Original Research

CFA Performance Evaluation: a Comprehensive Structural Equation Modeling

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A R T I C L E   I N F O

A B S T R A C T

In gas transmission lines, there are usually "four main factors that are necessary to create hydration. As it is always necessary to design the pipeline to transfer at high pressure (high density), also pipelines are exposed to ambient temperature and usually" with they face low temperatures. On the other hand, in the presence of water vapor (almost all-natural gases carry some amount of water vapor with them) and, more importantly, the presence of hydrocarbons, hydrate crystals are formed in addition to partial or complete blockage of gas transmission lines. Causes fouling of distillation tower trays, nozzles, valves and heat exchangers, wear on turbochargers, etc. After the discovery of gas hydrates as the cause of blockage of gas transmission pipelines by Hammer Schmidt in 1934. The collection of thermodynamic information increased the formation of hydrates, with more carbon dioxide being produced and released into the atmosphere by burning fossil fuels in homes and cars and burning waste gases in refineries and petrochemical industries, as well as in thermal power plants. It is one of the most important pollutants in the greenhouse effect, which causes global warming and gradual increase in temperature. Isolation and storage of greenhouse gases is one of the most fundamental environmental issues today.

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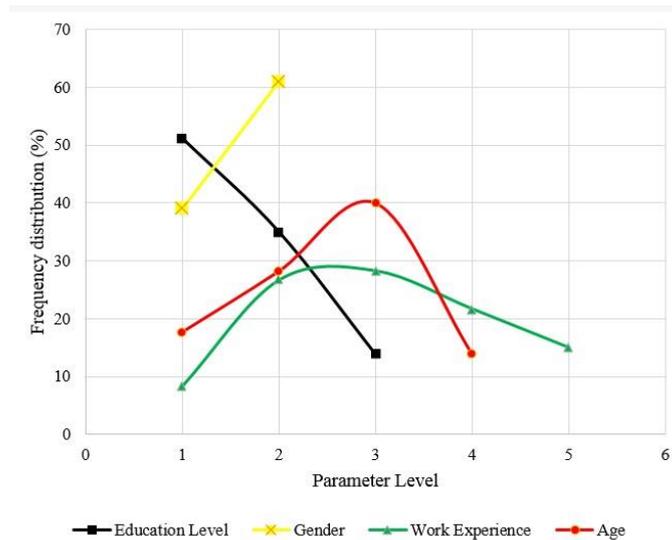
INTRODUCTION

In the current era, dramatic changes in management knowledge have made the existence of an evaluation system inevitable; so that the lack of evaluation system in various dimensions of an organization, including evaluation in the use of resources and facilities, employees, external processes, goals and strategies emerged as one of the symptoms of diseases of that organization [1-4]. Performance appraisal has been a challenge for researchers and users for many years. In the past, businesses used only financial metrics as a tool to evaluate performance, until Kaplan and Norton in the early 1980s [5-9]. They reviewing and evaluating management accounting systems, so identified many inefficiencies to evaluate the performance of organizations [10-14]. This inefficiency was due to the increasing complexity of organizations, the dynamics of the environment and market competition. Every organization urgently needs to be evaluated in order to be aware of the desirability and quality of its activities, especially in complex and dynamic environments [15-19]. On the other hand, the lack of evaluation and control system in a system means not communicating with the internal and external environment of the organization, the consequences of which are aging and ultimately the death of the organization [20-24]. The phenomenon of organizational death may not be felt by top managers due to its non-occurrence, but studies show that the lack of feedback system makes it impossible to make the necessary reforms to grow, develop and improve the activities of the organization, which eventually creates organizational death [25-26]. The shortcomings of traditional performance appraisal systems have led to a revolution in performance management. As a result researchers and users moving to create new performance appraisal systems that address

current goals and environments, and thus multiple appraisal processes for use by different organizations was created and these models have always been changing and developing [27-29].

Literature review

In all organizations, one of the most influential factors in the progress of the organization is the marketing dimension. Every organization spends a lot of resources to maintain and strengthen its performance capabilities, which of course puts some pressure on managers to evaluate their effectiveness [30-34]. To this end, creating an effective relationship between influential parameters such as marketing-related activities. On the other hand how to use resources with the financial performance and value of the organization has become one of the most basic priorities of marketing researchers [35-37]. Another key parameter in achieving each of predetermined goals is significant focus on internal processes. Processes designed by the management, governance and other personnel. Through internal processes and controls, it is possible to achieve the goals of the organization with regard to financial reporting, effectiveness and efficiency of operations and compliance with applicable laws and regulations. The internal processes of any organization as an effective system are very helpful in achieving the goals of financial performance of organization [38-42]. One of the most important issues in managing a company is managing the financial flow of the supply chain, which plays a significant role in

the growth and survival of that unit [43-46]. Also, managing the cash flow of the supply chain is a basic requirement of the organization's ability to adapt to a challenging economy. In general, supply chain cash flow deals with the flow of money along the chain, which helps companies to have an overview of the chain and optimize financial processes. Supply chain cash flow management deals with how to optimize a company's working capital. This optimization is done through coordination in the management of accounts payable, accounts receivable, cash and risk [47-49]. It is also well known that the external environment of the organization has a significant impact on its performance, so that the performance of an organization depends on the complexity and dynamism of the external environment. On the other hand, the degree of heterogeneity capacity and consensus of organizations are among the influential external factors [50-54]. In all organizations, utilization of the teams is increasingly vital and affects the success of organization as well as advancement of its goals. Creating capable teams leads to effective cooperation between employees, which plays a key role in expanding knowledge and skills through consultation and cooperation in the growing process of the organization. Creating individual motivation by delegating authority to the individual in decision-making of the lower levels of the organization leads to individual empowerment. It is known as a conscious learning process in the management system due to the relationship between this

important and individual performance. Also, in order to make the team more effective, the significant role of leadership cannot be ignored [55-59]. Therefore, considering the broad approaches of leadership, the importance of studying the behavior of leaders has become more prominent. Among various leadership behaviors, one of the most effective component is empowerment of leadership behaviors, which will be adapted by creating more independence for employees. In many studies, leadership has been evaluated from two perspectives, which are employee responses to empowerment and leadership actions [60-64]. On the other hand, many studies have been conducted by examining and evaluating the effects of human factors on the performance of organization. In these studies, the relationship between highly performance work practices systems versus firm ones has been compared. Meanwhile, the significant economic and statistical effects of these practices on the results of mid-term employees (turnover and productivity) and short-term and long-term measures of companies' financial performance have been proven [65-67]. Huselid et al. examines in detail the role of human resources on the factors such as the productivity, turnover and corporate financial performance were clarified [68-70].

Among different methods of analysis, factor analysis is a way to work with large volumes of data and summarize them into smaller sets of data that are easier and more understandable to manage [71-74]. Factor analysis is a way to find hidden patterns and shows how patterns overlap with each other and which features are seen in multiple patterns. This method is also used to create a set of similar variables called dimensions. Confirmatory factor analysis can be used in designing assessment tools in various fields such as finance, management, health approaches, customer service questionnaire and many others. The most important goal of confirmatory factor analysis is to determine the power of a predefined operating model with a set of observed data. In other words, confirmatory factor analysis seeks to determine the extent to which the number of factors and loads of variables measured on these factors are consistent with what was expected based on theory and theoretical model. In other words, this type of factor analysis tests the degree of conformity between the theoretical structure and the experimental structure of the research. In this method, first the relevant variables and indicators are selected based on the initial theory. Then, the way of loading variables and indicators on the existing factors is determined and compared with predetermined predictions. This research study focused on the capability of this great analyzing method for performance evaluation on financial units of Persian Gulf petrochemical companies.

Methodology

In order to analyze all collected data and development of research hypotheses, in this section, first a statistical description of the research sample was provided and then its hypotheses were developed. For clarification

the results pattern, first descriptive statistics were used to describe the main variables of the research and so demographic characteristics such as age, level of education, etc. Then, in the inferential statistics stage, in order to evaluate the appropriateness of the measurement tool that is questionnaire, confirmatory factor analysis (CFA) with partial least squares (PLS) approach was used by Smart PLS3 software. Also, to examine the type of data distribution, Kolmogorov-Smirnov test was applied for evaluating foregoing questions and corresponding objectives of the research.

Descriptive statistics

Descriptive statistics are great powerful tools for summarizing large sets of understudy data, through which it can be reported in an understandable way by using indicators. Descriptive statistics is considered as a basis for inferential tests. In this section, via application of descriptive statistics, demographic variables were described individually and so main significant ones were determined. Also descriptive indicators related to the questionnaire were presented.

Description of demographic variables

This part summarized the nature of statistical community via the factors as age, level of education and gender. In this study, 180 usable questionnaires were returned for further analysis. Table 1 printed the frequency distribution of individuals by level of education. As can be seen, bachelor's (BSc) degree, master's degree (MSc) and doctoral education (PhD) followed by 51.1%, 35% and 13.9%, respectively (Figure 1). The research findings indicated that the highest frequency is related to the age range of 36 to 45 years, which accounts for 40% of the total. In the contrast, for the range of 46 to 50 years old, the lowest values observed which 13.9% of the total is (Table 1 & Figure 1). Also as printed in the following, out of 180 participants in the statistical sample, 61.1% and 38.9% are male and female, respectively (Table 1 & Figure 1). Finally, for the final demographic parameter that is work experience, the highest frequency was reported for the category of 11 to 15 years (28.3%) and then followed by the employees of 6 to 10 years (26.7%). All the results summarized in the following (Table 1 & Figure 1).

Table 1. Frequency distribution of respondents based on demographic variables

Education level				
Level description	Parameter	No.	Frequency (%)	Cumulative frequency (%)
1	BSc	92	51.1	51.1
2	MSc	63	35	86.1
3	PhD	25	13.9	100
	Total	100	180	
Age				
Level description	Parameter	No.	Frequency (%)	Cumulative frequency (%)
1	≤ 25	32	17.8	17.8

2	26-35	51	28.3	46.1
3	36-45	72	40	86.1
4	46-55	25	13.9	100
	Total	180	100	

| **Gender** | | | | |
Level description	**Parameter**	**No.**	**Frequency (%)**	**Cumulative frequency (%)**
1	Male	110	61.1	61.1
2	Female	70	38.9	100
	Total	180	100	

| **Work experience** | | | | |
Level description	**Parameter**	**No.**	**Frequency (%)**	**Cumulative frequency (%)**
1	≤ 5	15	8.3	8.3
2	6-10	48	26.7	35
3	11-15	51	28.3	63.3
4	16-20	39	21.7	85
5	>20	27	15	100
	Total	180	100	
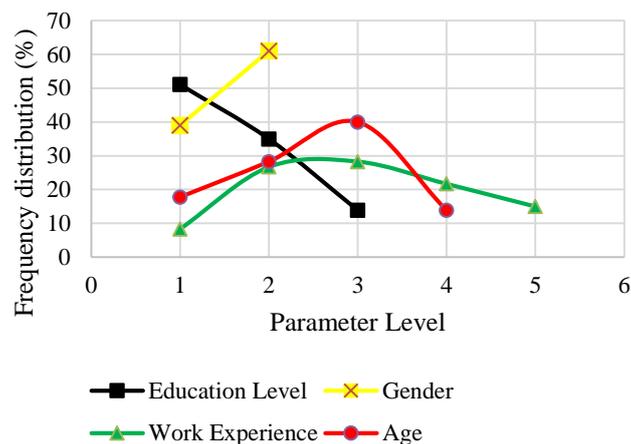
Figure 1. Frequency distribution of respondents by education level, gender, work experience and age

Description of understudy variables

The importance of variable description is vital while test results of the research hypotheses are extracted based on the data and indicators of these variables. In the foregoing research, all gathered data had a distance scale. To describe the research variables, central indicators and dispersion were used, which are discussed below. In this research, a questionnaire with a scale of five options (1 to 5) had been designed, then evaluated with their corresponding questions and finally averaged in the SPSS software. By the results it can be seen that all scores arranged in the interval that means between 1 and 5 which approved great accuracy for feeding, coding and computerizing in the software. In the following table, descriptive indicators of research variables have been summarized. It is obviously clarified that most of the understudy

society have chosen the options above 3 while the mean value appeared as more than 3. Also the coding and feeding of the questionnaire information into the software had been done completely without violation while the minimum and maximum values of parameter's score are more than 1 and less than 5, respectively. On the other hand variables followed an acceptable range in the case of skewness and elongation that is (+3 to -3) which demonstrated desirability of data. On the whole it can be concluded that results of the sample can be generalized to the statistical community with high confidence.

Table 2. Questionnaire scoring pattern in the software

Level description	Very high	High	Medium	Low	Very low
Score	5	4	3	2	1

Table 3. Descriptive indicators of research variables

Parameters	No.	Mean value	Standard deviation	Variance	Scores range		Earned values		Skewness	Stretching
Human resources	180	3.95	0.78	0.61	1	5	1	5	-0.98	1.03
Leadership	180	4.24	0.74	0.56	1	5	1.6	5	-1.24	1.31
External environment	180	3.33	0.66	0.44	1	5	1.2	5	-0.07	0.83
Internal processes	180	4.48	0.6	0.37	1	5	2.83	5	-1.27	0.46
Financial factors	180	4.007	0.8	0.64	1	5	1.67	5	-0.66	-.35
Production & procurement	180	3.76	0.83	0.69	1	5	1	5	-0.2	-0.6
Marketing	180	3.56	0.83	0.69	1	5	1	5	-0.2	-0.6

Descriptive indicators related to the questionnaire

In this part of the research, how to answer questions by understudy society is discussed via frequency table (Table 4). Here, it is perceived that the questions are well explained as the mean value is greater than 3 (the middle of the 5-point Likert spectrum) for all cases. In addition, level description of "high" and "very high" were chosen by most of them.

Table 4. Descriptive Indicators Related to the Questionnaire

Questions	Mean value	Standard deviation	Questions	Mean value	Standard deviation
Q1	4.16	.946	Q36	4.46	.828
Q2	4.07	1.039	Q37	3.97	1.121
Q3	3.87	1.005	Q38	4.27	.890
Q4	3.86	1.050	Q39	4.21	1.041
Q5	4.00	.945	Q40	3.87	1.158
Q6	4.00	1.073	Q41	3.58	1.108

Q7	3.84	1.134	Q42	3.94	1.074
Q8	3.87	1.090	Q43	3.93	1.028
Q9	4.40	.913	Q44	3.97	1.054
Q10	4.31	.993	Q45	4.09	1.026
Q11	4.13	.977	Q46	3.93	1.028
Q12	4.14	1.013	Q47	3.92	1.096
Q13	4.24	.899	Q48	3.99	1.049
Q14	4.28	1.025	Q49	4.13	.999
Q15	4.11	1.033	Q50	4.12	.961
Q16	4.21	.967	Q51	4.36	.844
Q17	4.34	.893	Q52	4.41	.831
Q18	4.32	.887	Q53	3.74	1.140
Q19	3.53	.899	Q54	4.04	1.045
Q20	2.71	1.065	Q55	3.76	1.212
Q21	3.57	.853	Q56	3.44	1.104
Q22	3.48	.862	Q57	3.52	1.027
Q23	3.38	.959	Q58	3.53	.954
Q24	4.37	.896	Q59	3.62	.935
Q25	4.40	.843	Q60	3.78	.925
Q26	4.46	.834	Q61	3.73	.877
Q27	4.54	.765	Q62	4.02	.815
Q28	4.57	.740	Q63	4.15	.787
Q29	4.76	.613	Q64	3.37	1.098
Q30	4.81	.560	Q65	3.69	1.150
Q31	4.16	.908	Q66	3.62	1.105
Q32	4.29	.900	Q67	3.76	1.151
Q33	4.41	.810	Q68	3.25	1.172
Q34	4.47	.862	Q69	3.54	1.125
Q35	4.61	.758	Q70	3.72	1.134

Result and Discussion

Inferential statistics

The role of descriptive statistics is to collect, summarize and describe quantitative information obtained from samples or statistical population. For this reason, when generalizing the obtained results to the whole statistical population, inferential statistics and statistical methods appropriate to the type of research method should be applied. In the inferential statistics section, the data normality test was used. In the meanwhile, according to the questionnaire and objectives of the research, Friedman ranking test and binomial test were used. Also, to evaluate and measure the questionnaire, confirmatory factor analysis (CFA) with partial least squares (PLS) approach were utilized by Smart PLS3 software.

Normality of data

To implement statistical analysis and logical inference of research hypotheses, clarification of data distribution is a top priority. It is obviously demonstrated that bell-shaped distribution followed a normal distribution. In the case of normal distribution of variables, parametric tests are used to evaluate the hypotheses, otherwise nonparametric tests should be used. In order to check the normality, Kolmogorov-Smirnov test is used,

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which follows the following hypotheses (Equation 1):

$$\begin{cases} H_0 = Normal\ distribution \\ H_1 = Abnormal\ distribution \end{cases}$$ Equation 1

If the significance level of corresponding test was less than the error value of 0.05, it indicates that it is abnormal, and in other case it followed an abnormal pattern. As it is printed, the significance level for all the variables has zero value (Table 5). Therefore, based on the above, it is concluded that data distribution of variables is abnormal.

Table 5. Distribution of variables based on Kolmogorov-Smirnov test

Parameters	Kolmogorov-Smirnov test		Distribution type
	Statics value	Significance level	
Human resources	0.113	0.00	Abnormal
Leadership	0.157	0.00	Abnormal
External environment	0.097	0.00	Abnormal
Internal processes	0.199	0.00	Abnormal
Financial factors	0.108	0.00	Abnormal
Production & procurement	0.161	0.00	Abnormal
Marketing	0.079	0.00	Abnormal

Confirmatory factor analysis of questionnaire (CFA)

In confirmatory factor analysis, the researcher tries to obtain confirmation of a hypothetical factor structure. That is, it determines whether the data is consistent with a certain factor structure in the hypothesis or not. Confirmatory factor analysis is also used to assess the validity of the indicators in the questionnaire to determine the necessary coordination and alignment between defined indicators. In other words, it can provide the validity of the questionnaire. In comparison with exploratory factor analysis, each factor is related to a specific subset of variables. Confirmatory factor analysis evaluates the degree of conformity between the theoretical structure and the experimental structure of the research. In the below shows the factor analysis model with standardized path coefficients and loads.
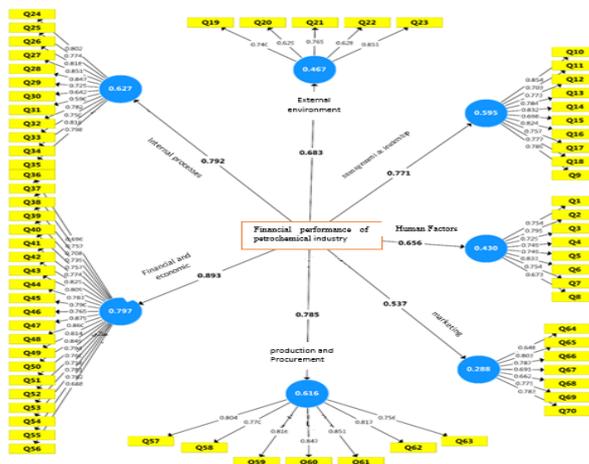

Figure 2. Confirmatory factor analysis model with standardized path coefficients
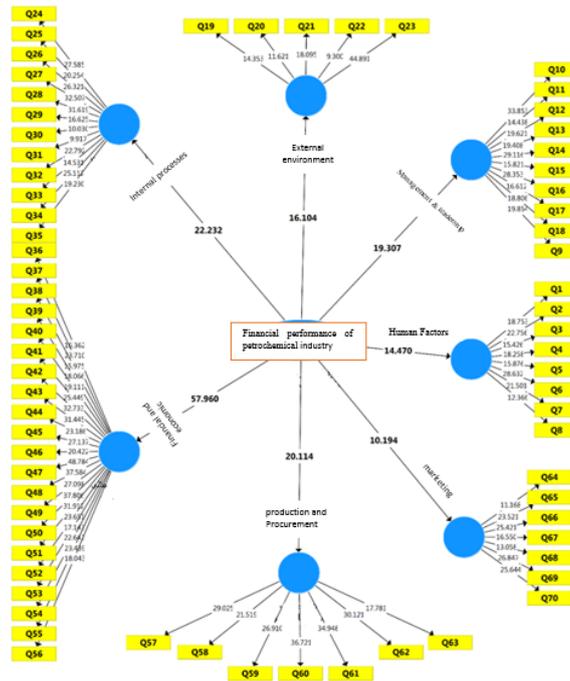
Figure 3. Confirmatory factor analysis in the case of significance coefficients T

Investigation of standardized factor load and T coefficients between sub-factors and latent variable

In order to investigate the correlation between the relevant latent variables and their corresponding indicators, the standardized coefficient measurement model is used. Standardized coefficients, in fact, represent standardized coefficients of path or factor loads between agents and markers. Existence of significant correlation between variables and questionnaire will lead to validity between variables. If the standardized factor load be higher than 0.4, it can be said that the questions have good explanatory power. On the other hand, the significance of each parameter is determined by T-values. Meanwhile, if the value of T coefficient be greater than the absolute value of 1.96 or the significance level be less than 0.05, the model parameters are

significant. In this case, the validity of the measurement structures of the relevant variables is confirmed at a significance level of 0.05. As can be seen, the value of t-statistic and level of significance between corresponding items and their latent variables were calculated to be greater than 1.96 and less than 0.05, respectively in all cases (Table 6). Therefore, significance of relationships between sub-factors and their corresponding variables was confirmed. Also, the amount of standardized factor load for all questions was more than 0.4, so elimination of no parameters were required. Identifier reliability indicates the amount of variations related to the latent variable which applied on the items. This parameter can be extracted by the variance analysis of corresponding items. As it is clarified by the latest studies for fitting the measurement model in the partial least squares (PLS) method, the requirement items

should be checked as Cronbach's alpha, Combined reliability (CR), factor load coefficients and its significance, mean of extractive variance (AVE). Fornell and Larcker matrix (Lazarus, 2014) and finally comparing the factor load of each index with different structures.

Table 6. Standardized factor loads and t-coefficients between latent variables and related questions

Parameters	Item	Factor load	Statistical value of T	Reagent reliability	Significance level	Result
Human factors	Q1	0.754	18.75	0.569	0.00	Desirable and meaningful
	Q2	0.795	22.75	0.632	0.00	
	Q3	0.725	15.42	0.526	0.00	
	Q4	0.749	18.25	0.561	0.00	
	Q5	0.749	15.87	0.561	0.00	
	Q6	0.833	28.63	0.694	0.00	
	Q7	0.754	21.5	0.569	0.00	
	Q8	0.673	12.36	0.453	0.00	
Management & leadership	Q9	0.789	19.85	0.623	0.00	Desirable and meaningful
	Q10	0.854	33.85	0.729	0.00	
	Q11	0.703	14.43	0.494	0.00	
	Q12	0.773	19.62	0.598	0.00	
	Q13	0.784	19.40	0.615	0.00	
	Q14	0.832	29.11	0.692	0.00	
	Q15	0.698	15.82	0.487	0.00	
	Q16	0.824	28.35	0.679	0.00	
	Q17	0.757	16.61	0.573	0.00	
	Q18	0.777	18.80	0.604	0.00	
External environment	Q19	0.740	14.35	0.548	0.00	Desirable and meaningful
	Q20	0.629	11.62	0.396	0.00	
	Q21	0.765	18.09	0.585	0.00	
	Q22	0.628	9.30	0.394	0.00	
	Q23	0.851	44.89	0.724	0.00	
	Q24	0.802	27.58	0.643	0.00	
	Q25	0.774	20.25	0.599	0.00	
Internal processes	Q26	0.818	26.32	0.669	0.00	Desirable and meaningful
	Q27	0.851	32.50	0.724	0.00	
	Q28	0.847	31.61	0.717	0.00	
	Q29	0.725	16.62	0.526	0.00	
	Q30	0.642	10.03	0.412	0.00	
	Q31	0.590	9.91	0.348	0.00	
	Q32	0.782	22.79	0.612	0.00	
	Q33	0.750	14.53	0.563	0.00	
	Q34	0.816	25.11	0.666	0.00	
	Q35	0.798	19.23	0.637	0.00	
Financial factors	Q36	0.696	16.36	0.484	0.00	Desirable and meaningful
	Q37	0.757	23.71	0.573	0.00	
	Q38	0.708	15.97	0.501	0.00	
	Q39	0.739	18.06	0.546	0.00	
	Q40	0.757	19.11	0.573	0.00	
	Q41	0.774	25.44	0.599	0.00	
	Q42	0.825	32.73	0.681	0.00	

	Q43	0.809	31.44	0.654	0.00	
	Q44	0.783	23.18	0.613	0.00	
	Q45	0.790	27.13	0.624	0.00	
	Q46	0.765	20.42	0.585	0.00	
	Q47	0.879	48.78	0.773	0.00	
	Q48	0.860	7.58	0.740	0.00	
	Q49	0.814	27.09	0.663	0.00	
	Q50	0.849	37.80	0.721	0.00	
	Q51	0.749	31.91	0.630	0.00	
	Q52	0.760	23.65	0.578	0.00	
	Q53	0.718	17.14	0.516	0.00	
	Q54	0.781	22.64	0.610	0.00	
	Q55	0.782	23.43	0.612	0.00	
	Q56	0.688	18.04	0.473	0.00	
	Q57	0.804	29.02	0.642	0.00	
Production & procurement	Q58	0.770	21.51	0.593	0.00	**Desirable and meaningful**
	Q59	0.816	26.91	0.666	0.00	
	Q60	0.847	36.72	0.717	0.00	
	Q61	0.851	34.94	0.724	0.00	
	Q62	0.817	30.12	0.667	0.00	
	Q63	0.756	17.78	0.572	0.00	
	Q64	0.648	11.16	0.420	0.00	
Marketing	Q65	0.803	23.52	0.645	0.00	**Desirable and meaningful**
	Q66	0.787	25.42	0.619	0.00	
	Q67	0.691	16.55	0.477	0.00	
	Q68	0.662	13.05	0.438	0.00	
	Q69	0.775	26.84	0.601	0.00	
	Q70	0.783	25.64	0.613	0.00	

Cronbach's alpha coefficient, composition reliability coefficient (CR) and average extracted variance (AVE)

The traditional index which is used to measure the reliability or internal consistency between observable variables in a measurement model is Cronbach's alpha coefficient. Internal consistency indicates the degree of correlation between a structure and its characteristics. The acceptance criterion for this index, which will indicate the reliability of the measurement model, is at least 0.7. In the PLS method there exist another criteria for evaluating internal consistency of the measurement model CR. If the value of the combined reliability for each structure is greater than 0.7, it indicates the appropriate internal stability for the measurement model. As the final one, convergence validity makes sense when the scores obtained from two tools on a desired concept are highly correlated. In other words, convergent validity means measuring the explanation of the hidden variable by observable ones, which is measured by the average variance extracted. Convergent validity index means measuring explanation of the hidden variable by its observable variables. This criterion has been proposed as an indicator for measuring the internal validity of measurement model. In simpler terms, this index reveals the degree of correlation of a structure with its indicators. A minimum value of 0.5 is considered for this index, which means

that the latent variable in question explains at least 50% of its observable variance. The table below shows the results of Cronbach's alpha coefficients, combined reliability and mean extraction variance. As can be seen, the Cronbach's alpha value and the CR coefficient of all variables are within the acceptable range and above 0.7. Also, the AVE value of all variables is all above the 0.5 limit. Therefore, it can be inferred that the convergent reliability and validity of understudy variables are acceptable (Table 7).

Table 7. Summarized results of Cronbach's alpha coefficient, CR and AVE

Parameters	Cronbach's alpha coefficients	CR coefficient	AVE
Human resources	0.892	0.914	0.570
Management & leadership	0.928	0.940	0.609
External environment	0.772	0.847	0.529
Internal processes	0.936	0.945	0.593
Financial factors	0.967	0.970	.0607
Production & procurement	0.912	0.930	0.655
Marketing	0.859	0.893	0.545

Divergent validity by fornell and larcker method

If the correlation between analyses that measure different characteristics represented low value, the analyzing method has divergent diagnostic validity. Divergent validity also measures the ability of a measurement model to differentiate the observable variables of that latent variable from the others in the model; as a result it plays a complementary role with respect of convergent validity. Table 8 shows the results of divergent validity study by Fornel and Larcker method. As it obviously printed, the value of the AVE root of the latent variables, which are located in the cells in the main diameter of the matrix, is greater than the amount of correlation between them, which are arranged in the lower left side. Therefore, it can be stated that in the foregoing model, hidden variables have more interaction with their corresponding questions with respect of the others. In other words, the divergent validity of the model followed an appropriate pattern.

Table 8. Divergent Validity by Fornell and Larcker Method

Parameters	Human resources	Management & leadership	External environment	Internal processes	Financial factors	Production & procurement	Marketing
Human resources	0.755						
Management & leadership	0.408	0.781					
External environment	0.577	0.439	0.727				
Internal processes	0.430	0.634	0.511	0.770			
Financial factors	0.469	0.596	0.510	0.569	0.779		

Production & procurement	0.477	0.548	0.540	0.584	0.632	0.809
Marketing	0.445	0.264	0.420	0.306	0.437	0.374	0.738

Evaluation of validity by comparing the factor load of each index with different structures

Comparing the factor load of items with their own structure in comparison of the others, specify divergent validity state. If the amount of factor load between items with their own structures is greater than the factor load of the same item with other structures, divergent validity is confirmed. According to the matrix

design, the rows of the table belong to the questions of the questionnaire and its columns related to the variables (Table 9). The displayed numerical values indicate the degree of correlation of indicators with structures. As it is clear, all questions have more factor load with their hidden variable, which demonstrates proper fitting of the model and as a result confirmation of divergent validity.

Table 9. Evaluation of Validity by Comparing the Factor Load of Each Index with Different Structures

Questions	Human factors	Management & leadership	External environment	Internal environment	Financial indexes	Production & procurement	marketing
Q1	0.754	0.320	0.495	0.338	0.318	0.282	0.266
Q2	0.795	0.258	0.462	0.338	0.337	0.328	0.321
Q3	0.725	0.371	0.491	0.390	0.317	0.360	0.376
Q4	0.749	0.288	0.412	0.323	0.333	0.340	0.330
Q5	0.749	0.282	0.418	0.319	0.314	0.358	0.359
Q6	0.833	0.281	0.471	0.318	0.414	0.424	0.345
Q7	0.754	0.353	0.397	0.298	0.449	0.423	0.317
Q8	0.673	0.307	0.331	0.270	0.336	0.349	0.375
Q9	0.353	0.789	0.377	0.480	0.483	0.422	0.119
Q10	0.339	0.854	0.368	0.545	0.515	0.477	0.224
Q11	0.201	0.703	0.283	0.431	0.415	0.309	0.159
Q12	0.329	0.773	0.318	0.500	0.416	0.374	0.171
Q13	0.319	0.784	0.355	0.497	0.466	0.381	0.231
Q14	0.346	0.832	0.379	0.553	0.427	0.464	0.270
Q15	0.340	0.698	0.325	0.503	0.471	0.479	0.242
Q16	0.307	0.824	0.336	0.486	0.521	0.460	0.231
Q17	0.324	0.757	0.328	0.441	0.447	0.437	0.208
Q18	0.313	0.777	0.349	0.499	0.478	0.453	0.193
Q19	0.409	0.330	0.740	0.317	0.321	0.394	0.189
Q20	0.335	0.295	0.629	0.390	0.339	0.344	0.364
Q21	0.457	0.293	0.765	0.360	0.378	0.376	0.315
Q22	0.381	0.294	0.628	0.358	0.362	0.311	0.285
Q23	0.497	0.378	0.851	0.424	0.442	0.513	0.362
Q24	0.388	0.484	0.435	0.802	0.503	0.471	0.289
Q25	0.398	0.505	0.465	0.774	0.438	0.531	0.281
Q26	0.300	0.517	0.377	0.818	0.443	0.452	0.280

Q27	0.316	0.511	0.372	0.851	0.435	0.442	0.198
Q28	0.440	0.504	0.446	0.847	0.444	0.483	0.247
Q29	0.397	0.499	0.316	0.725	0.417	0.478	0.155
Q30	0.251	0.478	0.262	0.642	0.403	0.384	0.069
Q31	0.220	0.469	0.358	0.590	0.425	0.355	0.267
Q32	0.320	0.466	0.435	0.782	0.455	0.446	0.295
Q33	0.319	0.368	0.402	0.750	0.369	0.412	0.269
Q34	0.298	0.513	0.408	0.816	0.499	0.484	0.261
Q35	0.293	0.534	0.413	0.798	0.409	0.431	0.187
Q36	0.326	0.368	0.362	0.363	0.696	0.421	0.229
Q37	0.386	0.545	0.463	0.464	0.757	0.491	0.342
Q38	0.344	0.421	0.355	0.422	0.708	0.448	0.277
Q39	0.328	0.388	0.331	0.361	0.739	0.412	0.214
Q40	0.391	0.446	0.368	0.439	0.757	0.434	0.349
Q41	0.334	0.494	0.491	0.461	0.774	0.507	0.413
Q42	0.398	0.474	0.399	0.499	0.825	0.534	0.413
Q43	0.369	0.430	0.397	0.445	0.809	0.513	0.448
Q44	0.326	0.447	0.338	0.456	0.783	0.503	0.411
Q45	0.371	0.451	0.345	0.541	0.790	0.513	0.402
Q46	0.376	0.402	0.352	0.381	0.765	0.479	0.412
Q47	0.377	0.509	0.362	0.398	0.879	0.530	0.371
Q48	0.363	0.473	0.376	0.475	0.860	0.542	0.359
Q49	0.372	0.480	0.441	0.487	0.814	0.530	0.280
Q50	0.395	0.504	0.425	0.464	0.849	0.581	0.365
Q51	0.394	0.527	0.338	0.505	0.794	0.529	0.273
Q52	0.330	0.481	0.372	0.483	0.760	0.490	0.279
Q53	0.295	0.455	0.415	0.474	0.718	0.471	0.321
Q54	0.410	0.557	0.472	0.429	0.781	0.506	0.365
Q55	0.387	0.410	0.444	0.332	0.782	0.419	0.317
Q56	0.398	0.451	0.502	0.394	0.688	0.451	0.263
Q57	0.363	0.481	0.458	0.446	0.536	0.804	0.328
Q58	0.362	0.461	0.466	0.516	0.518	0.770	0.320
Q59	0.332	0.420	0.376	0.366	0.517	0.816	0.291
Q60	0.371	0.414	0.408	0.481	0.483	0.847	0.233
Q61	0.413	0.464	0.474	0.504	0.539	0.851	0.348
Q62	0.413	0.433	0.466	0.522	0.530	0.817	0.343
Q63	0.442	0.428	0.401	0.463	0.452	0.756	0.241
Q64	0.208	0.152	0.240	0.071	0.298	0.190	0.648
Q65	0.359	0.190	0.349	0.195	0.322	0.346	0.803
Q66	0.347	0.182	0.310	0.327	0.368	0.301	0.787
Q67	0.382	0.221	0.352	0.193	0.249	0.193	0.691
Q68	0.310	0.216	0.286	0.250	0.340	0.246	0.662
Q69	0.363	0.215	0.313	0.236	0.364	0.305	0.775
Q70	0.310	0.185	0.317	0.261	0.304	0.319	0.783

Conclusion

This study investigates the effect of basic parameters in the field of financial management of twelve petrochemical companies in Persian Gulf. The conceptual model designed in this paper analyzes human factors, management and leadership, external processes, internal processes, production and procurement, economic indexes and marketing factor. For this purpose, the confirmatory factor analysis method has investigated the divergent validity and appropriateness of the questionnaire through Cronbach's alpha criteria, the significance of factor loads between questions and latent variables, the combined reliability coefficient (CR) and finally, the average extracted variance (AVE). For this important, the main hypothesis of the research had been answered after examining the correspondence of the measurement tool with confirmatory factor analysis technique and examining the normality of the data. It should be noted that due to the abnormality of data distribution, the binomial non-parametric test has been used. This test is equivalent to the nonparametric test of an independent sample t-test in which the assumption of zero defined when the mean of scores is less than or equal to the limit number 3. Based on the results of binomial analysis, the significance level of foregoing test for all variables represented zero and less than the 0.05 error level. So, according to the hypothesis, the average scores of foregoing parameters are higher than 3. On the other hand, for all types of factors there exist a significant difference between numbers of factors with high scores with respect of the others. In addition, the mean scores of all variables were higher than the mean. Therefore, it is inferred that according to the results, the seven identified factors can be considered as effective factors in the performance of the financial unit of the petrochemical industry with a probability of 95%. The next most important step is to rank the factors affecting performance quality of the petrochemical industry financial units. Using the Friedman ranking test, the organization's internal processes with an average rating of 5.91 had the most critical effect on the financial performance of organizations under review. On the other hand, as can be seen, since the significance level of test with the statistical value of 382.54 is less than 0.05, it is inferred that the null hypothesis of Friedman test is rejected and the opposite one confirmed. So each factor had its deep individual effect on the organization performance.

Table 10. Identifying the effective factors in the performance of the financial unit of the petrochemical industry using binomial test

Parameters	Ranging	Observed value	Test ratio	Significance level	Variables	Result
Human	≤3	25	0.14			
resources	>3	155	0.86	0.50	0.000	Confirmed
Total		180	1.00			
Management	≤3	13	0.07			
& leadership	>3	167	0.93	0.50	0.00	Confirmed
Total		180	1.00			

External environment	≤3	65	0.36	0.50	0.00	
	>3	115	0.64			Confirmed
Total		180	1.00			
Internal processes	≤3	5	0.03	0.50		
	>3	175	0.97			Confirmed
Total		180	1.00			
Financial factors	≤3	24	0.13	0.50		
	>3	156	1.00			Confirmed
Total		180	1.00			
Production & procurement	≤3	27	0.15	0.50	0.00	
	>3	153	0.85			Confirmed
Total		180	1.00			
Marketing	≤3	56	0.31	0.50	0.00	
	>3	124	0.69			Confirmed
Total		180	1.00			

Table 11. Friedman ranking test results

Test statistics	
Chi squared value	382.54
Free degree	6
Significance level	0.00

Table 12. Ranking of effective parameters on financial performance of Petrochemical industry, special case study

Parameters	Average rating	Ranking
Internal processes	4.21	1
Management & leadership	5.08	2
Financial factors	3.33	3
Human resources	5.91	4
Production & procurement	3.01	5
Marketing	3.01	6
External environment	4.29	7

References

[1]. A.A. Amir Sadeghi, *Production and Operations Management*, 2020, 10(2)

[2]. D.H. Constantin Blome, *International Journal of Production Research*, 2015, 32-49

[3]. A.K. Davis Lazarus, *Journal of Global Marketing*, 2014

[4]. J.L. Edmara Drigo, *IEEE Access*, 2020

[5]. A.P Finch, *Value in Health*, 2017

[6]. Y. Guo, H. Gao, Q. Wu, *I E E E Transactions on Sustainable Energy.*, 2017

[7]. M.A. Huselid, *Academy of Management Journal*, 2017, 38(3)

[8]. M. Esmaeili Bidhendi, Z. Asadi, A. Bozorgian, A. Shahhoseini, M.A. Gabris, S. Shahabuddin, R. Khanam, R. Saidur, *Environmental Progress & Sustainable Energy*, 2020, 39(1): 13306

[9]. S.G. J Luengo, *Elsevier*, 2009

[10]. K.T. Janet, E. Helms, *The Counseling Psychologist*, 2006

[11]. A. Bozorgian, *Advanced Journal of Chemistry, Section B: Natural Products and Medical Chemistry*, 2021, 3(1): 54

[12]. M.M. Kamyar Kabirifar, *Buildings*, 2019

[13]. H. Lilliefors, *Journal of the American statistical Association, Taylor & Francis.*, 1967

[14]. A. Bozorgian, *Int. J. Adv. Stu. Hum. Soc. Sci.*, 2020, 9(3): 205

[15]. M.J. Njuguna-Kinyua, *European Scientific Journal*, 2014

[16]. D.D. Sebastian Aparicio, *Technological forecasting and social Changes*, 2016

[17]. K.W. Smith, *Sociological Methids & Reaserch*, 1974

[18]. J.Y. Tong, *Journal of management information systems*, 1999

[19]. M. Pour Kiani, M. Pourjafari Jozam, M. Pourjafari Jozam, *Int. J. Adv. Stu. Hum. Soc.* Sci., 2020, 9(2): 150

[20]. M. Alikhani J. Khodayari, M. Dehnavi, J. Verij kazemi, *Int. J. Adv. Stu. Hum. Soc. Sci.*, 2020, 9(2): 165

[21]. S. Ketabi, A. Sadeghi, *Int. J. Adv. Stu. Hum. Soc. Sci.*, 2020, 9(1): 1

[22]. S. Salehi-Kordabadi, S. Karimi, M. Qorbani-Azar, *Int. J. Adv. Stu. Hum. Soc. Sci.*, 2020, 9(1): 21

[23]. M.R. Rahnama, M. Ajza Shokouhi, A. Heydari, *Int. J. Adv. Stu. Hum. Soc. Sci.*, 2020, 9(1): 37

[24]. Y. Kamyabi, M. Salahinejad, *Int. J. Adv. Stu. Hum. Soc. Sci.*, 2020, 9(1): 50

[25]. H. Jenaabadi, B. Ruzrokh, *Int. J. Adv. Stu. Hum. Soc. Sci.*, 2020, 9(1): 63

[26]. S. Rahimipour, *Int. J. Adv. Stu. Hum. Soc. Sci.*, 2020, 9(1): 72

[27]. K. Hashemi Fard*, Int. J. Adv. Stu. Hum. Soc. Sci.*, 2020, 9(1): 84

[28]. G. Zaeri, *Int. J. Adv. Stu. Hum. Soc. Sci.*, 2019, 8(4): 310

[29]. M. Shafaee, H.A. Bahramzadeh, *Int. J. Adv. Stu. Hum. Soc. Sci.*, 2019, 8(4): 321

[30]. B. Sahranavard, R. Hajhosseini, *Int. J. Adv. Stu. Hum. Soc. Sci.*, 2019, 8(4): 332

[31]. S. Abdollahyar, A. Masihpoor, *Int. J. Adv. Stu. Hum. Soc. Sci.*, 2019, 8(4): 350

[32]. M. Fathi Rkabdary, *Int. J. Adv. Stu. Hum. Soc. Sci.*, 2019, 8(4): 362

[33]. S.M. Sajjadi, S. Ansari, *Int. J. Adv. Stu. Hum. Soc. Sci.*, 2019, 8(4): 369

[34]. M.R. Rahnama, A. Bidkhori, A. Kharazmi, *Int. J. Adv. Stu. Hum. Soc. Sci.*, 2019, 8(4): 383

[35]. M. Gareche, S.M. Hosseini, M. Taheri, *Int. J. Adv. Stu. Hum. Soc. Sci.*, 2019, 8(3): 223

[36]. A. Olah Erfani, M. Almasi, H. Reshadatjoo, *Int. J. Adv. Stu. Hum. Soc. Sci.*, 2019, 8(3): 241

[37]. M. taghi Mahmoudi, M. Azar, R. Bahrami, *Int. J. Adv. Stu. Hum. Soc. Sci.*, 2019, 8(3): 255

[38]. S. Chehrazad, *Int. J. Adv. Stu. Hum. Soc. Sci.*, 2019, 8(3): 266

[39]. M. Haghgooei, *Int. J. Adv. Stu. Hum. Soc. Sci.*, 2019, 8(3): 274

[40]. H.R Taboli, M. Samie'e Darooneh, A. Ehsani, Int. J. Adv. Stu. Hum. Soc. Sci., 2019, 8(3): 282

[41]. G.A. Mohammad Hassani, *Int. J. Adv. Stu. Hum. Soc. Sci.*, 2019, 8(3): 289

[42]. M. Goudarzi, S. Mossallami Aghili, Z. Mokhtary Tajeek, *Int. J. Adv. Stu. Hum. Soc. Sci.*, 2019, 8(3): 301

[43]. Bakhtyari Mansourabad, *Int. J. Adv. Stu. Hum. Soc. Sci.*, 2019,; 8(2): 126

[44]. H. ghe.Moniri, N. Dohniyatkar, *Int. J. Adv. Stu. Hum. Soc. Sci.*, 2019, 8(2): 137

[45]. H.g. Moniri, N. Dohniyatkar, *Int. J. Adv. Stu. Hum. Soc. Sci.*, 2019, 8(2): 148

[46]. S.N. Jelodarloo, E. Nazari, Z. Hatami, K. Nouri, S. Nazari, *Int. J. Adv. Stu. Hum. Soc. Sci.*, 2019, 8(2): 158

[47]. Z. Hatami, S.N. Jelodarloo, E. EmamgholizadehTakle, E. Nazari, A. Hatami, *Int. J. Adv. Stu. Hum. Soc. Sci.*, 2019, 8(2): 168

[48]. E. Nazari, A. Derakhshan, K. Nouri, S. Nazari, S. Naseramini Jelodarloo, *Int. J. Adv. Stu. Hum. Soc. Sci.*, 2019, 8(2): 178

[49]. A. Bozorgian, S. Zarinabadi, A. Samimi, *Journal of Chemical Reviews*, 2020, 2(2): 122

[50]. A. Bozorgian, S. Zarinabadi, A. Samimi, Chemical Methodologies, 2020, 4 (4): 477

[51]. A. Samimi, *Progress in Chemical and Biochemical Research*, 2020, 3(2): 140

[52]. A. Bozorgian, Z. Arab Aboosadi, A. Mohammadi, B. Honarvar, A. Azimi, *Journal*

of Chemical and Petroleum Engineering, 2020, 54(1): 73

[53]. S.V. Mousavi, A. Bozorgian, N. Mokhtari, M.A. Gabris, H.R. Nodeh, W.A. Ibrahim, *Microchemical Journal*, 2019, 145: 914

[54]. A. Samimi, S. Zarinabadi, A. Bozorgian, A. Amosoltani, M.S. Tarkesh Esfahani, K. Kavousi, *Progress in Chemical and Biochemical Research*, 2020, 46

[55]. A. Bozorgian, *Progress in Chemical and Biochemical Research*, 2020, 3(2): 169

[56]. A. Bozorgian, Z. Arab Aboosadi, A. Mohammadi, B. Honarvar, A. Azimi, *Eurasian Chemical Communications*, 2020, 2(3): 420

[57]. A. Bozorgian, Z. Arab Aboosadi, A. Mohammadi, B. Honarvar, A. Azimi, *Progress in Chemical and Biochemical Research*, 2019, 31

[58]. N. Farhami, A. Bozorgian, *In Int. Conf. on Chem. and Chem. Process IPCBEE*, 2011, 10: 223

[59]. A. Bozorgian, *Journal of Chemical Reviews*, 2021, 3(1):50

[60]. A. Bozorgian, *Advanced Journal of Science and Engineering*, 2020, 1(2):34-39

[61]. J. Mashhadizadeh, A. Bozorgian, A. Azimi, *Eurasian Chemical Communications*, 2020, 2(4): 536

[62]. A. Bozorgian, M. Ghazinezhad, *J. Biochem. Tech.*, 2018, 2: 149

[63]. M. Bagheri Sadr, A. Bozorgian, *Journal of Chemical Reviews*, 2021, 3(1): 66

[64]. A. Bozorgian, *Polymer*, 2012, 2: 3

[65]. A. Bozorgian, S. Zarinabadi, A. Samimi, *Journal of Chemical Reviews*, 2020, 2(2): 122

[66]. E. Opoku, *Journal of Chemical Review*, 2020, 2(4): 211

[67]. A. Bozorgian, *Chemical Review and Letters*, 2020, 3(2): 79

[68]. A. Pourabadeh, B. Nasrollahzadeh, R. Razavi, A. Bozorgian, M. Najafi, *Journal of Structural Chemistry*, 2018, 59(6): 1484

[69]. A. Bozorgian, *Advanced Journal of Chemistry-Section B*, 2020, 2(3): 91

[70]. K. Kavousi, S. Zarinabadi, A. Bozorgian, *Progress in Chemical and Biochemical Research*, 2020, 7

[71]. A. Bozorgian, *Chemical Review and Letters,* 2020, 3(3): 94

[72]. M. Bagherisadr, A. Bozorgian, *Int. J. Adv. Stu. Hum. Soc. Sci.*, 2020, 9(4): 252

[73]. A. Bozorgian, *Int. J. Adv. Stu. Hum. Soc. Sci.*, 2020, 9(3): 229

[74]. A. Bozorgian*, Int. J. Adv. Stu. Hum. Soc. Sci.*, 2020, 9(4): 241