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Sustainability Performance Analysis for Food Supply Chain Processing Sector

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ABSTRACT

Increasing food demands, environmental aspects, and massive increase in population have an impact on the sustainability of a supply chain, especially in the food processing sector. In the food supply chain, there are many parameters from production to consumption like resources, packaging, and waste management, etc. that need to be considered for sustainability. The aim of this study is to determine the parameters affecting the sustainability of food supply chain and to measure the sustainability performance of the parameters along the supply chain. It involves the development of sustainability assessment model based on United Nations sustainable development goals to assess the sustainability practices and performance in industries. It helps in improvement in all levels in the food industry. This can certainly help local food processing industry of Pakistan to optimize their production processes, shrink wastes and increase the productivity. The gap identified that many industries were weak in terms of certain factors leadership and communication, educate and training, food affordability and availability, resource utilization and waste management. The developed sustainability assessment model comprises of three categories namely production, processing, and consumption. To facilitate the above-mentioned categories, the assessment model consists of thirteen factors on which sustainability in industries was assessed. These are: (i) Resource Utilization (ii) Safety of Products (iii) Technology and innovation (IV) Waste Management (v) Reliability (vi) Customer Satisfaction (vii) Packaging and traceability (viii) Food safety and food security (ix) Food affordability and availability (x) Leadership and communication (xi) Educate and training (xii) Health and Safety (xiii) Socio-cultural well-being. A comprehensive questionnaire was developed and conducted from one hundred (100) companies of Pakistan and the data was analyzed by reliability and validity test. Descriptive statistics, ANOVA with Friedman's Test and co-relation analysis was done to deeply investigate the results. AS-IS and TO-BE Model has been developed to check the current and future state of the research model. The performance score for each dimension was calculated via Analytic Hierarchy Process. Safety of products has been calculated to have the highest performance, with a score of 73.75 in sustainable food supply chain management performance evaluation, followed by the customer satisfaction 72.196%, Food safety and Food Security, at 72.16%, while the performance index score of the reliability is 70.91%, that of the Packaging and Traceability is 68.41%, while as resource utilization and waste management are the least performed indicators. The results of this study include feedback on parameters in the food chain from agriculture to consumers. The sustainable food supply chain performance evaluation for the food processing sector in Pakistan indicates that it has an overall performance of 65.5 %.

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1. Introduction

There will be a 60% rise in demand for food as a result of the world population rising by 2 billion people in the next 30 years, from 7.7 billion people now to 9.7 billion in 2050 [1]. Each day, 700 million people worldwide suffer hunger [2]. The eradication of poverty is among the most prominent of the Sustainable Development Goals, and the challenge of poverty eradication is the greatest for the least developed countries, where almost half of the population still lives in extreme poverty [3]. As per information from authorities of Pakistan Environmental Protection Agency, approximately 40% of prepared food ends up being discarded, as reported by Dawn in 2016. Given the substantial negative effects that the world's food business has on the environment and society, achieving sustainability in the food supply chain is vital [4]. The goal of this research is to find out how well-established food manufacturing companies are at implementing sustainable practices across their supply chains and operations. According to the WHO, 420,000 people are thought to die each year because of consuming unsafe food, which amounts to one out of every ten individuals [5]. FAO estimates that 1.3 billion tonnes of food are lost or wasted worldwide each year, or one-third of the food produced for human use [6]. Punjab accounts for 60% of Pakistan's food sector, whereas Sindh accounts for 30%, KPK for 6%, Baluchistan for 2%, and ICT for 2%. Pakistan has more than 2500 food manufacturing facilities in total [7]. From the perspectives of resource use, environmental degradation, and notably food security, the food production industry has important effects on sustainable development [8]. However, this industry hasn't yet gotten enough attention globally, much alone in Pakistan. The food production industry in Pakistan is a crucial industrial field due to its considerable contribution to the national GDP and sustainability issues. To address the concerns of food security, water use, and energy use in the future, an evaluation of food production operations is required. An efficient and effective sustainability assessment framework is required right now to support the food manufacturing sectors in a nation like Pakistan in particular for continual sustainability performance evaluation and analysis [9]. With growing population, depletion of natural resources and scarcity of agricultural land there is a strong need to adopt the sustainable practices within food system [10]. The awareness of sustainability is growing quickly among consumers, local and foreign legislative authorities, and corporate rivals [11]. A methodology for evaluation is needed in the industrial sector to develop and implement sustainability-oriented targets. Businesses in the food sector have unique sustainability problems related to the availability and use of natural resources, food safety, waste management, and unfair trade practices [12]. The effects of climate change, including increased temperatures and harsh weather, have already demonstrated an ability to cause severe disruption to global food supplies, as has political instability [13].

The research was designed to check the extent of adoption of sustainable practices and to measure the effective use of sustainable practices in terms of performance of food processing sector of Pakistan. So that healthy and nutritious food will be available for everyone on the planet. Less attention was paid, and research carried out in underdeveloped countries in food processing sector especially like Pakistan. So, the

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research is needed to check sustainability maturity index and sustainability performance of Agri-Food supply chain in Pakistan in structured way. The outcomes of this research will be helpful for policy making and legislation and for further research. The purpose of this study is to present a novel and comprehensive conceptual framework for assessing sustainable food supply chain management. The suggested framework would be used to evaluate the performance of Pakistan's food and beverage industry while considering variables affecting the economy, society, environment, food safety, and food security. The following are the main goals of this study:

1. To provide context for the food industry by carefully examining the variables (consumer happiness, resource use, product safety, innovation, dependability, business information, packaging, and waste management). This is accomplished by interviewing employees in the food industry using a questionnaire form.
2. To use SPSS to determine the performance of the parameters (dimensions and criteria), and to use the Analytic Hierarchy Process to determine the overall performance (AHP).
3. To understand the chain line that can be enhanced by calculating the performance score and to empower workers in the food industry to enhance their sustainability performance.

The research findings would be significant in enhancing the effectiveness and efficiency of sustainable practices in the Agri-food sector. It also intends to enable the firms to analyze how the sustainability practices have contributed to their organizational performance as well as identify the loopholes that may hinder sustainability performance. The research will be very useful in providing information on challenges faced in implementation of sustainability practices. Detailed instructions on how to apply the suggested 13 key indicators, which included those for energy and material consumption, the environment, economic performance, community development, and social justice, as well as employees and goods, were provided.

2.RESEARCH METHODLOGY

Factors have been identified from the literature and the detailed methodology for developing the survey questionnaire has been explained. Each factor is then described and then a sustainability performance assessment questionnaire has been developed.

2.1 Research Design

An assessment model was developed and then it is explored in different food processing industries of Pakistan through questionnaire-based survey. The methodology is adopted from the work of authors who worked on sustainable performance assessment with similar strategies. The quantitative technique is used to collect and analyze data. Figure 1 outlines the methodology's four steps in more detail.

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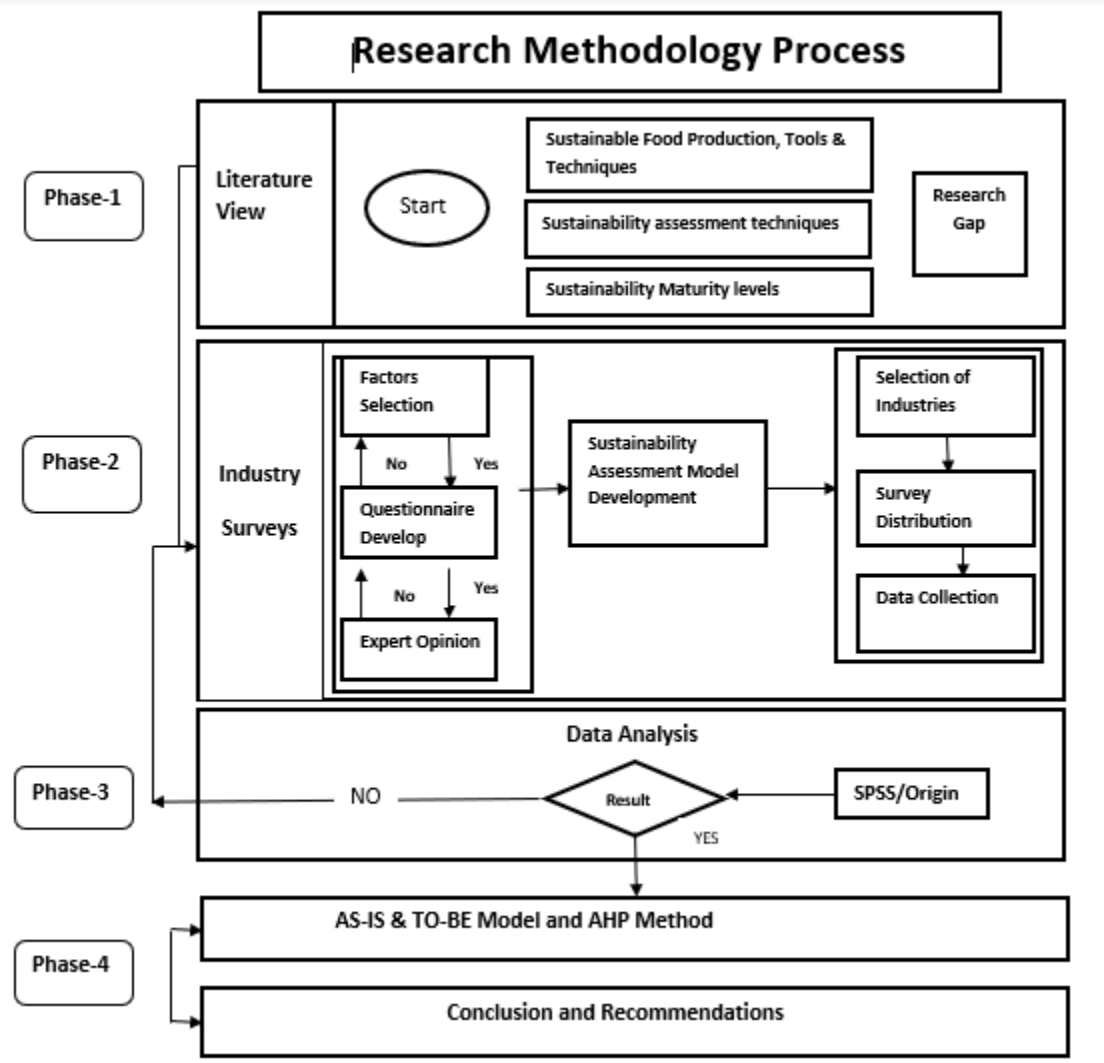

Figure 1: Methodology of the research.

2.2 Selection of Factors for Sustainability Assessment Model

According to the preceding section, the parameters for measuring sustainability performance were compiled from thorough literature research. From that we move one step further to screen the most occurring and most critical Sustainability performance measurement via expert's opinions and brainstorming as shown in figure 2.

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Figure 2: Sustainability performance indicators.

2.3 Questionnaire development

The questionnaire was developed for the surveying the leanness in the industries of Pakistan. The questionnaire is attached in the annexure A. The questionnaire is consisted of two main parts.

2.3.1 General Information

This part gathers the information about the respondent's demographic information. It asks for the following information.

Name	Rank in organization	Experience	Age	Organization type and Name

2.3.2 Survey Questions

These questions are asked to assess the lean manufacturing or leanness. Each factor is assessed further on four to five lean practices. The respondents were asked to rate the questions on 5 points likert's scale. Respondents were asked to rate the sustainability practices for both current and future state. This is done so to analyze AS-IS for current state while TO-BE for future state.

2.3.3 Sample size

The target population for this research survey was the food processing industries of Pakistan which are producing food products like Beverages, Baking, Fat and Oils, Sugar, Fruits and Vegetables processing meat and Dairy Products. Food Processing companies are selected because in these industries sustainability practices can be implemented and practices can be followed in an easy manner. For the uniformity of data, the food processing industries throughout the Pakistan are targeted including all provinces.

After screening industries located in areas of Punjab, Sindh, KPK and Baluchistan have been selected for our population. The number

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of industries comes out to be 100 (round figures). Questionnaires were distributed to the industries of food professionals that were at Officer, Executive or Managerial posts. By Cochran's formula sample size N was calculated having value of 79 [14].

3. RESULTS & DISCUSSIONS

3.1 Reliability Test.

Reliability test shows us high correlation among our variables as shown in the Table 1.

Table 1: Reliability test

Reliability Test of the Data

Case Processing Summary			
		N	%
Cases	Valid	88	100.0
	Excluded	0	0
	Total	88	100.0

Cronbach's Alpha	N of Items
0.952	88

Cronbach's alpha shows us the consistency of our data. We can see that the Cronbach alpha value of 0.952 indicates flawless dependability and a high level of internal consistency [15]. Therefore, there is a strong positive correlation among all 13 of our independent variables, indicating that they are tightly connected. which indicates that both the independent and dependent variables are moving in the same direction i.e. an increase in the independent variable (that is all the 13 factors) will increase dependent variable (Supply Chain Sustainability Performance) and decrease in independent variable would decrease the dependent variable.

3.2 Validity Test

Table 2: Validity Test Intra-Class Correlation Coefficient

Intra-class correlation coefficients measure the similarity among different variables of the same group. By the rule of thumb, values less than 0.5 shows weak reliability, similarly values between 0.75 to 0.9 shows good reliability and values above 0.9 shows strong reliability [16, 17]. In our case, average measures show that "Strong reliability" exists among the variables which mean that they are consistent; each variable has some similarity with the other variables. Average measures are selected because several ratings are used in the survey, not individual. Results revealed that our data and results are strong as shown in the Table 2.

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Descriptive Statistics					
	N	Skewness		Kurtosis	
	Statistic	Statistic	Std. Error	Statistic	Std. Error
Resorce Utilization	88	-.288	.257	-.351	.508
Safety of Products	88	-.225	.257	-.803	.508
Technology and Innovation	88	-.396	.257	-.305	.508
Customer Satisfaction	88	-.635	.257	.184	.508
Reliability	88	-.194	.257	-.639	.508
Packaging and Traceability	88	-.447	.257	-.386	.508
Waste Management	88	.213	.257	-.333	.508
Food Safety and Security	88	-.529	.257	-.406	.508
Food Affordability Availability	88	-.018	.257	-.153	.508
Education and Training	88	-.201	.257	-.552	.508
Leadership and Communication	88	-.630	.257	.132	.508
Health and Safety	88	-.639	.257	-.139	.508
Socio-Cultural Wellbeing	88	-.675	.257	-.283	.508
Challenges	88	-.065	.257	-.317	.508
Valid N (listwise)	88				

3.3 Skewness and Kurtosis:

Our data's skewness reveals whether it is symmetrical. Data is considered significantly skewed if the skewness is between -0.5 and -1 or 0.5 and 1 [18]. The variables in the aforesaid data are negatively skewed, indicating that the data is skewed to the left, indicating that the data is biased to the right. We may thus say that our data is symmetrical. The kurtosis value indicates how heavily or lightly tailed the data is. When comparing the values of the variables, we find that they are both light-tailed and heavy-tailed, indicating that our excess kurtosis is negative. The data sets without outliers are those with light-tailed platykurtic data. Those are Resource Utilization, Safety of products, Technology and Innovation, Waste Management, Reliability, Food Safety and availability, Packaging, Educate and training, Health and safety, Socio-well-being which are highly significant in measurement of dependent variable as shown in the Table 3.

Table 3: Skewness and Kurtosis

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Descriptive Statistics

	N	Range	Mean		Std. Deviation	Variance
	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
Resource Utilization	88	3.36	3.0633	.08021	.75246	.566
Safety of Products	88	2.63	3.9389	.07189	.67434	.455
Technology and Innovation	88	3.63	3.4773	.08375	.78568	.617
Customer Satisfaction	88	3.67	3.8731	.08873	.83237	.693
Reliability	88	2.80	3.8420	.07567	.70982	.504
Packaging and Traceability	88	3.38	3.7315	.08467	.79432	.631
Waste Management	88	3.67	2.8485	.08327	.78118	.610
Food Safety and Security	88	3.75	3.8636	.09621	.90251	.815
Food Affordability and Availability	88	4.00	3.2528	.08848	.83002	.689
Education and Training	88	4.00	3.5455	.09919	.93044	.866
Leadership and Communication	88	4.00	3.6932	.09123	.85578	.732
Health and Safety	88	4.00	3.7301	.10232	.95984	.921
Socio-Cultural Wellbeing	88	4.00	3.5455	.11812	1.10806	1.228
Challenges	88	3.00	2.9034	.06845	.64214	.412
Valid N (listwise)	88					

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From Friedman's test, we can see that 3 variables are being compared with one another as shown in the Table 4. By the rule of thumb, if p-value is less than 5% then we conclude that not all the group medians i.e. between people, between items, residual is equal. Therefore, rejecting the null hypothesis i.e. There is no difference between the variables [19].

Table 4: ANOVA with Friedman's Test

Sr.no.	Intra-Item Correlations		Kendall's Correlations		Spearman Correlations	
	Factor	**%**	**Factor**	**%**	**Factor**	**%**
1	Resource Utilization/Tech& Innovation	64%	Safety of Products/Reliability	56.6%	Resource Utilization/Packaging & Traceability	54%
2	Reliability/Customer Satisfaction	84.3%	Reliability/ Customer Satisfaction	69.9%	Safety Of Products/Customer Satisfaction	69.5%
3	Health & Safety/ Leadership & Communication	81.1%	Packaging Traceability/ Reliability	64.4%	Food Safety & Security/ Leadership &Communication	74.2%
4			Leadership & Communication/ Educate& Training	66.5%	Socio-Cultural Wellbeing/Health and Safety	77.5%
5					Customer Satisfaction/ Reliability	84%

In easy words our null hypothesis is that factors have no effect on sustainability Performance, while Alternate hypothesis is they have effect on sustainability performance. After this test, since value is less than 0.05, we reject the null hypothesis and conclude that factors have effect on sustainability Performance. Below is the comparison of different correlations greater than 50% among the factors as shown in Table 5.

Table 5: Co-relation comparisons

ANOVA with Friedman's Test						
		Sum of Squares	df	Mean Square	Friedman's Chi-Square	Sig
Between People		1526.911	87	17.551		
Within People	Between Items	643.997[a]	39	16.513	690.779	0.021
	Residual	2555.578	3393	.753		
	Total	3199.575	3432	.932		

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Total	4726.486	3519	1.343		
Grand Mean = 3.2480					
a. Kendall's coefficient of concordance W = 0.136					

3.4 Performance Index Score of Each Dimension

After completion of the mean score of the measurement variable, a performance index calculation was performed according to the results obtained of measurement variable in the previous table. The performance index of each dimension is calculated with the aim of obtaining an overall sustainable supply chain performance for the food processing sector. Index scores were calculated as percentage using the formula in the below equation 1.

$$\text{Percentage Index score} = \frac{1}{n}\sum_{i=1}^{n} ai\,\frac{100}{K} \text{----------Equation 1}$$

In this sense safety of products is calculated to have the highest performance in sustainability performance evaluation of food processing sector of Pakistan with a score of 73.75% and the waste management performance of the food processing industry was to be calculated as 54%. Ranking of dimensions based on Index Score is shown in Figure 3.

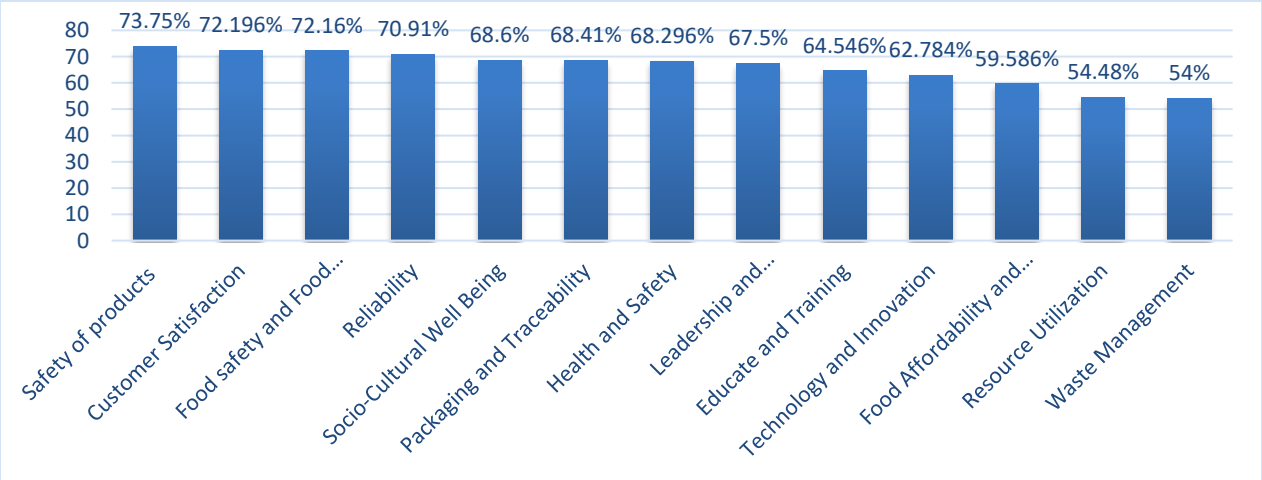

Figure 3: Ranking of dimensions based on Index Score.

Safety of products, Customer Satisfaction and Food safety & security factors are among the top three factors with highest performance. Safety of products initiates and open doors for opportunities for sustainable manufacturing of food products and helps in better transfer and flow of food items from the start of food supply chain to end consumer. If we see from the bottom factors that are given least attention in food processing industries in Pakistan are. Leadership and Communication, Educate and Training, Technology and Innovation, Food Affordability and Availability, Resource Utilization, Waste Management With performance scores, 67.50%, 64.55%, 62.78%, 59.59%, 54.48% and 54% respectively.

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3.5 Research Results of the AHP Method

Starting with the fact that the individual scores of the dimensions have various weights, each dimension (the measurement variable) is utilized to determine the final performance indices score of sustainable food supply chain management after the calculation of the performance indices. Applying the AHP approach for expert judgment in this procedure. The 13 dimensions of performance analysis were the main variables of sustainable food supply chain management. It is a fact that the effect of a particular process on these variables will affect chain employees positively. In this research AHP method was used to make dual comparison matrices for determining the relative importance of each factor or dimension, because the strength of each dimension will be different due to their relative importance [20]. 13×13-dimensional square matrix is an inter-dimensional comparison matrix shown in the Table. The matrix components on the diagonal of the matrix were taken 1.00 because this compares a factor or dimension with itself. The comparison of the dimensions is made according to the values of each according to their importance. For this study, five experts in the fields of Food Science and technology, Food Engineering and Industrial Engineering were consulted. The sustainability performance of Pakistan food supply chain sector was considered, and the importance of the 13 dimensions that are effective in performance analysis and evaluation was determined. The geometric mean of the results from 5 different experts is obtained for each comparison matrix value, and the final comparison matrix is made that is shown in the Table 6.

Table 6: AHP Cross comparison

Priority matrix and cross-comparison between the factors.													
	Resource Utilization	Safety of products	Technology and Innovation	Customer Satisfaction	Reliability	Packaging and traceability	Waste management	Food safety and Security	Food Affordability and Availability	Educate and Training	Leadership and Communicati	Health and Safety	Socio-Cultural Well Being
Resource Utilization	1	0.33	3	0.33	0.33	1	0.5	0.5	0.33	0.5	0.33	0.33	1
safety of products	3	1	0.5	2	1	1	3	1	1	0.5	0.33	1	0.5

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Technology and Innovation	0.33	2	1	3	3	2	0.5	1	0.5	1	1	1	0.33
Customer Satisfaction	3	0.5	0.33	1	1	1	0.5	0.5	0.5	0.33	0.33	0.5	1
Reliability	3	1	0.33	1	1	1	0.5	0.5	0.5	0.5	0.33	0.33	0.33
Packaging and traceability	1	1	0.5	1	1	1	0.33	1	0.33	0.5	0.5	0.5	0.33
waste management	2	0.33	2	2	2	3	1	1	0.33	0.33	0.5	1	3
food safety and security	2	1	1	2	2	1	1	1	1	0.5	0.33	1	2
Food affordability and availability	3	1	2	2	2	3	3	1	1	3	2	1	1
educate and training	2	2	1	3	2	2	3	2	0.33	1	1	0.5	1
leadership and communication	3	3	1	3	3	2	2	3	0.5	1	1	0.5	0.5

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health and safety	3	1	1	2	3	2	1	1	1	2	2	1	1
socio-cultural well being	1	2	3	1	3	3	0.33	0.5	1	1	2	1	1

After the configuration of the binary comparison matrix, the importance (priority) of each component was calculated. At this stage, the greatest eigenvector and the eigenvector corresponding to this eigen value come into the calculation and normalization. For this purpose, weights (%) for the 13 indicators were calculated by multiplying the sum of column-by-column elements and after that taking the average of row elements of the matrix. An important issue in the Analytical Hierarchy Process (AHP) is the consistency of the data collected by the expert opinion. Consistency ratio (CR) is used to calculate that the decision makers are acting consistently when comparing the criteria [21]. CR is used to test the consistency of the priority matrix and comparison between the factors. Consistency indicator (CI) can be calculated by using equation 2.

$$\mathbf{CI}=(\boldsymbol{\lambda max}-\mathbf{1})/(\boldsymbol{n}-\mathbf{1})$$ **Equation 2**

N	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
RI	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49	1.51	1.53	1.56	1.57	1.59

$\boldsymbol{\lambda}_{max}$ is calculated by taking the average of the Ratios of Weighted sum values and percentage weights of the factor that we calculated by using Microsoft excel 14.829. After calculation of this value Consistency indicator is calculated in above equation for n=13, CI value is calculated as 0.1524. RI is taken from the table that was used in AHP method from the table for n= number of factors as shown in the Table 7.

Table 7: RI value taken from AHP method.

In the final step consistency indicator (CI) is divided by Random index (RI) to obtain CR as shown in the equation 3.

$$CR = CI/RI$$ Equation 3

CR value has been calculated with the help of Microsoft excel 0.097. The CR value is less than 0.10 it shows that comparisons made by experts are consistent [22]. The overall sustainability performance of food supply chain sector was calculated by multiplying the performance index score (%) by the weight (%) of each dimension.

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3.6 Over all Sustainability Performance of Food Supply Chain Sector

The sustainability performance assessment factors were tabulated with respect to their ranks score. The overall sustainability performance of food supply chain sector was calculated by multiplying the performance index score (%) by the weight (%) calculated by AHP method generated by experts of each dimension. The overall sustainability performance of Pakistan food processing sector was 65.5% as shown in the Table 8.

Table 8: Over all Sustainability Performance of Food Supply Chain Sector

Rank	Dimensions	Performance (%)	Weight (%)	Overall Score (%)
1	Safety of products	73.75	0.0734	65.5%
2	Customer Satisfaction	72.196	0.0459	
3	Food safety and Food Security	72.16	0.0757	
4	Reliability	70.91	0.0441	
5	Socio-Cultural Well Being	68.6	0.0959	
6	Packaging and Traceability	68.41	0.0421	
7	Health and Safety	68.296	0.0996	
8	Leadership and Communication	67.5	0.1036	
9	Educate and Training	64.546	0.0933	
10	Technology and Innovation	62.784	0.0764	
11	Food Affordability and Availability	59.586	0.1200	
12	Resource Utilization	54.48	0.0457	
13	Waste Management	54	0.0836	

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3.7 AS-IS and TO-BE Model

The likert's scale data obtained from the survey was transferred to MS excel, after that mean values of each lean practices were calculated as shown in the Figure 4 below.

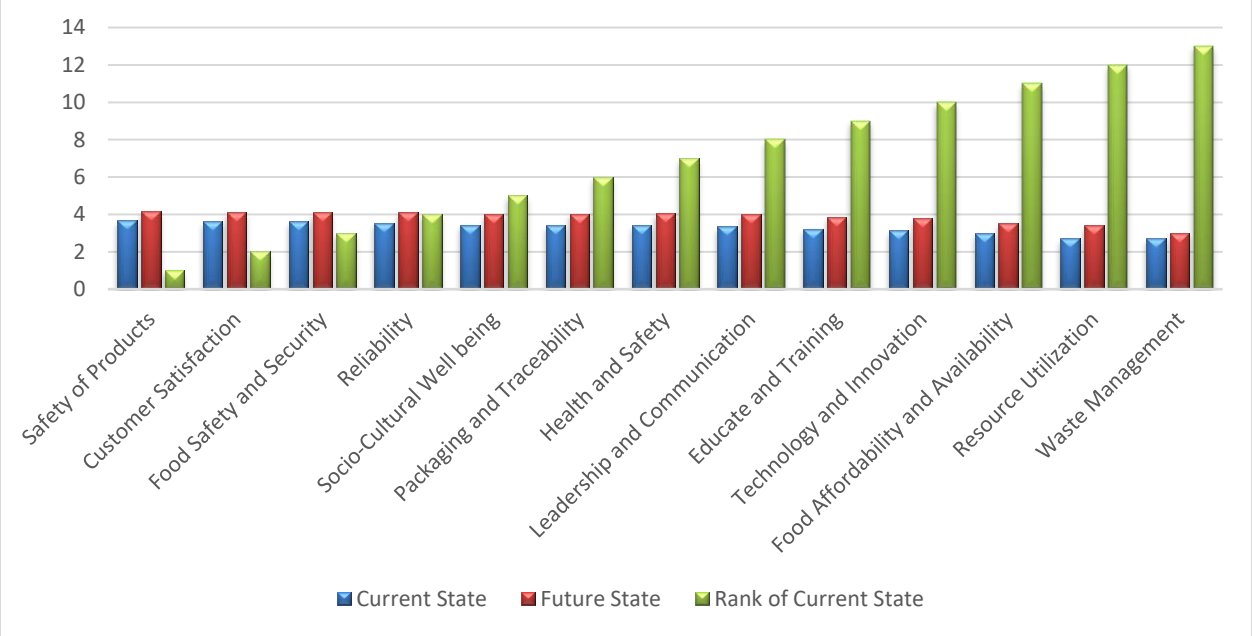

Figure 4: AS-IS and TO-BE Model

The sustainability performance of food supply chain sector may be improved by taking serious actions to eliminate these challenges with devotion and efficient use of resources.

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3.8: Challenges affecting the Implementation of Sustainable Food Supply Chain Management Practices:

The research required to establish the challenges or barriers affecting the implementation of sustainable management practices in food processing firms. Challenges affecting the Implementation of Sustainable Food Supply Chain Management Practices shown in Figure 5.

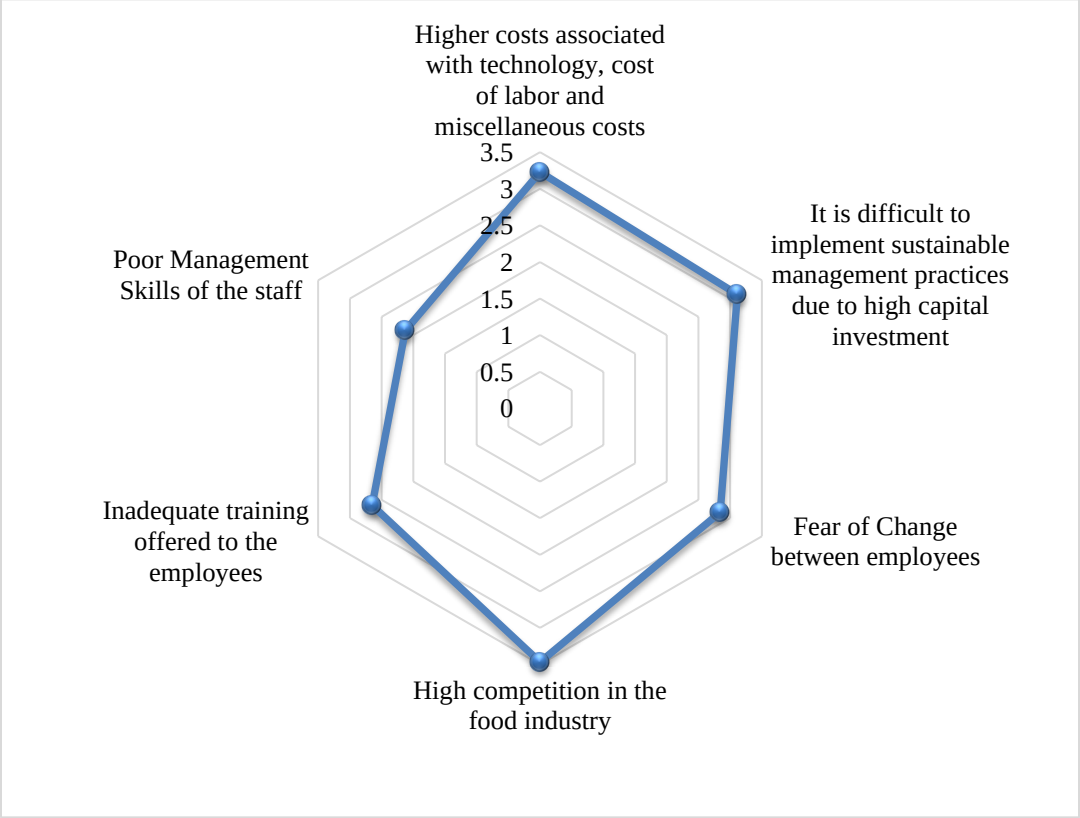

Figure 5: Challenges affecting the Implementation of Sustainable Food Supply Chain Management Practices

The research findings by analyzing the data in SPSS version 22 the respondents are agreed to great extent that the high competition in the industry is a great challenge as shown in the result by mean of **3.46.** The second great challenge is higher costs affiliated with technology, cost of labor and miscellaneous costs by a mean of **3.22.** High capital investments also making difficult to implement sustainable manufacturing practices in food industry as shown by mean of **3.11.** Fear of change between the employees is also a big concern as shown by the means of **2.84.** Others agreed that poor management skills and inadequate training offered to the employees are also a challenge in the implementation of sustainability practices in food industry as shown by means of **2.12** and **2.64** respectively.

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4. Conclusion

Most industries have implemented sustainability practices to some extent. Some of the industries have no sustainability thinking in their management but they are practicing the sustainability practices indirectly. The following are the main concluded points of this research.

1. The reliability test shows high correlation among variables and **Cronbach's alpha** shows the consistency of data with a value of 0.952 indicates flawless dependability and a high level of internal consistency.
2. Intra-class correlation coefficients measure the similarity among different variables of the same group. In this case, average measures show that "Strong reliability" exists among the variables which mean that they are consistent.
3. The kurtosis value indicates how heavily or lightly tailed the data is. When comparing the values of the variables, we find that they are both light-tailed and heavy-tailed, indicating that our excess kurtosis is negative. Factors like resource utilization, safety of products, technology and innovation, waste management, reliability, food safety and availability, packaging, education and training, health and safety, socio-well-being were highly significant in measurement of dependent variable.
4. Performance Index Score was calculated, and it was found that safety of products is calculated to have the highest performance in sustainability performance evaluation of food processing sector of Pakistan with a score of 73.75% . Leadership and Communication, Educate and Training, Technology and Innovation, Food Affordability and Availability, Resource Utilization, Waste Management With performance scores, 67.50%, 64.55%, 62.78%, 59.59%, 54.48% and 54% respectively.
5. For pairwise comparison AHP method was used to make dual comparison matrices for determining the relative importance of each factor.
6. The overall sustainability performance of Pakistan food processing sector was 65.5%.

In food safety and security dimension food safety policy and practices criteria scored highest. The criterion averages wages of the employees scored highest in food affordability and availability dimension. Vision and Strategy level scored highest in leadership and communication dimension. While the criterion appropriate and effective communication scored lowest. In health and safety dimension reduction in health and safety risks scored highest while resources to ensure health and safety scored lowest. This can be done by reducing the challenges faced which include poor management skills, lacking efficient use of resources, high capital investment, inadequate training offered and fear of change between the employees.

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4.1 Recommendations

The study on sustainability performance analysis of food supply chain sector recommends that food processing industries should get some insights on how to implement sustainable practices which will enable them to increase productivity, organizational performance and enhance the competitiveness of the industries. The organizational management skills of the staff in organizations need to be addressed on sustainability related issues and approaches. The food and beverage industry need to institute sustainable performance measurement practices that will appraise the sustainability performance of the supply chain and suggest new ideas and innovations as well as manage the existing ideas in the food supply chain. Food and beverages of Pakistan need to consider improving efficient utilization of resources and employee training on sustainability practices as to cater the needs for the needs of the growing consumer market. The companies need to make additional investments in recycling of the products, waste management and renewable energy usage and ecofriendly food processing operations. Food and beverages industry in Pakistan also need to work with stakeholders in the industry to cope with sustainability related challenges and issue prevailing in the food industry that will improve the sustainable supply chain performance.

Food and beverages industry is the second growing sector in Pakistan after textile and largest contributor in Pakistan's gross domestic product need to put some effort in improving the sustainable production of food products to remain competitive. This requires adopting sustainable management practices best suited for their sector of operation. Food processing industry also needs to establish sustainability performance measures that best measure the effectiveness and appropriateness of the sustainability practices adopted.

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