'Postharvest quality and physiological responses of clove bud extract dip on 'newhall' navel orange', *Scientia Horticulturea*, 1 May, Vol. 138, pp.253–258.