Chapter 20
Hierarchical Relationship Models of Strategic Crystal Elements of Telecom Service Business in India: An Empirical Validation

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Abstract Many strategy management thinkers and authors believe that continuity aspects of the organization have to be kept in mind while bringing in desirable strategic change. The telecommunication service sector, being a capital intensive sector, possesses a heavy continuity flywheel. At the same time, the sector is also subjected to high intensity change forces such as intense competition, rapidly changing technologies, consumer needs/expectations and shifting loyalties. Strategic outcome factors, namely enterprise factors and customer factors and forces of continuity and change constitute the four elements of flowing stream strategy crystal. Strategy formulation and recommendations can be made on the basis of intra- and interrelationships among these crystal elements. Total Interpretive Structural Modelling (TISM) of the strategic crystal elements gives the interpretation as well as the hierarchical relationships amongst the elements of the crystal. Empirical validation of these hierarchical relationships gives the predictive power of elements of crystal along with the directional relationships among the crystal elements. This chapter deals with empirical validation of these hierarchical relationships among strategic crystal elements of telecom service business in India. These validated hierarchies of strategic crystal elements not only provide the intrarelationships of various factors and forces but also the predictive power of relationship elements. Thus, the validated TISM helps in strategy development in this fast changing industry. This chapter concludes with recommendations on the basis of validated hierarchical relationships of strategic crystal elements.

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20.1 Introduction

Continuity aspects of the organization need to be kept in mind while bringing in desirable strategic change (Volberda 1998; Gioia 1998; Christensen and Cheney 2000; Leana and Barry 2000). Flowing stream strategy framework provides a flexible approach in managing the forces of continuity and change side by side (Sushil 2012a, b, 2013) for better organization results. Strategic outcome factors, namely enterprise factors and customer factors and forces of continuity and change constitute the four elements of flowing stream strategy crystal. Strategy formulation and recommendations can be made on the basis of intra- and interrelationships among these crystal elements. Total Interpretive Structural Modelling (TISM) of the strategic crystal elements gives the interpretation as well as the hierarchical relationships amongst the elements of the crystal (Sushil 2012c). This chapter arrives at the hierarchical relationships model, akin to TISM of the strategic crystal element variables. Thus, the process also leads to the empirical validation of the qualitative TISM of strategic crystal elements of telecom service business in India. Empirical validation of hierarchical relationship models of strategic crystal elements clarifies as to which of the intra-relationships of strategic crystal elements are important from strategy formation point of view. These validated relationships help in strategy development in this fast changing industry. This chapter, thus, helps in determining the relative importance of various strategic crystal elements and intrarelationships therein. This chapter concludes with recommendations on the basis of the validated hierarchical relationship models of strategic crystal elements.

20.2 Literature Review

Interpretive structural modelling (ISM) was created by Warfield (1973, 1974) which gave a powerful methodology for structuring complex issues. ISM gives a process by which a poorly understood system and loosely articulated mental models can be represented clearly by sets of elements and directional relationships. Though these ISM identified relationships are of great value in dealing effectively with the system and better decision-making, yet they lack an interpretation of the embedded object or the directional representation system. An interpretive structural model known as Total Interpretive Structural Modelling (TISM), however, gives the interpretation as well as the contextual relationships amongst the elements of structural model (Sushil 2012c, 2015). TISM, going beyond the ISM model which not only tells about 'how' various elements are interrelated, but also, tells us 'why' they interact in a particular manner as well. Total Interpretive Structural Modelling (TISM), therefore is an innovated form of Interpretive Structural Modelling (ISM); it has been used in this study for determining the hierarchical relationships among the crystal element variables. Qualitative TISM for strategic crystal elements were made (Khare 2014) through an expert survey by taking majority 'yes' responses and their interpretations, drawing up the resultant reachability matrix, and taking iteration steps.

This chapter is about arriving at validated hierarchical models of strategic crystal elements of Telecom Service Business in India. This is done through empirical survey and regression analysis. The next section gives in brief the various sub-elements/variables of flowing stream strategy crystal of telecom service business.

20.3 Strategic Crystal Elements of Telecom Service Business

These have been identified from the literature and verified (Khare 2012). These strategic crystal elements have been grouped in as continuity forces, change forces, enterprise factors and customer factors.

20.3.1 Continuity Forces

The continuity forces in the context of organizations refer to those factors, which contribute to inertia, or desire for sameness and stability. These forces, which provide continuity to an organization, differ from sector to sector. Following continuity forces of telecom service provision business have been identified and verified.

Existing Infrastructure The telecom companies have asset base consisting of cable ducts, buried copper cable, telephone exchanges, underground optical fiber transmission cables and equipment, microwave towers, satellite ground stations, submarine cables and cable landing stations and so on. All these constitute a heavy continuity flywheel.

Current Customer Base Telecom operators have varying customer base depending on their market share.

Core Competencies A company needs to develop core competencies relevant for the business. It also needs to keep in mind that it does not hive off a part of business, the core competency of which is crucial for remaining business.

Organization's Structure, System, Processes and People These are important organizational elements, which play an important role in devising developmental and growth strategies.

Expertise in Existing Technology The organizations want to exploit fully the existing technology before moving on to a new technology.

Organization Culture Organization culture plays a crucial role in shaping employee behaviour in it. Culture change needs to be managed in a gradual manner by a continuous process of learning and developing.

Company's Ownership Aspect There are varied ways in which companies are owned. Some are privately owned, some are owned by governments and some are widely held by global corporations.

20.3.2 Change Forces

Telecom service business is subject to many change forces. These are due to rapidly changing technology, globalization and convergence of voice, data and video. Following change forces of telecom service business have been identified and verified.

Competition Competitors are instrumental in forcing companies to change their marketing strategies, come up with innovative plans and offerings, lower their price and improve their brand image.

Emerging New Technologies Telecom sector is known for its fast changing technologies and it has impacted telecom service business greatly.

Governmental and Regulatory Telecom Policies Deregulation and subsequent policy changes by governments in their telecom markets have affected the telecom businesses in most of countries.

Globalization The telecom companies of the developed world have participated in big way in the growth of telecom business in developing countries.

Changing Customer Needs The customers, because of availability of alternate service, have become very demanding. Their needs are changing continuously.

Mergers and Acquisitions Intense competition in the sector has created a natural requirement of consolidation among the companies.

e-Business Processes All companies need to automate their processes to gain competitive advantage in the marketplace. An effective online e-Business capability across the company business operations (billing, provisioning, sales and service, planning, procurement, etc.) helps in reducing costs and enhancing revenue growth.

20.3.3 Enterprise Factors

The management of a company is answerable to its shareholders. There are certain parameters which any management monitors to check the health of the company. These enterprise factors (strategic in nature) are important to the management as they determine shareholder's value. Following enterprise factors of telecom service provision business have been identified and verified:

Market Share This parameter reveals the company's relative strength in the market relative to the competitors.

Customer Satisfaction The customer, generally, has certain standards/expectation of service quality associated with the service, which he compares with actual service delivered.

Average Revenue per Unit (ARPU) ARPU means the earning of the operator per subscriber per month.

Earnings before Interest, Tax, Depreciation and Amortization (EBITDA) EBITDA is a measure of a company's operating profitability. If a company has higher EBITDA, it indicates that the company's operations are more profitable compared to its competitors.

Compounded Annual Growth Rate (CAGR) CAGR is a compounded rate of growth of a number (say investment) over several years. CAGR (in the context of telecom service industry) is used as an index to indicate as to how a particular service provider is performing vis-à-vis industry or its competitors.

Network Rollout and Product/Services Innovation Speed Speed of network rollout determines as to how fast the operator can tap its potential customers.

Productivity per Employee Employees of a company constitute a major input cost of a telecom operator. At the same time these very employees generate the revenues. Their talent, motivation level, and commitment to the company are very important for its profitability and survival in the market.

20.3.4 Customer Factors

It is now well-accepted proposition that customer is the king in the marketplace. The companies, which can conquer the heart and mind of its customers, will end up as winners. Following customer factors of telecom service business have been identified and verified:

Product Price Price is one of the important factors on which customer relies while choosing a service provider.

Quality of Telecom Service The customers get highly annoyed if the service quality of the provider is not good. The customers think about changing their service provider and often do, if the companies do not pay attention to their quality parameters.

Product/Rate Plan Innovation It is important for the service provider to bring out new rate plans and innovative products on a regular basis. This way the provider positions itself as being different from others.

Brand Image of the Operator Consumer has become very much brand conscious. The brand image of an operator communicates to the customer as to what value he can expect from the brand.

20.4 TISM of Strategic Crystal Elements

TISM can be formed by following some steps, namely, defining the contextual relationships and interpretation of microvariable of a particular strategic crystal element, pairwise comparison of microvariables by a group of domain experts

(to obtain interpretive logic knowledge base of each paired relation), drawing up of the reachability matrix and doing level partition. The graphical representation of the interpretive relationships in the form of a Total Interpretive Structural Model (TISM) for telecom service business in India (Sushil 2013; Khare 2014; Khare et al. 2014) is, thereafter arrived at (Appendix). This is done by deploying a survey questionnaire which is developed using the theoretical backdrop of TISM. This questionnaire is distributed among senior telecom executives of various telecom operating companies in India and responses obtained. The interaction matrix giving significant relationship interpretations is arrived at based on significant responses. Several iteration steps on the relationship matrix lead to level partition and draw up the TISM of strategic crystal elements (Figs. 20.5, 20.6, 20.7, and 20.8 in Appendix). Authors have drawn TISM for other domains such as education (Prasad and Suri 2011), e-Governance (Nasim 2011) and performance management (Yadav and Sushil 2014) deploying similar methodology.

20.5 Empirical Validation of Hierarchical Relationships of Strategic Crystal Elements

As stated earlier, qualitative TISMs (Appendix) have been developed on the basis of a survey conducted among senior executives of Telecom sector. This had led to a qualitative relationship model, providing a hierarchy of variables along with the interpretation of cause and effect reasoning of the relationships. The TISM has been carried out for four sets of variables of respective strategic crystal, namely continuity forces, change forces, enterprise factors and customer factors. This exercise had categorized the variables of the respective strategic crystal elements into different levels depending on their driving power. Stepwise regression analysis has been conducted in the following sections to determine the relationships among the variables of a particular element of forces and factors. While the qualitative TISM has determined the cause and effect relationships along with the interpretation, the regression analysis will determine the predicting power of variables of these relationships.

20.5.1 Validated Model for Interrelationships Among Microvariables of Continuity Forces

The customer base was noted to be the most dependent of the continuity forces in the qualitative TISM. Taking customer base as the dependent variable and all other continuity forces as independent variables, stepwise regression analysis has been carried out. Based on this framework, the hierarchical relationship among the continuity factors has been determined and depicted in Fig. 20.1. The beta values of the predictor relationships have been stated along with directional relationship
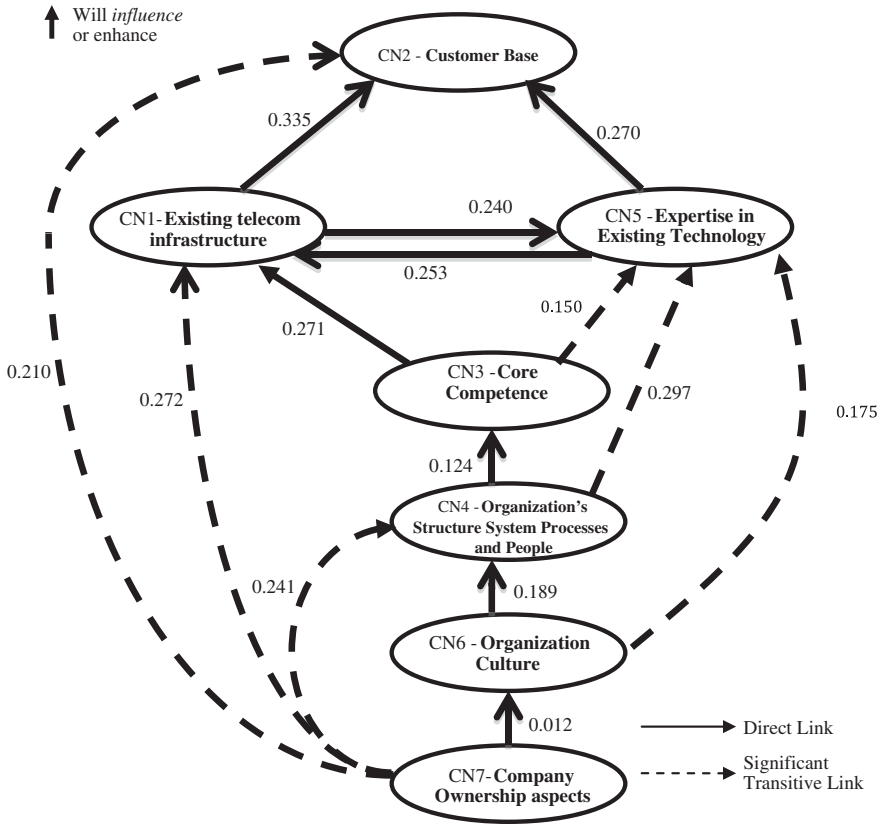
Fig. 20.1 Empirically validated hierarchical relationship model of continuity forces of telecom service sector

arrows. The dependent variables at different hierarchical stages, the predictor independent variables and the final R-square prediction values have been presented in Table 20.1. It is revealing to note that this hierarchical interrelationship diagram closely resembles the qualitative TISM for continuity forces (Fig. 20.5 in Appendix).

20.5.1.1 Discussion on Validated Hierarchical Relationship Model of Continuity Forces

It is observed that the customer base, existing telecom infrastructure and company organization structure, system and processes are affected relatively more strongly by company ownership aspect compared to organization culture. Company's organization culture affects organization structure, system and processes of the company, which in turn affects company's core competence directly, and its

Table 20.1 Predictor variables hierarchy of continuity forces microvariables and TISM verification

Sr. No.	Dependent variable	Predictor variables	Final R square
1	CN2—Customer base	CN5, CN7, CN1	0.250
2	CN1—Existing telecom infrastructure	CN5, CN7, CN3	0.186
3	CN5—Expertise in existing technology	CN4, CN1, CN6, CN3	0.183
4	CN3—Core competence	CN4	0.226
5	CN4—Organization's structure system processes and people	CN7, CN6	0.095
6	CN6—Organization culture	CN7	0.000
7	CN7—Company ownership aspects		

expertise in existing technology in transitive manner. Expertise in existing technology and existing telecom infrastructure almost equally affect each other. Customer base is relatively affected more strongly by existing telecom infrastructure compared to expertise in existing technology. The companies need to pay attention to company ownership aspect, organization culture, its structure, system and processes and its core competence as these elements drive the customer base which is directly related to company revenues.

20.5.2 Validated Model for Interrelationships Among Microvariables of Change Forces

Similar to the continuity forces, stepwise regression analysis has been carried out for the change forces in this section. The e-Business process was noted to be the most dependent of the change forces in the qualitative TISM analysis. Therefore, stepwise regression analysis, taking e-Business processes as the dependent variable and all other change forces as independent variables has been carried out. This analysis led to the hierarchical relationship among the change forces (depicted in Fig. 20.2). The beta values of the predictor relationships have been stated along with directional relationship arrows. The dependent variables at different hierarchical stages, the predictor independent variables of that stage and the final R-square prediction values have been presented in Table 20.2. It has been observed that this interrelationship diagram resembles, to a marked extent, with the TISM for change forces as determined earlier (Fig. 20.6 in Appendix). It is important to note that 'e-Business processes' and 'Mergers and Acquisitions' do not seem to have a relationship path.
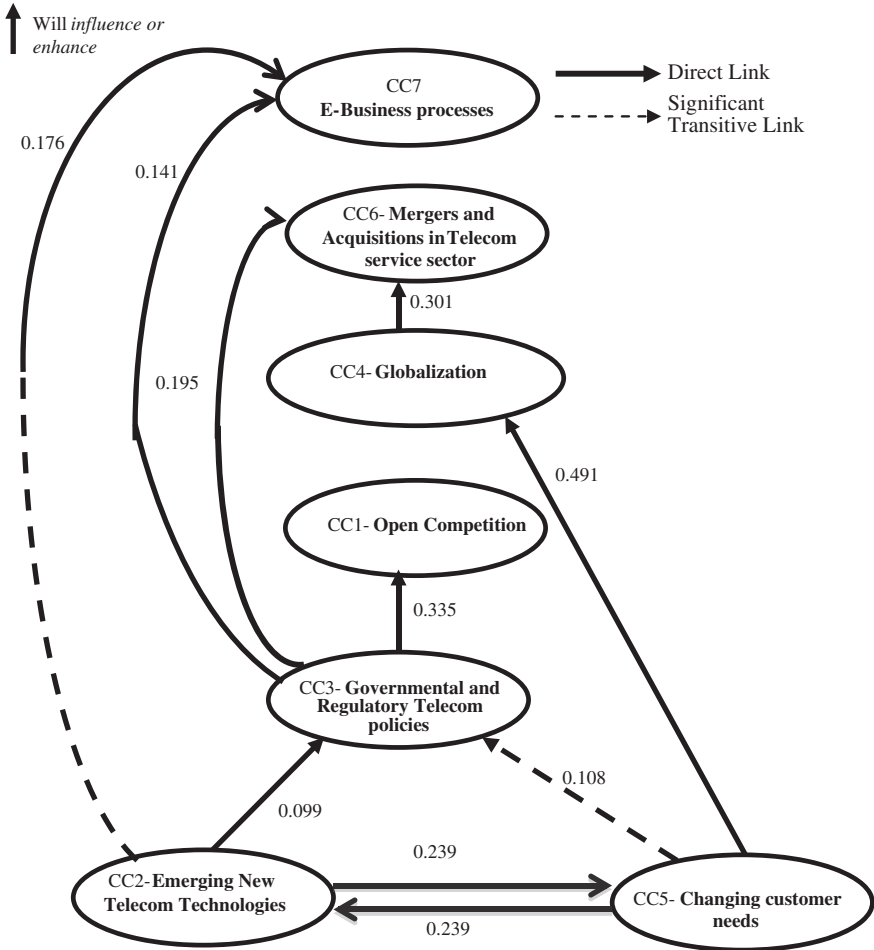
Fig. 20.2 Empirically validated hierarchical relationship model for change forces of telecom service sector

20.5.2.1 Discussion on Empirically Validated Hierarchical Relationship Model of Change Forces

It is observed that emerging new technologies and changing customer needs are two change forces, which are driving the other change forces. These change forces are also affecting each other equally. Governmental and regulatory telecom policies are affected more by changing customer needs compared to emerging new telecom technologies. The regulator, it seems, is influenced more by customer needs. Governmental and regulatory telecom policies also drive open competition quite strongly. e-Business processes; mergers and acquisitions and globalization are the

Table 20.2 Predictor variables hierarchy of change forces microvariables and TISM verification

Sr. No.	Dependent variable	Predictor variables	Final R square
1	CC7—e-Business processes	CC2, CC3	0.250
2	CC6—Mergers and acquisitions in telecom service sector	CC4, CC1	0.131
3	CC4—Globalization	CC5	0.241
4	CC1—Open competition	CC3	0.035
5	CC3—Governmental and regulatory telecom policies	CC5, CC2	0.027
6	CC2—Emerging new telecom technologies	CC5	0.057
7	CC5—Changing customer needs	CC2	0.057

most driven change forces. The company managements must be sensitive about the change forces which are at bottom half of TISM diagram, especially those which might be having high impact.

20.5.3 Validated Model for Interrelationships Among Microelements of Enterprise Factors

Similar to the stepwise regression analysis for the continuity and change forces, it has also been carried out in the context of the enterprise factors. The Compounded Annual Growth Rate (CAGR) has been observed to be the most dependent of the enterprise factors in the qualitative TISM analysis. Taking CAGR as the dependent variable and all other enterprise factors as independent variables, stepwise regression analysis has been conducted. Based on this procedure, the hierarchical relationship among the enterprise factors has been determined and depicted in Fig. 20.3. The beta values of the predictor relationships have been stated along with directional relationship arrows. The dependent variables at different hierarchical stages, the prediction independent variables of that stage and the final R-square prediction values have been shown in Table 20.3. Like other findings, this interrelationship diagram, by and large, resembles with the qualitative TISM for enterprise factors as determined earlier (Fig. 20.7 in Appendix). The analysis has been helpful in identifying the transitive relationships among the hierarchical factors.

20.5.3.1 Discussion on Empirically Validated Hierarchical Relationship Model of Enterprise Factors

It is observed that productivity per employee is the most important enterprise factor and it influences all other enterprise factors. However, it affects network rollout speed more strongly compared to other enterprise factors. The companies need to
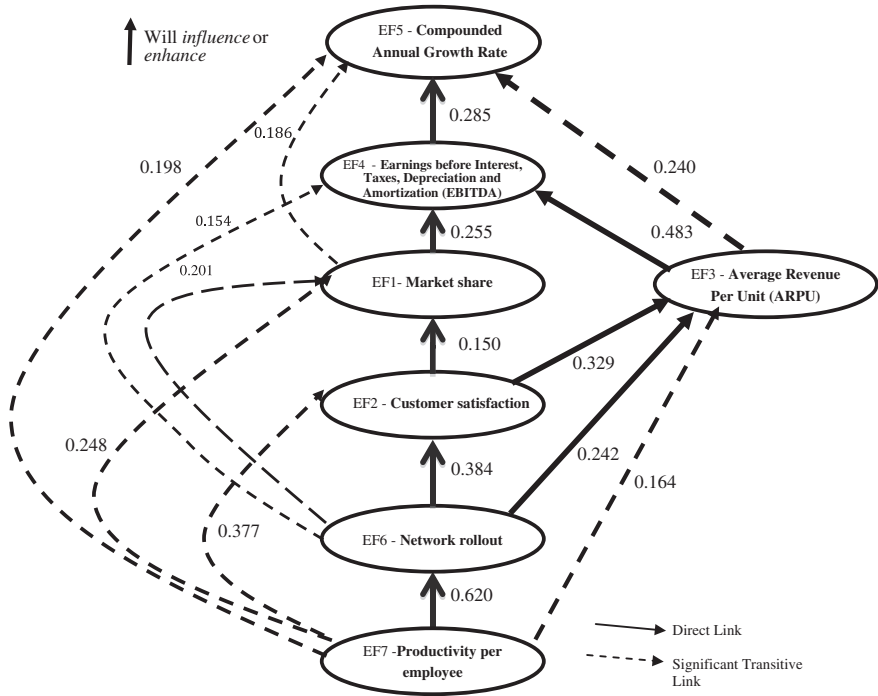
Fig. 20.3 Empirically validated hierarchical relationship model for enterprise factors of telecom service sector

Table 20.3 Predictor variables hierarchy of enterprise factor microvariables and TISM verification

Sr. No.	Dependent variable	Predictor variables	Final R square
1	EF5—Compounded annual growth rate (CAGR)	EF4, EF1, EF7, EF3	0.593
2	EF4—Earnings before Interest, Taxes, Depreciation and Amortization (EBITDA)	EF3, EF1, EF6	0.606
3	EF1—Market share	EF7, EF2, EF6	0.373
4	EF3—Average revenue per unit (ARPU)	EF2, EF6, EF7	0.408
5	EF2—Customer satisfaction	EF6, EF7	0.469
6	EF6—Network rollout speed	EF7	0.384
7	EF7—Productivity per employee		

really study as to what motivates employees to work hard and be highly productive. Network rollout speed is the second most important enterprise factor which leads to higher customer satisfaction. It is also observed that network rollout speed and customer satisfaction influence average revenue per unit (ARPU) leading to higher overall revenue. From the TISM diagram, it is also seen that compounded annual growth rate and EBITDA are the most dependent enterprise factors. The important enterprize factors which emerge from the above validated relationship diagram are productivity per employee, network rollout speed, and customer satisfaction.

20.5.4 Validated Model for Interrelationships Among Microelements of Customer Factors

Stepwise regression analysis related to the customer factors constitutes the subject matter of this section. The Product Price and the Brand Image were noted to be the most dependent of the customer factors at the same level in the TISM analysis. Taking first, the Product Price as the dependent variable and all other customer factors including Brand Image as independent variables, stepwise regression analysis has been conducted. Thereafter, in stepwise regression analysis, the Brand Image was taken as the dependent variable and all other customer factors including Product Price as independent variables. Based on the results, the hierarchical relationships among the customer factors have been determined and depicted in Fig. 20.4. The beta values of the predictor relationships have been provided along with directional relationship arrows. The dependent variables at different hierarchical stages, the predictor independent variables of that stage and the final R-square prediction values have been shown in Table 20.4. It is a matter of satisfaction to note that this interrelationship diagram resembles quite closely with the TISM for customer factors as determined earlier (Fig. 20.8 in Appendix).

20.5.4.1 Discussion on Empirically Validated Hierarchical Relationship Model of Customer Factors

From the TISM of customer factors, it is seen that the company's ability to bring out innovative products and rate plans is the most influential customer factor affecting quality of telecom service directly and its brand image transitively. The quality of telecom service is another customer factor, which is second most important factor after the company's ability to bring out innovative products, and rate plans. Company's brand image and its product price affect one another almost in equal manner. These two customer factors are most dependent customer factors and are directly influenced by quality of telecom service.

20.6 Overall Findings and Interpretations

Validated hierarchical relationship models have been brought out as a result of this exercise. The cause and effect interpretations provided by qualitative TISM are further enhanced by the validated model. Thus, this exercise provides key insights into not only how the microvariables are related to each other and why one leads to another, but also which variables have relatively higher predictive power. The findings of this chapter are summarized as follows:
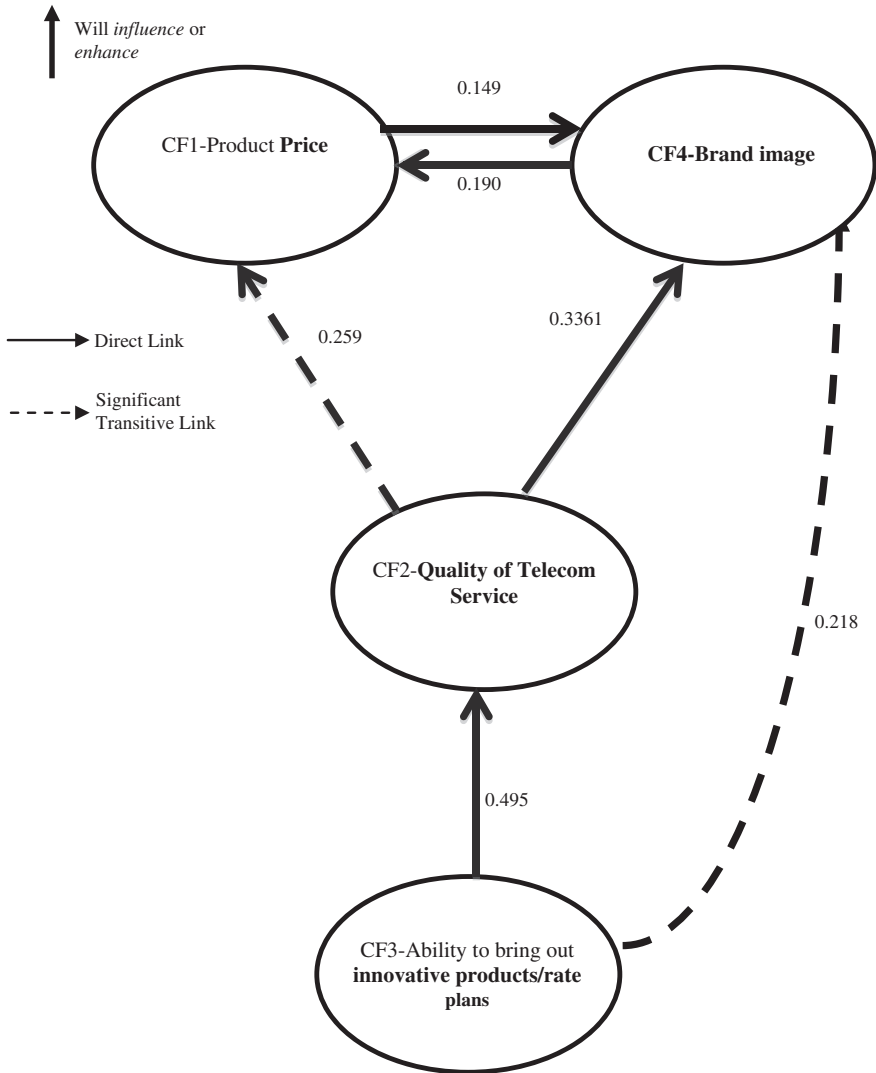
Fig. 20.4 Empirically validated hierarchical relationship model for customer factors of telecom service sector

Table 20.4 Predictor variables hierarchy of customer factor microvariables and TISM verification

Sr. No.	Dependent variable	Predictor variables	Final R square
1	CF1—Product price	CF2, CF4	0.152
2	CF4—Brand image	CF2, CF3, CF1	0.305
3	CF2—Quality of telecom service	CF3	0.246
4	CF3—Ability to bring out innovative products/rate plans		

i. Company ownership aspect affects customer base, existing telecom infrastructure and company organization structure, system and processes relatively more strongly compared to organization culture.

ii. Existing telecom infrastructure necessitates the companies to have expertise in existing technology. Expertise in existing technology leads companies to continue with the existing telecom infrastructure.

iii. Company ownership aspect, existing telecom infrastructure and company organization structure, system and processes are most important predictors of customer base.

iv. Emerging new technologies and changing customer needs are predictors of each other in almost equal measure.

v. Governmental and regulatory telecom policies have fairly big influence on open competition in the sector.

vi. Productivity per employee is the most important predictor of almost all other enterprise factors.

vii. Network rollout speed is the second most important predictor of enterprise factors such as customer satisfaction and average revenue per unit (ARPU) which all lead to higher overall revenue.

viii. 'Innovative Product/Rate Plan' predicts in a significant manner the 'Quality of Service', which in turn predicts both 'Product Price' and the 'Brand Image.

ix. 'Product Price' and 'Brand Image' predict each other.

20.7 Conclusion

TISM serves as an important tool to understand the relative strength of elements of strategic crystal in a hierarchy. The qualitative TISM gives the hierarchic relationship along with interpretations of the relationships. The empirical validation gives the magnitude of relationship quotient in the form of beta factor. Since the qualitative TISM resembles the validated relationship models, the resulting validated model with interpretations help in drawing up strategic recommendations for the sector.

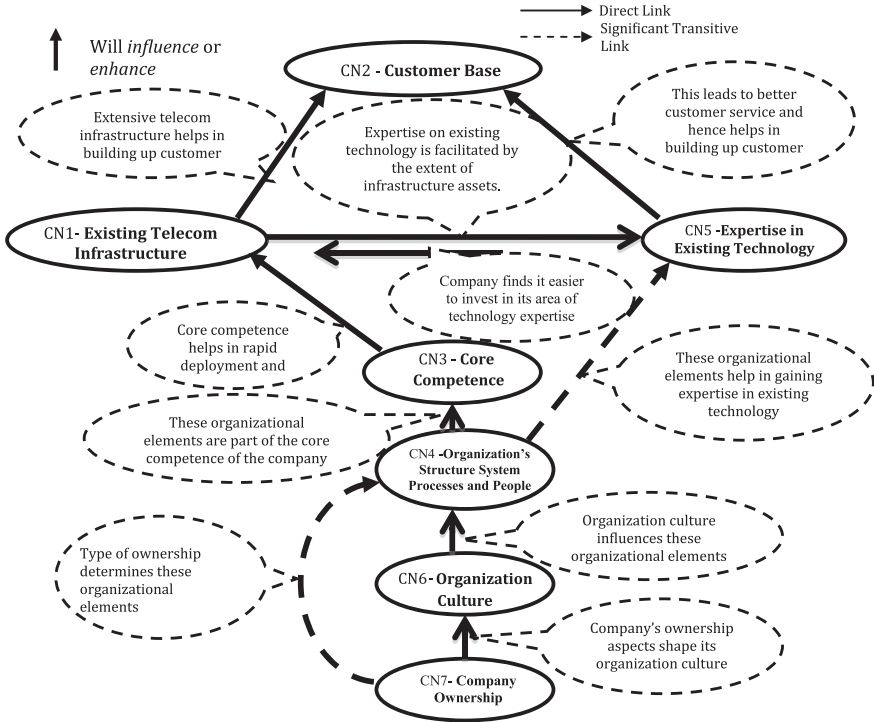## Appendix

See Figs. 20.5, 20.6, 20.7, and 20.8.

Fig. 20.5 Total interpretive structural modelling (TISM) for *continuity forces* of telecom service sector

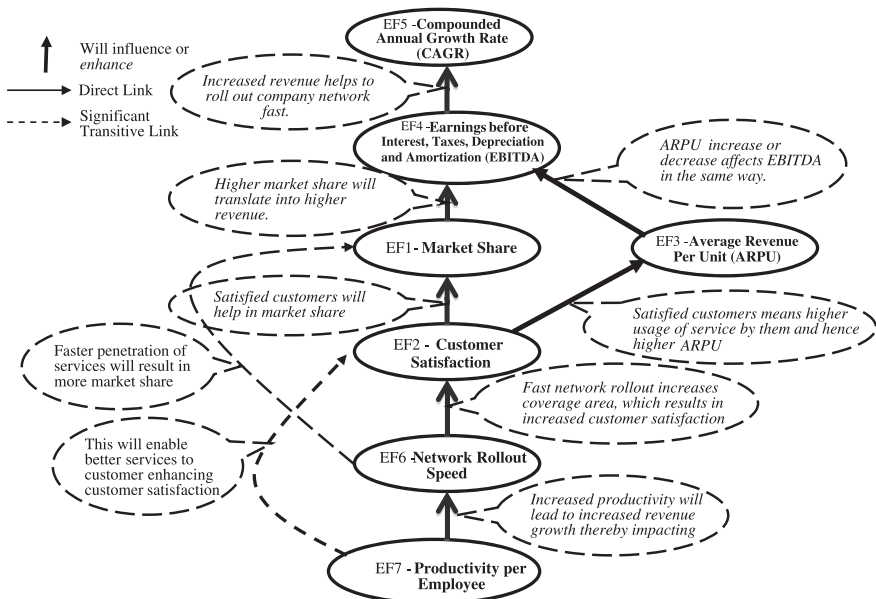**Fig. 20.6** Total interpretive structural modelling (TISM) for *change forces* of telecom service sector

Fig. 20.7 Total interpretive structural modelling (TISM) for strategic *enterprise factors* of telecom service sector
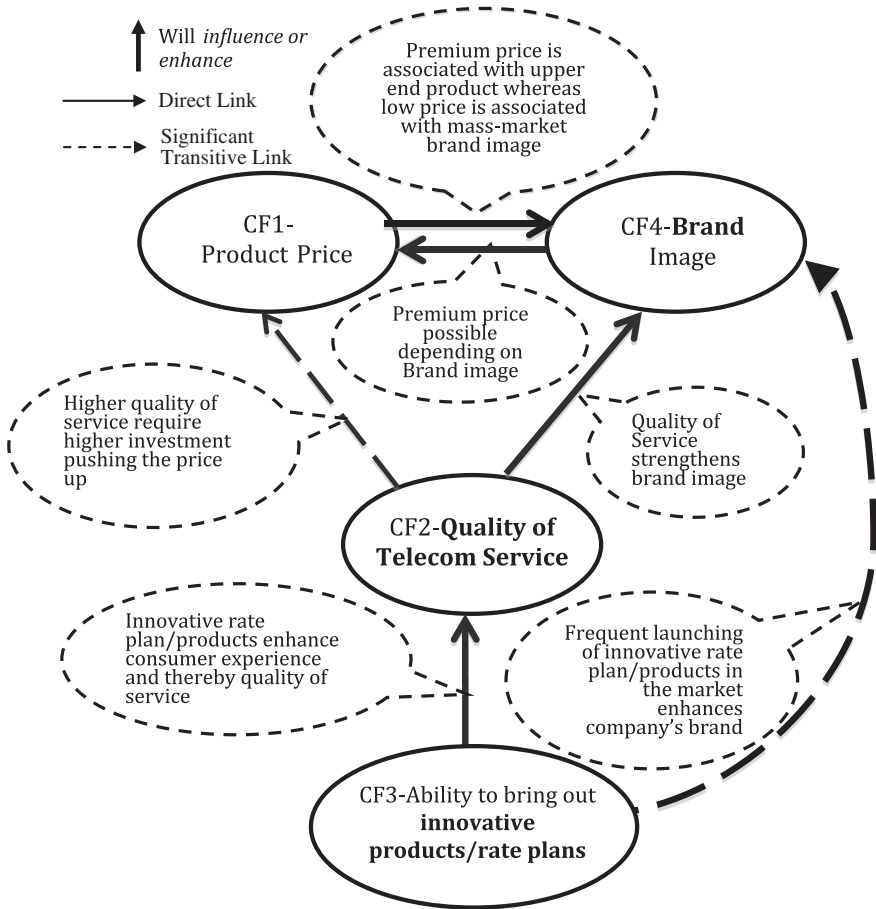
Fig. 20.8 Total Interpretive structural modelling (TISM) for strategic *customer factors* of telecom service sector

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