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Compiling the strategy plan using a hybrid of BSC – ISM

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C H R O N I C L E

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A B S T R A C T

Since strategy planning describes organization strategy and helps people understand it, it has a significant role in strategic management by drawing cause-and-effect relations; this plan provides the management more power to correct administrating of strategies. In this paper, Interpretive Structural Modeling (ISM) approach is used to produce a strategic planning for tile and ceramic industry. In the method introduced in this paper, after identifying the key measure of function assessment in case study of tile and ceramic by using ISM stages, cause-and-effect relations among the measures have been identified and finally the diagraph which is the strategic plans in four dimensions (BSC) has been drawn.

1. Introduction

Kaplan and Norton have concluded that nowadays successful companies do not depend just on financial measures to assess their function, but they assess them considering three other aspects including customers, internal processes, learning and growth, as well (Kaplan & Norton, 1992). Kaplan and Norton’s findings support the fact that successful companies define their objectives in each of these four aspects and select the measures in each aspect to achieve these objectives. They found out the objectives in these four aspects are joined together in a chain of cause-and-effect relations. Progressing and directing the unclear finance leads to function improvements of process which results in successful customer attraction and maintaining and subsequently satisfaction of stock-holders (Kaplan & Norton, 1992). The concept of balanced scorecard (BSC) was introduced by Kaplan and Norton in the early 1990s as a means to assess the function. However, its usage by companies went beyond the function assessment and according to Kaplan and Norton’s findings in 1996, after studying a hundred big and famous American companies in different industries, balanced assessment was introduced as a strategic management system (Hunt, 2003). In spite of spending time and abundant power on compiling the strategies, most companies do not benefit enough out of their attempts. Successful administration of strategy requires three factors: defining, assessing and managing the strategy. Before assessing and managing the function on strategy basis, it is necessary to have a precise and complete definition of

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strategy so that all members of the organization understand it. Strategy plan does this. The importance of strategy plan is so high that Kaplan and Norton consider it as a distinct stage and name it “strategy plan: transformation of clear finance to clear consequences” in their third book. In fact, this plan is the missed link between formulations of strategy and administrating it, which gives the managers much more power to correct administration of strategies. The strategy plan can solve the problem of misperception of the programs unity by providing a frame of cause-and-effect relation among objectives, consequences and strategy, and cause to a big functional jump in most organizations by relating managerial processes to a definite and clear strategy (Evans, 2005). In their studies Kaplan and Norton (2004) obtained a general pattern of strategy plan which is used in all organizations and industries. Although the four-dimensional model of balanced scorecard provides a common language to describe the organization value-increasing strategies which can be used by administrative groups to debate the directing and prioritizing their own agency; however, they should consider their strategy measures as a collection of causative relations to achieve the objectives of four mentioned dimensions not as functional indicators in four independent dimensions. If cause-and-effect relations among different measures in strategy plan are defined accurately, the organization will achieve a path which describes and shows how objectives and strategies are attained. The strategy plan is the cause-and-effect process to clarify strategic objectives. Identifying organization’s main measures, the plan makes a logical relation among measures. Hence, creating the strategy plans along with logical relations leads to clarifying the strategic paths in organizations (Evans, 2005).

Recent developments in function assessment systems indicate that the companies produce strategic plans and define the relations among main function variables by referring to historical data of function measuring. Doing this, managers obtain a collection of levers to manage the business. The degree of reliability to these levers depends on logical relations among variables which are drawn on the basis of mental judgments and managers’ experiences (Thakkar et al., 2006). Interpretive Structural Modeling (ISM) is a technique which provides us a better understanding of the path of complicated relations among system variables which is called problem or challenge (Jharkharia & Shankar, 2004).

In up-to-now-done research, strategy plans have been designed based on mental judgments and managers’ experiences, and ISM model has rarely been used. Regarding this issue, the following cases can be pointed out. Thakkar, et al. (2006) used a conceptual model of ISM to develop BSC model in designing logical relations among strategic objectives. Saleh Olia, et al. (2013) designed a strategy plan for a pipe and joints manufacturing company in Yazd by using ISM model. Kazemi and Karimi Rahmatabadi (2010) used ISM model to draw a plan of relations between strategic objectives of Vali Asr University of Rafsanjan. In the following parts, ISM methodology is described and used in a case study to draw strategy plan of tile and ceramic in Kerman Province. Finally, the conclusion part analyses the obtained plan of BSC and ISM combination.

2. Interpretive Structural Modeling (ISM) Methodology

Interpretive Structural Modeling Methodology is a method which is used to produce a quantitative model in qualitative one in this paper. This technique was introduced by Warfield in 1973 (Warfield, 1973) and used in organizations and big corporations extensively by professional counselors, afterward. It is an efficient and effective method for subjects in which qualitative variables are placed in various levels and affect each other simultaneously. In fact, ISM is a method for identifying and summarizing among special elements, which defines an issue. The benefit of this model is that it illustrates complicated issues graphically (Ravi & Shamkar, 2005). ISM transforms the ambiguity of efficient models (Sage, 1977). ISM is a suitable method for analyzing the effect of one element on others. This method investigates the type and direction of complicated relations among elements (Singh and Kant, 2008). What are the benefits of ISM? Although each one of ISM’s outcomes is a benefit, generally the following factors can be known as the benefits of this method comparing with similar techniques:

1. ISM method is understandable for different users in different groups.
2. ISM provides a tool for integration of the perceptions of different participants.
3. ISM is used easily and is understandable for the majority of audiences.
4. The beauty of ISM is that it designs the structure of a complicated subject related to under-study problems well, the way in which the diagrams are used as well as the words.

What are the drawbacks of ISM? Every method has both benefits and drawbacks. The drawbacks of ISM is to identify comprehensive relations among variables, which always depends on the knowledge of the user of this technique regarding under-study organization or industry. So, individual ideas which judge the relations between variables can influence the final results. ISM can act as a tool for arranging and directing the complexity of the relations among variables; however, it cannot inform us about the weight of each variable (Vivek et. al., 2008).

2.1. The stages of ISM Methodology performance

1. Identifying the elements that are related to the subject. It can be done by a poll or any technique of choral problem solving.
2. Creating a comprehensive relation between the components by investigating the Mutual relation between them.
3. Creating a structural self-interaction Matrix (SSIM) of components which shows mutual relations between the components of the system.
4. Creating a reachability matrix from SSIM and investigating it with regard to transition. Transition of conceptual relations is a basic theory in ISM which states that if A depends on B and B depends on C, A definitely depends on C.
5. Reachability matrix partitioning in different levels.
6. Based on the given relations in reachability Matrix, a diagraph is drawn and transition dependency is omitted.
7. The results of diagraph in a final model of ISM are made through the replacement of knots.
8. Revising ISM model to investigate the conceptual mismatches and creating the essential changes.

3. Case study: Strategy planning of tile and ceramic industry using BSC-ISM compound model

The measures of function assessment in a case study of tile and ceramic factories in Kerman province have been identified in four dimensions of BSC (Kazemi, 2009). These measures along with their abbreviations are shown in Table 1.

Table 1
Measures of function assessment in tile and ceramic industry

Perspectives	Abbreviation	Indicator
Financial (F)	F1	Side benefit
	F2	Rate of investment efficiency
	F3	Ratio of finance circulation
Customer (C)	C1	Average price of sold products
	C2	Size variety
	C3	Design variety
	C4	Market share
Internal processes (P)	P1	Formal daily production of factory
	P2	Average quality rate
	P3	Number of design per moment
	P4	Number of size per moment
	P5	Type of technology for main machineries of the factory (pressing, kiln, glaze line)
Learning (L)	L1	Quality growth of the current year compared with last year
	L2	Ratio of professional workforce
	L3	Ratio of education hours (person/hour)

3.1. Creating structural self-interaction matrix (SSIM)

After identifying the variables of the problem or the under-study subject, conceptual relations among variables in the frame of structural self-interactive matrix is demonstrated. ISM suggests the use of professional ideas based on different managerial techniques like brainstorming, nominal technique, etc. To develop conceptual relations between variables, questions can be used to identify the relations among variables.

V: Means *i* leads to *t*.
A: Means *t* leads to *i*.
X: Means two variables have mutual relation
O: Means lack of or a weak relation between two variables *i* and *j*.

This matrix has been completed for our considered subject by the managers of three tile factories of Kerman province (Almase Kavir, Berelian, Fakhar) and the results are demonstrated in Table 2.

Table 2
Structural self-interaction matrix

Measure	Benefit side	Ratio of investment efficiency	Ratio of finance circulation	Average price of sold products	Size diversity	Design diversity	Market share	Official daily production of factory	Average quality degree	Number of design per moment	Number of size per moment	Type of main machinery technology in the factory
Learning hours ratio	V	V	O	V	V	V	V	V	V	V	V	A
Professional workforce ratio	V	V	O	V	V	V	V	V	V	V	V	X
Quality growth compared with last year	N	N	N	N	O	O	N	N	N	O	O	A
Type of main machinery technology in the factory	N	N	N	N	N	N	N	N	N	N	N	
Number of size per moment	N	N	O	N	N	O	N	N	O	O		
Number of design per moment	N	N	O	N	O	N	N	N	O			
Average quality degree	N	N	N	N	O	O	N	X				
Official daily production of factory	N	N	N	V	A	A	X					
Market share	N	N	N	A	A	A						
Design diversity	N	N	N	N	O							
Size diversity	N	N	N	N								
Average price of sold products	N	N	N									
Ratio of investment efficiency	N	N										

3.2 Reachability matrix

Reachability matrix is obtained from SSIM and indicates the relations among the variables as binary. Various relations shown by N, A, X and O symbols, previously used in SSIM, are shown by 0 and 1 in this matrix. The following rules are used to replace A, N, X and O in SSIM by 0 and 1 reachability matrix.

a) If *i, j* entrance in SSIM is V, it will be 1,0 in reachability matrix , and *j, i* entrance will be 0.
b) If *i, j* entrance in SSIM is A, it will be 0 in reachability matrix , and *j, i* entrance will be 1.
c) If *j, i* entrance in SSIM is X, both *i, j* and *j, i* entrance will be 1.
d) If *i, j* entrance in SSIM is O, both *i, j* and *j, i* entrance will be 0.

Of course there is an exception in this case which will be explained. The final reachability matrix is made by evaluating if the variables are transitive. Transition is a concept in SSIM Method that says if we have three elements in a way that the first leads to the second and the second leads to the third, the first will lead to the third with a mediator. Transition relation in reachability matrix is shown by 1*. It means if two variables *j* and *i* have transitive relation together, *1** is used to indicate this relation. It should be mentioned this symbol is O in SSIM.

The ultimate reachability matrix also specifies dependence power of each element. The driving power of a specific variable includes all variables which may help obtain them (including the variables itself). And dependence power includes all variables that can help obtain this specific variable (including the variable itself). The driving and dependence power can be used in MICMAC analysis in which variables are classified into four groups – driver or independent, autonomous, linkage, and dependent – which will be described. The reachability matrix for our under-study variables, regarding that they are transitive, is demonstrated in Table 3.

Table 3
The reachability matrix for research variables

Criteria	L3	L2	L1	P5	P4	P3	P2	P1	C4	C3	C2	C1	F3	F2	F1	driver power	Level
L3	1	1	1	0	1	1	1	1	1	1	1	1	1*	1	1	14	2
L2	0	1	1	1	1	1	1	1	1	1	1	1	1*	1	1	14	2
L1	0	0	1	0	0	0	1	1	1	0	0	1	1	1	1	8	3
P5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15	1
P4	0	0	0	0	1	0	0	1	1	0	1	1	1*	1	1	8	3
P3	0	0	0	0	0	1	0	1	1	1	0	1	1*	1	1	8	3
P2	0	0	0	0	0	0	1	1	1	0	0	1	1	1	1	7	4
P1	0	0	0	0	0	0	1	1	1	0	0	1	1	1	1	7	4
C4	0	0	0	0	0	0	0	1	1	0	0	0	1	1	1	5	5
C3	0	0	0	0	0	0	0	1	1	1	0	1	1	1	1	7	4
C2	0	0	0	0	0	0	0	1	1	0	1	1	1	1	1	7	4
C1	0	0	0	0	0	0	0	0	1	0	0	1	1	1	1	5	5
F3	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	3	6
F2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2	7
F1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2	7
Dependence power	2	3	4	2	4	4	6	11	12	5	5	11	13	15	15		
Level	9	8	7	9	7	7	5	4	3	6	6	4	2	1	1		

3.3 MICMAC analysis

Identifying and classifying key variables are essential for developing under-study systems. Comparing Hierarchy of variables in various classifications leads to having a rich resource of information. This does not determine the importance of specific variables on its own. However, it determines the specific variables which play an important role indirectly. This analysis helps investigate the domain of each variable. In this analysis under-study variables are classified in four groups. The first group shows the variables with weak motivating and dependency power. The second includes dependent variables with weak motivating but strong dependency power. The third group includes the relevant variables with strong motivating and dependency power. These variables are unstable because any change in them affects the others and also they themselves will be affected via feedback. The forth group represents independent variables with strong motivating but weak dependency power. This analysis and determination of each under-study variable's domain are shown in Fig. 1.

3.4 Leveling of reachability matrix

Sum of input and output for each variable is obtained from reachability matrix. Output collection for a specific variable includes the variable itself and other variables that may help obtain them. Input collection includes the variable itself and other variables that may help obtain the variable. Furthermore, partnerships are determined for these two collections and a variable which doesn't lead to another variable is put in high level of SSIM. After determining of high- level element, this variable is omitted from the list of remaining variables. This process continues until the levels of variables are determined.

Identifying the variables' levels helps make the diagraph and final model of ISM. The results of leveling of reachability matrix for under-study problem's variables are shown in Table 4.

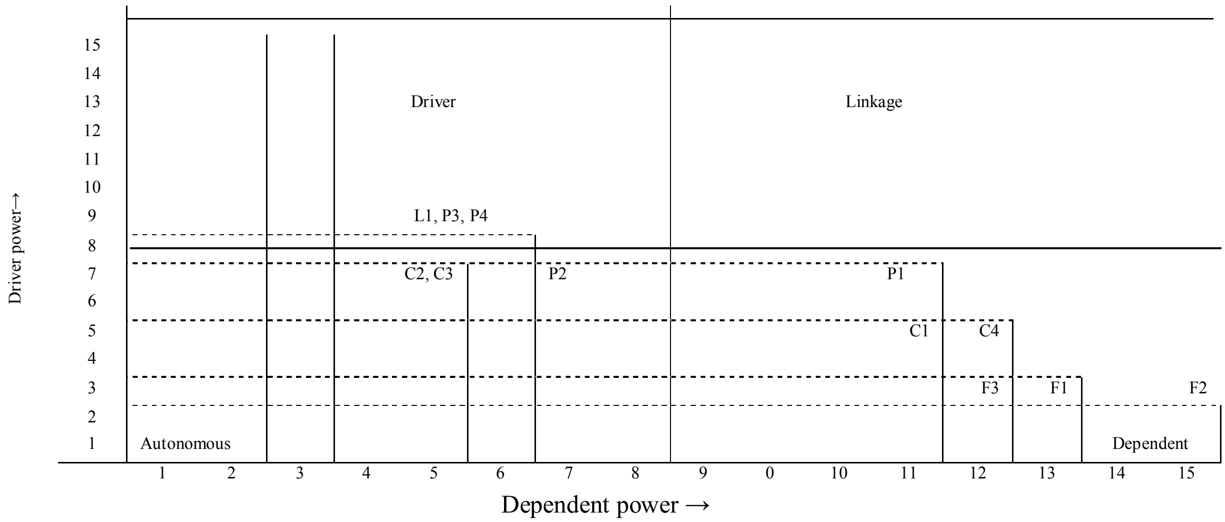

Fig. 1. Classification of research variables

Table 4
Leveling of reachability matrix

Criteria	Reachability set (output)	Antecedent set (input)	Intersection set	Level
L3	L3,L2, L1, p4 ,p3, p2 p1,C4,C3,C2,C1,f3,f2,f1	L3, P5	L3	6
L2	L2,L1, p5, p3, p2, p1, C4, C3,C2, C1, f3, f2, f1	L2,L3,p5	P5	6
L1	L1,p2,p1,C4,C1,f3,f2,f1	L1,L3,L2,p5	L1,	5
P5	P5,L3,L1,L2,p4,p3,p2 p1,C2,C1,C3,C4,f1,f2,f3	P5,L2	P5,L2	7
P4	P4,p1,c4,c2,c1,f3,f2,f1	P4,p5,L3,L2	P4,	5
P3	P3,p1,c4,c3,c1,f3,f2,f1	P3,L3,L2,p5	P3	5
P2	P2,p1,c4,c1,f3,f2,f1	P2,L3,L2,L1,p5,p1	P2,p1	4
P1	P1,p2,c4,c1,f3,f2,f1	P1p2,c4,c3,c2,L3,L2,L1,p4,p5,p3	P1,p2,c4	4
C4	C4,p1,f3,f2,f1	C4,L3,L2,L1,p5,p4,p3,p2,p1,c3,c2	C4,p1	3
C3	C3,p1,c4,f1,f2,f3	C3,L3,L2,p5,p3	C3	4
C2	C1,p1,c4,c1,f3,f2,f1	C2,L3,L2,p5,p4	C2	4
C1	C1,c4,f3,f2,f1	C1,L3,L2,L1,p5,p4,p3,p2,p1,c4,c3,c2,c1	C1,	3
F3	F3,f2,f1	F3,L3,L2,L1,p5,p4,p3,p2,p1,c4,c3,c2,c1	F3	2
F2	F2,f1	F2,f1,L3,L2,L1,p5,p4,p3,p2,p1,c4,c3c2c1	F2,f1	1
F1	F1,f2	F1,f2,L3,L2,L1,p5,p4,p3,p2p1c4c3c2c1f3	F1,f2	1

3.5 Construction of final model on basis of ISM (diagraph)

The constructive model is created based on reachability matrix and its leveling. Here, the conceptual relations of reachability matrix transition should be omitted. To do this, interactive relations of former and latter measures are drawn on level basis. Cause-and-effect relations for under-study variables are drawn in seven levels in Fig. 2.

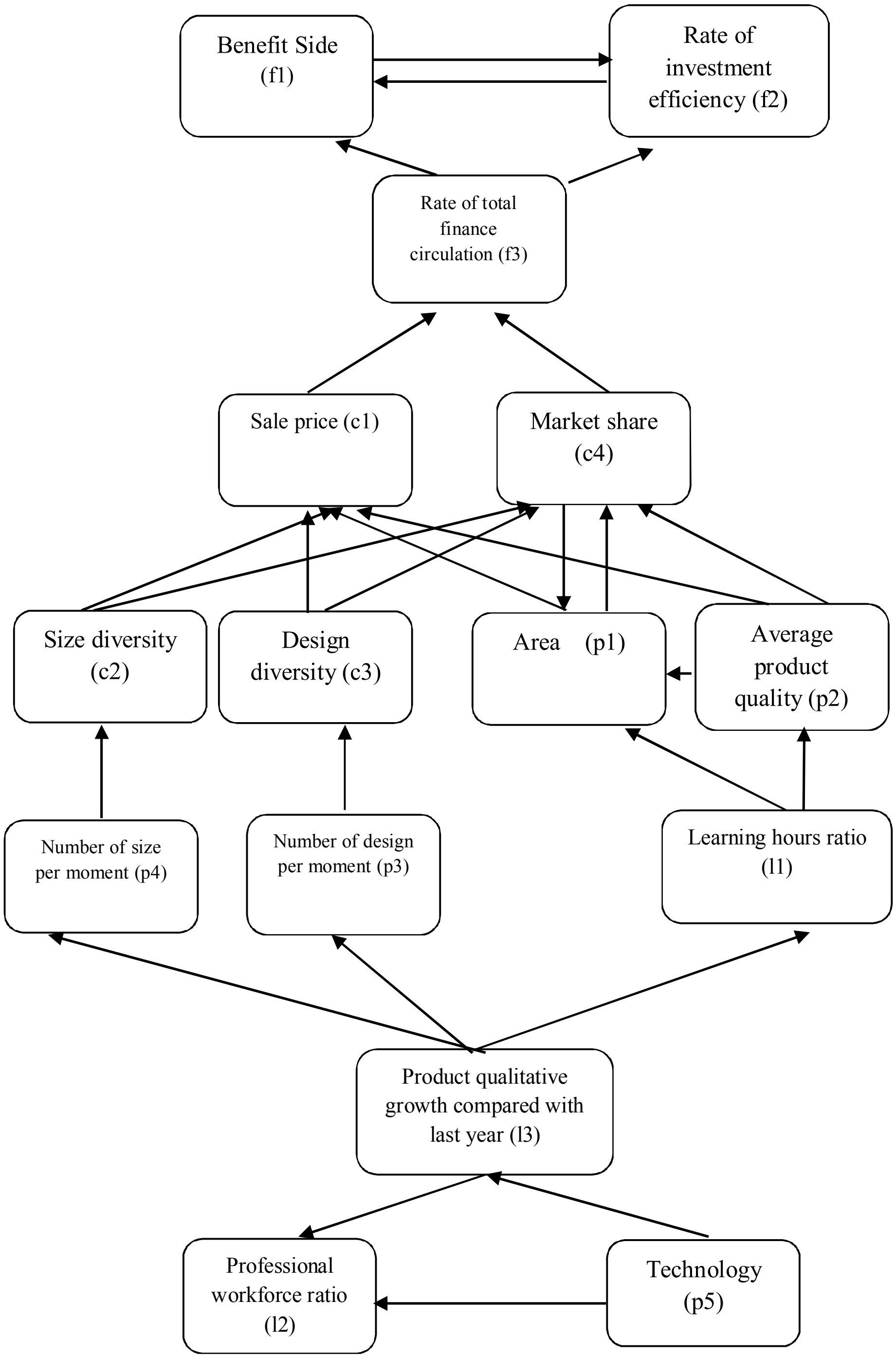

Fig. 2. Leveled diagraph of function assessment measures in tile and ceramic industry

To draw the strategy plan of tile and ceramic industry in four perspectives of BSC, relations of measures in these four perspectives are classified again in the frame of Fig. 3.

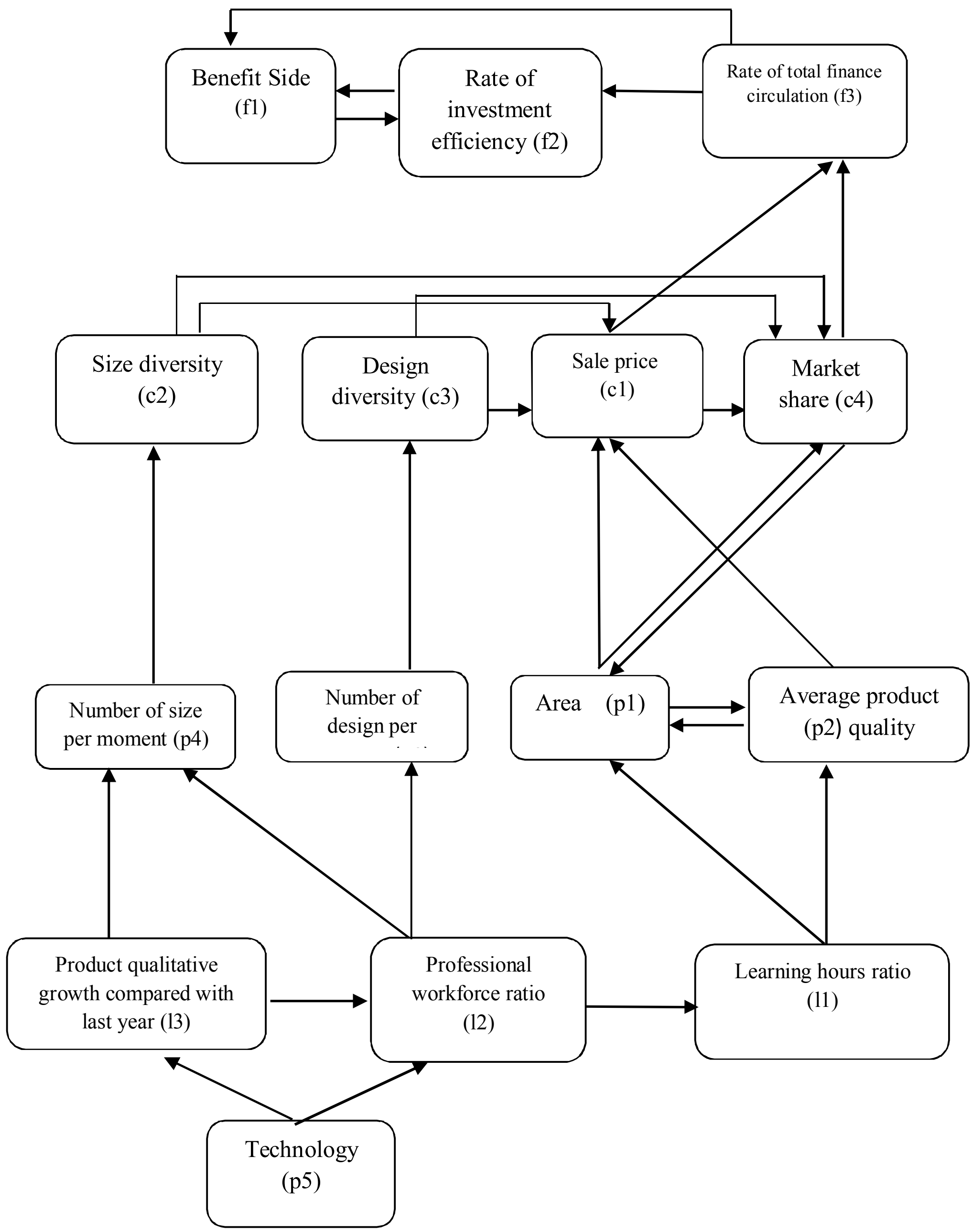

Fig. 3. Strategy plan of tile and ceramic industry in four perspectives of BSC Model

4. Conclusion

Determining evaluating measures of function has a basic role in controlling and directing the organization toward development. Using descriptive structural modeling helps the managers to identify the main measures and their interactions. This study is an analysis about determining evaluating measures of tile and ceramic industry function and specifying their interactions based on descriptive structural modeling. This specifies these measures efficiently and effectively and omits the complexity of ambiguities among measure relations simply.

In this research, the relations between fifteen evaluating measures of tile and ceramic functions are specified by using ISM model. Then the strategy plan of these measures was provided in four perspectives of BSC. Drawing the logical relations among measures in four perspectives of BSC specifies the strategic paths for the organization to achieve the aims. As the tile and ceramic is a beneficial one, profitability is the ultimate aim. The final measures of side benefit and the rate of investment efficiency in financial perspective are in the peak of the plan. These two measures have the same level and mutual relation. The strategy plan shows the managers the direction of achieving profitability. So, to improve the measured for higher levels, the ones for lower levels should be considered.

According to the accomplished research the measure for machinery technology is the most fundamental one in this industry. The producing system of most of the factories in tile and ceramic industry is a continuous system. The efficiency of these producing systems depends intensively on the type of used technology in machineries. As it is represented in figure 3, this measure appears as the most fundamental one in learning and growth dimension. The higher the technology of the factory is, the more direct effects it has on the educational hours and professional work force. These three measures have strong motivating power. As a result, the managers of tile industry should consider the constant Promotion of these three measures to achieve continuous improvement.

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