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The Indore Management Journal (IMJ) is a biannual journal published by the Indian Institute of Management Indore, with an objective to provide a diverse perspective on management functionalities to its readers as well as a medium to share experiences, knowledge and practices with the wider community. IMJ publishes empirical and theoretical investigations that enhance the understanding of various phenomena related to Business and Management. The journal is structured to include one general and one special issue every year. We welcome proposals for special issues of IMJ from potential guest editors. Please share your suggestions with us.

Editorial

We thank our readers for their support and encouragement. We are happy to inform you that the new advisory committee has been constituted to improve the content of Indore Management journal (IMJ). Taking some of your views, we have revised the content and structure of IMJ. The IMJ will be published twice a year and will be focused on management issues based on research work.

The present issue carries nine articles across multiple disciplines. The first article explores the challenges faced by the marketers while selling safe water in rural areas, which faces severe problems in terms of availability of safe drinking water. Based on a case study, the article proposes solutions to penetrate the rural market. The second article explores the impact of expertise and trustworthiness of celebrity endorsers on consumer attitude towards products. On the basis of an empirical study it argues that the above impact depends on whether the product is a high value or a low value item. The third article explicates the predictors of consumer's attitude towards online advertisement. In addition, it explains the role played by advertising value. Innovation is argued to be critical for sustaining competitive advantage. Based on the literature, the fourth article proposes the linkages among different leadership styles on organizational innovation. The fifth article is based on a study in Indian banking sector. It examines the comparative accuracy and explanatory performance of five important valuation models and proposes the suitability of these valuation models in the Indian context. The sixth article highlights the importance of packaging and demonstrates how the various aspects of packaging explains significant variance in chocolate purchase decisions. The seventh article reviews the models used to measure efficiency of a firm and highlight the recent developments in stochastic frontier model. The eighth article introduces the concept of dealer-supplier identification and provides a conceptual framework for greater selling efforts from the dealers. The last article highlights the importance of private standard setting in Intellectual Property management. It discusses the role of competition authorities in standard setting process and suggests an approach suitable in Indian context.

Editorial Team
Indore Management Journal (IMJ)

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Market Based Solutions to Safe Drinking Water: Approaches and Constraints

Saripalli Bhavani Shankar

Abstract

Universal access to safe drinking water still remains a goal to be achieved in India. In spite of huge spending on development of water infrastructure, we have not been able to arrest the spread of water borne diseases. The constraints faced by the state Governments in supplying safe drinking water to their citizens and ever increasing demand for drinking water is paving the way for private players. Rural India with the concentration of a large percentage of population and limited infrastructure faces serious problems in terms of availability of safe drinking water.

In this scenario, low cost water purifiers produced by companies are making their inroads into villages either through regular channels or through non-government organisations. Further, some companies are setting up their own foundations, which propagate business models, selling safe drinking water profitably. This article looks into such market based solutions and analyses their strengths and weaknesses. It elaborates on the challenges faced by marketers, while selling water purifiers or safe water to large number of rural consumers. Finally, it suggests that marketers need to sell the concept of safe water, change the behaviour of consumers, and focus on products or services which are acceptable, affordable, and available continuously.

1. Introduction

Water is intricately connected with the cultural fabric of India having both economic and social connotations (UNICEF[1] , 2013). Indian Government has been stepping up measures to provide potable drinking water to its citizens. In line with this, census 2001 and 2011 data (see Table 1) suggests that people are shifting away from contamination prone open source of water such as well, to safer means such as tap, hand pump, or tube well. This may help in achieving water safety for the larger population. Similarly, data reveals (see Table 2) that 2.6 percent of the rural households travel longer distances to access water, whereas for the rest, the source of water has shifted to their premises (Census, 2011).The 69th round of survey conducted by the National Sample Survey Organisation (NSSO) highlights that, households in rural areas spend 35 minutes compared to 31 minutes spent by urban households in collecting and fetching water (NSSO, 2013:16-17).

Though the household level statistics present a good picture about the availability of drinking water, still there are some limitations. Government determines the coverage from the point of view of physical availability and access to water. The national or state level data may not provide a clear understanding of who is accessing and who is denied access to the drinking water.For instance, in rural areas, physical location of the house, religion, caste, other social and economic differences play a major role in determining access to the source of drinking water (UNICEF, FAO[2] and SaciWATERs[3], 2013). Currently, 30 percent of the rural population lacks access to drinking water. Only seven out of 29 states in India have ensured full water availability in rural areas (Sevea, 2013). According to a report by Ernest and Young (2011), in India, about 89 percent of available water is used for irrigation, 6 percent for industrial consumption, and 5 percent for domestic purposes.

1 UNICEF – The United Nations Children's Fund

2. FAO – Food and Agriculture Organisation of the United Nations

3. SaciWATERs – TheSouth Asia Consortium for Interdisciplinary Water Resources Studies

According to the report, demand-supply mismatch in water between years 2007 and 2030 will increase from 27 billion liters a day in 2007 to 94 billion liters a day in 2030. This staggering mismatch in demand and supply of water creates opportunities for private players, specifically in case of drinking water.

2. Need for Clean Drinking Water

About 87.7 percent households in rural areas perceive[1] their drinking water to be of good quality. So the percentage of rural households treating their drinking water is only 32.3 percent, including those perceiving their water to be of good quality. This is due to the difference between the perceived quality and the objective measure of water quality across households and regions (NSSO, 2013:18-19). Further, the percentage of rural households using some method of water purification is only 27.3 percent (see Table 3). Of the 27.3 percent people doing water treatment in rural areas, 15.4 percent strain the water through cloth, which does not purify water except for removing solid suspended particles. About 7.7 percent boil the water, 2.4 percent add bleach / chlorine, 3.3 percent use ceramic/sand or other water filter and only 0.1 percent use electronic water filter to purify water (MoSPI, 2011:139).

Moreover, cleanliness of the surroundings of water source is important to prevent fluoride, arsenic, iron, nitrate, heavy metals, salinity, persistent organic pollutants, and pesticides from polluting water. Religious practices promoting dumping of offerings in water source degrade water quality. Defecation on boundaries of water bodies due to lack of safe latrines results in bacteriological contamination of water, rendering drinking water interventions ineffective. In addition to clean surroundings, hygiene behaviour in ways and means of water collection is important (Khurana and Sen, 2008). Lack of clean water source or hygiene behaviour in collection and storage may lead to communicable diseases such as diarrhoea. Adi Media report (2012) quoting the World Bank estimates, suggests that 80 percent of communicable diseases in India are water related. About 10 million illnesses and 0.7 million deaths in Indiacould be attributed to diarrhoea. Of these deaths,0.4 million are children aged less than five years, making diarrhoea number one disease causing children's death (Adi Media, 2012). Sanitation and safe drinking water are interrelated and can save lives of children and reduce the number of days lost due to ill health among adults.

Although it is Government's responsibility to ensure continuous supply of drinking water, limitations in its mechanisms prompt market based solutions. Private companies and non-government organisations (NGO) are coming up with ways and means to provide adequate and safe drinking water. This article looks at challenges faced by companies and NGOs in marketing drinking water to rural households and suggests measures to address the same.

3. Private Sector Efforts in Providing Clean Drinking Water

Companies are moving aggressively to tap the existing need for clean drinking water in rural markets. However, the existing need for drinking water should be converted to demand for ensuring profitability of such ventures. Poor economic conditions of rural households and ingrained belief that, water is ubiquitous (so must be available for free), may constrain the success of drinking water marketing. Majorly, two options are available for drinking water marketing; one, the indirect way of marketing water purifiers and the other, selling safe drinking water in various quantities as per the customer's requirement. However, for both options marketing strategy should focus on acceptability, affordability, availability, and awareness (Sheth and Sisodia, 2012).

3.1 Water Purifiers Market

3.1.1 Product: In India demand for water purifiers has been growing at an average rate of 15.49 percent in last 14 years (see Table 4). Domestic and institutional water purifier segments occupy 70 percent and 30 percent of the market respectively. Geographically, north, west, east, and southern regions in India account for 25 percent, 40 percent, 25 percent and 10 percent market share respectively[4] . Companies are constantly innovating and introducing purifiers to serve the demand for water purification. Ultra violet (UV), reverse osmosis (RO), ultra filter (UF), total dissolved solids (TDS), and silver

4 Market forecast of drinks and beverages in India (2010-2020) http://www.indiastat.com/table/marketforecast/10143/marketforecastofdrinksandbeveragesinindia20102020/10411/10415/data.aspx, accessed as on June 30, 2014

nano are some of the technologies used in the water purifiers.Table 5 presents details of nine major players in water purifier market. A total of 85 models are available, of which 12 are storage type and 73 are online type water purifiers[2]. The prices of purifiers available in the market range from INR 999 to INR 54,000. GfK (2014) statistics suggest an increase in demand for both top end and bottom end water purifiers. Lower pricing is the driving force behind the increase in demandfor storage type purifiers. Additional benefits over storage type purifiers are leading demand of online purifiers.

*3.1.2Price:*Estimates of the Ministry of Statistics and Programme Implementation (MoSPI) suggest that, the average monthly expenditure per person in rural India is INR 763 of which INR 395 (51.77 percent) was spent on food alone (MoSPI, 2011:156). So annually INR 4416 is available with an average rural person (INR 22080 if we consider a family of five) for expenses after spending on food[3]. Moreover, many rural households do not have access to running water and uninterrupted power supply, making storage type water purifier a suitable choice. Storage type water purifiers are available in the range INR 999 to INR 3800 (see Table 6). Under the aforementioned constraints, low cost product such asTata Swach, which ispriced [4] at INR 999 seems a suitable option for price sensitive consumers. However, average monthly expenditure figures [5] given by MoSPI are misleading and estimation of real demand is possible if we have disaggregated data on income or expenditure of various rural consumer segments.

3.1.3 Place: Companies are shifting from direct sales to traditional channels such as distributor and dealer / retailer to meet the demand for water purifiers. Leading manufacturers are also supporting their sales through service outlets (GfK, 2012:36).Lowest priced Tata Swach is sold through network of retailers. Companies such as Hindustan Unilever Limited (HUL) and Eureka Forbes Limited (EFL) collaborated with Spandana and ACCESS, which are microfinance institutions (MFIs) to sell their purifiers (on pilot[6] basis) to rural and peri-urban consumers. Spandana and ACCESS played the crucial role of consumer education, demand aggregation, extension of credit, and retailing of cartridges. Spandana helped sales of HUL's Pureit in Madhya Pradesh and Tamil Nadu, whereas Pragathi Seva Samithi a second-tier MFI under umbrella of ACCESS sold EFL's Aquasure in Andhra Pradesh. HUL and EFL subsidised price of purifiers, collected the money in instalments, and provided after sales service to consumers during the pilot sales (Dargan and Elliott, 2012).

3.1.4 Promotion: As on 31st March 2012, out of the estimated 148 million households with television (TV), an estimated 94 million are cable TV subscribers and 46.25 million are direct to home (DTH) subscribers registered with private service providers. In terms of radio listenership for the year 2010-11, Vivid Bharati has 40.7 percent listenership, regional stations and local radio stations had 49 percent listenership, FM rainbow had 37.7 percent listenership and FM gold had 18.9 percent listenership[5] . Considering the scale of viewership and listenership it is possible for a marketer to advertise their purifiers in the suitable media. Most of the advertisements on TV are for online purifiers, HUL's Pureit being an exception. In general advertisements on benefits of water purification are issued in public interest by the Government of India and the state governments.

3.2 Business Model toMarket Drinking Water: Sarvajal

Waterhealth, Waterlife, Sarvajal, and Nandi foundation are some of the organisations marketing safe drinking water to rural households in India. Sarvajal'sfranchise business model established by Piramal foundation, for marketing safe drinking water is discussed in this paper. It is because franchise model helps in rapidly expanding Sarvajal concept of universal access to safe drinking water with investments coming from interested parties. As in franchising, Piramal foundation can control the business to ensure smooth functioning of franchisees. More importantly, the uniqueness of this model lies in staying away from the Government subsidies and managing to keep the water price low (Economist, 2013).

Sarvajal initiative began in 2008 and evolved over six years of existence with 154 franchisees catering to more

5. Percentage of Listenership of Various Channels"of All India Radio (AIR) in India (2009-2010 to 2011-2012)http://www.indiastat.com/table/media/21/airradio19912013/450129/714551/data.aspx, and
Overall Status of Broadcasting and Cable TV Services in India, http://www.indiastat.com/table/media/21/television/276/767805/data.aspx, accessed as on June 30, 2014

than one lakh personsin six states of India (Jewell, 2013). Sarvajal establishes cloud-based remote monitoring systems at each franchise with best-in-class reverse osmosis and ultrafiltration units. These units provide real-time intelligence, quality management, and help reduce operational costs. Customized enterprise resource planning (ERP) is provided to franchises for managing its processes. The ERP integrates Soochak (meter), water automated teller machine (ATM), supply chain operations, service and maintenance[6] .

3.2.1 Product: Sarvajal targets villages with more than 1000 households and where water suffers mineral contamination. Ground water is extracted from the bore well owned by the franchisee, purified to 50-150 TDS (a World Health Organisation standard)and sold to customers. Dispensers stop automatically if the water is not of approved quality(Sevea, 2013).

3.2.2 Price: Franchises sell 20 litres of water at six rupees (30 paisa) and if the water is sold through ATM, it would cost 36 paisa per litre. For 20 litres, an optional delivery charge of four rupees for normal water and nine rupees for chilled water is collected. This additional delivery and chilling fee is kept by the franchisee(Sevea, 2013).

3.2.3 Place: Sarvajal model believes in establishing localised processing and distribution of safe water, compared to the centralised distribution of water through pipes, which is costly thus making it infeasible to achieve universal supply of water in rural areas (Sevea, 2013). Customers can come with the containers and pre-paid cards provided by Sarvajal to fill water at their nearest ATMs. One litre, five litre, and 10 litre purchase options are available at each ATM.After inserting the card, required quantity of water can be collected by pressing the respective switch designated for the aforementioned quantities of water. Strategic locations are chosen to place the ATMs so as to provide uninterrupted services to people of all communities (Paliwal, 2013).

3.2.4 Promotion: In the first three months of franchisee establishment in a new village, Sarvajal conducts awareness and advertisement campaigns. The campaign fee is collected from the franchisee. In low performing villages one day campaigning is taken up mostly through role plays and games for kids. Value proposition of Sarvajal is "*Clean water is accessible right in the beneficiaries' village and clean water is vital to health*". Free container cleaning services are provided to all customers once in a month. To encourage existing franchisees, Sarvajal offers incentives on volumes sold and rewards on new franchisee referrals. Toll free landline was also established for receiving client feedback (Sevea, 2013).

3.2.5 Investment and Revenue Sharing:A franchisee incurs capital expenditure of about INR 8,40,000 towards setting up the water treatment plant and four solar powered water ATMs, and little more than INR 17,400 for meeting the monthly operational costs[7].In the first month, 100 percent revenues are kept by franchisee and second month onwards 20 percent of sales revenues are shared with Sarvajal. Further, three paisa per litre is shared from water sales through ATM. The RO units of franchisees operate currently at 40 percent efficiency, but they are trying to improve the capacity utilisation. The franchisees target only 60 percent of the total drinking water market in the concerned village/s and achieve 50 percent penetration. Expected revenues from the business are INR 54,000 per month with 50 to 65 percent profit. Franchisee typically reaches break-even in 20 to 30 months' time (Sevea, 2013).

3.2.6 Services Received by Franchisee: Sarvajal provides technology, training, monitoring, maintenance, and community awareness services to franchisees (Piramal, 2014).

4. Constraints in Marketing Drinking Water

Drinking water being a public good, marketing it for profit, especially in rural areas has some constraints. This section describes constraints faced by organisations involved in marketing purifiers and safe drinking water to rural households.

4.1 Marketing Purifiers

Felt need to purify water, male member's awareness about benefits of water purification, and provision of microfinance from organisations such as Spandana and ACCESS to purchase purifiers led to sales of low-end storage type water purifiers. However, inability of

6. Sarvajal.com, Products, http://www.sarvajal.com/#products, accessed as on June 30, 2014

consumers to purchase cartridge for the second time due to financial constraints, lack of after sales service for supporting cartridge replacement, dissonance stemming from purifier's inability to reduce brackishness, inconvenience in refilling the purifier by the household, difficulty in finding a suitable safe place for purifier at home, perception that storage type purifiers are delicate, aspirational need for status overtaking real need to purify water, subsidy in price seen as an opportunity to make money through resale, and younger women with children having no decision making power in purchase are found to be some reasons constraining the purifier sales (Ganesan, 2011; Ganesanand Bastian, 2012).

4.2 Marketing Safe Drinking Water

Though Sarvajal was able to emerge as one of the solutions for universal water accessibility, there are some challenges hindering its scale-up. They are (a) constraints faced by franchisees in obtaining cheaper loans for establishing and expanding the business, (b) regulatory risk as Sarvajal sells lose water through ATMs unlike the regulated bottled water industry, (c) waste water management by franchisees to justify ground water sourcing, (d) people's willingness to pay for water, which is a public good, and (e) opposition from existing businesses selling purified water at higher prices in highly polluted areas e.g. industrialized South Gujarat, may constrain the expansion of Sarvajal's business(Kaul, 2010; Sevea, 2013). To set up another plant, afranchisee needs new property and capital, and the new plant location may or may not fall in the franchisee's range of influence. These issues may confine a franchisee to one location and limit his/her income and growth opportunities. Though on the face, it may appear that the Sarvajal business model helps more people becoming entrepreneurs and earning better income, it also poses challenges to Sarvajal as an organisation. Finding people willing to take up an entrepreneurial venture is the major challenge. Even if Sarvajal finds a new franchisee, he / she may be competing with existing franchiseefor same customers unless the markets are clearly demarcated.A significant dilemma faced by the business model is, whether Sarvajal should encourage existing franchisees with entrepreneurial spirit to expand operations or should it encourage new franchisees to create income generating opportunities.

5. Discussion

It is understood that there are constraints in marketing purifiers as well as marketing safe drinking water to rural households. If we delve deeper, adoption of water purifiers by large number of rural households is influenced by existing beliefs, attitudes and established behavioural patterns. Advertising campaigns both by Government and private companies share important benefits of safe drinking water and hygienic behaviour to adopt while collecting, storing and consuming water. However, it may not be safe to assume that people will change their unhygienic practices after knowing how the diseases spread through unsafe water (Wijk and Murre, 1995). This is because people make sense of new information in light of their own perceptions, meanings, and cultural backgrounds. So informing people about the steps to remain healthy may not solve the problem. People need to get an opportunity to think, discuss and relate the new practice with their life. In absence of which they may not remember the information, let alone apply such information (Rivers and Aggleton, 1993). So to promote adoption of new behaviours, it is necessary for marketers to provide consumers with opportunities of relating the hygiene practices of water collection and storage to their family health.

The case in point is water purifier, which can be categorised as resistant innovation, which have clear competitive advantages over the existing products. However, such products either conflict with the consumer belief structures or require large behavioural changes from existing status quo in which consumer finds satisfaction (Ram and Sheth, 1989). While adopting products of resistant innovation, consumers have to incur psychological and economic switching costs as they have to learn new routines and habits or embrace new traditions and values (Garcia, Bardhi and Friedrich, 2007). In case of water purifiers, consumers must learn new routines and habits i.e. filling purifier regularly, storing it in safe place, and changing its cartridge regularly. In this process, not only the consumers incur psychological switching costs of accepting that the

purifier will help improve overall health of the family, but also economic switching costs of spending money on purchase of purifier and regular replacement of cartridges. It is due to these significant costs consumers may resist adopting water purifiers. Likewise, the newness of the product in consumer's life and consumer inertia to adopt new behaviour may hinder the process of purchase and continuous usage of water purifiers.

Ganesan and Bastian (2012) observed reselling of HUL's Aquasure by rural households, which was sold to them at subsidised prices through Spandana. Further, they also highlighted that lack of distribution and after sales service led to discontinuity even by interested households. These findings suggest that companies need to focus on the acceptability aspects than simply emphasising on affordability as in the case of HUL's Aquasure. Most important is the establishment of local eco-system, where the consumer who is made aware of the benefits of safe drinking water, gets positive reinforcement from regular service extended by well entrenched distribution channels. In absence of such eco-system it is difficult to ensure continuous usage of water purifiers by large number of rural households.

Furthermore, Sarvajal's business model of marketing safe drinking water to rural households seems to address constraints faced by marketers of water purifiers. This is because Sarvajal's service is a receptive innovation from consumer's point of view. Receptive innovation does not require consumers to alter their existing belief structures, attitudes, traditions or entrenched routines significantly(Ram and Sheth, 1989). Because of this,consumers need not move far from their established comfort zones while adopting products categorised under receptive innovation (Garcia, Bardhi and Friedrich, 2007).Rural households are used to collecting water from various sources e.g. wells, bore wells, ponds where purity is not ascertained. Sarvajal's business model simply altered the mode of collection, from freely available water with questionable purity to purchase of purified water.Henceforth, consumers need not move far from their established water collection behaviour, but need to pay for water collected from a Sarvajal franchisee or ATMs. Apart from creating a business opportunity for franchisees, the model addresses the consumer affordability issue to a large extent by supplying water at lowest price possible and continuously innovating to improve its services. However, Sarvajal needs to address the dichotomies in terms of promoting few entrepreneurs, increasing their sales / profits versus more entrepreneurs earning their living by marketing safe water to rural households.

The belief, attitude, subjective norm, and enabling factors model of Hubley (1993) suggests that individuals adopt a new practice (e.g. using water purifier or purchasing safe drinking water from ATM), when they believe that such practice has net health or other benefits and consider those benefits important. Individuals will then develop positive attitude towards their own behaviour. Whether an individual (rural or urban), subscribes to the idea of water purification or not depends on his or her positive or negative views (i.e. subjective norms) which he or she receives from others in his or her immediate environment i.e. community, hamlet, or village. Enabling factors such as (1) skills required for maintaining the purifier or collecting water at ATM, (2) time needed to adopt the new behaviour, and (3) means available to change the existing entrenched behaviour i.e. availability of affordable purifier with good after sales service or availability of water ATMswill determine adoption and continuation of new practices. Companies have to take steps to ensure that customers are convinced of the health benefits emanating out of drinking safe water and the means of getting that safe water fits their ideas of hygiene and health at large.

5.1 Behaviour Change Programmes in Practice

Lifebuoy and Shell oil are the two examples discussed in this sub-section to highlight the efforts taken by multinational companies (MNCs) in creating awareness and promoting their products. Essentially, these two campaigns aimed at changing the existing behaviour of the population towards a desirable behaviour. Both campaigns are focussed on improving the health of population through change of attitude and behaviour of people. Lifebuoy focussed on inculcating hand washing habits essential to prevent dominant communicable diseases such as diarrhoea and Shell focussed on simple measures to be adopted for reducing the ill effects of indoor air pollution.

5.1.1 Lifebuoy: Lifebuoy's behavioural change programme was one example of efforts taken by Unilever to change the consumer behaviour. The programme had three significant activities (a) hand washing behaviour change programmes, (b) skill development and partnerships, and (c) advocacy. Hand washing behaviour change programme was designed as a four step model with (i) creating awareness as to why the habit is important, (ii) obtaining commitment from people in a public forum through pledge to ensure practice of the new behaviour, (iii) reinforcing the behaviour by ensuring that consumers continue to practice hand washing for 21 to 50 days, and finally (iv) rewarding the consumers through social recognition for sticking to the healthy behaviour. 'Mothers programme' was also organised to drive the commitment to behaviour change by involving doctors, medical staff, mothers and children. Mass media was used to drive home the message about benefits of hand washing. Digital media was also used wherever appropriate to promote the campaign. Visual glow germ demonstration was used to show that soap and water are necessary to wash away invisible germs. This was helpful in communicating the message that 'visibly clean is not necessarily clean from germs' (Unilever, 2012). School children were targeted through 'The School of 5' campaign where children were assisted by five different cartoon characters who each represent and promote a different soap use occasion (Gopal, 2011). The behavioural change programme aims to change behaviour of one billion people around the world. Till now Unilever was able to change the behaviour of 130 million consumers around the globe (Unilever, 2014).

5.1.2 Shell Oil: Shell oil launched a campaign since 2008 against indoor air pollution to promote simple measures of reducing smoke while cooking in the kitchen. The campaign named 'My kitchen, My pride' was launched in the state of Karnataka covering 112 villages with population between 5000 and 20,000. The promotional campaign included wall posters, wall paintings, mobile van campaigns, flipchart stories, interactive games and street plays to increase awareness about indoor air pollution and its harmful effects. Shell foundation also launched sale of improved cooking stoves in partnerships with local NGOs to address the indoor air pollution (Kashyap, 2012). KhidkiAmma[8], an old woman's character was created around which stories were woven to be shared with women and children. Local opinion leaders in the villages were contacted to promote the idea of kitchen with big windows. With the active support from school principal, children were taught the dangers of smoke in the kitchen. Door to door campaigns were also conducted for interacting with women to spread the message of indoor air pollution (Shell Foundation, 2009).

Campaigns of Unilever and Shell have demonstrated that it is possible to change the behaviour of peopleeither by engaging with them directly or through local NGOs. Manufacturers of water purifiers as well as companies selling safe water can adopt some of these promotional elements to engage with their consumers to create the desired behaviour. However, multiplicity of languages with their dialects, variations in penetration of mass media pose challenges for large scale mass communication in rural India. Considering this, companies must design innovative below the line (BTL) promotional campaigns including street plays, puppet shows, demonstrations in local fairs, wall paintings, door-to-door campaigns, etc. to engage and educate the consumers about the processes of protecting the sources of water, handling and storing of water, purification, and hygiene behaviour while drinking water. Involving Government agencies established for the purpose of water hygiene and sanitation may bring synergy into the campaign.

6. Conclusion

It is important for businesses to innovate and produce products or services, which are affordable and help in delivering safe drinking water to people. However, such product or service innovation should be backed by creation of local eco-system which ensures (1) product or service fit with the cultural aspects of concerned consumers, thereby increasing its acceptability, (2) regular supply of spare parts and after sales service i.e. improving its availability, and finally (3) well-crafted awareness campaigns promoting suitable behaviour among consumers, so that they can realise the benefits of safe drinking water.

Notes

1. Perception of households with respect to quality of drinking water is measured by asking respondents if the water was bad in taste, bad in smell, bad in taste and smell, bad due to other reasons or had no defect. The perception in rural areas of only 7 states and 2 union territories is lower than national average (87.7 percent).
2. An online water purifier is attached to a running water pipeline and requires electricity to operate.
3. Total monthly expenditure is INR 763 out of which INR 395 is spent on food alone leaving INR 368 with an individual in a family. So annually, INR 4416 is remaining to be spent on other items of need by the concerned individual.
4. Tata Swach initial price is INR 999 and for every 3000 liters of water processed, cartridge needs to be changed. If we consider minimum 2 liters of water consumption per person in a family of five, then total 3650 liters of water will be consumed by the family in a year. This means at least once a year, the cartridge costing INR 500 needs to be purchased by the household.
5. Data provided by Ministry of Statistics and Programme Implementation only gives highest and lowest expenditure segments of rural population. Only 9.2 percent population live in the highest monthly per capita expenditure class of INR 890 and more. About 3.4 percent lives with monthly per capita expenditure of INR 0 to 235. These figures do not include, expenses incurred on purchasing water or water purifier per se, which is needed for better understanding.
6. Sale of purifiers on pilot basis was carried out between December 2010 and June 2011 in Andhra Pradesh, between February 2010 and September 2010 in Madhya Pradesh and between August 2009 and May 2010 in Tamil Nadu.
7. Operational cost includes electricity, diesel, human resources, tax, loan instalments, and marketing.
8. Khidki means window and amma means mother/ aunt. In India in almost all villages there are women who are named after their special traits or appearance. As the name KhidkiAmma suggests, the woman is a gossip monger who peeps in peoples' homes through their windows and spreads village gossip. KhidkiAmma urges people to have bigger windows, i.e. acknowledge and act on indoor air pollution problem in kitchen. As such characters are culturally rooted they help in spreading the message.

Tables

Table 1: Sources of Drinking Water in Rural India (2001-2011)

Source	2001	2011	Change
Tap	24.3	30.8	6.5
Well	22.2	13.3	(8.9)
Hand pump/Tube well	48.9	51.9	3
Others	4.5	4.0	(0.5)

Note: Figures are given in percentages; Figures in brackets indicate reduction in households having access to that source.

Source: Census 2011, Main source of drinking water 2001-2011, http://www.censusindia.gov.in/2011census/hlo/Data_sheet/India/Drinking_Water.pdf, accessed as on June 20, 2014.

Table 2: Availability of Drinking Water in Rural India (2001-2011)

Distance from source	2001	2011	Change
Within Premises	28.7	35.0	6.3
Near Premises	51.8	42.9	8.9
Away from premises	19.5	22.1	(2.6)

Note: Figures are given in percentages; Figure in brackets indicate worsening situation.

Source: Census 2011, Main source of drinking water 2001-2011, http://www.censusindia.gov.in/2011census/hlo/Data_sheet/India/Drinking_Water.pdf, accessed as on June 20, 2014.

Table 3: Methods of Treatment Used Prior to Drinking Water in Rural Areas

Treatment Used	Percentage
Strain through cloth	15.4
Boil	7.7
Ceramic, sand or other water filter	3.3
Electronic purifier	0.1
Alum	0.9
Add bleach/chlorine	2.4
Allowing water to stand and settle	0.5
Other	0.3
No treatment	72.7

Note : Total percentages may add to more than 100.

Source: National Family Health Survey III: 2005-06 and Selected Socio-Economic Statistics India, 2011, Ministry of Statistics and Programme Implementation, Government of India, pg.139. http://mospi.nic.in/mospi_new/upload/sel_socio_eco_stats_ind_2001_28oct11.pdf.,accessed as on June 19, 2014.

Table 4: Demand for Water Purifiers

Year	INR (Billion)	Percentage change	Year	INR (Billion)	Percentage change
2001-02	6.90	—	2008-09	19.12	16.51
2002-03	7.95	15.22	2009-10	22.33	16.79
2003-04	9.14	14.97	2010-11	26.17	17.20
2004-05	10.54	15.32	2011-12	30.75	17.50
2005-06	12.18	15.56	2012-13	34.86	13.37
2006-07	14.12	15.93	2013-14	39.53	13.40
2007-08	16.41	16.22	2014-15	44.82	13.38

Source: Demand for purifiers: Past and future, http://www.indiastat.com/table/marketforecast/10143/marketforecastofdrinksandbeveragesinindia20102020/10411/10415/data.aspx, accessed as on June 30, 2014.

Table 5: Major Players in Indian Water Purifier Market

Company	Brands	Technology	Product Design	Price Range (INR)
Eureka Forbes	Aquaguard (13) Aquasure (14)	UV, RO, UF technology	Online and storage filters	1,999-27,999
Hindustan Unilever	Pureit (9)	UV, RO, 4 stage germ kill	Online and storage filters	1,200-16,000
Ion Exchange	Zero B (9)	Ion exchange technology	Online and storage filters	7,490-33,000
Kent Ro Systems	Kent (10)	UV, RO, UF, TDS control	Online filters	14,500-54,000
Whirlpool	Classic (1), Purafresh(2) UTS (1)	RO technology	Online filters	15,500-17,500
Tata	Swach (2)	Silver Nano technology	Storage filters	999-2,050
Luminous	Biocare(1) Envy(2), Touch(2), Magna (1)	UV, RO, UF technology	Online filters	9,990-18,900
Hi-tech	V top, D top, K top etc. (10)	UV, RO	Online filters	7,000-21,000
Nasaka	Essel Nasaka (8)	UV, RO, UF, 6-12 stage filtration	Online and storage filters	2,900-18,900

Note: Figures in brackets indicate number of models available in each brand; UV – Ultra violet, RO – Reverse osmosis, UF – Ultra filter, & TDS – Total dissolved solids.

Source: Compiled from Sulekha.com website, http://homeappliances.sulekha.com/water-purifier/water-purifier_products-models-with-prices, accessed as on July 1, 2014.

Table 6: Water Purifiers with Storage Type Design

S. No	Brands with storage type design	Price (INR)
1	Tata Swach Smart Water Purifier (Silver Nano Technology)	999
2	Intella Water Purifier (4 Stage-Germ Kill)	1200
3	Pureit Classic Water Purifier (4 Stage-Germ Kill)	1550
4	Aquasure Xtra Tuff Water Purifier (Germ Kill)	1999
5	Tata Swach La Vita Water Purifier (Silver Nano Technology)	2050
6	Aquasure Galaxy Water Purifier (Germ Kill)	2199
7	Aquasure Amrit With Kitanu Magnet Water Purifier (Germ Kill)	2499
8	Pureit Classic 23 L Water Purifier (4 Stage- Germ Kill)	2600
9	Essel Nasaka Xtra Pure Water Purifier (6 Stage Filtration)	2900
10	Essel Nasaka Xtra Sure Water Purifier (6 Stage Filtration)	2950
11	Puteit Advanced Water Purifier (4 Stage-Germ Kill)	3100
12	AutoFill Water Purifier (4 Stage- Germ Kill)	3800

Note: Brands of nine companies have been considered.

Source: Compiled from http://homeappliances.sulekha.com/water-purifier/water-purifier_products-models-with-prices, accessed as on July 1, 2014.

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Celebrity Endorsement on Multiple Products: A Comparison of High Value Versus Low Value Items

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Abstract

Celebrity endorsement is a popular attempt by the marketers to create greater recognition for the advertisement and more importantly the brand. In the Indian context, the concept of celebrity endorsement is growing rapidly in the recent years. It is a fact that single celebrity endorsing multiple products / brands in Indian context and number of such instances are growing year after year. This study makes an attempt to understand credibility endorser, who endorses multiple product categories.

A sample of 150 respondents were selected and shown television commercials of the celebrity featuring in three products. Only those responses, where the evaluations were furnished for all the three products have been used in the study.

The current study provides evidences for two product categories - low involvement and high involvement (as well as high value item / low value items) in nature. For high involvement / high value item, trustworthiness and attractiveness emerged as most significant constructs and expertise as less important. For the low involvement / low value items, trustworthiness and expertise emerged as more important factor than attractiveness.

Keywords: *Celebrity Endorsement, Multi-Product Endorsement, Confirmatory Factor analysis*

1. Introduction

Media and entertainment (M&E) sector in India is expected to reach INR 1.2 Lakh Crores by the 2015 (Business Line, 2011), with a growth rate of 13.2 percent. The advertising spending across all the media accounted for INR 266 billion for the year 2010, which is about 41 percent of the overall revenue of M&E sector with a growth rate of 17 percent over 2009. Particularly the television industry added almost 100 million viewers during the year 2010 and taken the tally to 600 million viewers with 550 channels (KPMG, 2011).

Endorsement is age old concept in marketing and advertising theory. Endorsement creates familiarity to advertisements. Celebrity endorsers are portrayed several ways in the advertisements; commonly noticed endoresements include celebrities, typical consumers, professional experts and company presidents (Friedman, Termini and Washington, 1976). The celebrity endorser is defined as any individual who enjoys public recognition and who uses this recognition on behalf of a consumer good by appearing with it in an advertisement (McCracken, 1989). Two different schools of thoughts emerged in celebrity endorsements; one school of thought emphasises on source credibility, while the other on source attractiveness. These schools of thought brought out various research perspectives on celebrity endorsement. As an endorser, the person fulfils various objectives set forth by the sponsors, which includes creating familiarity for the brand, creating a link between the brand and the audience, transfer his values to the brand / sponsor and finally develop differentiation for the brand from other brands.

Indian celebrity endorsement for various product / services centres around Bollywood actors such as Amitabh Bachchan, Shahrukh Khan, and cricket players such as Sachin Tendulkar, MS Dhoni. In the recent times, a school of thought developed in the Indian retail industry on celebrity endorsers. In particular, the advertising industry started preferring the stars from film industry over cricketers due to the fact that their recognition surpasses one hit or a flop film, unlike the cricket players whose brand value changes with each tournament and sometimes with matches.

A study by Jain et al (2010) based on content analysis of Indian television commercials for the period 1995-2007, for about 556 advertisements, 56 celebrities, showed that multiple products / brands are endorsed by the same celebrity endorsers. For instance, the popular Bollywood film star Amitabh Bachchan is seen to endorse

brands like Cadbury, State Bank of India (SBI), Pepsi, Dabur, and Nerolac; Pepsi is endorsed by Aamir Khan, Aishwarya Rai, Sachin Tendulkar, Vijay and Rahul Dravid. Another supporting results on multiple product endorsement was brought out by Patra and Datta (2010); the authors pointed out that in the year 2008, leading Hindi movie stars from Bollywood such as Shah Rukh Khan was endorsing 42 brands, Hrithik Roshan was endorsing 20 brands, Juhi Chawla was endorsing 17 brands and Amir Khan was endorsing 10 brands while the leading cricketers such as Sachin Tendulkar and Rahul Dravid were endorsing more than 15 brands each. Thus, it is very evident that the Indian media and entertainment industry, particularly the television commercial sector is in the process of engaging the single celebrity endorser for multiple product categories. This research work envisages bringing out the differences in the evaluations of single celebrity endorsing a high valued item/brand and low valued items/ products by the audiences.

2. Literature Review

Celebrity endorsement has been extensively researched for several decades. Relationship between a product class and endorsement components was studied by Friedman and Friedman (1976). They provided evidence that the use of celebrity endorser would improve believability of the product class, which has high psychological or social risk. Moreover, a comparison across experts or typical consumer endorsers concluded that purchase intention was high when the product was endorsed by a celebrity. However, interesting evidence was found in a study on technology-oriented products (Biswas and Das 2006); the results were quite opposite. Expert endorsement were found to be more effective in perceived risk reduction than by using a non-celebrity endorsement or celebrity endorsement. Expert celebrity endorsement, in general, associated with high technological product categories; an expert celebrity endorser, would lead a customer to perceive the product category more favourably than other category of endorser.

Physical attractiveness in celebrity endorsement is addressed by Kahle and Homer (1985). In their study attractiveness was viewed along with likability and based on the studey they concluded that the informational cue of attractiveness of the celebrity endorser would have been travelled through a central route to the customers than through a peripheral route. For instance, it is argued that a stunningly attractive celebrity endorser, who claims to use a beauty product, will reach the viewer more quickly than other information presented in the communication.

In a study, Saleem (2008) compared single celebrity endorsement and multiple celebrities' advertisement on purchase intentions, attitude towards advertisement and demographic characteristics like gender and age. He concluded that no significant differences across the gender or age groups. Lee and Thorson (2008) explored the involvement conditions with celebrity endorsement and concluded that endorsement works more favourably for higher product involvement than low product involvement. They established the necessity for a match between the chosen celebrities and products. Marshall et al (2008) added further insight to the work of Lee and Thorson (2008). The authors brought out the importance of congruence between the ideal image / real image of the endorsers and advertisement communication and stressed that real image should not be too away from the target market for maintaining a sustained relation.

A study by Chandy et al (2001) on the issue of ad cues effect on consumer behaviour in the context of new versus well-established markets. They concluded that young consumers prefer advertisements which have argument-focused appeal, expert sources and negatively coined information appeals.

In a study on examination of celebrity expertise in Indian context, Gupta and Dang (2009) concluded that celebrity endorsement is useful to develop attitude towards the advertisements. Further no evidences on the relationship between the expertise factor and attitude towards brand and purchase intentions were found. Another study in the Indian context by Jain et al (2010) attempted to capture the way the celebrities are portrayed in the ads and the study results showed that implicit portrayal is more popular than explicit or imperative

modes. Also the authors reported a lack of fit between the celebrities presented in the ads and the categories endorsed. Brajesh and Gouranga (2011) in their work on celebrity endorsements for Fast Moving Consumer Goods category provided evidence that celebrity acts as an important factor to create interest in the minds of viewers rather than various components in the advertisements such as message, background set etc.

Studies also addressed the significance of negative information of the celebrity endorsers and its impact on brands endorsed. Till and Shimp (1998) found a strong associative link of the chosen celebrity and the product endorsed failed to recognize the negative information presented about the celebrity endorser. Further they found that celebrity evaluation and product evaluation are in direct relationship with each other; if the celebrity is evaluated more favourably, resulted in more favourable evaluations for the product category he/she endorsed and vice-versa.

Goldsmith, Lafferty, and Newell (2000) research efforts added the dimension of corporate credibility and attitude on advertisement / brand on the literature of celebrity endorsements. Celebrity endorsement works through the route of 'Attitude on Ad' and in turn 'attitude on ad' influence on other variables. In contrast, corporate credibility works through all of the advertising effectiveness variables, even when all the theoretically supported causal linkages are incorporated into the model. Banyte, Stonkiene and Piligrimiene (2011) studied the role of sport celebrity in non-sport product advertisement in Lithuanian context. They argued that the endorsement by a celebrity is valuable with a proportion of risk as well. To overcome it, they advised the firms to place a moral clause in the contracts they entered with these celebrities, which would control the behaviour of the celebrity to certain extent.

Research gap, not addressed by the previous research works, is a direct comparison of high value items and low value items endorsed by the same celebrity endorser. Thus, the research work proposed tests the model on credibility of celebrity endorser for two different categories of products viz., high value items versus low value items.

Hypotheses and Proposed Model

Perceived expertise, Trustworthiness, and Attractiveness have been identified as the domain of source-credibility by Ohanian (1990). Kahle and Homer (1985) brought out the significance of attractiveness of the celebrity endorsers; they argued that involvement level superseded by the physical attractiveness factor in attitude changing process and attractiveness is positively related to credibility of the endorser.

Alba and Hutchinson (1987) defined Expertise as "ability to perform product-related tasks successfully". McCracken's (1989) research defined expertness as perceived ability of the source to make valid assertions. This expertise dimension was further explored by Biswas and Das (2006); they concluded that the expertise is useful in reducing perceived risk. However, non-expert non-celebrity endorser did not seem to be as effective as an expert endorser. Gupta and Dang (2009) study related the expertise with advertisement attitude; expertise is related positively with attitude towards the ad and useful in developing positive attitude towards the credibility of celebrity endorser.

Trustworthiness is defined as "the perceived willingness of the source to make valid assertions" McCracken (1989). Tripp, Jensen, and Carlson (1994) studied the likeability and trustworthiness with knowledge of the celebrity endorser; the authors concluded that irrespective of number of products endorsed no significant differences were observed in the perceived relationship between these two attributes vis-à-vis knowledge. However, another argument was brought out from the study findings of Priester and Petty (2003); it is argued that the celebrity expertise status will be diluted since he/she endorses many products irrespective of the merits of the products. Some concerns were expressed by Banyte et al (2011) in using sport celebrities to endorse non-sport goods; in this context, the target market respondents / audiences may give higher importance for trust and respect rather than physical attractiveness component and suggested that trustworthiness in positive relation with endorser's credibility.

The proposed model (figure 1) exhibits these hypotheses.

3. Methodology

Commercials of the three brands were considered for the study purpose; a jewellery shop commercial [high value item], a packaged Atta brand, marketed by a well-known Indian company and a 'papad' brand, marketed by a popular south Indian company, [both belong to low value product category]. These television commercials [which are approximately 20 second duration] are endorsed by the same celebrity endorser, who is a south Indian film star, Sneha, who endorses Idhayam's DOTS papad [Marketed by Idhayam group], Aashirvaad atta [marketed by ITC] and Jos Alukkas [a popular jewellery retail outlet]. The researcher showed all three television commercials of the selected product categories to the randomly chosen respondents through a 'laptop'. Then the respondents furnished their evaluations about the credibility of the celebrity endorser who appeared in the endorsement ad of product after seeing each product immediately.

3.1 Measures

The measures for source credibility endorsement constructs were adopted from the study of Ohanian (1990); source credibility measure encompasses three constructs, namely, endorsers' perceived expertise, trustworthiness, and attractiveness. These measures have a fairly high level of reliability values, which are in the range of 0.89 to 0.90. Research investigating source expertise in persuasive communication generally indicates that the sources perceived expertise has a positive impact on attitude change. A considerable body of research in advertising and communication suggests that physical attractiveness is an important cue in an individual's initial judgment of another person. These three domains are identified as measures for celebrity endorser's credibility.

3.2 Sample and Profile

This study aims to bring out the differences in evaluations of source credibility, if any, in a single celebrity endorser, while endorsing multiple products / brands by consumers, the questionnaires were given to 150 people; 102 usable samples - that is, those respondents, who furnished evaluations for all the three products given to them, were used in the analysis. The data were collected from the Vellore town of Tamil Nadu.

Out of the 102 respondents, 30 per cent of them were male and majority of them belonged to the age group of 15 - 39 (85 percent). Nearly 90 percent of the respondents reported that they watch television for about 2 hours daily.

4. Results

The proposed model was tested by LISREL 8.72; 'unweighted least square' procedure was used for each of the product category. The model fit for each product category was assessed by the Chi-square test (x^2) (Joreskog and Sorbom, 1988), the goodness-of-fit indices and examination of the contribution of the individual constructs. Table 1 summarizes the results.

The figures - 2, 3 and 4 portray the fitted model with contribution of each construct and contribution of each latent construct to the model for measuring celebrity endorsement credibility.

For the jewellery shop advertisement, the overall fit measures show an acceptable level of fit, except for RMSEA (0.095), which is marginally above the prescribed level; GFI (0.94), AGFI (0.91) and Chi-Square/DF ratio (1.904) are showing acceptability of the fitted model. Attractiveness (0.91), Trustworthiness (0.91) followed by expertise of the celebrity (0.73) are found to be important factors in creating source credibility of the celebrity endorser. For the model pertaining to 'papad' brand, the entire overall fit measures, except RMSEA (0.104) show acceptable level of fit and RMSEA is marginally above the threshold level. GFI (0.96), AGFI (0.94) and Chi-Square/DF ratio (2.091) are supporting model fit for the 'papad' brand. Trustworthiness (0.99) followed by expertise (0.86) and attractiveness (0.81) are found to be important factors in creating source credibility of the celebrity endorser for the 'papad' brand endorsement.

Similar overall fit measures are obtained for Atta brand endorsement; RMSEA is found to be marginally above the prescribed threshold level and the rest of the indices support a valid fit for the model [GFI (0.95), AGFI (0.92) and Chi-Square/DF ratio (2.323)]. Similar importance

beta measures that of the 'papad' brand, are obtained for Atta brand too; Trustworthiness (0.96) followed by expertise (0.80) and attractiveness (0.77) are found to be important factors in creating source credibility of the celebrity endorser for the 'Atta' brand endorsement.

5. Discussion

The current study provides evidence for two product categories - low involvement and high involvement (as well as high value item / low value items) in nature. Findings in source credibility studies are equivocal; for instance, Erdogan (1999) study did not provide any conclusive evidence on the set of important factors/ constructs for source credibility and what factors are more important than others in certain situations.

A notable finding from the study is that for the high involvement / high value item, the celebrity endorser credibility model suggests that Trustworthiness and attractiveness emerged as most significant constructs and expertise considered with lowest importance. For the low involvement / low value items, Trustworthiness and expertise emerged as more important rather than attractiveness. The study results are thus, in support of the Elaboration Likelihood theory proposed by Petty, Cacioppo and Schumann (1983).

As explained in the 'match-up' by Kahle and Homer (1985) further discussed by Kamins (1990), the respondents / consumers may perceive the celebrity's image as congruent with the luxury jewellery products and since use of the such products can enhance one's attractiveness and the celebrity endorser in the ad is an attractive individual. Thus, in product category such as jewellery, in which elaboration is likely, the respondent's attitude change happened through the information - attractiveness, which is felt as core of the diligent consideration.

However, when we refer attractiveness, it is not referring simply to the physical attractiveness; as referred by Erdogan (1999), attractiveness includes "any number of attributes such as intellectual skill, personality properties, lifestyle or athletic prowess that consumers might perceive in a celebrity endorser". Hence, for a high value item, attractiveness emerged as very significant factor in credibility endorsements. Thus, the current research work supports the earlier attempt by Erdogan (1999). The logical detection is that the consumers may attach greater credence to the attractiveness of a chosen celebrity and equate attractiveness with credibility.

Tripp, Jensen, and Carlson (1994) study reported that the number of products endorsed by the celebrity and the number of exposures to the celebrity operate independently on consumers' attitudes and number of exposures to the celebrity neither enhances nor disguises the multiple product endorsement effect; moreover, the study reported that expertise would be less affected by multiple product endorsements than trustworthiness. However, in the current study, there are evidences that importance attached to expertise factor varies with product category (high value vs. low value).

In recent decades, multiple brand endorsement by Indian celebrity endorsers is common, which bring the concept of celebrity over exposure. In spite very large number of products/brands endorsed by the celebrities, the celebrities were given high acceptance rating by the respondents (Patra & Datta 2010). It is also pointed in many literatures that the endorsement of a poorly perceived brand can decrease consumers' perception of the celebrity's attractiveness, trustworthiness, expertise, and credibility.

6. Managerial Implications

As pointed out by Tripp, Jensen, and Carlson (1994), multiple product endorsement shall have negative attitude towards advertisements, which could potentially harm the attitude towards product/brand. This study provides implications for the decision makers as well as support the earlier research works on celebrity endorsement; particularly portraying the selection of celebrity endorser according to the product category chosen; in high value product category, credibility of endorser is predicted by trust and attractiveness of the endorser while in low value items, particularly in categories like edibles trust and expertise play important role. Also, the way credibility towards celebrity endorsers formed, varied significantly with product category - for

high value items, attractiveness is considered more important than expertise.

On similar lines with the findings of Choi, Lee and Kim (2005), the marketing firms rather than placing emphasis on the celebrities' ability to endorse the products convincingly, the focus is on their ability to attract attention or render cultural meanings to the product in an implicit manner, particularly on high value items.

For the low value product categories, attractiveness is considered as low importance factors. As argued by Choi et al. (2005), rather than placing emphasis on the celebrities' ability to endorse the products convincingly, the focus may be on their ability to attract attention or render cultural meanings to the product in an implicit manner; and the appearance of celebrities as characters other than themselves might also enhance the entertainment or publicity value of the commercials. Particularly, for the low value categories, like the items investigated in the study [packaged atta brand / papd brand] which are grocery related product categories, the firms may place more emphasis on celebrity endorser's ability to endorse the brand, which is likely to produce positive brand enhancement.

Also, for the celebrity endorsers, it provides insight for the process of formation of credibility for the endorser through the product/brand endorsed. Particularly, while multiple product endorsements, when the factors affecting credibility keep on changing with respect to the product category chosen, the image / credibility of endorser in a questionable state. Moreover, the celebrity should be cautious enough with multiple endorsements, since more favourable initial attitudes towards him/her may become unfavourable with increased exposure levels; if the celebrity possesses any kind of negative attitude, this might further tamper the attitude towards the celebrity endorser.

7. Limitations

One concern is the sample size (102); this is partially attributed to the research methodology adopted, where the respondents had to watch all the three television commercials, and later have to respond to the questions. Every product, they need to respond for about 15 questions and in total, 45 questions should be answered, which consumed more of the respondent's time. Many respondents initially showed greater degree of reluctance to watch the entire advertisements and to fill the questions, since they have already watched commercials many times. The study has used only two products/ brands, from low value items and one in high value category; thus, the generalization of the findings beyond certain product ranges before undertaking series of such studies is limited.

8. Future Research Directions

Indian media industry, particularly the television advertisement sector is witnessing exponential growth in the recent decade. Very limited research work has been taken up in the Indian context to understand the celebrity endorsements, in spite of growing celebrity endorsement. Range of celebrity endorsers, including sports stars across different product categories may be studied to get better understanding of the celebrity endorsers. Another research input, more valuable for the industry is those advertisements which are modified only on the audio tracks; a specific study on this kind of advertisement shall bring down the production cost considerably, provided if it address on attitude towards sponsor organisations, cultural differences of ad context and attitude towards advertisement and brand.

9. Conclusion

The source credibility model - consist of celebrity trustworthiness, celebrity expertise, and celebrity attractiveness - captures the differences in celebrity source effects, among the product/ brand categories and identified the most influential components for each product categories of the celebrity endorser. Particularly, in the Indian context, in recent years, the single celebrity endorsing multiple product categories is growing. The study findings shall be useful for the decision makers, who are planning for celebrity endorsements.

Further, despite the growth in the Media and Entertainment industry, very limited study attempts have been made in the Indian context to comprehend the credibility models; this study findings provide insights in terms of low value versus high value items and brought out the differences. For the high value

items [like the one chosen in the study], the attractiveness factor emerged more important than expertise dimension whereas for the brands, [Atta and Papad brands], attractiveness considered as low importance dimension in credibility of celebrity endorsers.

The advertising agencies and marketers often portray the celebrity endorsers for the brands like Atta brand or 'Papad' brand as spokespersons in the Indian context; they are expected to deliver factual information on product in an explicit manner, which is very popular in low-context communication style characteristics of the United States (Choi et al; 2005.), the findings also supported by the emergence of expertise as more important than attractiveness dimensions (Table 2).

Appendix

Table-1 Model Fit indices

Model Fit Parameters	Jeweller shop ad	Branded Papad product	Packaged Atta brand
Chi-Square	165.66	181.92	202.11
Degrees of Freedom	87	87	87
Chi-Square /DF Ratio	1.904	2.091	2.323
Goodness of Fit Index (GFI)	0.94	0.96	0.95
Adjusted Goodness of Fit Index (AGFI)	0.91	0.94	0.92
Root Mean Square Error of Approximation (RMSEA)	0.095	0.10	0.11

Figure 1

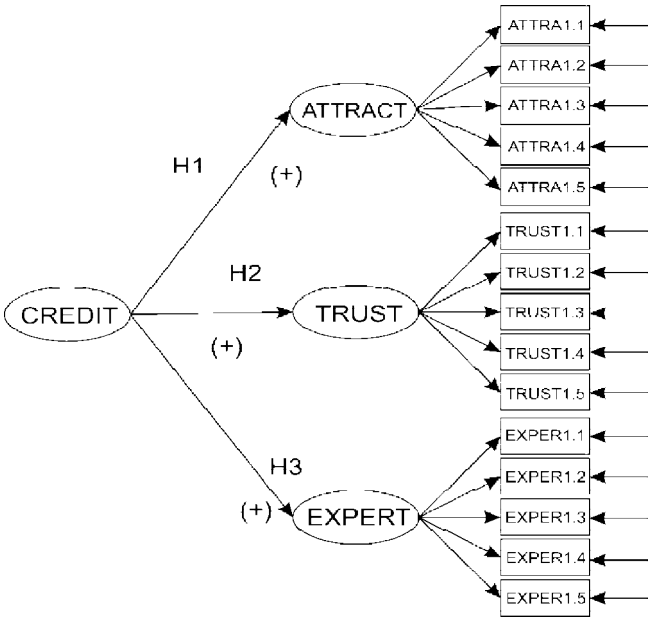
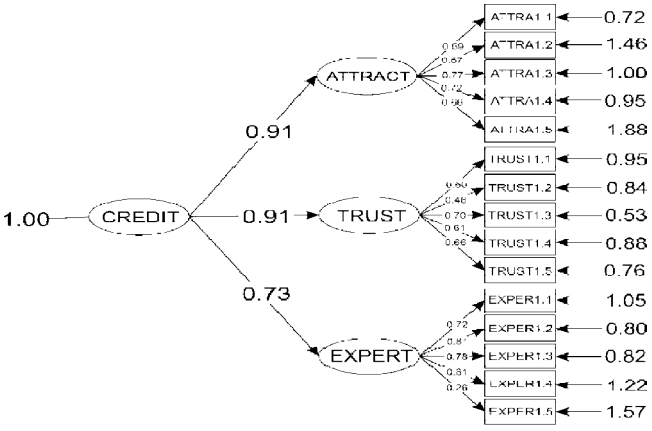


Figure 2
Fitted Model for Jeweller shop Ad

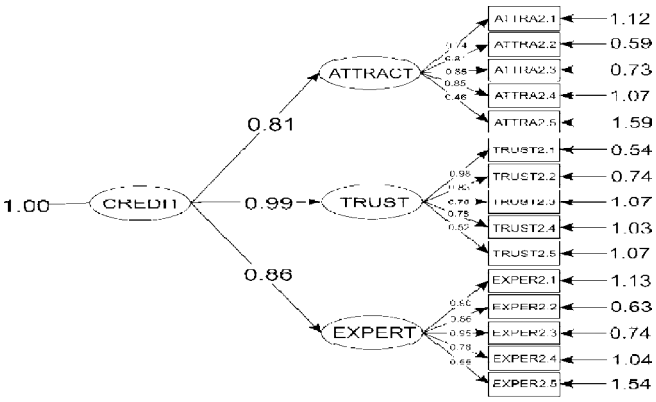


Chi-Square=165.66, df=87, P-value=0.00000, RMSEA=0.095

Table-2 Measurement Model Fit indices

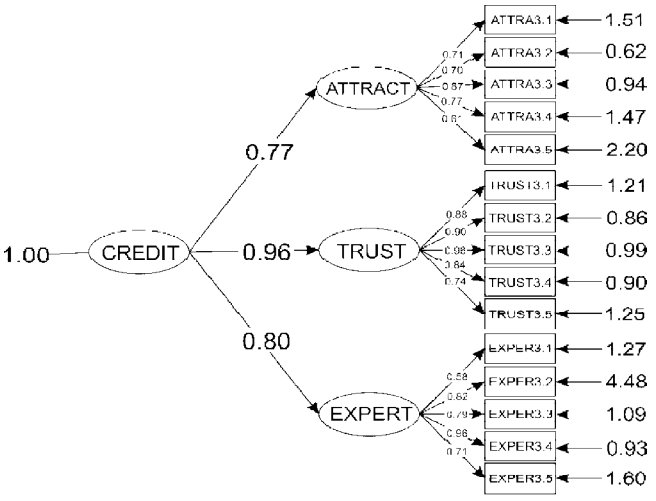
Construct	Measure	Jewellery shop advertisement			Papad Advertisement			ATTA Advertisement		
		Beta (t-Value)	Standard-ized Beta	Beta (Standard-ized Beta) (t-Value)	Beta (t-Value)	Standard-ized Beta	Beta (Standard-ized Beta) (Sig.)	Beta (t-Value)	Standard-ized Beta	Beta (Standard-ized Beta) (Sig.)
Attractiveness	Attractive-unattractive	0.59	0.57		0.74	0.57		0.71	0.50	
	Not classy-Classy	0.67 (8.88)	0.49	0.91			0.81	0.70	0.66	0.77
	Ugly-Beautiful	0.77 (8.99)	0.61	(0.91)	0.85 (9.04)	0.71	(0.81)	0.87 (8.56)	0.67	(0.77)
	Plain-Elegant	0.72 (8.64)	0.59	9.74	0.85 (9.44)	0.64	21.65	0.77 (7.56)	0.53	19.87
	Not sexy-Sexy	0.66 (8.24)	0.43		0.46 (5.77)	0.34		0.61 (7.13)	0.38	
Trustworthiness	Undependable-Dependable	0.50	0.45		0.98	0.80		0.88	0.62	
	Dishonest-Honest	0.46 (6.95)	0.45	0.90	0.83 (15.37)	0.69	0.99	0.90 (13.45)	0.700.96	
	Unreliable -Reliable	0.70 (8.06)	0.69	(0.91)	0.76 (14.71)	0.59	(0.99)	0.96 (13.57)	0.69	(0.96)
	Insincere-Sincere	0.61 (7.53)	0.54	8.99	0.78 (14.51)	0.61	19.92	0.84 (12.14)	0.66	19.74
	Untrustworthy-Trustworthy	0.66 (7.59)	0.60		0.52 (11.58)	0.45		0.74 (11.19)	0.55	
Expertise	Not an expert-Expert	0.72	0.58		0.90	0.65		0.58	0.46	
	Inexperienced-Experienced	0.81 (9.30)	0.67	0.73	0.86 (13.07)	0.74	0.86	0.82 (6.23)	0.36	0.80
	Unknowledgeable-Knowledgeable	0.78 (9.51)	0.65	(0.73)	0.95 (13.85)	0.74	(0.86)	0.79 (6.24)	0.60	(0.80)
	Unqualified-Qualified	0.61 (7.95)	0.48		0.78 (12.44)	0.61		0.96 (6.31)	0.70	
	Unskilled-Skilled	0.26 (4.58)	0.21	11.08	0.55 (10.36)	0.40	20.01	0.71 (5.65)	0.49	20.86

Figure 3
Fitted Model for Papad Brand Ad



Chi-Square=181.92, df=87, P-value=0.00000, RMSEA=0.104

Figure 4
Fitted Model for Atta Brand Ad



Chi-Square=202.11, df=87, P-value=0.00000, RMSEA=0.114

End Note

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Role of Advertising Value as a Mediator in Formation of Attitudes towards Online Advertising in Indian Online Space

Rajeev Kumar Malik and S. K. Dubey

Abstract

Advertising effectiveness in all mediums of advertising has been a topic of interest and research among scholars for a long time. It has been found in advertising literature that Consumers' Attitude towards advertising has got a direct relationship to the effectiveness of any advertisement. This attitude of consumers' is influenced by their beliefs regarding online advertising and can be successfully predicted by the dimensions of those beliefs. These dimensions of beliefs lead to advertising value that plays a mediating role in prediction of attitudes. The advertising value model proposed by Ducoffe (1996) has been validated in this paper for online advertising in India. Research design was descriptive. Data were collected from 200 Indian consumers through a structured, non-disguised questionnaire using non-probability convenience sampling. Instrument consists of 19 items anchored on agreement continuum scale ranging from strongly disagree to strongly agree and 6 questions related to demographic profile of consumers. Regression analysis was used to investigate the mediating role of advertising value between predictors (Informative, Entertainment and Irritation) and criterion (Attitude towards online advertising). Information and entertainment have got positive relationship with attitudes towards online advertising among Indian consumers while irritation was found negatively related with attitudes. This study provides an insight regarding predictors of attitude towards online advertising and role of mediating variable in prediction of attitudes of Indian consumers towards online advertising. The results may not be generalized due to limited sample size and sample not being the true representative of the population due to convenience sampling.

Keywords: Information, Entertainment, Irritation, Advertising Value, Attitude towards online advertising.

1. Introduction

Consumers' attitudes toward advertising have been considered important to track because of their likely influence on consumers' exposure, attention, and reaction to individual ads (Alwitt and Prabhakar, 1992) through a variety of cognitive and affective processes (Lutz, 1985).The internet as an advertising medium offers many unique challenges to advertisers as compared to traditional media advertising. In online medium consumers' can easily bypass the advertisements if they want to do so. Online advertising exposure is largely dependent on the consumer's choice, it is mainly important to understand the structure of one important driver of online advertising exposure i.e. attitudes toward online advertising (Shavitt et al. 1998). Internet being a cost effective medium to reach target audience, has paved the way for tremendous growth of online advertising. Despite substantial growth in online advertising budgets and revenues by companies all over the world, there has been a lack of understanding among marketers about how consumers judge or respond to online advertising. Many of the existing measures of online advertising effectiveness have been shown to either overestimate or underestimate the consumers' response to online advertising. Unfortunately there are number of studies done to examine the attitudes of consumers towards online advertising in developed world but fewer have been done in developing countries like India. Hence, in the present study researchers applied a theoretical framework on consumers' perceptions of online advertising and their attitude towards online advertising in Indian context. Advertising value model (Ducoffe, 1995, 1996) has been used to assess online advertising and effort has been made to investigate the mediating role of advertising value between predictors (Informative, Entertainment and

Irritation) and criterion (Attitude towards online Advertising) in Indian online space.

2. Objectives of the Study

The study has the following two objectives.

1) To study the relationship of perceived information, perceived entertainment, perceived irritation and perceived value on attitudes towards online advertising among Indian consumers.

2) To analyse the mediating role of advertising value between perceived information, perceived entertainment, perceived irritation and attitudes towards online advertising among Indian consumers.

3. Review of Literature

3.1 Attitude

There have been several ways in which the concept of attitude has been defined by psychologists and behavioural researchers. Peter and Olson (2002) have given the three component model of attitude which consist cognition, affect and conation. In this model they show "attitude is a person's overall evaluation of a concept". However, a widely accepted definition among researchers was given by Fishbein and Azjen (1980) who defined, "attitude as a person's favourable or unfavourable feelings toward an object". A person's evaluations are formed by the cognitive system and are affective in nature. These evaluations are a product of integrated knowledge, beliefs and or meaning regarding a concept. During the integration process, a person decides on the personal relevance and whether it is favourable or unfavourable (Peter et al. 2002).

3.2 Online Advertising

"Online advertising maybe defined as a form of marketing communication on the Internet intended to persuade an Internet user (viewers, readers or listeners) to purchase or take an action based on content displayed on a website (or webpage). This communication may be in relation to products, ideas or services". Online Advertising includes many forms of commercial content-from electronic advertisements that are similar to traditional advertisements (e.g., billboards, banner ads) to formats that are different from traditional advertisements, such as corporate Web sites (Ducoffe,1996).

3.3 Advertising Value

Ducoffe (1995) proposed the advertising value construct to measure consumers' perceptions regarding the relative worth or utility of advertising. Through a series of studies Ducoffe (1995, 1996) developed a model based on three antecedents of perceived value: informativeness, entertainment and irritation. Importantly, these antecedents pertain to the consumer's experience with the advertising rather than traditional advertising effectiveness measures such as message recall, brand attitudes, and purchase intent. The model demonstrated that the advertising value construct is an antecedent of the attitude toward advertising construct.

3.4 Online Advertising Effectiveness

Advertising effectiveness in all mediums of advertising has always been a topic of interest and research among scholars, even then there is a lack of definitive yardstick to measure advertising effectiveness. Advertising recall, Attitudes toward the brand (AB), Attitudes towards the Ad (Aad) and purchase intentions have been widely accepted among academics and practitioners as indicators of advertising effectiveness (Mackenzie and Lutz 1989, Stewart 1999). Aaker et al. (1990) concluded that informative, entertaining, and dislikeable are the key factors that explain attitude towards advertising. Research suggests that these traditional measures of advertising effectiveness do not provide a good measurement in case of online advertising because of their emphasis on outcomes (Pavlou and Steward, 2000). In a more recent study it was revealed that the acceptance of advertising on social networking sites is related to the entertainment and information content they provide (Taylor et al., 2011). Ducoffe (1995, 1996) posited a model to assess advertising effectiveness which is based on three components of perceived value of advertising viz. informative, entertainment and irritation. These components apply to the consumer's experience with the advertising rather than traditional advertising effectiveness measures such as message recall, brand

attitudes, and purchase intent. This model also suggested advertising value is a predictor of the attitude toward advertising. Moreover this model could be used among different channels of advertising like television, print and online.

Informative value of the advertising is most important factor in predicting attitudes towards the brand (Brown and Stayman, 1992). Informative value has been positively related to consumers' attitude towards advertising (Taylor et al., 2011). Advertisers have always tried to provide entertaining advertisements in order to increase the effectiveness of message as entertainment factor relates positively with advertising effectiveness measures like advertising recall, attitudes toward the brand (AB), attitudes towards the Ad (Aad) (Shimp, 1981; Mackenzie and Lutz, 1989; Shavitt et al., 1998). In present time entertainment has got more importance in advertising because there is lot of advertising and advertisers and consumers both want to break the clutter. Now consumers tend to seek entertainment in brand related communications and associate themselves well with the advertisements, which are high in entertainment.

Irritation with advertising seems to be negatively correlated with advertising value and consumers' attitude towards advertising. Literature also supports this notion as according to Greyser (1973) consumers can get irritated by the content of advertising as well as by the clutter. One more thing that can cause irritation in consumers is the perceived deception or dishonesty in advertising. Loss of privacy is also a factor that can contribute to irritation content of advertising in case of online advertising (Taylor et al., 2011). In a recent study done in China, Romania and United States it was found that belief factors which includes information, entertainment, economy, credibility and value corruption were significant predictors of attitude toward online advertising (Wang, Sun and Thompson, 2010).

Based on the above discussions we propose the following hypotheses.

H_{1a}: There is a positive relationship between perceived information and attitude towards online advertising.

H_{1b}: There is a positive relationship between perceived entertainment and attitude towards online advertising.

H_{1c}: There is a negative relationship between perceived irritation and attitude towards online advertising.

H_{1d}: There is a positive relationship between perceived value and attitude towards online advertising.

H_{1e}: Advertising value mediates the relationship between perceived information and attitude towards online advertising.

H_{1f}: Advertising value mediates the relationship between perceived entertainment and attitude towards online advertising.

H_{1g}: Advertising value mediates the relationship between Perceived Irritation and Attitude towards online advertising.

4. Research Methodology

A 25 item online questionnaire was prepared using Google Doc and link was sent through personal email of the researcher. All questions were compulsory in the questionnaire and were regarding demographic profile and other predictor and criterion variables of the study.

4.1 Sample

The link containing questionnaire was sent to 200 respondents. All the participants were told in advance that participation in this study is purely voluntary. Some of the close friends of researcher also provided referral from their network and also forwarded the e-mail link so that maximum and randomized responses could be generated. Sampling method was convenience cum snow-ball sampling thus being non-probability sampling technique. Only 177 questionnaires were filled within given time period despite several attempts by researcher and his friends. This sample is not a true representation of Indian online consumers but could be considered well enough for theory validation (Table 1).

4.2 Measures

All independent variables viz. perceived informative content, entertainment; irritation and perceived value were measured adapting established scales (Ducoffe,

1996). Participants were asked to respond to five-point, Likert-type scales (1=strongly disagree, 5=strongly agree) by selecting the option that best represented how they felt about online advertising. Dependent variable i.e. attitude toward advertising was measured using a three-item, established scale by Pollay and Mittal (1992). Details about the reliability scales are given in the table 2, all constructs achieved good reliabilities except irritation (.681) which is also acceptable for psychological construct having three items only (Cronbach, 1951). In case of psychological constructs values of alpha below .70 can be expected because of the diversity of the constructs being measured (Kline, 1999).

5. Data Analysis

Primary data analysis through Pearson correlations coefficients revealed significant relationships between the independent and dependent variables. Correlation coefficients are significant at the .01 level.

Pearson correlations revealed significant, positive relationships between the attitude towards advertising and perceived information variable for Indian consumers, $r(177) = .78$, $p < 0.01$, supporting H1a. There were also significant, positive relationships between the attitude towards advertising and the perceived entertainment variable, $r(177) = .65$, $p < 0.01$, supporting H1b. Since the relationship between the attitude towards advertising variable and the irritation variable was significant and negative, $r(177) = -.27$, $p < 0.01$, H1c was supported. A high degree of positive relationship between perceived value and attitude towards online advertising was found, $r(177) = .84$, $p < 0.01$, H1d was also supported. The relationships between advertising value and attitudes towards television advertising remain consistent with the Ducoffe (1995, 1996) findings. The above computations of correlations gave us the degree of relationship between the above variables and to find out the functional relationship and investigation of mediation we had to go for regression analysis.

5.1 Test of Mediation through regression analysis

Mediation is a hypothesized causal chain in which one variable affects a second variable that, in turn, affects a third variable. The intervening variable "mediates" the relationship between a predictor and an outcome variable. Baron and Kenny (1986) proposed a four step approach in which several regression analyses are conducted and significance of the coefficients is examined at each step. The purpose of first three steps is to establish the zero order correlations among the variables under study. If one or more of these relationships are non-significant, researchers usually conclude that mediation is not possible or likely (MacKinnon, Fairchild, and Fritz, 2007). Since all correlational coefficients were found significant we could just examine the mediating role by looking at the regression coefficients of mediator variable when controlling for the effect of independent variable. Results of mediation analysis are shown in the table 3.

It is clearly inferred from the table 3 that since beta coefficients of both independent as well as mediator variable are significant in all models, our findings support partial mediation. Advertising value partially mediates the relationship between perceived entertainment and attitude towards online advertising. It has also got partial mediating effect between the relationship of perceived information and attitude towards online advertising. Advertising value was also found partial mediator effect between the relationship of perceived irritation and attitude towards online advertising. Hence all alternate hypotheses about mediation effect (H_{1e}, H_{1f} and H_{1g}) were supported.

6. Conclusion

On the basis of the study it can be concluded that value of online advertising that could be formed on the basis of information, entertainment and irritation content present in advertisements is directly related to consumers' attitude. Hence consumers form a favourable or unfavourable attitude based on perceived value of online advertising. There may be other factors involved in formation of consumers' attitude but by increasing the information and entertainment content in online advertising, advertisers can get consumers' favourable attitude towards online advertising. This favourable attitude towards online advertising could help in forming positive perceptions and favourable attitude towards their brand. This favourable attitude towards online

advertising and favourable brand attitude could lead to increased purchase intentions for their brands in online environment (Mackenzie and Lutz 1989). This study was an attempt to explore the mediating role of advertising value between predictors of attitude towards online advertising and attitude towards online advertising. More in depth studies for assessment of this relation are suggested to gain more understanding of this relationship because our findings only supported partial mediation. There might be other mediating or moderating variables that account for the variability in consumers' attitude towards online advertising. Despite these limitations this study could provide insights to online advertisers regarding Indian consumers' perceived value and attitude towards online advertising.

Appendix

Table 1: Demographic Profile of Respondents

Variables		Number	Percentage
Age (Mean=24.84, S.D.=4.91)	15-24 Years	86	48.58 %
	25-34 Years	76	42.93%
	35 and above	15	8.47%
Gender	Male	111	62.7%
	Female	66	37.3%
Educational Qualification	Graduate	84	47.5%
	Post Graduate	68	38.4%
	Above PG	25	14.1%
Monthly Income	Up to 25000	121	68.4%
	25001-50000	35	19.7%
	50001 & above	21	11.8%

Table 2: Reliability Statistics

Scale	Mean	Cronbach's alpha	No. of Items
Attitude	11.1808	.868	3
Informative	22.5367	.880	6
Entertainment	13.2203	.879	4
Value	11.6497	.856	3
Irritation	7.9209	.681	3

Table 3: Mediation Analysis

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	4.818	.577		8.351	.000
	Entertainment	.481	.042	.653	11.405	.000
2	(Constant)	1.017	.470		2.162	.032
	Entertainment	.150	.037	.203	4.096	.000
	Value	.702	.049	.718	14.466	.000
3	(Constant)	1.962	.572		3.428	.001
	Information	.409	.025	.780	16.480	.000
4	(Constant)	.925	.485		1.908	.058
	Information	.135	.036	.258	3.728	.000
	Value	.619	.068	.633	9.157	.000
5	(Constant)	13.391	.624		21.454	.000
	Irritation	-.279	.075	-.270	-3.711	.000
6	(Constant)	2.813	.616		4.566	.000
	Irritation	-.128	.041	-.124	-3.099	.002
	Value	.805	.039	.823	20.545	.000
Dependent Variable in all models is Attitude towards Online Advertising						

End Note

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Linking Various Leadership Styles to Organizational Innovation: A Theoretical Approach

Rama Shankar Yadav

Abstract

A growing research on the impact of leadership style on innovation and the mixed results which have been reported complicate the efforts among the academicians and the practitioners to identify the best leadership style whose impact is most facilitative on different innovation types. Although many studies (Al-Husseini & Elbeltagi, 2012; Oke, Munshi, & Walumbwa, 2009; Vaccaro, Jansen, Van Den Bosch, & Volberda, 2012) have reported a positive association of Transformational leadership style on innovation and organizational performance; other studies (Makri & Scandura, 2010; Mejia-Trejo, Sanchez-Gutierrez, & Vazquez-Avila, 2013) have found positive linkages of Transactional leadership, Strategic leadership and Participative leadership respectively with innovation and organizational performance. Since there are contrasting views on the linkages, there is a need to explore the facilitative impact of different leadership styles on different innovation types. Adding to this conversation, we found that the Transformational Leadership style facilitates radical innovation whereas transactional leadership facilitates incremental innovation.

Keywords: Transformational leadership, Transactional leadership, Innovation, Performance.

1. Introduction

The beginnings of research on management and innovation can be traced to about five decades ago (Denti & Hemlin, 2012) and since then much has been talked and worked upon innovation and various factors linked to it. Much work explores the linkages between different leadership styles and innovation. It has been agreed that leadership is crucial and has an important role in facilitating innovation in organizations (Mumford, Scott, Gaddis, & Strange, 2002). But which leadership style is more important or facilitates which type of innovation and at what stage of innovation is still a point of contention. The present study tries to explore these linkages. We argue that innovation in organization is an outcome of the interaction of various factor such as individual, team, leadership and organizational support. The interaction of these factors facilitates radical or incremental changes in products, services or processes. Innovation involves various activities before it comes for implementation or reaches the market for its usage. Throughout the entire journey, the role of the leader is very crucial for the successful creation or implementation of the new innovation relevant to the firm.

In the following section, certain definitions of innovation are provided which might be helpful in understanding the linkage between the leadership and the innovation type. "Innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace, organization or external relations" (OECD, 2005:46). According to Tushman & Nadler (1986) "Innovation is a complex and uncertain endeavor which shifts over time and requires the close collaboration of R&D, marketing, sales, and production". Knight(1967) has defined innovation as a process which is "The adoption of a change which is new to an organization and to the relevant environment".

Sometimes creativity and innovation are used interchangeably by the researchers (Basadur, 2004). It is now generally accepted that creativity is restricted only to the stage of idea generation and innovation is implementation of those successful ideas (Amabile, Conti, Coon, Lazenby, & Herron, 1996; Anderson, De Dreu, & Nijstad, 2004).

Leadership has an important role to play while competing in a dynamic and turbulent environment as it helps in enhancing organizational performance (Ireland, Hitt, & Webb, 2005). It has been universally accepted that for survival one needs to innovate and hence the role of

a leader becomes crucial. In this section, we propose the relationships between different leadership types and innovation processes.

Transformational Leadership is considered more facilitative than other leadership styles for budding organizational innovation (Al-Husseini & Elbeltagi, 2012; Oke et al., 2009; Vaccaro et al., 2012). Alternatively, studies of Mejia-Trejo et al. (2013) and Makri & Scandura (2010) have found positive linkages of Transactional leadership and Strategic leadership respectively for the innovation and organizational performance. Further, some previous empirical researches exploring the linkages between innovation and transformational leadership have yielded contradictory results. For example, researchers (Keller, 2006; Vaccaro et al., 2012) have found positive linkages between innovation and transformational leadership whereas, others found a negative linkage between the two (Jaussi & Dionne, 2003). The current study tries to examine the impact of various leadership styles on different innovation types. In the present study, radical & incremental innovation has been taken as the type of innovation.

2. Theoretical Framework

There are many researches that study various dimensions of leadership and its impact on innovation. Leadership research has focused significantly on transformational, transactional, strategic and many other leadership forms and studied their impacts on innovation. We strongly believe that leadership is very important for innovation and subsequent organisational performance. The potential reasons for our belief are two-fold.

(a) Leaders are the architects of the environments which facilitates innovation (Hemlin, Allwood, & Martin, 2008). There is a plenty of work on leadership which focuses on the importance of leaders in constructing the context that promotes empowerment such as the bottom-up approach to decision making. Leaders motivate and facilitate problem solving skills in subordinates. They also develop a positive and healthy team climate (Anderson & West, 1998) and serve as role model for maintaining and doing high quality work within the team.

(b) Leaders play crucial roles in the top-down approach; they direct and manage critical activities within the organization. They have control over the organizational resources and hence they manage activities by allocating these resources depending on the need. They encourage individuals and teams towards creativity and innovation by managing the reward system (Mumford & Gustafson, 1988), granting autonomy and freedom to individuals and teams (Hunter, Bedell-Avers, & Mumford, 2007). Thus, a leader play a dual role (a) providing support and an environment so that creative efforts of individuals can be converted to innovation (thus focusing on the facilitator role of the leaders), and (b) Managing organization's objectives and activities (leader as a manager for innovation).

From the above we can conclude that leaders and their leadership style impact innovation and facilitate activities which foster innovation, but which leadership style is best suited and in what stage is it beneficial is still not clear. In an attempt to address these issues, the present paper systematically reviews relevant research articles which have studied the impact of various types of leadership styles on innovation. Many researchers (Jung, Wu, & Chow, 2008; Oke et al., 2009) have addressed the issue in their work. However, very few studies have combined various leadership types and triedto answer the above question. For example,Yoshida, Sendjaya, Hirst, & Cooper (2013) have studied the positive impact of servant leadership on team innovation; Yan (2011) studied the role of participative leadership on innovation, Ryan and Tipu (2013) have studied the impact of active leadership on innovation. Transformational leadership and its impact has been studied by researchers (Paulsen, Callan, Ayoko, & Saunders, 2013; Samad, 2012); the importance of transactional leadership has also been highlighted by the researchers (Mejia-Trejo et al., 2013; Oke et al., 2009). A comprehensive work on leadership style and innovation has been carried out by (Oke et al., 2009) where they conclude that transformational leadership style is more facilitative for exploratory innovation and transactional leadership is more helpful in facilitating exploitative innovation. In this paper we have tried to extend their work by reviewing more recent literature. We have made an attempt to explore

the most facilitative leadership style for radical and incremental innovation.

As discussed earlier leadership and its impact on innovation process and organizational performance has been widely studied in strategy literature and other related management disciplines. But which leadership style is more facilitative for a particular type of innovation has not been studied in much detail. In this work we have tried to contribute to this particular area. We have tried to find out which leadership style is more facilitative for radical innovation and incremental innovation. Radical innovation, incremental innovation, transformational leadership and transactional leadership has been studied in detail and by comparing the common characteristics of the leadership style and the innovation type we have tried to propose the answer to our question (Which leadership style is more facilitative for radical and incremental innovation type?).

3. Literature Review

Since this a conceptual paper based on literature review; the methodology revolves majorly on the selection and rejection of research articles. We did our research article search in various steps.We did our search in December 2013 and January 2014 and searched for articles which were published mostly after the year 2000. Only few classic papers like (Knight, 1967; Mumford & Gustafson, 1988; Tushman & Nadler, 1986) and (Anderson & West, 1998) were used in the literature review (mainly for quoting definitions). The articles were searched using the online resources and mainly on EBSCO discovery and Google Scholars. Keywords like leadership, innovation, creativity, transformational leadership, transactional leadership, charismatic leadership, role of leadership; organizational performance etc. were used while doing the online search. The word creativity was searched intentionally since it has been frequently used interchangeably along with innovation. Prior to final selection the abstract of each article was reviewed so that only relevant articles can be kept in the selected pool. All the relevant article which fulfilled the search requirement whether qualitative or quantitative articles were kept in the pool. Generally a thumb rule was used in which we treated innovation as a dependent variable and leadership type as an independent variable. Only peer reviewed articles were selected in the pool and thus our search excluded working papers and dissertations. At the initial stage we had a gross pool of about 200 articles and after reviewing the abstract along with the abstract about 55 articles were selected in the main pool.

3.1 Leadership and Innovation

Discussing the relationship between leadership style and innovation type a great deal of literature is available. The positive impact of transformational leadership on innovation has been found by majority of researchers (Al-Husseini & Elbeltagi, 2012; Bossink, 2007; Chen & Chen, 2012; Eisenbeiß & Boerner, 2010; Engelen, Schmidt, Strenger, & Brettel, 2013; García-Morales, Jiménez-Barrionuevo, & Gutiérrez-Gutiérrez, 2012; Gumusluoglu & Ilsev, 2009; Jung et al., 2008; Michaelis, Stegmaier, & Sonntag, 2009; Oke et al., 2009; Paulsen et al., 2013; Samad, 2012 and Vaccaro et al., 2012); . In another study Mejia-Trejo et al., (2013) found positive linkage of transactional leadership on innovation and Oke et al., (2009) argued that transactional leadership is facilitating in nature for exploitative innovation. Studies (Bossink, 2007;Elenkov, 2008;and Makri & Scandura, 2010) have found positive linkages of Strategic Leadership with innovation process and on the other hand, Yan (2011) found a positive linkage between Participative Leadership style and innovation.

Some researchers (Ashbaugh, 2013; Rego, Sousa, & Marques, 2012; Ryan & Tipu, 2013 and Yoshida et al., 2013) have found positive linkages of innovation with Servant Leadership, Active Leadership, Authentic Leadership and Personal Leadership style respectively. A detailed literature review on different leadership styles and innovation has been presented in tabulated form down below. (Table 1 to 6)

In the following section I have reviewed the literature linking radical innovation, incremental innovation, transformational leadership and transactional leadership.

3.2 Radical Innovation

Radical innovation has been defined in a number of ways but the core idea remains the same. It is now some what universally accepted among the research and managerial community that, an innovation which establishes a breakthrough benchmark in newness in its category i.e., considered as considerably new in the market or the contextual unit of analysis is radical innovation. But we will consider few classic definitions of radical innovation to identify its critical features. Researchers (Dewar & Dutton, 1986; Ettlie, Bridges, & O'keefe, 1984) have defined radical innovation in terms of those innovations which lead to fundamental changes and clear cut modifications in the existing activities and lead to adoption of new practices in an organization. Damanpour (1991) has also talked on the same ground and classified that if the degree of change in the existing practices of the organization is high then it is radical and if low then it is incremental innovation. Sorescu, Chandy, & Prabhu (2003) have defined radical innovation as an innovation which is high on offering substantially different technology and significantly higher value to the customers. But in order to expand, business firms always face a demand for new knowledge creation and new routines within the firm and risk failure while entering into new business territories. Radical innovation is highly risky but equally important for the development of industries and organizations. Some other characteristics of radical innovation are longer duration, high cost, meandering, unpredictable in nature, (Bers, Dismukes, Miller, & Dubrovensky, 2009;Rice, O'Connor, Leifer, McDermott, & Standish-Kuon, 2000). Thus we can infer that radical innovation can take place in an environment where the senior leadership promotes risk taking and continuously motivates the team members so that the momentum within the team members is maintained. Further the leadership accepts the failures and is not hesitant in investing in project even if some failures occur in the initial stages. The impact of radical innovation is magnificent in nature and a radical innovation (has the potential to) can transform an organization to a dominant player in the industry (Chandy & Tellis, 2000). Thus, if a company wants to transform into a big giant and enjoy leadership they should foster radical innovation but at the same time they also need a leader who is capable of facilitating radical innovation and innovative culture in the organization. The leadership should be open to two way communication as it promotes idea generation and decision making among team members. The leadership should not promote centralization and should encourage independence and autonomy in subordinates, because centralization reduces the probability of radical product innovation as it restricts communication networks between the top management and the staff (Jansen, Van Den Bosch, & Volberda, 2006). The leadership should not promote formalization in the decision making and planning of product development, since it is detrimental to radical product innovation (Salomo, Weise, & Gemünden, 2007). Thus, the leadership should be open to ideas from the staff, promoting risk taking behavior and should consistently motivate the team through its inspirational and caring nature.

3.3 Incremental Innovation

Incremental Innovation is generally low on the newness aspect but it is a continuous improvement in the product or process (Ettlie et al., 1984). Hoonsopon and Ruenrom (2012) have defined incremental innovation as "the development of products that have minor changes in attributes, and the benefits from these changes are minimal from the customer's perspective". Centralization of decision making is positively related to incremental innovation (Cardinal, 2001). The reason for this relationship is faster decision making which does not involve much input from the staff but is focused on a directive from the top management about how to finish the job. It is a market dominated strategy and is generally promote in large organizations which usually enjoy market share and need only small but continuous improvement in the product and processes. Incremental innovation is more facilitative when there is a formalization in decision making as it assists routine jobs, minimizes deviations from rules and procedures and communicates clear cut "what to do" for a known environmental condition (Cardinal, 2001). Thus, in incremental innovation there is routine work and very little risk involved while performing the activities related to incremental innovation. To bring out major difference

between radical and incremental innovation, we use the classification proposed by Chandy & Tellis (1998) (See Table 7).

3.4 Transformational Leadership

Transformational leadership has always been important for innovation and researches (Paulsen et al., 2013; Samad, 2012) have talked about its impact on innovative behavior. In this section, we have tried to understand some of the basic characteristics of transformational leadership and, based on those characteristics, we intend to propose a suitable innovation type.

A great deal of literature is available on transformational leadership, but for this article we will be using the characteristics of transformational leadership as proposed by Bass and his colleagues (Hater & Bass, 1988;Seltzer & Bass, 1990; Bass & Riggio, 2005). According to them, transformational leaders have the Charisma in their personality which is not only capable of creating imagination, long vision and meaning in the project; but also inspires value, respect and confidence in the team. The second characteristic of transformational leaders is Inspiration, by virtue of which they transfer elevated prospects in the team and communicates plans and objectives through simple and plain methods. The third characteristics is Intellectual Stimulation which is capable of promoting rationality, brainpower, decision making, and careful problem solving in the team. The fourth but a very important characteristic is Individualized Consideration which results in personal caring, coaching, advise and attention to each team member. Conger & Kanungo (1998) have mentioned that in a Charismatic domain, the leader articulates an innovative strategic vision, shows sensitivity to the needs of the members, takes personal risks and is highly sensitive to the changing environment. Shamir, House, and Arthur (1993) have mentioned the appealing vision and ideological aspects of work which transformational leaders exhibit. They communicate high performance expectation to subordinates and have immense confidence in themselves and their subordinates. Under a transformational leadership the followers have a feeling of trust, loyalty, admiration and respect. As a result, the motivation factor is much higher and they perform higher than the expected level (Yukl, 1999). Thus, transformational leadership is grounded in the principles of promoting the decision making and risk taking behaviours of team members, as well as instilling a sense of confidence in them.

3.5 Transactional Leadership

Transactional leadership has also been very impactful for innovation. The works of many researchers have revealed the same (Mejia-Trejo et al., 2013;Oke et al., 2009). In this section we will discuss some significant characteristics of transactional leadership and we will try to propose the kind of innovation it facilitates. Literature has treated transactional leadership as a leadership style which is purely based on transactions and exchange. It has major governing components such as contingent rewards and Management by exception. management by exception means that the manager does not enter the problem situation until it becomes serious and critical (Bass & Avolio, 1990). It includes series of exchanges between leaders and followers (Bass, 1985). The leaders classify the follower's role and if the instructions are followed, the followers are rewarded. Basically, it is oriented towards short-term fulfillment of objectives. Thus, we can conclude that the work environment under transactional leadership is more formal in nature, where subordinates receive clear communication about their routine jobs and a clear chain of command is followed while performing the job. Minimal deviations from rules and procedures take place which results in very little risk taking behavior. The tables below summarize the various key points related to transformational leadership (Table 8), transactional leadership (Table 9) and radical as well as incremental innovation (Table 10).

4. Findings

Based on the literature review and comparing the characteristics of transformational and transactional leadership styles and those needed for facilitating radical and incremental innovation, it was found that there are high degrees of similarities between the characteristics

possessed by a transformational leader and those reuired for facilitation of radical innovation. From literature, it has been found that a transformational leader possesses innovative strategic vision, trusts and has confidence in subordinates, displays respect and caring for subordinates. She/He is sensitive to the changing environment and is capable of high risk taking initiatives and displays exemplary behavior to motivate her/his subordinates, promotes knowledge sharing and acquisition and at the same time accepts the failure of subordinates. The necessary environment for radical innovation, includes a need for broader vision, unique strategy, high risk taking environment, promoting aggressive experimentation, long term realization, development and application of new technology, high level of knowledge acquisition and sharing, informal structure and trust driven processes which are inspirational in nature.

At the same time, transactional leaders are instrumental in nature and they promote the performance culture by rewarding success and punishing failure. Since there is a culture of punishing failure, very little or no experimentation or risk-taking is promoted under transactional leaders. Leaders have a short-term vision and is interested in short-term realization of goals and objectives. They clearly communicate the expectations to subordinates and the necessary mechanisms to solve the problem. These leaders generally believe in chain of commands and favor centralization of processes. On observing the facilitative conditions for incremental innovation, it was noted that the literaturepoints out that incremental innovation generally requires a narrow focus, traditional approach, low-risk taking environment, short-term realization of profits, contractual nature with employees and suppliers, application of existing technology, low level of knowledge acquisition, formal structure and incentive driven processes. Since the degree of similarity between transformational leadership and radical innovation and transactional leadership and incremental innovation is high, It can be proposed that transformational leadership is facilitative for radical innovation and transactional leadership is facilitative for incremental innovation.Thus the propositions are as follows.

Proposition.1. Transformational leadership facilitates radical innovation.

Proposition.2. Transactional leadership style facilitates incremental innovation.

5. Conclusion

This study began with the observation that much work has been done in exploring the impact of leadership style and innovation type. In this paper, an attempt has been made to explore the most facilitative leadership style for radical and incremental innovation types separately.

A simple methodology was adopted to study the problem through a comparison of the necessary traits possessed by transformational leaders and transactional leaders while simultaneously studying the necessary environment which facilitates radical and incremental innovation. On comparing the characteristics of leadership style and conditions required to facilitate radical and incremental innovation, it was found that majority of the characteristics of transformational leadership style and radical innovation were compatible. On the other hand, transactional leadership characteristics were found to be aligned with the environment required for incremental innovation. Thus it is proposed that transformational leadership is facilitative for radical innovation whereas transactional leadership is facilitative for incremental innovation.

6. Implications for Future Research and Practice

This research has implications for future research and practice. The findings of this research article are propositions which may be tested empirically in Indian firms as well as in MNCs in Indian and international settings. This research proposes that transformational leadership is facilitative for radical innovation and transactional style is facilitative for incremental innovation. It gives a message to managers to maintain the right mix of transactional and transformational leadership styles in the talent pool so that organizations can achieve results for radical as well as incremental innovation processes.

Appendix

Table.1: Different Leadership Type and Relationship With Innovation

Authors	Leadership Type	Positive Relationship with
Vaccaro et al. (2012)	Transformational Leadership	Innovation in large firms
Samad (2012); Al-Husseini & Elbeltagi (2012)		Product and service innovation
Paulsen et al. (2013)		Innovation in R&D
Oke et al. (2009)		exploratory innovation
García-Morales et al. (2012)		Organizational Innovation
Michaelis, Stegmaier & Sonntag (2009); Bossink (2007)		Innovation
Gumusluoglu & Ilsev (2009); Jung et al. (2008), Engelen et al. (2013)		Organizational Innovation and Creativity
Eisenbeiß & Boerner (2010)		Team innovation
Chen & Chen (2012)		Technological Innovation
Oke et al. (2009)	Transactional Leadership	Exploitative Innovation
Mejia-Trejo et al. (2013)		Innovation
Makri & Scandura (2010); Elenkov (2008) and Bossink (2007)	Strategic Leadership	Product Innovation and Knowledge creation

Table.2: Linkages between Leadership Style and Innovation Which Have Been Cited Only in One Article

Authors	Leadership Type	Positive Relationship with
Yoshida et al. (2013)	Servant Leadership	Team innovation
Ryan & Tipu (2013)	Active Leadership	Innovation
Rego et al. (2012)	Authentic Leadership	Employee creativity
Ashbaugh (2013)	Personal Leadership	Innovation
Tsai (2012)	Creative Leadership	Organizational Innovation and Creativity
Miles (2007)	Value Based Leadership	Innovation
Lloréns Montes, Ruiz Moreno & García Morales (2005)	Support Leadership	Innovation
Elenkov & Manev (2005)	Executive Leadership	Innovation
Denti & Hemlin (2012)	Facilitative Leadership	Innovation
Chen & Chen (2012)	Visionary Leadership	Innovation
Carmeli, Gelbard & Gefen (2010)	Innovation Leadership	Innovation
Bossink (2004)	Interactive Leadership	Sustainable to Innovation
Yan (2011)	Participative Leadership	Innovation in small firms

Table.3: Showing Different Type of Leadership Style Studied in Literatures Which Have Effect on Innovation

Various Types of Leadership Style Studied in Literature		
Transformational Leadership	Transactional Leadership	Participative Leadership
Servant Leadership	Creative Leadership	Active Leadership
Authentic Leadership	Support Leadership	Charismatic Leadership
Diverse Leadership	Strategic Leadership	Tenure Leadership
Executive Leadership	Facilitative Leadership	Visionary Leadership
Innovation Leadership	Interactive Leadership	Personal Leadership

Table.4: Showing Relationship of Transformational Leadership with Different Innovation Type

Leadership Type	Positive Relationship With	Authors
Transformational	Product Innovation	Al-Husseini & Elbeltagi (2012); Samad (2012)
	Process Innovation	Al-Husseini & Elbeltagi (2012)
	Service Innovation	Samad (2012)
	Technological Innovation	Chen & Chen (2012)

Table 5: Showing Some Moderating Variable Which Affect the Relationship Between Leadership Type and Innovation Leadership Type

Leadership Type	Relationship with Innovation	Moderator	Type of Paper	Authors
Transformational	Positive	Organizational Size	Quantitative	Vaccaro et al. (2012)
		Organizational Context	Qualitative	Oke et al. (2009)
		Organizational Culture, Structure and external environment	Quantitative	Jung et al. (2008)
Executive	Positive	Social Culture	Quantitative	Elenkov & Manev (2005)
Transactional	Positive	Organizational	Quantitative	Vaccaro et al. (2012)

Table.6: Showing Some Mediating Variable Which Affect the Relationship Between Leadership Type and Innovation

Leadership Type	Relationship with Innovation	Mediator	Type of Paper	Authors
Transformational	Positive	Perceived support	Quantitative	Paulsen et al. (2013)
		Follower's commitment	Quantitative	Michaelis et al. (2009)
		Knowledge sharing	Qualitative	Al-Husseini & Elbeltagi (2012)
Authentic	Positive	Psychological Capital	Quantitative	Rego et al. (2012)
Servant Leadership	Positive	Organizational and team climate	Quantitative	Yoshida et al. (2013)

Table.7: Radical vs. Incremental Innovation

Types of Product Innovations

		Customer-Need Fulfillment	
		Low	High
Newness of Technology	Low	Incremental innovation	Market breakthrough
	High	Technological breakthrough	Radical innovation

Source : Chandy and Tellis (1998)

Table.8: Showing Transformational Leadership Types with its Specific Characteristics

Transformational Leadership

Charisma

1. Innovative strategic Vision
2. Unconventional behavior,taking risks
3. Snesitive to environment change
4. Self confidence and trust in team
5. Model Exemplary behavior
6. Emphasise collective Identity

Individual consideration

1. Promotes interactive process
2. Mutual trust
3. Respect for subordinate ideas and feelings
4. Coaches, and advises
5. Gives private care and attention, treats each follower as an individual

Intellectual Stimulator

1. Promotes knowledge aquisition and sharing
2. Promotes Rationality
3. Brainpower,and
4. Enhanced problem solving skils

Inspirational

1. Cascades the elevated prospects
2. Explains important objects in simple ways
3. Inspires by his functional and behavioral traits

Table.9: Showing Transactional Leadership Types with its Specific Characteristics

Transactional Leadership

Contingent Reward

1. Rewards are given for following orders
2. Punishments are also well-understood
3. Incentivising short term goal

Management by exception

1. Expected performance, no attention required
2. Praise and reward for exceeding expectation
3. Corrective action and punishment for under performance

Leader-Memember Exhange

1. Leaders develop an exchange with each otheir subordinates
2. Subordinate is given a salary and other benefits, and
3. Company/Manager gets authority over the subordinate

Clear structures

1. Communicate clearly what is expected
2. Clear chain of commands and procedures to achieve it
3. Formal set of discipline

Table.10: Features of Radical and Incremental Innovation

Radical Innovation	Incremental Innovation
1. Broader Vision	1. Narrow focus
2. Unique strategy	2. Traditional Approach
3. High Risk	3. Low in risk taking
4. Aggressive policy/ Experimentation	4. Policy aiming to preserve the market share
5. Long term realization	5. Short term realization
6. Development and Application of new technology	5. Contractul nature with employees and suppliers
7. High level of Knowledge acquisition and sharing	6. Application of exisitng technology
8. Informal structure	7. Generally low level of knowledge acquisition and Sharing
9. Trust driven process	8. Formal strucure
10. Specialist cum generalist role	9. Incenrive Driven process
11. Inspirational	10. Chain of command
	11. Echange

End Note

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Comparative Accuracy and Explanatory Performance of Valuation Models: Evidence from India

Ranjit Tiwari and Harish Kumar Singla

Abstract

The purpose of this paper is to empirically examine the comparative accuracy and explanatory performance of discounted cash flow (DCF), residual income model (RIM), equity dividend (ED), P/E multiple (PE_M) and P/B multiple (PB_M) valuation models for the Indian banking sector and come up with a composite valuation model (CV) to see whether combining value estimates increase the valuation accuracy. To achieve the objective of the study we determined the intrinsic values using all the six models. Further, we compared the models based on prediction errors and the explanatory performance of market value on value estimates. The study uses panel regression to forecast estimates of earnings and measure explanatory performance. The study uses annual data points starting from March 31, 2002 to March 31, 2012.The comparative framework shows that the most appropriate method for value estimate is provided by RIM and ED models and therefore has higher ability to account for long term market expectations for the banking sector whereas composite value estimates stay in between DCF, RIM and ED models (best three) and prescribes a middle path. Hence, combining make sense because in volatile emerging economies it is always good to follow a midway path to avoid extreme values. This paper provides academicians and practitioners with a snapshot of the applicability of DCF, RIM, ED, PE_M and PB_M valuation models for Indian banking industry and also shows how a composite value (CV) estimate can improve valuation accuracy.

Keywords: Financial forecasting, Valuation models, Prediction error, Panel data, India.

1. Introduction

Valuation has always been an essential element in financial decision making whether it is choosing investments for a portfolio, in deciding on the appropriate price to pay or receive in a takeover/merger/acquisitions and in making investment, financing and dividend choices when running a business. Being a developing nation with huge growth prospects the assessment of valuation models becomes important as these models are used by a multitude of investment bankers, money managers, securities analysts, and regulators to accurately value equity assets. Thus, the accuracy of these methods in determining the value of an equity asset is an issue of utmost importance to have a more realistic value estimate. The immediate question arises as to which valuation methods to use which is most appropriate in terms of accuracy and explanatory power?

However, having surveyed wide-range of literature available on valuation, we find that even after having the standard-setting work (Copeland, Koller, Timothy and Murrin, 1990) on valuation, the empirical studies (Dermine, 2010; Francis et al., 2000; Frankel and Lee, 1995, 1996; Gross, 2006; Jiang and Lee, 2005; Kaplan and Ruback, 1995; Levin and Olsson, 2000; Penman and Sougiannis, 1998; Plenborg, 2002) have shown conflicting results regarding the most suitable valuation model. On the other hand most of the studies concentrate on the accuracy of valuation models to industrial companies and we have little empirical evidence for banking industry. We also find that almost all the studies in the literature are conducted in respect to developed nations and we are using those models as a proxy for valuing companies in developing nations. Getting motivated with these issues prevailing in previous research, we decided to empirically examine the comparative accuracy and explanatory performance of DCF (discounted cash flow), RIM (residual income model), ED (equity dividend), P/E multiple (PE_M) and P/B multiple (PB_M) valuation models for the Indian banking sector and come up with a composite valuation model (CV) to see whether combining value estimates increase valuation accuracy because past literature shows that no single procedure is conclusively precise. Hence, combining

value estimates makes sense because every bona fide estimate provides information, so relying on only one estimate ignores information.

Though the issue is important strikingly little academic studies have explored the comparative accuracy of these models for banking industry in India. This paper attempts to provide academicians and practitioners with a snapshot of the applicability of valuation models by comparing estimated values derived from the prescribed models to the observed market values to arrive at a better value estimate for banking sector companies in India. The contribution of this paper is to add empirical evidence to this research area.

The empirical findings of the paper suggest that RIM and ED are superior to DCF, PE_M and PB_M valuation models. CV estimate is also better than DCF, PE_M and PB_M valuation models. Though it has not outperformed RIM and ED but it is more informative than RIM and ED individually because CV is the combined value estimate of RIM, ED and DCF (best three models). Hence, combining value estimates do make sense because in volatile emerging economies it is always good to follow a midway path to avoid extreme values. Our results could motivate academicians and practitioners to use composite valuation model as an alternative to individual models to arrive at a more realistic value estimate.

2. Literature Review

Several studies have investigated the ability of one or more of these valuation methods to generate reasonable estimates of market values. Kaplan and Ruback (1995) provided evidence that cash flow estimates significantly outperform estimates based on comparable or multiple approaches. Frankel and Lee (1995; 1996) found that the value estimates based on Abnormal earnings (AE) explain significantly larger portion of the fluctuation in security prices than value estimates based on earnings, book values, or a combination of the two. Bernard (1995) compared the ability of forecasted dividends and forecasted abnormal earnings to explicate fluctuations in current security prices. He found that dividends explain 29% of the variation in share prices, compared to 68% for the combination of current book value and abnormal earnings forecasts. Penman and Sougiannis (1998) also provided a comparative analysis of dividend, cash flow, and abnormal earnings-based value estimates using infinite life assumptions. Irrespective of the length of the time horizon, Penman and Sougiannis found that abnormal earnings (AE) value estimates have significantly smaller (in absolute terms) mean signed prediction errors than free cash flow (FCF) value estimates, with dividend discount (DIV) value estimates falling in between. Francis et al. (2000) extended previous investigations by comparing the reliability of intrinsic value estimates obtained from DIV, FCF and AE model. They contrast the reliability of value estimates in terms of their accuracy and explainability. Their results revealed that AE value estimates perform significantly better than DIV or FCF value estimates. Berkman, Bradbury, and Ferguson (2000) in their study compared the estimates of value obtained from conventional discounted cash flow and price earnings valuation methods to the market price. They suggested that the best discounted cash flow method and the best price earnings comparable method have similar level of accuracy.

Levin and Olsson (2000) discussed that the company's forecasted performance stays stable after the valuation horizon and that its expected development, as described by its parameters, holds indefinitely if the steady state condition is maintained. They also claim that the steady state condition is necessary for the three models to yield identical estimates when terminal values are used. Therefore, any violation in the steady state condition can cause internal inconsistencies in valuation models and thus have a significant impact on the equity value estimates. Plenborg (2002) also argued that Cash flow model (CFM), Dividend discount model (DDM), and Residual income model (RIM) valuation methods should provide consistent and identical estimates of intrinsic firm value, provided that the forecasts of the different variables are consistent with each other within a clean surplus relationship and all the assumptions are identical. Moreover, for all sets of accounting rules, these models provide similar estimates of value when infinite horizon forecasts are employed. However, these zero-error conditions are very restrictive. Practically, forecasts are made over finite horizons so different

accounting principles yield different estimates of value with finite-horizon forecasts. For this reason, steady state terminal values, which usually have considerable weight in equity valuation, are calculated in practice to correct for error introduced by the truncated forecast horizon, and such calculations are necessary for all clean-surplus accounting methods. Gentry, Reilly and Sandreho (2003) provided an integrated valuation system (IVS) that allows for academia and practitioners to simulate changes in the firm's financial strategy and the effects of these modifications on the value of a stock. Moreover, they presented theoretically the conditions when the dividend discount model value estimates are equal to the cash flow model value estimates. They also stated that the only time for the equivalency condition is when the pay-out ratio is equal to one as well as the return on investment equals the cost of equity. Benada (2003) assessed empirically whether, over five year valuation horizon, the DDM, FCF, and the RIM are empirically equivalent. Their results introduced empirical support for these predictions of equivalence between these three price-based valuation models. Furthermore, they found that the price-based valuation models, within each class of the CFM and the RIM, outperformed the non-price based valuation model accompanied with the dominance of the RIM over CFM in both the approaches. Jiang and Lee (2005) also suggest that for equity valuation, book value and accounting earnings in residual income model contain more useful information than dividends alone.

Lundholm and O'Keefe (2001), Fernandez (2003), have criticised previous studies (e.g. Penman et al. (1998), Francis et al. (2000), and Courteau et al. (2000)) that introduced empirical support to make the comparison of the three theoretically equivalent valuation models (DDM, FCF and the RIM), and they concluded that there is nothing to be learned from an empirical comparison of these models. Though, Lundholm & O'Keefe (2001) and Fernandez (2002) both were theoretically correct but issues related to forecast horizons and steady state conditions put forward by Planborg (2002), Levin and Olsson (2000), and Jennergren (2008), where overlooked, which empirically support the comparison of valuation models because of these implementation issues resulting from applying them.

Xavier and Vinolas (2003) proposed a new corporate valuation method "Financial and Economic value added," (FEVA) that integrates the Economic value added (EVA), DCF, and Modigliani and Miller (MM) approaches and allows a detailed analysis of financial and economic corporate value drivers. They suggest that the new formula is mathematically consistent with previous methodologies, and holds the principle of one value and superior value estimates. Kenton (2004) said that no single procedure is conclusively the most precise and accurate in all situations. Therefore, financial analysts very often run through more than one methodology when asked to value a company. Kenton aims to fill the gap and inspires further research on this question by proposing simple rules for combining value estimates. Combining makes sense because every bona fide estimate provides information, so relying on only one estimate may ignore information. He therefore proposed five rules of thumb for combining two or more value estimates into a superior value estimate. Yoo (2006), found that combining several simple multiple valuation estimates of a firm, each of which is based on a stock price multiple to a historical accounting performance measure of the comparable firms improves the valuation accuracy. Vardavaki and Mylonakis (2007) introduced the theoretical framework for the systematic series of actions required for equity valuation and examined the relative explanatory power of various equity valuation models when applied to firms in the UK food and drug retail sector. Their results supported the findings of previous studies that the combined valuation model is more informative because the accuracy of equity value estimate is higher for combined valuation model. This can be substantiated by the fact that this model takes into account both the economics and the accounting characteristics of the investigated firms.

Liu, Nissim and Thomas (2007) examined whether valuations based on cash flow multiples are better than earnings multiple and found that despite intuitive claims that operating cash flows are superior than earnings as a measure of value, security prices are better explained by reported earnings than by reported operating cash flows. Imam,Barker and Clubb (2008), revealed that analysts use both earnings multiples and DCF. However,

book value multiples are less preferred by the analysts in their study. Demirakos, Strong and Walker (2010) suggested that earnings multiples outperform DCF models. Further, Nissim (2011) in their study found that book value multiple performs relatively better than other multiples and conditioning the book value multiples on ROE significantly enhances the valuation accuracy of book value multiples. He also concluded that over the past decade book value multiples have performed better than earnings multiples. Earlier, Deng, Easton and Yeo (2009) and Lie and Lie (2002) also suggested similar findings.

As far as banks are concerned only few studies have been performed to empirically examine the accuracy of these models. As in the case of non-banks, however, the DCF approach is the standard valuation model that is generally focused on bank valuation literature, with only few contributions such as Uyemura, Kantor and Pettit (1996), and MSDW (2001) included the residual income approach in their discussion. In recent studies Gross (2006) and Dermine (2010) have supported the use of residual income model over discounted cash flow and dividend discount model.

It is evident from the above literature review that majority of the work concentrates on the valuation of industrial companies: Though the number of articles and research papers in the area of bank valuation have increased recently only a few contributions give a detailed and comprehensive overview of the performance of bank valuation models. Hence, the comparison of these valuation models will be worthwhile in understanding the most suitable valuation model for Indian banking industry to have a more realistic value estimate. It is also observed that since no single procedure is conclusively the most precise and accurate in all situations, we go a step further and combine the value estimates of different models to empirically examine whether combining value estimates increase valuation accuracy.

3. Data and Methodology

3.1 Data

We take our sample of banking sector companies from CMIE's (Centre for Monitoring Indian Economy) prowess data base. We have considered all 40 BSE (Bombay Stock Exchange) listed banking companies for the purpose of the study. The study uses 11 years data starting from March 2002 to March 2012. Further, we split the data into two parts; first part includes data from March 2002 to March 2007 for the purpose of earnings estimation and computation of intrinsic values. Second part includes data for price i.e. our proxy for market values from March 2008 to March 2012 for the purpose of comparison between computed intrinsic values and observed market values.

3.2 Methodology

The study provides an empirical assessment of DCF, RIM, ED, P/E multiple and P/B multiples techniques of valuation. But before doing the comparison we need to arrive at the intrinsic values using these approaches. Further, comparisons of the models are based on prediction errors and the explanatory performance of market value on value estimates. Details of the models are discussed below.

3.2.1.Residual Income Model

The residual income model of Edward-Bell-Ohlson is used in explaining the relation between value estimates and observed market prices. Residual income (RI) is generally defined as operating earnings less a capital charge for the equity capital (e_t) used by the company, as described by Equation.

$$RI = ROE_{t+i} * e_t - r_e * e_t \quad ...1$$

Intrinsic value of the firm at time t is equal to the current equity i.e. book value of equity (B_t), plus the present value of future economic profits:

$$IV_t = B_t + \sum_{i=1}^{t} \frac{E_t\left[\left(ROE_{t+i} - r_e\right) * B_{t+i-1}\right]}{\left(1+r_e\right)^i} + \frac{TV}{\left(1+r_e\right)^i} \quad ...2$$

$$TV = \frac{RI_i}{r_e - g} \quad ...3$$

Where: *RI* is residual income; *IV* is intrinsic value; B_t is book value at time t; $E_t(.)$ is expectation based on information available at time t; ROE_{t+i} is after tax return on equity at t+i; r_e is cost of equity; TV is terminal value.

3.2.2. Discounted Cash Flow Model

The discounted free cash flow model used by Francis et al. (2000) is applied here which they abstracted from the work of Copeland, Koller, and Murrin (1994). Since our study is concentrating on equity part of the valuation we will be using FCFE (free cash flow to equity).

$$IV_t = \sum_{i=1}^{t} \frac{\in_t}{(1+r_e)^i} + \frac{TV}{(1+r_e)^i} \quad ...4$$

$$TV = \frac{\in_i}{r_e - g} \quad ...5$$

Where: *IV* is intrinsic value; $\in_t$ is free cash flow to equity; r_e is cost of equity; g is minimum growth rate; *TV* is terminal value.

3.2.3. Equity Dividend Model

The discounted dividend model attributed to Williams, 1938, equates the value of a firm's equity with the sum of the discounted expected dividend payments to shareholders over the life of the firm, with the terminal value equal to the liquidating dividend:

$$IV_t = \sum_{i=1}^{t} \frac{DIV_t}{(1+r_e)^i} + \frac{TV}{(1+r_e)^i} \quad ...6$$

$$TV = \frac{DIV_t}{r_e - g} \quad ...7$$

Where: *IV* is intrinsic value; DIV_t is forecasted dividend; r_e is cost of equity; g is the minimum growth rate(average of inflation from 1991 to 2007); TV is terminal value.

3.2.4. Multiples Valuation Model

Equity multiples have been very popular among analysts as it is less time consuming and a simple straight forward method of calculating value. In an informal study, Damodaran found that the ratio of use of DCF to Multiples is 1:10. We have used equity multiples for the purpose of the study as we are focusing on equity valuation. The multiples used are:

Price to Earning per share ratio (PE_M)

$$PE\_M_{i,t} = \frac{Price_{i,t}}{EPS_{i,t}} \quad ...8$$

$$IV_{i,t} = FPE\_M_{i,t} * FEPS_{i,t} \quad ...9$$

Where: PE_M is price to earning per share, Price is market price, EPS is earning per share, IV is intrinsic value, FPE_M is forecasted price to earning per share, FEPS is forecasted earning per share.

Price to Book value ratio (PB_M)

$$PB\_M_{i,t} = \frac{Price_{i,t}}{BV_{i,t}} \quad ...10$$

$$IV_{i,t} = FPB\_M_{i,t} * FBV_{i,t} \quad ...11$$

Where: PB_M is price to book value, Price is market price, BV is book value, IV is intrinsic value, FPB_M is forecasted price to book value, FBV is forecasted book value.

3.2.5. Forecast Horizon

We assume an explicit forecast period of five years to compute the intrinsic values that correspond to the length of forecast period put forward in literature (see Copeland et al., 2000; Rappaport, 1986). Forecast horizon is divided into two phases, the first phase represents an explicit forecast period for the first four years and the second phase describes the terminal value of the firm (i.e. the remaining life of the firm) after fourth year.

3.2.6.Explicit Forecast Estimates

Future earnings and other parameters of the respective models are forecasted using first order stochastic process following Charles M. C. Lee et al. (1999).We use panel regression with cross section weights to estimate a feasible GLS specification assuming the presence of cross section heteroskedasticity.

Earnings and Book value forecast under RIM model:

$$ROE_{it} = \beta_0 + \beta_1 ROE_{i,t-1} + \varepsilon_{i,t} \quad ...12$$

Where: ROE is return on equity; t–1 is lagged term; β_0 is constant; β_1 is coefficient; ε is error term.

$$BV_{i,t+1} + FEPS_{i,t+1} - FDPS_{i,t+1} \quad ...13$$

Where: BV is book value; FEPS is forecasted earnings per share $(FEPS_{i,t} = \beta_0 + \beta_1 FEPS_{i,t-1} + \varepsilon_{i,t})$; FDPS is forecasted dividend per share $(FEPS_{i,t+1} = FEPS_{i,t+1} * POR)$; POR is dividend payout ratio; t-1 is lagged term; t+1 is forecast period.

Cash flow forecast under FCFE model:

$$CF_{i,t} = \beta_0 + \beta_1 CF_{i,t-1} + \varepsilon_{i,t} \quad ...14$$

Where: CF is cash flow; t-1 is lagged term; β_0 is constant; β_0 is coefficient; ε is error term.

Equity dividend forecast under ED model:

$$ED_{i,t} = \beta_0 + \beta_1 ED_{i,t-1} + \varepsilon_{i,t} \quad ...15$$

Where: ED is equity dividend; t-1 is lagged term; β_0 is constant; β_1 is coefficient; ε is error term.

PE_M and PB_M forecast under Multiples valuation model:

$$PE\_M_{i,t} = \beta_0 + \beta_1 PE\_M_{i,t-1} + \varepsilon_{i,t} \quad ...16$$

Where: PE_M is price earning per share ratio; t-1 is lagged term; β_0 is constant; β_1 is coefficient; ε is error term.

$$PB\_M_{i,t} = \beta_0 + \beta_1 PB\_M_{i,t-1} + \varepsilon_{i,t} \quad ...17$$

Where: PB_M is price book value ratio; t-1 is lagged term; β_0 is constant; β_1 is coefficient; ε is error term. (Table1)

3.2.7. Estimation of Cost of Equity

Models under consideration calls for a discount rate that corresponds to the riskiness of future cash flows to shareholders. Discount rate for the purpose of study has been calculated using Capital asset pricing model (CAPM):-

$$r_e = r_{ft} + \beta_t * [E(r_{mt} - r_{ft})]_{constant} \quad ...18$$

Where: r_e is cost of equity; β is beta (we have taken ten years average beta for the purpose of the study); r_m is market return (we have considered ten years average return of the industry as market return for the purpose of the study); r_f is risk free rate of return (the study uses average of annual weighted average interest rate on government Securities).

3.2.8. Accuracy and Explanatory Value of the Model

Once the intrinsic values are estimated the comparison of the models are performed using signed and absolute prediction error to measure the accuracy of the model. Explanatory values of the models are performed using univariate regression of market value on value estimates. The study will use panel regression with cross section weights; it will estimate a feasible GLS specification assuming the presence of cross section heteroskedasticity.

$$MV_{i,t} = \beta_0 + \beta_1 IV_{i,t} + \varepsilon_{i,t} \quad ...19$$

Where: MV is market value; IV is intrinsic value; β_0 is constant; β_1 is coefficient; ε_i is error.

3.2.9. Composite Value Estimates (CV)

Composite value estimates for the study is computed using two different methods. Under first method, we combine the value estimates by averaging the best three models (i.e. DCF RIM and ED in our case). Under second method, we combine the models using weighted average accuracy of the models. First we calculate the prediction error (PE) of the models, next we compute the weighted average prediction error (WAPE), $(WAPE_{DCF} = PE\ of\ DCF / (PE\ of\ DCF + PE\ of\ RIM + PE\ of\ ED);\ WAPE_{RIM} = PE\ of\ RIM / (PE\ of\ DCF + PE\ of\ RIM + PE\ of\ ED);\ WAPE_{ED} = PE\ of\ ED / (PE\ of\ DCF + PE\ of\ RIM + PE\ of\ ED))$. Finally we take the weighted average accuracy (WAA), $(WAA = 1 - WAPE)$ to combine the models.

$$IV_c = (IV_{DCF} + IV_{RIM} + IV_{ED})/3 \quad ...20$$

$$IV_c = IV_{DCF} * WAA_{DCF} + IV_{RIM} * WAA_{RIM} + IV_{ED} * WAA_{ED} \quad ...21$$

where IV_c is combined value estimate, IV_{DCF} is intrinsic value from DCF, IV_{RIM} is intrinsic value from RIM, IV_{ED} = is intrinsic value from ED, WAA is weighted average accuracy of the model.

3.2.10. Determinants of the Prediction Error

This part of our analysis studies the determinants of the prediction error of the value estimates from the most suitable valuation model. We search for differences of the results by bank size and profitability as potential determinants of the prediction error of the value

estimates. Based on the general principles of capital markets and corporate finance, we formulate two hypotheses concerning the characteristics of the prediction errors in relation to these potential determinants.

We foresee the prediction error of the value estimates to be related to bank size (market capitalization, here after MC) and profitability (return on equity, here after ROE), as potential drivers of the predictive power of the market. We expect the stock prices of banks with a high market capitalization to be on average more efficient assuming a constant free float and ownership structure. We therefore hypothesize that the prediction error for larger banks (MC_{i2}) will be closer to zero than for smaller banks (MC_{i1}), as described in hypothesis H1.

$$H1: PE_{i_{1,t}} \geq PE_{i_{2,t}} \text{ for } MC_{i_{1,t}} \leq MC_{i_{2,t}} \quad ...22$$

Examining the relationship between the prediction error and bank profitability, we expect the predictive power of the market for profitable banks (ROE_{i_2}) to be higher than for banks with low profitability (ROE_{i_1}). The underlying rationale is that higher profitability implies both higher investor interest in a bank and higher coverage by analysts. We hypothesize the prediction error to be negatively correlated to return on equity as a measure of bank profitability, as described in hypothesis H2.

$$H2: PE_{i_{1,t}} \geq PE_{i_{2,t}} \text{ for } ROE_{i_{1,t}} \leq ROE_{i_{2,t}} \quad ...23$$

The following sections examine the validity of the above-formulated hypotheses based on the regression analysis on these potential drivers of the prediction error.

$$PE_{i,t} = \alpha_0 + \beta_1 MC_{i,t} + \beta_2 ROE_{i,t} + \mu_{i,t} \quad ...24$$

We define the absolute prediction error (PE) as the dependent variable of our regression model. The independent variables are ROE as a measure of profitability and the logarithm of market value (MC) as a measure of bank size. As extreme results may distort the true picture of the relationship between the dependent variable and independent variables, we control 5 percent of the outliers from the dependent and the independent variables. We run three different regression models (OLS, Fixed effects and Random effects) to overcome the issues of model specification. To further verify the consistency of the results we conduct GMM (Generalized Method of Moments) test. It is an advanced econometric tool in use over fixed effects and random effects, it accounts for the unobserved time-invariant bilateral specific effects and it can deal with potential endogeneity arising from the inclusion of the lagged dependent variables and other potential endogenous variables.

4. Empirical Results

The prediction error of the value estimates describes the relative error and is defined as market value minus intrinsic value scaled by Market value.

4.1 Comparative Accuracy of the Models

In the following section, we compare the accuracy of the value estimates from the RIM, DCF, ED, PE_M and PB_M valuation models. To measure the accuracy, we look at the signed and absolute prediction errors of the value estimates from the five alternative valuation models, as displayed in Table 2.

We first look at the signed prediction errors of the value estimates. As already described in Section 3.2.8, we find a mean prediction error of -0.48 for the value estimates from the equity dividend model (see, Table 2a). We thus observe a biased result with observed market values being on average 48 percent lower than the value estimates from the equity dividend model. For the residual income model, discounted cash flow model, P/B multiple and P/E multiple the resulting undervaluation is significantly higher with a mean prediction error of -0.78, -1.83, -2.76 and -2.86. The median values of the models reveals the fact that there is concentration of high negative values in DCF, RIM, PE_M and PB_M models than that of ED model which reflects high undervaluation in case of PE_M, PB_M,DCF and RIM respectively. Furthermore, the results from the valuation models differ significantly in terms of dispersion. Equity dividend model is preferred because of its low dispersion (1.98). As far as interquartile range is concerned we find that discounted cash flow model, PE_M and PB_M have higher interquartile range of 1.96, 2.57 and 2.18 respectively. The interquartile range of the prediction errors of the value estimates from the equity dividend model and residual income model are 0.99 and 0.97.

In order to get a better understanding of the accuracy of the results from the models, we next study the absolute prediction errors of the value estimates (see, table 2b). Again, the results from the equity dividend model show a lower average prediction error (dispersion) compared to the results from DCF, RIM, PE_M and PB_M. We observe a mean absolute prediction error (dispersion) for the equity dividend value estimates of 1.23 (1.62). The absolute prediction errors (dispersion) for the results from DCF, RIM, PE_M and PB_M are significantly higher with a mean error (dispersion) of 2.28 (3.87), 1.30 (2.27), 2.92 (5.94) and 2.90 (4.99) respectively. Absolute prediction error and dispersion confirms the findings of signed prediction error that ED is an improvement over DCF, RIM, PE_M and PB_M model. But it can be observed from table 2 that the difference between ED and RIM has narrowed down.

As far as the central tendency of the results from the models are concerned we find that 13.17%, 14.37%, 22.56%, 6.15% and 17.44% of the observations of ED, DCF, RIM, PE_M and PB_M respectively are within 20% of the prediction error and 50% of the prediction error lies between 31.14%, 40.12%, 49.74%, 14.36% and 33.33% of the sample observation for ED, DCF, RIM, PE_M and PB_M respectively. Hence, the accuracy of the results from RIM is significantly higher than that of ED, DCF, PE_M and PB_M model (see, table 3).

When comparing the mean prediction error and central tendency of the prediction error we observe that ED is better in case of mean prediction error and RIM appears to be more suitable under central tendency of the errors. Therefore to further confirm the results we measure the explanatory performance of the models in section 4.2.

4.2 Explanatory Performance of the Models

To test the explanatory performance of the value estimates, we examine the ability of the value estimates to explain cross-sectional variation in the observed market values. Table 4 reports the results of the univariate regressions of market value on the value estimates from the six valuation models.

The explained variability of the univariate regressions is higher for the residual income model with R^2 explaining 19 percent of the variation in market value compared to 12 percent for discounted cash flow model, 14 percent for equity dividend model, 1 percent for PE_M and 12 percent for PB_M. The coefficient estimates for all models are significant. The smaller coefficient for the discounted cash flow model, PE_M and PB_Mare in line with the larger bias in the results from this model. The coefficients of RIM and ED models are more or less same but RIM is slightly better than ED model in terms explainability (see, table 4).

Summarizing the results for the accuracy and explanatory performance of the value estimates from the alternative valuation models, so far, we observe the superiority of the equity dividend model in terms of accuracy whereas RIM has a slightly better explanatory power than DCF, ED, PE_M and PB_M. Hence, we can say that both ED and RIM are superior to DCF, PE_M and PB_M, and are equally likely.

4.3. Do Combining Value Estimates Increase Valuation Accuracy

To empirically examine the fact that whether combining value estimates increase valuation accuracy, we prefer average method over weighted average accuracy of the models to compute the value estimates, because, the prediction error is low in case of average method (see, section 3.2.9). Prediction error of composite value estimates presented in table 3a, 3b reveals that both signed prediction error and absolute prediction error alone with their dispersion stay in between the prediction errors and dispersions from DCF, RIM and ED model, whereas the explained variability of the univariate regression of market value on value estimates stay in between DCF, RIM and ED model with R^2 explaining 14 percent of the variation in market value (see, table 4). Though composite value estimates do not outperform RIM and ED models in particular but in volatile emerging economies like India it is always good to follow a midway path to avoid extreme values.

4.4. Determinants of the Prediction Error

In the following section we measure the determinants of prediction error of the value estimates from the residual income valuation model (most suitable model

in our case) with the help of three different regression models. First we estimate the regression model with ordinary least squares (OLS), assuming homogeneity of the parameters and abstracting from heteroscedasticity and autocorrelation. The coefficient for size is statistically not significant (see, Table 5), with expected negative sign. The results therefore reject hypotheses H1 (that size is negatively correlated with prediction error). The coefficient for ROE is statistical not significant. The results therefore reject hypotheses H2 (that higher profitability leads to lower prediction error). The low R^2 of 0.04 implies that the independent variables only explain a small part of the variation of the dependent variable. The F-statistic is 3.58, which rejects the null hypothesis of joint insignificance of coefficients and therefore suggests that the regression model is well-specified.

The omission of entity specific features might lead to a bias in the resulting estimates. In fixed effects model we relax the restrictive assumption of parameter homogeneity and introduce heterogeneity of the intercepts to our model to gain further insights into the hypothesized relationships. The coefficient for size is statistically not significant (see, Table 5), with expected negative sign. The results therefore reject hypotheses H1. The coefficient for ROE is statistical not significant. The results therefore reject hypotheses H2. The R^2 of 0.75 is an improvement over OLS and implies the incremental explainability of the model. The F-statistic is 11.00, which rejects the null hypothesis of joint insignificance of coefficients and therefore suggests that the regression model is well-specified.

Further we analyse the impact of random effects model to rip the benefits of increased efficiency in the absence of effect endogeneity. But we find that the model is not significant and as a result, the random effects model does not produce efficient estimates and the fixed effects model stays the preferred estimator for our model. To further verify the consistency of the results of fixed effect model we conduct GMM test, which confirms the findings of fixed effect model (see, table 5), hence, the results are robust.

5. Conclusion

We conducted the empirical study to examine the comparative accuracy and explanatory performance of DCF, RIM, ED, PE_M and PB_M for the Indian banking sector. We find that equity dividend model is superior to discounted cash flow model, residual income model, PE multiple and PB multiple estimates in terms of accuracy (see, table 2). But the explanatory power of RIM value estimate is slightly better than ED model (see, table 4). As far as the central tendency of the prediction errors are concerned RIM is better than other valuation models (see, table 3). About 22.56% and 49.74% of the sample observations of RIM are within 20% and 50% of the prediction error respectively. Our results are in line with the theory of highly volatile Asian markets. Gross (2006) in his study of Banks and shareholder value reported high dispersion for Asian markets. Otherwise also he reported prediction error of 1.92 for DDM (Dividend Discount Model). The probable determinants of prediction error i.e. size and profitability have no significant relationship with prediction error except intercept, which accounts for firm specific characteristics in the model.

In comparison to prior research on fundamental value estimates, we find that our results are consistent with Bernard (1995), Penman and Sougiannis(1998), Francis et al. (2000), Subrahmanyan et al. (2004), and Kenton (2004), on superiority of residual income value estimates over DCF, PE_M and PB_M. But we also find that ED model which was empirically proved to be less accurate then RIM and DCF has better accuracy than RIM and DCF for Indian banking sector. Our results support the superiority of ED and RIM over DCF, PE_M and PB_M and therefore have higher ability to account for long term market expectations for the banking sector. Composite value estimates though do not outperform RIM and ED in particular, but have more information content (Kenton, 2004) then the individual models. So, combining value estimates make sense because in volatile emerging economies it is always good to follow middle path to avoid extreme values. The present study provides empirical evidence regarding accuracy of valuation models for banking industry from one of the fastest growing emerging economies in the world.

Appendix

Table 1: Univariate Regression of Forecast Estimates

Year = 2003 -2007; N = 40						
Statistic	**CF**	**ED**	**ROE**	**EPS**	**PE_M**	**PB_M**
Constant	2517.7310*	46.3917*	10.0051*	2.5737*	-2.9374*	0.0993*
OLS Coefficient	1.0482*	1.1809*	0.4679*	1.0649*	1.6339*	1.0791*
OLS R-square	0.4551	0.9624	0.2153	0.4460	0.1199	0.9932
Model Significance	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

* statistically significant at the 5 percent level

** statistically significant at the 1 percent level

Source: Own calculation

Table 2: Prediction error

a. Signed	**PE_DCF**	**PE_RIM**	**PE_ED**	**PE_PE_M**	**PE_PB_M**	**PE_CV**
Mean	-1.8295	-0.7784	-0.4769	-2.8568	-2.7642	-1.0908
Median	0.0335	0.1199	0.3978	-0.9360	-0.8624	0.1339
Std. Dev.	4.1090	2.4982	1.9785	6.3046	5.0768	2.8659
Interquartile	1.9696	0.9730	0.9972	2.5694	2.1792	1.3406
b. Absolute	**APE_DCF**	**APE_RIM**	**APE_ED**	**APE_PE_M**	**APE_PB_M**	**APE_CV**
Mean	2.2974	1.2982	1.2344	2.9240	2.9015	1.6059
Median	0.5908	0.5104	0.6558	0.9748	0.9130	0.5460
Std. Dev.	3.8654	2.2707	1.6156	5.9422	4.9992	2.6107
Interquartile	1.1890	0.6188	0.4932	2.2268	1.9999	0.5826

Source: Own calculation

Table 3: Central tendency of value estimates

Details	**DCF**	**RIM**	**ED**	**PE_M**	**PB_M**	**CV**
IV within 20% of the MV (percent)	14.37	22.56	13.17	6.15	17.44	14.87
* The central tendency is defined as the percentage of observations with value estimates within 20% of observed market value.						
Details	**DCF**	**RIM**	**ED**	**PE_M**	**PB_M**	**CV**
IV within 50% of the MV (percent)	40.12	49.74	31.14	14.36	33.33	37.95
* The central tendency is defined as the percentage of observations with value estimates within 50% of observed market value.						

Source: Own calculation

Table 4: Univariate Regression of Market value on Value Estimates

Year = 2008 - 2012; N = 40						
Statistic	**DCF**	**RIM**	**ED**	**PE_M**	**PB_M**	**CV**
OLS Coefficient	0.0367*	0.0720*	0.0764*	0.0004	0.0444*	0.0531*
OLS R-square	0.1241	0.1869	0.1420	0.0124	0.1242	0.1414
Model Significance	0.0000	0.0000	0.0000	0.1216	0.0000	0.0000
* statistically significant at the 5 percent level ** statistically significant at the 1 percent level						

Source: Own calculation

Table 5: Panel multivariate Regression of determinants of prediction error

Year = 2008 - 2012; N = 40				
Statistic	**OLS**	**Fixed effect**	**Random effect**	**GMM**
Intercept	0.6393*	1.8311*	1.5811*	2.4564*
Size	0.0000	0.0000	0.0000	0.0000
Profitability	0.0670	-0.0129	0.0053	-0.0040
Model R-square	0.0363	0.7492	0.0160	---
Model Significance	0.0297	0.0000	0.7899	0.0000
* statistically significant at the 5 percent level ** statistically significant at the 1 percent level				

Source: Own calculation

End Note

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The Power of Sensation Transference: Chocolate Packages & Impulse Purchases

Suraj Kushe Shekhar and Raveendran P.T

Abstract

Packaging, which is often debated as the fifth 'P' of marketing mix has gained so much popularity in recent times that it has now become an integral element of the modern lifestyle and the branding process. The present study scrutinized the influence of chocolate packaging cues in making informed purchase decisions of chocolates on first purchase. Three packaging cues namely 'Visual cues', 'Promotional Cues' and 'Informational Cues' evolved after exploratory factor analysis were refined using confirmatory factor analysis and then subjected to Full Structural Modelling to test specific hypotheses. Results indicated that 'Visual Cues' & 'Promotional Cues' had direct positive significant effect in the buying influence of chocolates. However, results also showed that the 'Informational Cues' had negative influence if not significant. Further it was reported that 32% of the variance associated with packaging and buying Influence was accounted by its three predictors: visual cues, informational cues and promotional cues. It was even observed that 'visual cues' had large influence as compared to 'promotional cues' on students purchase decision of chocolates based on packages.

Keywords: Consumer, Chocolate, Package, Product, Purchase

1. Introduction

Packaging is the science, art, and technology of enclosing or protecting products for distribution, storage, sale, and use. It also refers to the process of design, evaluation, and production of packages. Packaging can be described as a coordinated system of preparing goods for transport, warehousing, logistics, sale, and end use. Packaging contains, protects, preserves, transports, informs, and sells (Soroka, 2002). Packaging is any container or wrapping in which the product is offered for sale and can consist of a variety of materials such as glass, paper, metal or plastic, depending upon what is to be contained (Brassington & Petit, 2002). Packaging is defined as an extrinsic element of the product (Olson & Jacoby, 1972) - an attribute that is related to the product but does not form part of the physical product itself. It is a structure prepared to contain a commercial food product, i.e. enabling it easier and safer to transport, protecting the product against contamination or loss, degradation or damage and maintaining a convenient way to dispose the product (Sacharow & Griffin, 1980). As per Hine (1995), in a modern retail environment, a package is not just a container but a tool for delivering goods in the best condition for use. Keller (1993) identified packages as non-product-related but brand-related elements. But according to Richardson et al. (1994), packages are product-related but with extrinsic attributes. Similar to the statement by Richardson et al. (1994), Underwood (2003) explained packages as product-related attributes, but different from the previous two explanations. Underwood (2003) stated that packages are intrinsic or extrinsic attributes based on their features. He suggested that they are a intrinsic when they are physical part of the content (e.g. toothpaste tube), and they are extrinsic when the information on the package (e.g., logo, picture) is taken into account. He further added that packaging is posited to influence the brand and self-identity via mediated (through exposure to mass-communication culture and mass media products) and lived in experience (interaction with the brand, typically resulting from purchase and usage). To summarize, a package can be identified as a designed-product served for use, which has to meet many requirements to satisfy the demands of the stakeholders (e.g., manufacturer, distributor, retailer) and especially those of consumers/ users.

In todays world product package is often considered the fifth 'P' of the marketing mix. Although advertising is a major sales promotion tool, packaging is even more

critical. This is because, for other promotional tools, there is always the need for communication to persuade and attract the consumer. However, when packaging is properly done, the products can sell by themselves. Proper packaging is an easier, cheaper means of advertising and hence huge amount of money spent on advertisement and promotional techniques can be redirected by ensuring that things are done properly during the product packaging stage. In order to perform the role effectively and to reap the right results and benefits for the manufacturer (increase in profit margins), a product's packaging must be attractive, informative, and clearly identify with the product. Packaging must also continuously communicate the product's real benefits and create awareness to ensure image and brand preference.

According to Doherty and Tranchell (2007), the world loves chocolates. They opined that nine out of ten people like chocolates and the tenth person always lies. Using a bit of humour, they even added that chocolate could make everyone smile, even bankers. Packaging in chocolate industry is therefore critical. Today packages are designed to go with different occasions, different social classes and to differentiate between different brands. Based on the results from relevant previous research studies, it was found that there exists a relationship between food products packaging and consumer purchase behaviour.

2. Objective of the Study

Marketing environment has become increasingly complex and competitive. Advertising is a highly effective means of communication. But reaching the entire target market with advertising for most products is generally not a feasible option. Fragmentation of the media has shown that it has become extremely difficult as well as expensive to reach potential consumers and communicate with them, which, in turn, has forced marketers to adopt more innovative means of reaching their target market. In contrast to advertising, which has limited reach, a product's packaging is something which all consumers experience and which has strong potential to engage the majority of the target market. This makes packaging an extremely powerful and unique tool in the modern marketing environment. Apart from its benefits in terms of reach, some marketers believe that packaging is actually more influential than advertising, as it has a direct impact on how they perceive and experience the product. For products with low advertising support, packaging takes on an even more prominent role as it becomes the key vehicle to communicate the brand positioning. But despite the importance of packaging, there is limited marketing research currently available to the public in the area of packaging research. Most textbooks and literature agree that packaging plays a vital role in marketing, but there is little empirical research available investigating its impact on the marketing function and how best to leverage packaging in a marketing context particularly with regard to various low involvement and high impulse purchase product categories, where companies, cannot invest too much in advertising. The present study examined the influence of packaging cues on students purchase behaviour for one such high impulse and hedonistic product category namely: Chocolates.

3. Literature Review

3.1 Visual Cues (VC)

Colour is the most important tool for emotional expression of a package (Hine, 1995) as it reflects an image for the product (Sauvage, 1996). Underwood (2003) opined that consumers associate meaning to package colours in three different ways: "the physiological, the cultural, and the associational". The first one is described as universal and involuntary (e.g. the colour red speeding up the pulse). The second one, cultural meaning for colours, occurs over long periods of time in different societies (e.g. the colour black relates to elegance in Europe). The third one, associational meaning, is developed through marketing efforts (e.g. the colour pink relates to products with low calories). In addition, colour is considered a tool for brand identification and visual distinction (Underwood, 2003). It is also an important factor that promotes legibility the texts and comprehension of images placed on the package.

Shape of a package is normally the first element that the consumer notices in stores (Sauvage, 1996). It is a prominent factor while creating an image about the product and the brand. For example, Sonsino (1990)

opined that an old-fashioned shape of a package could suggest reliability and maturity to the consumer. In addition, the shape of a package affected the quality of experiential benefits, which sdemonstrates of the packaging being used (Underwood, 2003). Shape is also considered an important concern for retailers since they prefer easy to stack shapes especially for fast-moving consumer goods (Sonsino, 1990).

Size of the package is also an important element when considering the visibility of a package and the information it displays. It also affects the perception of the contents (Sonsino, 1990). For example, large-sized cereal packages are usually perceived as plentiful and small packages make cereals seem heavy or solid. In addition, when size is considered as a structural element, it determines the portions which a consumer/user would typically use and, thus, it becomes related to the convenience function (Sonsino, 1990).

Typography is considered as the basic tool for communication because it provides mandatory and important information about the contents, such as ingredients, production and expiry dates (Sonsino, 1990). The author further adds that carefully chosen typography is important for readability. He also states that different styles of typography could change the perception of the package and the brand (e.g. solid strong typography usually represents reliability or durability).

3.2 Informational Cues (IC)

The second type of packaging elements, is informational elements: which include information provided on the package and technologies used in the package. One of the packages' functions is to communicate product information, which can assist consumers in making their decisions carefully (Silayoi & Speece, 2007), and written or verbal information has a great capacity to do this. However, written information on a package can also create confusion by conveying either too much information or mislead through inaccurate information (Silayoi & Speece, 2007) in some cases. However, in a study by Silayoi and Speece (2007), consumers were found to use explicit product information to assess the health benefits and many other aspects of quality. Yet, consumers were more likely to read the label to check that the product information was consistent with their needs if the package made it seem that the product was worth investigating (Silayoi & Speece, 2007). This suggested that informational elements were relevant only if the graphic elements had performed well.

3.3 Promotional Cues (PR)

In today's world, Children have growing spending power in terms of being customers in their own right (Pettersson & Fjellstrom, 2006). They are also major influencers within the family decision making unit. This unique power of children has resulted in making them an increasingly attractive target segments for marketers (Coughlin & Wong, 2003). In a study on the nutritional content of products targeted to children, Lobstein (2008) defined and classified a children's food product as one which used familiar cartoon characters appealing to children (e.g., Tony the Tiger, Mr. Men); had tie-ins with children's TV programmes or films (e.g., Postman Pat, Star Wars); used child-oriented animals or creatures (e.g., dinosaurs, sharks); worked with child-oriented product shapes (e.g. alphabet pasta); gave free gifts or special promotional offers suitable for children; and used words such as 'kids' or 'ideal children's snack' or 'perfect for school lunch boxes'.

Children constitute a major segment with high affinity towards chocolates. The 'chocolate affinity' factor which combines the cost and purpose due to which consumers buy a particular chocolate, has emerged as an important factor that affects consumers' buying behaviour (Doherty & Tranchell, 2007).Whitaker et al., (1997) investigated into children's perception and attitude to food and referred to children's food as that which is a combination of food and fun. In other words, children's food was perceived as 'eatertainment'. Golan & Crow (2004) observed specific 'eatertainment' techniques employed by marketers like: premium offers, i.e. offers of free gifts such as free toys, stickers, trading cards, etc. inside packages of snack foods, cereals and convenience foods; children's licensed characters and movie tie-ins on food packaging; 'Kidz meals' combining child-sized portions

* Contructs mentioned here are the individual elements (variables) of the three packaging cues mentioned in the study. Eg. Colour is one such construct of Visual Cues.

of food with soft drinks and free toys or confectionery; and fun product designs that incorporate interactive play value, often incorporating unusual shapes, textures, colours, tastes and smells, and characters printed directly onto the food.

3.4 Packaging and Buying Influence (PBI)

As the package is a critical factor in communicating to the customers, which in turn assists the decision making process, the package standing on the shelf affects the consumer decision process and package design ensures that consumer response is favourable (Silayoi & Speece, 2004). Consumers' intention to purchase depends on the degree to which consumers expect that the product can satisfy their expectations about its use (Kupiec & Revell, 2001). But when they have not thought about the product before entering the store, this intention to purchase is determined by what is communicated at the point of purchase. How they perceive the subjective entity of products, as presented through communication elements in the package, influences choice and is the key to success for many food product marketing strategies. Thus the package becomes a critical factor in the consumer decision making process because it communicates to consumers at the time they are actually deciding in store and finally trigger purchase decisions.

4. Hypotheses of the Study

4.1 Influence of Visual Cues

Aesthetic response can be defined as an experience (i.e., visual, emotional) that occurs in reaction to a specific stimulus (Berlyne, 1974; Veryzer, 1998). This sensory stimulation can encourage viewers to imagine how a product looks or feels when in use. Visual attributes such as colour, style and shape can arouse consumer emotion, communicate values and convey meaning to both users and viewers. If consumers perceive positive aesthetic experience from a product, they are more likely to further examine and potentially purchase that product (Eckman, Damhorst & Kadolph, 1990; Morganosky, 1984). Hence it is hypothesized that:

H1: Visual Cues of chocolate packages generate a direct positive effect on purchase decisions of chocolates.

4.2 Influence of Informational Cues

It is assumed that when consumers initially encounter a newly launched product, important information is communicated through the information given on product packages. In this case, consumers may even infer about the missing information by drawing a connection between available pieces of information, one of which is written information. Upon facing a newly launched chocolate brand, consumer's cognitive responses incline towards informational contents. These positive responses develop favourable evaluations towards the brand. Thus, 'informational cues' which are relevant to consumers' ability to produce output are a likely source of consumers' influence on purchase decisions. Hence it is hypothesized that:

H2: Informational cues of chocolate packages generate a direct positive effect on purchase decisions of chocolates.

4.3 Influence of Promotional Cues

Marketers come up with various promotional initiatives to market their products to children. Free gifts, cartoon characters, product extra are strategies to win children's heart. But little empirical evidence exists if such strategies work well with all product categories. Since chocolate is a product category mostly consumed by children, it is hypothesized that:

H3: Promotional cues of chocolate packages generate a direct positive effect on purchase decisions of chocolates.

5. Research Methodology

Descriptive research (Malhotra, 2004) was used in the study. The researcher elicited responses from student respondents from Kannur district of Kerala, India. The use of student sample offered the distinct advantage that it increased the homogeneity of respondents, which reduced the amount of irrelevant variation in the outcome variable (Judd & Kenny,1981). A total of 100 responses were collected from students who were undertaking their lower secondary schooling. 56% of the students were females. Students were at an average age of 11 years. Prior to the final data collection, a pre-test was

conducted amidst 40 respondents to refine and validate the questions included. Final data was collected in the classroom with prior permission from the concerned authorities. The questionnaire captured students' behaviour with respect to chocolate packages on first purchase. Respondents were asked to imagine that they were purchasing a chocolate for the first time, something they had not tasted or seen before, but may have heard about. It could even be a new brand pitched in the market. Respondents were even asked to imagine that they were purchasing a chocolate bar or chocolate boxes (family packs, special packs, festival packs) but not single toffees (e.g. 50 paise éclairs), assorted chocolates, candies or chewing gums. 10 communicative components (independent variables) of chocolate packages were used in the study and arranged on a 5 point Likert's scale. Respondents were asked to mark their responses with regard to the influence of all the communicative components of chocolate packages in a typical situation/ scenario as mentioned earlier. Multi-item measures were used to get the data on the constructs considered. The variables used in the section were borrowed from the works of Underwood et al., 2001; MacInnis & Price, 1987; Sehrawet & Kundu, 2007; Imram, 1995; Keller et al., 1997; Hill & Tilley, 2002; Sonsino, 1990; Rokka & Uusitalo, 2008; Suraj & Raveendran, 2012;Ampeoro & Vila, 2006 and Silayoi & Speece, 2004. Exploratory Factor Analysis (EFA), which was initially performed (to understand the nature of the facets on ten independent variables, revealed that the ten original variables were clustered around three subscales (factors): VC, IC and PC. The convergent validity of the evolved constructs after EFA was confirmed using Confirmatory Factor Analysis (CFA) using SPSS AMOS 20 software. The convergent validity was assessed by checking the loading of each observed indicator on the underlying latent construct. Loadings greater than 0.2 were retained as validated by the specifications of Anderson & Gerbing, 1988. Later, a full structural model testing was performed to test three specific hypotheses, as described earlier, using structural equation modelling (using SPSS AMOS 20 software). Here, PBI was designated as the dependent variable and the three factors, which evolved after EFA, were designated as the independent variable.

Overall reliability statistics were tested using Cronbach's alpha coefficient for 12 variables and was found to be 0.93. This was considered to be 'very strong' (Malhotra, 2004). Reliability/internal consistency of the multi-item scales of each of the constructs was also tested using Cronbach's alpha coefficient measures. The minimum acceptable reliability for primary research should be in the range of 0.50 to 0.60 (Nunnally, 1967).The details of the reliability statistics for the dependent and independent constructs are as shown in Table 1:

6. Results

The three independent factors followed the three hypotheses formulated in the study. Figure 1 shows the overall result.

In order to examine the simultaneous effect of the three independent constructs, their relationships were estimated through structural equation modelling. The fit of the structural model was estimated by various indices in the results demonstrated a good fit. For models with good fit, most empirical analyses suggested the ratio of X^2 -normalised to a degree of freedom (X^2/df) should not exceed 3 (Hair et al., 2012). According to Hair et al. (2012), researchers should report at least one incremental index and one absolute index, in addition to the chi-square value; at least one of the indices should be badness-of-fit index (BFI). For the badness-of-fit index, Root Mean Square Error of Approximation (RMSEA) was chosen as it often provided consistent results across different estimation approaches (Sugawara & MacCallum,1993). Following this guideline, other than chi-square and normed X^2/df value, model fit for the present study was examined using multiple indices which included goodness-of-fit Index (GFI), comparative fit index (CFI), Tucker-Lewis index (TLI), and a BFI, RMSEA (Hu & Bentler, 1999).

Following common practice, acceptable model fit is indicated by a value greater than .90 for GFI, CFI, TLI and a value of less than 0.08 for RMSEA. However, a cut-off value close to .95 for TLI, CFI, and a cut-off value close to .06 for RMSEA were needed to support a relatively good fit between the hypothesized model and the observed data (Hu & Bentler, 1999). In accordance

with many other SEM researchers, the more stringent criteria proposed by Hu & Bentler (1999) for approximate fit indices were adopted in the present study too.

After examining the above mentioned fit indices, it was observed that the overall model fit for the structural model was reasonably good. The full structural model fit (X^2 = 106.3, X^2/df = 2.21, GFI = .957, TLI = 0.930, CFI = 0.943, RMSEA = 0.048) demonstrated adequate fit in the first estimation itself. Hence the structural model was used as the benchmark for hypotheses testing. When the squared multiple correlations (R^2) were examined, it was reported that 32% of the variance associated with PBI was accounted by its three predictors: VC, IC & PR.

Hypothesized paths with non-significant z-statistics were not supported as such findings had no substantive interpretation attached tothem.The size of effect of a particular exogenous variables on its endogenous constructs was determined by examining the respective absolute magnitude of the standardized path coefficients (Hair et al., 2012). The details of the hypotheses testing are shown in Table 2.

It was observed (Table 2) that VC had direct positive effect (β=.681, p<.05) on the buying influence of chocolates. This is to say that when students associations with VC were high, the tendency to buy chocolates was also high. H1 is thus supported. It was even observed that PC had direct positive effect (β =.067, p < .05) on the buying influence of chocolates. It was observed that when students associations with PC were high, the tendency to buy chocolates was also high. H2 is also supported. However, results showed that the impact of IC on buying influence was negative (β= -.476). The result was insignificant (p >.05) too. H_3 is thus rejected. The interpretation concerning the size of the effect of the standardized path coefficients for the present study was based on Kline's (2005) recommendations. Accordingly, standardized path coefficients with absolute values less than .10 indicated a small effect, with values around .30 indicated a medium effect, and with values greater than .50 indicated a large effect (Kline 2005). The details of the hypotheses testing indicated that VC (β= .681) had a greater influence on students' purchase decision of chocolates based on packages when compared to PC (β= .067).

7. Conclusions and Implications for Further Research

This study was conducted to examine the effects of three important packaging cues namely: VC, IC and PC and how students subjectively evaluated the chocolates based on packaging. In general this study allowed analysis of direct influence of the packaging cues on purchase decisions. Therefore the direct effects of these cues were tested. The results proposed a model where two packaging cues (VC and PC) showed direct positive, significant influence on students purchase decisions. Further, it was observed that IC had no significant influence on purchase decisions. The study hypothesised that IC had a positive influence on purchase decisions of chocolates. However the results have shown that the IC had negative influence even though it was of minor significant. The reason might be that: (a) IC may not be important cues for students' perception of chocolate packages. It may be perhaps because students give more importance to VC and PC ;(b) It might even be that the relationship between IC andbuying decisions' was chocolate specific. Therefore, it was concluded that the influence of IC, in the presence of VC and PC was not that important to students in making purchase decisions for chocolate products. Results supported the findings of Silayoi & Speece, 2004; Silayoi & Speece, 2007, Ampuero & Vila, 2006; Rundh,2005, which mention the influence of visual elements of product packages. Result were also in accordance withthe findings of Hill & Tilley, 2002; McNeal & Ji, 2003; Hémar-Nicolas & Gollety, 2012 and Pires & Agnate, 2012, which mention the influence of promotional components of product packages.

Like any research, there were some limitations in this study too. Future research should continue to test and refine the relationships of the present study and the variables that moderate them. Firstly, it is clear that future research is required to yield a more complete understanding of the phenomena surrounding purchase influence for the purpose of reaffirmation of the findings of the present study. This study attempts to outline

major variables that logically and theoretically impact the linkages in purchase decision scenarios in Kerala. However, data should be collected across the nation and from third world countries as well to determine if the same results are achieved. Secondly, the three cues studied here are themselves a simplified abstraction. Other potentially important cues were excluded from the present study. Notable is product attributes, which could play a very important role in forming consumer perceptions and purchase decisions. Further, as chocolate is a type of product that is consumed irrespective of age groups, the study could even be extended to all age groups from infants to senior citizens. Such an extended study would throw more light on the significant differences across several demographic variables. The study can also be extended to understand the different purchase mechanisms of young consumers from urban and rural areas. The study could even be extended to diverse products/brands as well as to unbranded chocolates and the consumer behaviour patterns can be interpreted with different methods of analysis such as discriminant analysis, cluster analysis and so on.

Although earlier studies have shown an increase in the managerial focus towards packaging, a review of the marketing literature shows that only few theoretical contributions have been made in the area of packaging and relatively fewer efforts towards its impact on the marketing function such as consumer behaviour (Rettie & Brewer, 2000). Marketers often measure consumer brand perceptions and ignore the pack. But we see that consumers react to unbranded products wherein packaging plays a vital role in reinforcing consumer perceptions (Underwood, 2003). Packaging helps to drive the way consumers' experience a product and this is believed to be true for chocolate packaging as well. Though earlier studies have been undertaken in chocolate consumption behaviour, there is hardly any marketing literature that studies chocolate packaging and its direct effect on purchase and final consumption. For chocolate consumers, the product is the package and its contents combined (Suraj & Raveendran, 2012). Today there are different categories of chocolate packages like ordinary packs, family packs, gift packs, festival packs etc. A layman who wishes to buy a chocolate from the market would always choose one that has an eye catching package. Chocolate packaging, thus, has a hypnotic effect on the customers mind (Patwardhan et al., 2010). Today researchers spend very little time and money researching the connections between packaging and the direct experience of the product. The situation is worse when it comes to low involvement purchase categories like chocolates where researchers can not afford to spend too much money on packaging research (Giyahi, 2012).

As chocolates are found to have high impact on young consumer purchase patterns, the importance of chocolate packages becomes crucial especially when targeted at young consumers. The results of this study substantially contribute to the theoretical and practical understanding of consumer purchase decisions towards chocolates based on its package. A model, which was developed based on the study, indicates that when consumers decide to purchase a chocolate, they may retrieve the constructs (factors)* and directly relate these to purchase intentions. From a practical standpoint, the results of the study would provide managers with greater insights concerning the potential benefits and limitations associated with consumers purchase strategies. The research even clarifies the confusing role of 'informational cues' (Ampuero & Vila, 2006;Silayoi & Speece, 2007) in addition to 'visual cues' (Ampuero & Vila, 2006) and 'promotional cues' (Pettersson & Fjellstrom, 2006; Coughlin & Wong, 2003; Lobstein,2008; Golan & Crow,2004; Suraj & Raveendran, 2012). The research even also examines how the multi packaging cues manipulate other cues in addition to 'Informational Cues'.

Appendix

Table 1: Summary of reliability measurement

Sr. No	Dimensions*	Variables*	Nature	Number of items	Alpha values
1.	Visual Cues (VC)	Colour (Co), Size (Si), Shape (Sh) & Typography (Ty)	Independent	4	0.82
2.	Informational Cues (IC)	Nutritional Info (Nu), Flavour (Fl) & Ingredients (In)	Independent	3	0.84
3.	Promotional Cues (PR)	Free gifts (Fr), Characters (Ch) & Extra (Ex)	Independent	3	0.90
4.	Packaging and Buying Influence (PBI)	Chocolate packaging is important (1) & Chocolate packaging influence buying (2)	Dependent	2	0.79

Source: Survey data

**The full structural modelling that follows in Figure 1 used the codes given under 'Dimensions' and 'Variables' of Table 1*

Table 2: Hypotheses testing
Standardized regression weights

Sr. No	Path			Estimate	p	Remarks
H1	PBI	<---	VC	.681	.018	Significant
H2	PBI	<---	IC	-.476	.409	Non Significant
H3	PBI	<---	PR	.067	.002	Significant

Source: Survey data

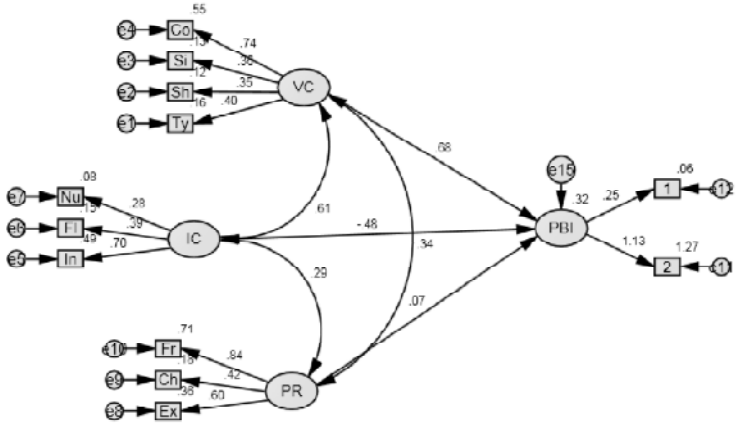

Figure 1: Chocolate packaging cues and buying influence Full Structural Modelling

End Note

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Recent Developments in Stochastic Frontier Model with Correlated Error Components

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Abstract:

The possibility of measuring efficiency of a firm on the basis of information on inputs and outputs was first introduced by Farrell (1957), followed by Koopmans (1951) and Debreu (1951). Since then one of the most widely used approach of efficiency analysis has been frontier approach. Aigner and Chu (1968) suggested a deterministic frontier model for estimating inefficiency which later found to have limitation of isolation of inefficiency from the noise as both are mixed together in the error term of the model. This model was improved with inclusion of noise, termed as stochastic frontier model (SFM), by Aigner, Lovell and Schmidt (1977), Meeusen and van den Broeck (1977) almost simultaneously where the error is decomposed into two random components representing the noise and inefficiency with the assumption of independence. After a long period researchers argued the validation of the independence assumption between the error components. In recent years several researches have been developing SFM with correlated error components under different modelling approaches. This paper surveys this journey of SFM with correlated error components and discusses different statistical approaches already developed to model SFM with correlated error components.

Key words: Frontier approach, deterministic frontier model, stochastic frontier model, copula function.

JEL Classification: C3, C10, C52

1. Introduction

Ever since the stochastic frontier model (SFM) was proposed by Aigner, Lovell and Schmidt (1977) and Meeusen and van den Broeck (1977), the last three decades has seen extensive development in the literature of the SFM. The central research of the SFM is to estimate the inefficiency of a concerned firm or economic agent. Two broad paradigms for measuring inefficiency developed throughout this period, one based on an econometric approach to estimation of theory based models of production, cost or profit and other based on nonparametric, programming approach to analysis of observed outcomes. In this paper we survey the underlying models and econometric techniques that have been used in studying technical inefficiency in the stochastic frontier framework, on which a number of review papers (see: among others, Greene, 1993 and Murillo-Zamorano, 2004), and a few books (Coelli, Rao and Battese, 1998; Fried, Lovell and Schmidt, 1993 and Kumbhakar and Lovell, 2000) have already been written. We also present some of the recent developments in econometric methodology in the context of SFM with correlated error components. Needless to say the present review is not comprehensive and owes much to these excellent books and review articles. The omission of other topics does not mean that we consider them unimportant. Also, the author restricts the survey within the cross-section data model only.

Many applications of the SFM in diverse field have been coming up since its inception. SFM has many applications in management discipline like financial industries and resource-based industries. We have reported a few of them here. Khatri et al. (2002) estimated inefficiency for corporate sector performance and examined the role of corporate governance for a panel dataset of 31 of the largest non-financial companies listed on the Kuala Lumpur stock exchange for the period 1995 to 1999. Dawson & Dobson (2002) used SFM to measure managerial efficiency for English football association. Troutt et al. (2005) analysed the performance of a set of mutual funds from morning star database using SFM. Camanho and Dyson (2005) estimated the cost efficiency for a set of bank branches. Cummins et al. (2005) measured the efficiency for the Spanish insurance industry. Silva et al. (2005) measured profit efficiency

for a set of Portuguese bank branches and found that profit improvement of bank branches is due to allocative efficiency in the long run whereas technical efficiency is responsible for the short run. Dar A. A. (2007) studies firm efficiency in studies of labor market of Canada. Dolton et al. (2007) examined how students allocated their time to efficiently score from a survey conducted in April 1999 on first and final year students from the different qualifications offered at the University of Malaga. Choi, K.-S. (2011) used stochastic frontier function to measure the efficiency of baseball manager. Brissimis et al. (2011) estimated efficiency on a panel dataset of commercial banks of 13 EU countries for the period 1996 to 2003 and found that the most technically efficient banking sectors were in Austria, Germany and the UK.

The plan of the paper is as follows. Section 2 describes modeling of technical inefficiency which is the prime interest of these models, and Section 3 considers econometric analysis of estimating the technical inefficiency. Section 4 describes the basic cross-sectional SFM, its different methods of estimation. Section 5 discusses different approaches of modeling and estimation methods of SFM with correlated error components. In Section 6 we present an illustrative study of the different modeling approaches using US electricity data. Finally, Section 7 gives the concluding remarks and some future research developments in the field.

2 Modeling Inefficiency

The production frontier or its dual cost frontier, or the convex conjugate of the two, the profit frontier, represents the maximum output obtained with a given set of inputs or the minimum cost of producing that output given the prices of the inputs or the maximum profit attainable given the output, inputs, and prices of the inputs. The estimation of frontier functions is the econometric exercise with the underlying theoretical proposition that no observed firm can exceed the frontier. Measurement of (in)efficiency is, then, the empirical estimation of the extent to which observed agents (fail to) achieve the theoretical frontier. The estimated model of production, cost or profit is the means to the objective of measuring inefficiency.

The measures of the different concepts of efficiency, addressed by Debreu (1951), Farrell (1957), Koopmans (1951) and Shephard (1953) are based on the economic notion of 'technology'. A firm's technology can be alternatively represented by Production Set (T), Output Set $(P(x))$ or Input Set $(L(y))$.

Let a firm uses inputs $x = (x_1, ..., x_n) \in R_+^n$ to produce outputs $y = (y_1, ..., y_m) \in R_+^m$. A production technology is given by the input-output combination $z = (x, y)$. A production technology is said to be feasible if and only if y can be produced from the input x using the given technology i.e. $T = \{(y, x) = z : x \text{ can produce } y\} \subset R_+^{m+n}$.

The output set $P(x)=\{y:z=(y, x) \in T\} \subset R_+^m$ consists of all those feasible outputs that can be produced using the input x and the input set $L(y)=\{x:z=(y, x) \in T\} \subset R_+^n$ consists of all those feasible inputs x that can produce a given level of output y.

Shephard (1953, 1970) introduced the notion of distance function to provide a functional form of technology. Distance function can be described in terms of both the output set $P(x)$ and the input set $L(y)$. The input and output distance functions are respectively $d_i(y,x)= max(\lambda:x/\lambda \in L(y), \lambda>1)$ and $d_0(y,x)=max(\mu:y/\mu \in P(x), 0<\mu< 1)$. This input distance function gives the maximum radial reduction in input to produce a given level of output whereas output distance function gives the maximum radial expansion of output possible for a given level of inputs.

The Debreu - Farrell input and output oriented measures of technical efficiency are respectively $TE_i(y, x)= max(\theta : \theta x \in L(y))$ and $TE_0(x, y)=max(\phi : \phi y \in P(x))$.

Let a firm uses inputs x with prices $q = (q_1....q_n)$ and we have single output y that can be sold at price p. The production frontier is then:

$$f(x)=max\{y:y \in P(x)\}=max \{y:x \in L(y)\}$$

which is the maximum possible output technologically feasible for this level of inputs.

In this case, the output oriented measure of technical efficiency becomes ratio of maximum to actual output

$$TE_0(x, y)=[max(\phi y \leq f(x)]^{-1}$$

3 Econometric Analysis of the Efficiency

Cobb and Douglas (1928) estimated production function using OLS technique using the observed outputs and inputs to estimate the efficiency of a firm in early twentieth century long before Farrell (1957). However, the assumption of OLS with observations lie around the estimated model violated the frontier property of the production function that each observation lies below the frontier. Next forty years ignored the frontier property of the production function and estimated 'average' production function which ruled out its use for efficiency estimation.

The possibility of measuring the efficiency of a firm on the basis of information on the inputs used and output produced started with Debreu (1951), Farrell (1957) and Koopmans (1951). Two different approaches of efficiency analysis have been developed since then: one is the Frontier Approach and the other is Data Envelopment Approach (DEA). Since the present work follows the frontier approach of efficiency, we omit the review of the vast literature on efficiency analysis by the Data Envelopment Approach. Detailed discussions on this approach of efficiency analysis can be found in Coelli, Rao and Battese (1998); Fried, Lovell and Schmidt (1993).

The frontier approach is based on the econometric analysis and requires stochastic specification of the frontier function. This approach estimates the frontier model and provides some estimators for efficiency. Estimation of efficiency under this approach is carried out on deterministic as well as stochastic frontier models. In a deterministic frontier model inefficiency is represented by a single one-sided stochastic term with no specification of noise whereas the stochastic frontier model has random noise separated out from inefficiency leaving the observational errors with two latent components called noise and inefficiency.

Consider a set of *'n'* firms produces a single output using a certain technology and *'K'* inputs. Let y_i be the output, and x_i be the vector of the inputs used, by the ith firm. Then the ith observational equation of the production frontier model is given by

$$y_i = f(x_i, \beta)TE_i, \ i = 1,2,....,n \qquad (3.1)$$

where $f(x_i, \beta)$ is the production frontier, β is the vector of unknown technological parameters and TE_i is the output oriented efficiency of ith firm. All the observations satisfy the frontier property with respect to the estimated production frontier. Hence, we have

$$TE_i = y_i/f(x_i, \beta) \qquad (3.2)$$

which defines the technical efficiency as the ratio of observed output to the frontier output under the current technology. The amount by which an observation lies below the frontier is called inefficiency when $TE_i < 1$. The production frontier model given in equation (3.1) is called deterministic frontier model. This model was estimated by Aigner and Chu (1968) using programming technique. Richmond (1974) improved upon the COLS estimates to make them unbiased and consistent. In order to give statistical content to the programming estimators proposed by Aigner and Chu (1968), Schmidt (1976) estimated the model (3.1) by the maximum likelihood (ML) method assuming exponential and half-normal distribution. Later, Greene (1980) estimated another deterministic frontier model assuming ε_i's are distributed as gamma variables. This model too was estimated by the ML method.

4 The Stochastic Frontier Model

Although the deterministic frontier approach of Aigner and Chu (1968) and Schmidt (1976) estimates the frontier function respecting its frontier property, an obvious limitation of this approach is that one cannot isolate the effect of inefficiency from that of the random noise as both are lumped together in the disturbance term of the model. Also, it violates one of the regularity conditions required for application of ML method viz. the support of the distribution of y must be independent of the parameter vector.

The stochastic frontier approach of efficiency analysis which aimed to rectify the above mentioned limitation of the deterministic frontier approach, was introduced

by Aigner, Lovell and Schmidt (1977), Meeusen and van den Broeck (1977) almost simultaneously. The novelty of the stochastic frontier approach lies in i) decomposing the disturbance term into two random components representing the "random noise" and the "inefficiency" and ii) associating the frontier property with the stochastic frontier rather than the deterministic frontier. While the decomposition enables one to separate out the effects of random noise from the inefficiency and makes the support of the distribution of y independent of the parameter space, the concept of stochastic frontier ensures the frontier restriction on the observed outcomes.

Under the above assumptions, the simplest stochastic production frontier model can be represented as

$$y_i = f(x_i, \beta).exp(v_i)TE_i \quad (4.1)$$

where $f(x_i, \beta)$ is the deterministic frontier indexed by the unknown technological parameter vector β, y_i is the observed output, x_i is a vector of inputs, v_i is the random noise, $TE_i = exp(-u_i)$ is efficiency of the firm and u_i is one-sided (non-negative) latent random variable. The shortfall of the observed output (y_i) from the stochastic optimal outcome, given by $exp(-u_i)$, measures the technical efficiency of the firm characterized by stochastic elements that varies across firms.

Assuming $f(x_i, \beta)$ takes the log-linear Cobb-Douglas form (4.1) can be expressed as a linear function of the unknown parameters,

$$y_i = x_i'\beta + v_i - u_i \quad (4.2)$$

where y_i is an appropriate known function of output and x_i is a vector of appropriate known functions of the inputs.

The model in (4.2) has two error components, often referred as "composed error" model. For statistical inference, the two-sided random noise (v_i) is assumed to be normally distributed and a number of probability distributions have been used to model the one-sided inefficiency (u_i). Moreover, random noise (u_i) and inefficiency (v_i) are assumed to be independent.

4.1 Estimation of the Cross-section Data SFM

Let $g(v_i, \theta)$ and $h(u_i, \eta)$ be respectively the densities of v_i and u_i indexed by the unknown parameter vectors θ and η and $\gamma=(\beta, \theta, \eta)'$ be the unknown parameter vector of the model.

The OLS would not be appropriate for estimating the parameter vector γ as the intercept term of the deterministic frontier and the non-zero mean of u_i are mixed together in the intercept term of the regression model which can not be separated out from the OLS estimate of the intercept in the regression equation. However, MOLS method of Richmond (1974) can be applied to estimate γ under specific probability distribution of $'u_i'$. Thus it is necessary to specify the distributions of and for parametric estimation of SFM. Given the distributional assumptions regarding the error components, the parameters of the cross-section data SFM has been estimated by a spectrum of estimation methods viz. likelihood-based parametric, semi-parametric, Bayesian and Bayesian semi-parametric methods. In the parametric estimation of the SFM, however, the ML method, and their different variants like Simulated ML and EM method, played a dominant role, although COLS, MOLS, two-step OLS, GMM and IV methods have been used in specific situations.

The log-likelihood function of the model, based on the output y_i can be obtained from the joint probability density of (u_i, v_i) using the transformation $\varepsilon_i=y_i - x_i'\beta$ and integrating out u_i and is then given by

$$l(\gamma|y) = \sum_{i=1}^{n} log \int_0^\infty g(y_i - x_i'\beta + u_i, \theta)h(u_i, \eta)du_i, \gamma \in \Gamma \quad (4.3)$$

The expression (4.3) gives the general expression for the log-likelihood function of the model. The shape of the likelihood function and the nature of the likelihood equations, however, will crucially depend upon the choice of the probability densities of u_i and v_i.

While the density function of the random noise v_i has been the universally accepted as $N(0, \sigma_v^2)$, the choice of the density function for the inefficiency, however, has been varied. In fact, a sizeable portion of the works in the SFM literature has been devoted on the estimation of SFM under alternative density function of the inefficiency. For example, in normal-half-normal SFM, proposed by Aigner et al. (1977), $u_i \sim N^+ (0, \sigma_u^2)$. The model was estimated using ML method via BHHH

algorithm. Meeusen and van den Broeck (1977) proposed the normal-exponential SFM where $u_i \sim Exp(l/\theta)$. The parameters of the model were estimated by ML method. Greene (1997) later estimated the model by MOM.

Both the normal-exponential and the normal-half-normal SFM postulate that the mode of the inefficiency distribution is at zero which goes against the common perception of the distribution of inefficiency among firms. In response to this criticism, Stevenson (1980) proposed truncated normal i.e. $u_i \sim TrN\left(\mu_u, \sigma_u^2\right)$, which has a non-zero mode, as a plausible probability model for inefficiency and estimated the model by ML method. Later Battese and Coelli (1988) used Australian diary data to estimate the model by the COLS and the ML methods under two alternative assumptions regarding the parameter μ_u. They also performed the likelihood ratio test for $H_0 : \mu_u = 0$ and found it significant for the dairy data.

The normal-gamma SFM where $u_i \sim G(P, \Theta)$, proposed by Beckers and Hammond (1987), has several attractive properties and nests the normal-exponential SFM. The log-likelihood function of the normal-gamma SFM is not only complicated but also involves integrals which has no closed form and can be approximated using some suitable numerical approximation. Greene (1990) estimated the model with approximating the intractable integral by the mathematical quadrature formula. Later Greene (2003) used Simulated Maximum Likelihood (SML) method to estimate the same model where the intractable integral in the log-likelihood function is estimated by MC simulation using Halton numbers.

5. Stochastic Frontier Model with Correlated Error Components

The noise-inefficiency independence is an important assumption that has been consistently maintained in most of studies on SFM. Recently, however, some researchers argue regarding the validity of this assumption. The logic behind this argument is that the noise-inefficiency correlation may arise due to the effect of noise which is beyond a firm's control on the efficiency which is under firm's control in taking economic decisions under uncertainty. For example, Pal and Sengupta (1999) who were first to relax the noise-inefficiency independence assumption in a simultaneous equation cross-section data SFM argued that the cropping decision in agriculture may depend upon on random factors like weather of the previous season. They estimated a stochastic production frontier model with correlated error components by systems approach using cross-section information on Indian agricultural firms and found significant noise-inefficiency correlation in the data. Subsequently Smith (2008) argued that this assumption should be relaxed at least for the empirical verification in absence of any economic logic or empirical evidence in support of any noise-inefficiency independence. Smith (2008) also found significant negative noise-inefficiency correlation in both cross-section as well as panel data SFMs.

Moreover, the effects of many institutional and social factors which are beyond the control of a firm but affect its productive efficiency are accounted for by the noise component of the composite error SFM and may lead to noise-inefficiency correlation. Finally, it is has been felt that in absence of any empirical evidence in support of the noise-inefficiency independence, one needs to develop an SFM with correlated error structure at least for empirical verification (Bandyopadhyay and Das, 2006). Furthermore, misspecification of the model is also another potential source of noise-inefficiency correlation. For example, let the true model be $y_i = a + bx_i + cz_i + v_i - u_i$ where z_i, is age of the firm, v_i is the noise and u_i is the inefficiency. Suppose u_i is uncorrelated with both x_i and v_i but correlated with z_i. Now, if the implemented model is $y_i = a + bx_i + w_i - u_i$, where $w_i = cz_i + v_i$, then clearly the error (w_i) and the inefficiency (u_i) are correlated in such a model. The noise-inefficiency correlation in this case arises due to the misspecification of the "true" model. These evidences which support the noise-inefficiency correlation will enable us to empirically verify the validity of this assumption.

Using the equation (4.2), a cross-section SFM with correlated error components can be written as:

$$y_i = x_i'\beta + v_i - u_i, \; i = 1,2,.....,n \qquad (5.1)$$

$$-\infty < v_i < \infty, \; 0 < u_i < \infty$$

where the latent random variables v_i and u_i, assumed to be statistically dependent, have the joint density function $f(v_i, u_i; \theta)$ indexed by the parameter vector θ.

It is necessary to develop the noise-inefficiency dependence structure through an appropriate joint density function of v_i and u_i to implement the model. In a few studies that have been carried out so far on correlated error components SFM in recent years such as Bandyopadhyay and Das (2006), Burns (2004), Pal (2004), Pal and Sengupta (1999), Smith (2008) three alternative approaches towards modeling noise-inefficiency dependence can be found which may be termed as: Distribution Specific Approach (DSA), Conditional-Marginal Approach (CMA), and Copula Approach (CA).

In DSA one assumes a suitable joint density function of the error components like the truncated bivariate normal distribution (Pal and Sengupta, 1999; Bandyopadhyay and Das, 2006). On the other hand in CMA, the joint density function of the error components can be obtained by combining the marginal distribution of the inefficiency with the conditional distribution of the random noise given the inefficiency (Pal, 2004). In CA, joint distribution function of the error components can be obtained by combining the marginal distributions of noise and inefficiency through a copula function (Burn, 2004; Smith, 2008).

5.1 Distribution Specific Approach (DSA)

Pal and Sengupta (1999) proposed the first ever SFM with the correlated error components which was based on the distribution specific approach. The model they used was a cross-section data simultaneous equation stochastic production frontier model which presented as $ln\ y_i = ln\ \beta_0 + \sum_k \alpha_k\ ln\ x_{ki} + v_i - u_i$

and $ln\ \frac{w_{ki}}{P_i} - ln\ \beta_0 - ln\ \alpha_k + ln\ x_k - \sum_j \alpha_j ln\ x_{ji} = u_i + z_{ki}$, $i = 1,.....n.$

where y_i is the output with P_i as output price, x_i is a set of inputs with price w_i. Regarding the distributions of error components, it was assumed that i) (u_i, v_i) are jointly distributed as truncated bivariate normal with parameters $\left(\mu_u, 0, \sigma_u^2, \sigma_v^2, \rho\right)$ with u_i being truncated at zero, ii) technical inefficiency (u_i) and allocative efficiency (z_i) are assumed to be independently distributed and iii) $z = (z_1,.....z_m)' \sim MN(0, \Sigma)$. Making the transformation $Z_1 = u + v$ and $Z_2 = z + lu$ where $l = (1, 1,.....1)'$, the density function of (Z_1, Z_2) can be written as

$$f\left(Z_1, Z_2\right) = \left[\left(2\pi\right)^{(n+1)/2} \sigma_v \sigma_u |\Sigma|^{1/2} \sqrt{1-\rho^2}\, \Phi\left(-\frac{\mu_u}{\sigma_u}\right)\right]^{-1} \sigma_* exp\left(-\frac{a_*}{2}\right) \Phi\left(-\frac{\mu_*}{\sigma_*}\right)$$

where

$$\frac{1}{\sigma_*^2} = \frac{1}{1-\rho^2}\left(\frac{1}{\sigma_u^2} + \frac{1}{\sigma_v^2} + \frac{2\rho}{\sigma_u \sigma_v}\right) + l' \Sigma^{-1} l$$

$$\mu_* = \sigma_*^2 \left[\frac{1}{1-\rho^2}\left\{\frac{Z_1}{\sigma_v^2}\left(1 + \rho\frac{\sigma_v}{\sigma_u}\right) + \frac{\mu_u}{\sigma_u^2}\left(1 + \rho\frac{\sigma_u}{\sigma_v}\right)\right\} + l' \Sigma^{-1} Z_2\right]$$

$$a_* = \left[\frac{1}{1-\rho^2}\left\{\frac{\mu_u^2}{\sigma_u^2} + \frac{Z_1^2}{\sigma_v^2} + 2\rho\frac{\mu_u}{\sigma_u}\frac{\mu_v}{\sigma_v}\right\} + Z_2' \Sigma^{-1} Z_2\right] -$$

$$\sigma_*^2 \left[\frac{1}{1-\rho^2}\left\{\frac{Z_1}{\sigma_v^2}\left(1 + \rho\frac{\sigma_v}{\sigma_u}\right) + \frac{\mu_u}{\sigma_u^2}\left(1 + \rho\frac{\sigma_u}{\sigma_v}\right)\frac{\mu_u^2}{\sigma_u^2}\right\} + l' \Sigma^{-1} Z_2\right]^2$$

The model was estimated by the ML method using S-PLUS software.

Das (2009) proposed a SFM with correlated error components for a single equation SFM in the line of Pal and Sengupta (1999) where v_i and u_i are assumed to be jointly distributed as truncated bivariate normal with parameter vector $\theta = \left(\mu_v, \mu_u, \sigma_v^2, \sigma_u^2, \rho, u_0\right)' \in \Theta$ where u_i is truncated below at u_0 an unknown non-negative point of truncation. The model was referred as truncated bivariate normal stochastic frontier model (TBN-SFM). The truncation point can be considered as the threshold level of inefficiency for the firms. Das (2009) analysed the specification and estimation of different sub-models under TBN-SFM.

The joint density function of and under this specification is given by

$$f(v_i, u; \theta) = C\ \exp\left[-\frac{1}{2\left(1-\rho^2\right)}\left\{\left(\frac{v_i - \mu_v}{\sigma_v}\right)^2 - 2\rho\left(\frac{v_i - \mu_v}{\sigma_v}\right)\left(\frac{u_i - \mu_u}{\sigma_u}\right) + \left(\frac{u_i - \mu_u}{\sigma_u}\right)^2\right\}\right]$$

$$-\infty < v_i < \infty,\ u_0 < u_i < \infty$$

where,

C = $\left(2\pi\sqrt{1-\rho^2}\sigma_u\sigma_v\right)^{-1}\Phi^{-1}\left(-(u_0-\mu_u)/\sigma_u\right)$ and Φ is the distribution function of a standard normal variable.

Using the transformation and after simplification, the density function of y_i can be written as

$$f(y_i;\gamma)=\frac{1}{\sigma.\Phi\left/\left(\alpha_1\sqrt{1+\alpha_2^2}\right.\right)}\Phi\left(\alpha_1+\alpha_2\frac{y_i-x_i'\beta-\mu}{\sigma}\right)\phi\left(\frac{y_i-x_i'\beta-\mu}{\sigma}\right) \quad (5.2)$$

$$\gamma=\left(\beta,\mu_v,\mu_u,\sigma,\lambda,\rho,u_0\right)'\in\Gamma$$

where

$\sigma=\sigma_v\sqrt{1+\lambda^2+2\rho\lambda},\lambda=\sigma_u/\sigma_v$, $\alpha_1=-u_1^0\sqrt{1+\lambda^2+2\rho\lambda}\left/\sqrt{1-\rho^2}\right.$, $u_1^0=(u_0-\mu_u)/(\lambda\sigma_v)$, $\alpha_2=(\lambda+\rho)\left/\sqrt{1-\rho^2}\right.$, $\mu=\mu_v-\mu_u$

The density function of given in (5.2) does not follow a y_i standard distribution under the parametric specification of γ. However, under the transformation of parameter vector $\gamma=\left(\beta,\mu_v,\mu_u,\sigma,\lambda,\rho,u_0\right)'\rightarrow\delta=(\xi,\sigma,\alpha_1,\alpha_2)'$, y_i follows extended skew-normal (ESN) with parameters ξ, σ, α_1 and α_2 (Azzalini, 1985) where $\xi = x'\beta+\mu$. This re-parameterization, however, is not interest specific as the different measures of inefficiency cannot be expressed in terms of δ.

Under alternative parametric restrictions, the TBN-SFM nests a number of sub-models viz. i) with $u_0 = \mu_v = \mu_u = \rho = 0$, we get the normal-half-normal SFM (Aigner et al., 1977), ii) with $u_0 = \mu_v = \rho = 0$, we get the normal-truncated normal SFM (Stevenson, 1980), iii) with $u_0 = \mu_v = 0$, we get TBN-SFM of Pal and Sengupta (1999) and (iv) with $u_0 = \mu_v = \mu_u = 0$, we get TBN-SFM of Bandyopadhyay and Das (2006).

The moment generating function (MGF) of derived in Das (2009) and is presented as

$$M_y(t)=\left[exp\left(t\xi+\frac{t^2\sigma^2}{2}\right)\Phi\left(\frac{\alpha_1+\alpha_2 t\sigma}{\sqrt{1+\alpha_2^2}}\right)\right]\Bigg/\Phi\left(\frac{\alpha_1}{\sqrt{1+\alpha_2^2}}\right)$$

Using the expression of MGF of y we get the following expressions for the first four moments and the measures of skewness and kurtosis of y.

The expressions for first four moments, skewness and kurtosis are respectively given by:

$$E(y) = \xi + d\sigma h(k)$$

$$Var(y) = \sigma^2\left[1-d^2kh(k)-d^2h^2(k)\right]$$

$$\mu_3(y)=\sigma^3d^3h(k)\left[\{h(k)+k\}^2+\left\{h^2(k)+kh(k)-1\right\}\right]$$

$$\mu_4(y)=3\sigma^4+\sigma^4\Big[d^4h(k)\ \left\{k\left(3+k^2\right)+4\left(1-k^2\right)h(k)-3h^2(k)\ \left(2k+h(k)\right)\right\}+6d^2h^2(k)\Big]$$

$$\gamma_1(y)=\frac{d^3h(k)\left[\{h(k)+k\}^2+\left\{h^2(k)+kh(k)-1\right\}\right]}{\left[1-d^2kh(k)-d^2h^2(k)\right]^{3/2}}$$

$$\gamma_2(y)=\frac{3+\left[d^4h(k)\ \left\{k\left(3+k^2\right)+4\left(1-k^2\right)h(k)-3\left(2k+h(k)\right)\ h^2(k)\right\}+6d^2h^2(k)\right]}{\left[1-d^2kh(k)-d^2h^2(k)\right]^2}-3$$

where

$d=\alpha_2\left/\sqrt{1+\alpha_2^2}\right.$, $k=\alpha_1\left/\sqrt{1+\alpha_2^2}\right.$ and $h(k)$ is the hazard rate of a standard normal variate.

Putting different parametric restrictions in above equations one can get the expressions for the first four central moments, skewness and kurtosis of y for different sub-models.

Das (2009) examined analytically the identification status of the TBN-SFM and standard normal-half-normal and normal-truncated normal SFM which are nested by the TBN-SFM. It was found that i) the normal-half-normal SFM is globally identifiable, ii) normal-truncated normal SFM is locally near-identifiable and iii) TBN-SFM is either unidentifiable or near-identifiable even in a restricted parameter space. Pal and Sengupta (1999) model with restriction $u_0 = \mu_v = 0$ is near identifiable and Bandyopadhyay and Das (2006) model with restriction $u_0 = \mu_v = \mu_u = 0$ is unidentifiable.

Of interest in the SFM is the technical efficiency which is based on the conditional distribution of inefficiency given the observational error. The measure of technical efficiency due to Battese and Coelli (1988) is given by:

$$E\left(exp\left(-u_i\right)\mid\varepsilon_i\right)=\frac{1-\Phi\left(z_i+\sigma_*\right)}{1-\Phi\left(z_i\right)}exp\left(-\mu_{*i}+\frac{1}{2}\sigma_*^2\right)$$

where

$$\mu_{*i}=\frac{\mu_u\left(1-\rho\lambda\right)-\left(\varepsilon_i-\mu_v\right)\lambda\left(\lambda-\rho\right)}{\left(1+\lambda^2-2\rho\lambda\right)}$$

$$\sigma_*=\frac{\sqrt{1-\rho^2}\lambda\sigma_v}{\sqrt{1+\lambda^2-2\rho\lambda}}$$

$$z_i=\left(u_0-\mu_{*i}\right)/\sigma_*$$

and

$h(z) = \phi(z)/\Phi(-z)$ is the hazard (or failure rate) rate for a standard normal variate.

5.1.1 Estimation of Different TBN-SFM

Das (2009) proposed the EM method to estimate the parameters of the near-identifiable TBN-SFM Pal and Sengupta (1999) model. The TBN-SFM can be readily recast in "missing data" framework as the latent random variable inefficiency *"u"* can be considered as the variable with missing observations. Then, $y = (y_1,.....,y_n)'$, $u = (u_1,.....,u_n)'$ and $w = (y', u')'$ respectively be the observed data, the missing data and the complete data vectors and let $f(w; \theta)$, $g(y; \theta)$ and $h(u \mid y, \theta)$ be the density function of the complete data, observed data and missing data given the observed data respectively where $\theta=\left(\beta,\mu_u,\sigma_v^2,\sigma_u^2,\rho\right)\in\Theta$. Also let $l(\theta|w)$, $l(\theta|y)$ and $l(\theta|u, y)$ be the associated log-likelihood functions.

The proposed EM algorithm based on Dempster et al. (1977) can be described as follows:

E-Step: Let $\hat{\theta}_n$ be the estimate of θ at the nth step of iteration. Then, given $\hat{\theta}_n$, the Q-function of the model is given by

$$Q\left(\theta\mid\hat{\theta}_n\right)=\int l\left(\theta\mid w\right)h\left(u\mid y;\hat{\theta}_n\right)du$$

Note that, conditional on y, w and $\hat{\theta}_n$, the Q-function $Q\left(\theta\mid\hat{\theta}_n\right)$ is a function of θ and $\hat{\theta}_n$. M-Step: In the M-step, the Q-function is maximized with respect to θ to obtain $\hat{\theta}_{n+1}$, the (n+1)th step estimate of θ. Thus

$$\hat{\theta}_{n+1} = \arg\max Q\left(\theta\mid\hat{\theta}_n\right)$$

Given $\hat{\theta}_n$, the first order conditions for maximization of $Q\left(\theta\mid\hat{\theta}_n\right)$ are highly non-linear in $\hat{\theta}_{n+1}$, and is solved by using BHHH or BFGS algorithm. The Q-function of the model is given by (Details are found in Das (2009))

$$Q\left(\theta\mid\hat{\theta}_n\right)=-\frac{n}{2}log\left(\sigma_u^2\sigma_v^2\left(1-\rho^2\right)\right)-nlog\Phi\left(\mu_u/\sigma_u\right)-\frac{1}{2\left(1-\rho^2\right)}$$

$$\left[\frac{1}{\sigma_v^2}\sum_i\varepsilon_i^2+\frac{n\mu_u^2}{\sigma_u^2}-2\mu_u\frac{\sigma_v+\rho\sigma_u}{\sigma_u^2\sigma_v}\sum_i E_{u|y}\left(u_i\right)\right.$$

$$-2\frac{\sigma_u+\rho\sigma_v}{\sigma_v^2\sigma_u}\sum_i\varepsilon_i E_{u|y}\left(u_i^2\right)+2\rho\frac{\mu_u}{\sigma_u\sigma_v}$$

$$\left.\sum_i\varepsilon_i+\frac{\sigma^2}{\sigma_u^2\sigma_v^2}\sum_i E_{u|y}\left(u_i^2\right)\right]$$

where $u\mid y\sim N^+\left(\mu_*,\sigma_*^2\right)$ $E_{u|y}\left(u_i\right)=\sigma_*\left(h\left(z\right)-z\right)$, $E_{u|y}\left(u_i^2\right)=$ $\sigma_*^2\left(z^2+3zh\left(z\right)-1\right)$, $\mu_*=\left[\mu_u\sigma_v\left(\sigma_v+\rho\sigma_u\right)+\varepsilon_i\sigma_u\left(\sigma_u+\rho\sigma_v\right)\right]/$ $\sigma^2,\sigma_*^2=\left[\left(1-\rho^2\right)\sigma_u^2\sigma_v^2\right]\Big/\sigma^2, z=-\mu_*/\sigma_*$, and $h(z)$ is the hazard rate of a standard normal deviate.

The Bandyopadhyay & Das (2006) model can be estimated using the type-II maximum likelihood method (TML) of Berger et al. (1999) where the parameters of interest are first estimated by the integrated likelihood method and the estimated value of these parameters are used in the full likelihood function of the model to estimate the rest parameters. Das (2009) applied this method to estimate the Bandyopadhyay & Das (2006) model where the model becomes identifiable if either of the unidentifiable parameters ρ and λ is known. This feature helps to use this method to estimate the unidentified model.

The estimation method is applied treating the unidentifiable parameter λ as the nuisance parameter and the remaining parameters β, σ and ρ as the parameter

of interest. The parameter vector γ can be written as $\gamma = (\gamma_1, \lambda)'$ where $\gamma_1 = (\beta, \sigma, \rho)$. Let ρ be the likelihood function of the model and $\omega(\gamma)$ be a non-negative weight function of the unidentifiable parameter λ. Then the integrated log-likelihood function (ILF) of the model is given by

$$\tilde{l}(\gamma_1) = log \int_0^\infty L(\gamma_1, \lambda)\omega(\lambda)d\lambda$$

In the first step of the TML, the identifiable parameter γ_1 is estimated by maximizing the integrated log-likelihood function and the TML estimate of γ_1 is given by

$$\hat{\gamma}_{1TML} = arg \max_{\gamma_1} \tilde{l}(y_1)$$

In the second step, $\hat{\gamma}_{1TML}$ is substituted in the log-likelihood function of the model and the unidentifiable parameter λ is estimated by maximizing the resulting log-likelihood function of the model given $\hat{\gamma}_{1TML}$ and the TML estimate of λ is given by

$$\hat{\lambda}_{TML} = arg \max_{\lambda} l(\hat{\gamma}_{1TML}, \lambda) = arg \max_{\lambda} log\ L(\hat{\gamma}_{1TML}, \lambda)$$

In order to implement the TML method, one needs to specify $\omega(\lambda)$, the weight function of the nuisance parameter λ. Das (2009) used one informative and one non-informative weight function for this model. The informative weight function is given by the type-2 beta density whereas the improper non-informative weight function is proportional to the reciprocal of the parameter given by λ. Das (2009) also studied the asymptotic behaviour of these estimators empirically through MC simulation and the results showed fairly good sampling properties of the estimators for moderately large samples.

The ILF under the non-information weight function was derived in Das (2009) and is given by

$$\tilde{l}(\gamma_1)\alpha - \frac{n}{2}log\sigma^2 - \frac{1}{2\sigma^2}\sum_{i=1}^{n}\varepsilon_i^2 + \sum_{i=1}^{n} log \int_0^\infty \frac{1}{\lambda}\Phi\left(\alpha_2 \frac{\varepsilon_i}{\sigma}\right)d\lambda$$

where $\varepsilon_i = y_i - x_i'\beta$, $\alpha_2 = (\lambda + \rho)/\sqrt{1-\rho^2}$.

The above ILF under non-informative weights involves intractable integral and can be evaluated using the MC simulation method as it can be expressed as a expectation of some function of the parameter λ. Thus the ILF can be written as

$$\tilde{l}_2(\gamma_1)\alpha - \frac{n}{2}log\sigma^2 - \frac{1}{2\sigma^2}\sum_{i=1}^{n}\varepsilon_i^2 + \sum_{i=1}^{n} log E_\lambda\left[\Phi(\alpha_2\varepsilon_i/\sigma)/\{\lambda h(\lambda)\}\right]$$

where, $h(\lambda)$, the importance sampling density, given by the density function of $N^+(0, 1)$.

Das (2009) used the MC simulation method and the simulated ILF can be presented as

$$\hat{l}_2^s(\gamma_1)\ \alpha - \frac{n}{2}log\sigma^2 - \frac{1}{2\sigma^2}\sum_{i=1}^{n}\varepsilon_i^2 + \sum_{i=1}^{n} log \frac{1}{R}\sum_{k=1}^{R}\Phi(\alpha_{2k}\ \varepsilon_i/\sigma)/\{\lambda_k h(\lambda_k)\}$$

where $\alpha_{2k} = (\lambda_k + \rho)/\sqrt{1-\rho^2}$, λ_k, $k = 1,....,R$ is a random sample of size R from $N^+(0, 1)$.

5.2 Conditional Marginal Approach (CMA)

In the conditional-marginal approach proposed in Pal (2004) the joint density function of error components are generated by combining the marginal density of inefficiency with the conditional density of the noise given inefficiency. This is much more generalised approach over distribution specific approach as different non-normal distributional assumption on the error term can be taken and joint density function can be developed through conditional distribution approach to introduce non-independence. For example, Pal (2004) developed a SFM with correlated noise-inefficiency by taking the conditional density of noise given inefficiency as normal whereas the marginal density of inefficiency as half-normal. In his specification the conditional density function of noise given inefficiency can be taken as normal with mean $\{\rho\sigma_v(u - \mu_u)\}/\sigma_u$ and variance $\sigma_v^2(1-\rho^2)$ and $u \sim N^+(0, \sigma_u^2)$ as one have bivariate normal distribution as joint density function with being the correlation coefficient. Pal (2004) also proposed a gamma distribution as the marginal distribution of u i.e. $u \sim G(P, \Theta)$ to ensure the uni-modality of the distribution which fits the situation of only a very few

observations near the frontier curve and $v \mid u \sim N\left(\left\{\rho\sigma_v\left(u-\mu_u\right)\right\}\Big/\sigma_u, \sigma_v^2\left(1-\rho^2\right)\right)$. However, they did not derive the joint distribution and marginal distribution of error under these assumptions. We described the model with the assumption of $\mu_u = 0$. The joint distribution can be obtained as follows:

$$f\left(u_i, v_i\right) = f\left(v_i \mid u_i\right) f\left(u_i\right) = \frac{\Theta^P}{\Gamma\left(P\right)\sigma_v\sqrt{1-\rho^2}}\Phi\left(\frac{v_i - \rho\sigma_v u_i/\sigma_u}{\sigma_v\sqrt{1-\rho^2}}\right) exp\left(-\theta u_i\right) u_i^{P-1}$$

Using the transformation and integrating out *ui*, the marginal density of *εi* will be

$$f\left(\varepsilon_i\right) = \frac{\Theta^P}{\Gamma\left(P\right)\sigma_v\sqrt{1-\rho^2}}\int_0^\infty \phi\left(\frac{\varepsilon_i - u_i - \rho\sigma_v u_i/\sigma_u}{\sigma_v\sqrt{1-\rho^2}}\right) exp\left(-\theta u_i\right) u_i^{P-1} du_i$$

Using the transformation $\varepsilon_i = y_i - x_i'\beta$, and after some simplification the density function of *yi* becomes

$$f\left(y_i\right) = \frac{\Theta^P}{\Gamma\left(P\right)\sigma_*\left(1-\psi\right)} exp\left(-\frac{1}{\left(1-\psi\right)^2}\left(\varepsilon_i\Theta - \frac{\left(1-\rho^2\right)\sigma_v^2\Theta^2}{2}\right)\right)\int_0^\infty \phi\left(\frac{u_i - \mu_{*i}}{\sigma_*}\right) u_i^{P-1} du_i$$

where

$$\varepsilon_i = y_i - x_i'\beta$$

$$\psi = \rho\sigma_v/\sigma_u$$

$$\mu_{*i} = \left[\varepsilon_i\left(1-\psi\right) + \left(1-\rho^2\right)\sigma_v^2\Theta\right]\Big/\left(1-\psi\right)^2$$

$$\sigma_*^2 = \frac{\sigma_v^2\left(1-\rho^2\right)}{\left(1-\psi\right)^2}$$

The log-likelihood function for one observation is then

$$l\left(\gamma \mid y_i\right) = P log\Theta + log\sqrt{P} - log\left(\sigma_*\left(1+\psi\right)\right) +$$

$$\frac{1}{\left(1-\psi\right)^2}\left(\varepsilon_i\Theta + \frac{\left(1-\rho^2\right)\sigma_v^2\Theta^2}{2}\right) + log\int_0^\infty \phi\left(\frac{u_i - \mu_{*i}}{\sigma_*}\right) u_i^{P-1} du_i$$

where $\gamma = \left(\beta, \sigma_v^2, \sigma_u^2, P, \Theta, \rho\right)$.

This intractable integral involved in the log-likelihood function can be expressed as the expectation of a function of the random variable u_i where $u_i \sim N^+\left(\mu_{*i}, \sigma_*^2\right)$ as

$$l\left(\gamma \mid y_i\right) = P log\Theta + log\sqrt{P} - log\left(1+\psi\right) +$$

$$\frac{1}{\left(1+\psi\right)^2}\left(\varepsilon_i\Theta + \frac{\left(1-\rho^2\right)\sigma_v^2\Theta^2}{2}\right) + log\Phi\left(\frac{\mu_{*i}}{\sigma_*}\right) + log\,E\left(u_i^{P-1}\right) \quad (5.3)$$

One can randomly draw a sample from this distribution and then use the simulated draws to estimate the expectation of the function with sample mean. The resulting log-likelihood function is known as the simulated log-likelihood function and given by

$$\tilde{l}\left(\gamma \mid y\right) = P log\Theta + log\sqrt{P} - log\left(1+\psi\right) +$$

$$\frac{1}{\left(1-\psi\right)^2}\left(\varepsilon_i\Theta + \frac{\left(1-\rho^2\right)\sigma_v^2\Theta^2}{2}\right) + log\Phi\left(\frac{\mu_{*i}}{\sigma_*}\right) + log\frac{1}{R}\sum_{r=1}^{R} u_{ir}^{P-1} \quad (5.4)$$

where u_{ir} is a random sample of size *R* from the distribution of u_i.

Similarly, an exponential distribution as the marginal distribution of u_i can be taken by assuming *P = 1* in the gamma model i.e. $u_i \sim Exp\left(\Theta\right)$. The corresponding log-likelihood function is then has following form

$$l\left(\gamma \mid y_i\right) = log\Theta - log\left(1+\psi\right) + \frac{1}{\left(1-\psi\right)^2}\left(\varepsilon_i\Theta + \frac{\left(1-\rho^2\right)\sigma_v^2\Theta^2}{2}\right) + log\Phi\left(\frac{\mu_{*i}}{\sigma_*}\right)$$

The simulated log-likelihood function in (5.4) is smooth continuous function of the parameter vector γ and can be maximized by using DFP or BFGS method. By the Lindeberg-Lévy variant of the Central Limit Theorem, (5.3) will be a consistent estimator of (5.4). However, as the log transformation is non-linear, the simulated log likelihood is a biased estimator of the log likelihood. As a result, the estimates obtained from maximising the simulated log likelihood are affected by simulation bias which can be minimised by increasing *R*. Moreover, the

simulated maximum likelihood estimators are consistent and asymptotic normal as $n \to \infty$ and $R \to \infty$ with $\sqrt{n}/R \to 0$ (Lee, 1999). Furthermore, Bhat (2001) found that the computation time was approximately one tenth associated with using 100 Halton draws than with 1000 pseudo-random draws.

The Battese & Coelli (1988) estimator of technical efficiency, for the SFM with correlated error components is based on the conditional distribution as follows:

$$TE_i = E\left[exp(-u_i) \mid \varepsilon_i\right] = \frac{1}{f(\varepsilon_i)} \int_0^{\infty} exp(-u_i) f(u_i, \varepsilon_i) du_i = \frac{E\left[exp(-u_i) u_i^{P-1}\right]}{E\left[u_i^{P-1}\right]} \quad (5.5)$$

The simulated estimator of (5.5) for the ith firm is given by:

$$\hat{TE}_i = \frac{\sum_{r=1}^{R} exp(-u_{ir}) u_{ir}^{P-1}}{\sum_{r=1}^{R} u_{ir}^{P-1}}$$

5.3 Copula Approach

Smith (2008) introduced the SFM with dependent error components where the joint probability distribution of two error components is built by the copula approach of statistical modelling. In this approach the multivariate distribution function can be built using a copula function and marginal density functions of the random variables. The copula function represents the dependence structure among these random variables. Formally, an 2-variate copula function, $C_\rho(u_1, u_2)$ is a bivariate distribution function of the uniform [0,1] random variables:

$$C_\rho(u_1, u_2): [0,1]^2 \to [0,1]$$

where $u_i \sim U(0,1)$ for $i = 1,2$ and $\rho \in \Omega$. This modelling technique is based on a representation theorem of Sklar (1973). This theorem states that for every bivariate distribution function has a unique copula function that captures the dependence structure between the random variables. The joint distribution function of a set of random variables can be uniquely expressed as a function of copula function whose arguments are the marginal distribution functions of these random variables.

Let $F(u_i, v_i; \theta)$ be the joint distribution function of the random variables u_i and v_i. Then, by Sklar's representation theorem, there is a unique copula function, $C_\rho(u_1, u_2)$ so that

$$F(u_i, v_i; \theta) = C_\rho\left(H(u_i; \delta_1), G(v_i; \delta_2)\right) \quad (5.6)$$

where $H(u_i; \delta_1)$ and $G(v_i; \delta_2)$ are distribution functions of u_i and v_i respectively, ρ is the parameter that captures the dependence between u_i and v_i, $\delta = (\delta_1, \delta_2)'$ and $\theta = (\delta, \rho)'$.

The copula approach of statistical modelling uses the relation (5.3) to generate a bivariate distribution function $F(u_i, v_i; \theta)$ from a given set of distribution functions, $F(u_i, \delta_1)$ and $G(v_i, \delta_2)$ and an bivariate copula function, $C_\rho(u_1, u_2)$. The corresponding bivariate density function, $F(u_i, v_i; \theta)$ is obtained by differentiating (5.6) with respect to u_i and v_i,

$$f(u_i, v_i, \theta) = C_\rho\left(H(u_i; \delta_1), G(v_i; \delta_2)\right) h(u_i; \delta_1) g(v_i; \delta_2) \quad (5.7)$$

$$\theta = (\delta_1, \delta_2, \rho), -\infty < v_i < \infty, \ 0 < u_i < \infty$$

where $h(u_i, \delta_1)$ and $g(v_i; \delta_2)$ are density functions of u_i and v_i respectively and $C_\rho(u_1, u_2) = \partial^2 C_\rho / \partial u_1 \partial u_2$ is the bivariate copula density function.

After some simplification and integrating u_i, we get the density function of y_i from (5.7) as

$$f(y_i, \gamma) = \int_0^{\infty} c_\rho\left(H(u_i; \delta_1), G(y_i - x_i'\beta + u_i, \delta_2)\right) h(u_i; \delta_1) g(y_i - x_i'\beta + u_i, \delta_2) du_i \quad (5.8)$$

$$\gamma = (\beta, \delta_1, \delta_2, \rho)$$

Subsequently the likelihood function of the copula-based SFM for $y_i, \ldots . y_n$ is:

$$L(\gamma) = \sum_{i=1}^{n} \int_0^{\infty} c_\rho\left(H(u_i; \delta_1), G(y_i - x_i'\beta + u_i, \delta_2)\right) h(u_i; \delta_1) g(y_i - x_i'\beta + u_i, \delta_2) du_i \quad (5.9)$$

Some of the well known bivariate families of copula

which can be used for modelling noise-inefficiency dependence structure are Fairlie-Gumble-Morgenstern (FGM), Ali-Mikhail-Haq (AMH), Normal, Frank, Plackett family (see: Nelson, 1999; Smith, 2008).

Smith (2008) developed the analytical expression for the density function of observational error with the assumptions that $u_i \sim Exp(\sigma_u)$ and $v_i \sim L(\sigma_v)$ under FGM copula where

$$h(u_i;\sigma_u)=\frac{1}{\sigma_u}exp\left(-\frac{u_i}{\sigma_u}\right), H(u_i;\sigma_u)=1-exp\left(-\frac{u_i}{\sigma_u}\right),$$

$$g(v_i;\sigma_v)=\frac{1}{\sigma_v}exp\left(-\frac{v_i}{\sigma_v}\right)\left(1+exp\left(-\frac{v_i}{\sigma_v}\right)\right), G(v_i;\sigma_v)=\left(1+exp\left(-\frac{v_i}{\sigma_v}\right)\right)^{-1}$$

The density function of y_i is given by

$$f(y_i,\gamma)=z_i\left[\frac{1-\rho}{\sigma_u+\sigma_v}{}_2F_1\left(2,1+\frac{\sigma_v}{\sigma_u};2+\frac{\sigma_v}{\sigma_u};-z_i\right)+\right.$$

$$\frac{2\rho}{\sigma_u+2\sigma_v}{}_2F_1\left(2,1+\frac{2\sigma_v}{\sigma_u};2+\frac{2\sigma_v}{\sigma_u};-z_i\right)+\frac{2\rho}{\sigma_u+\sigma_v}$$

$$\left.{}_2F_1\left(3,1+\frac{\sigma_v}{\sigma_u};2+\frac{\sigma_v}{\sigma_u};-z_i\right)-\frac{4\rho}{\sigma_u+2\sigma_v}{}_2F_1\left(3,1+\frac{2\sigma_v}{\sigma_u};2+\frac{2\sigma_v}{\sigma_u};-z_i\right)\right]$$

where

$$z_i=exp\left(\frac{y-x_i'\beta}{\sigma_v}\right)$$

and

$${}_2F_i(a,b;;c;s)=\frac{\Gamma(c)}{\Gamma(c-b)\Gamma(b)}\int_0^1 t^{b-1}(1-t)^{c-b-1}(1-st)^{-a}dt=\sum_{i=0}^{\infty}\frac{(a)_i(b)_i}{(c)_i}\frac{s^i}{i!}$$

One difficulty with the copula-based SFM, however, is that the log-likelihood function based on the density function of y_i of the model involves intractable integrals which are to be evaluated either numerical method or MC method. Smith (2008) estimated the model by ML method approximating the log-likelihood function using numerical integration. The ML method was performed using BFGS algorithm. The standard normal-half-normal distribution was used for the distributions of the error components in a cross section study of US electricity data with the AMH, the Frank family and the Plackett families of copula.

However, this method can be computationally burdensome in case of certain copula functions. As an alternative, simulation estimation procedure can be used. Simulated maximum likelihood (SML) is one of the popular methods which uses simulation technique to approximate an integral arises in the likelihood function and have no closed form. The estimation procedure involves transforming the integral as an expectation with respect to the distribution of a random variable. One can randomly draw from this distribution and then use the simulated draws to estimate the expectation with a sample mean. The log-likelihood function of (5.6) can be written as

$$L(\gamma)=\sum_{i=1}^{n}E_{ui}\left[c_\rho\left(H(u_i;\delta_1),G(y_i-x_i'\beta+u_i,\delta_2)\right)g(y_i-x_i'\beta+u_i,\delta_2)\right] \quad (5.10)$$

where the $E_{ui}[.]$ is the expectation with respect to the distribution of u_i.

Burns (2004) used Halton sequence based SML technique for estimating the parameters copula-based cross section data SFM. The simulated likelihood function of (5.8) can be written as

$$L(\gamma)=\sum_{i=1}^{n}\frac{1}{R}\sum_{k=1}c_\rho\left(H(u_{ik};\delta_1),G(y_i-x_i'\beta+u_{ik},\delta_2)\right)g(y_i-x_i'\beta+u_{ik},\delta_2)$$

where u_{ik} are random draws from the distribution of u_i and R is the number of random draws used in the estimation. Burn (2004) used Halton sequence (Halton, 1960) based random draws which provides computational efficiency and accuracy than Uniform random draws in terms of simulation. Bhat (2001) found more accurate result with 100 Halton draws than 1000 pseudo-random draws. Train (1999) and Sandor and Train (2004) confirmed this result in the context of multinomial logit models. Burn used the model of Smith (2008) to illustrate the proposed SML method to estimate SFM with correlated error components using US electricity data. The model was estimated under AMH, Plackett, Normal, FGM and Frank families of copula using normal-half-normal error components.

Burns (2004) developed the analytical expression for the density function of y_i with the assumptions that $u_i \sim N^+\left(0,\sigma_u^2\right)$ and $v_i \sim N\left(0,\sigma_v^2\right)$ under FGM copula where

$$h\left(u_i;\sigma_u^2\right)=\frac{2}{\sigma_u}\phi\left(\frac{u_i}{\sigma_u}\right), H\left(u_i;\sigma_u^2\right)=2\Phi\left(\frac{u_i}{\sigma_u}\right)-1, g\left(v_i;\sigma_v^2\right)=$$

$$\frac{1}{\sigma_v}\phi\left(\frac{v_i}{\sigma_v}\right),\ G\left(v_i;\sigma_v^2\right)=\Phi\left(\frac{v_i}{\sigma_v}\right)$$

The density function of y_i is given by

$$f\left(y_i;\gamma\right)=E_u\left[\phi\left(\frac{y_i-x_i'\beta+u_i}{\sigma_v}\right)\left\{1+\rho\left(1-2\Phi\left(\frac{y_i-x_i'\beta+u_i}{\sigma_v}\right)\right)\left(3-4\Phi\left(\frac{u_i}{\sigma_u}\right)\right)\right\}\right]$$

The corresponding simulated likelihood function can be written as

$$\tilde{L}(\gamma)=\sum_{i=1}^{n}\frac{1}{R}\sum_{k=1}\left[\phi\left(\frac{y_i-x_i'\beta+u_{ik}}{\sigma_v}\right)\left\{1+\rho\left(1-2\Phi\left(\frac{y_i-x_i'\beta+u_{ik}}{\sigma_v}\right)\right)\left(3-4\Phi\left(\frac{u_{ik}}{\sigma_u}\right)\right)\right\}\right]$$

The Battese & Coelli (1988) estimator of technical efficiency, for the SFM with correlated error components under copula approach can be expressed as follows:

$$TE_i=E\left[exp\left(-u_i\right)|\,\varepsilon_i\right]=\frac{1}{f\left(\varepsilon_i\right)}\int_0^\infty exp\left(-u_i\right)f\left(u_i,\varepsilon_i\right)du_i=$$

$$\frac{E_{ui}\left[exp\left(-u_i\right)c_\rho\left(H\left(u_i;\delta_1\right),G\left(\varepsilon_i+u_i,\delta_2\right)\right)g\left(\varepsilon_i+u_i,\delta_2\right)\right]}{E_{ui}\left[c_\rho\left(H\left(u_i;\delta_1\right),G\left(\varepsilon_i+u_i,\delta_2\right)\right)g\left(\varepsilon_i+u_i,\delta_2\right)\right]} \quad (5.11)$$

The simulated estimator of (5.11) for the ith firm is given by:

$$\hat{TE}_i=\frac{\sum_{r=1}^{R}\left[exp\left(-u_i\right)c_\rho\left(H\left(u_i;\delta_1\right),G\left(\varepsilon_i+u_i,\delta_2\right)\right)g\left(\varepsilon_i+u_i,\delta_2\right)\right]}{\sum_{r=1}^{r}\left[c_\rho\left(H\left(u_i;\delta_1\right),G\left(\varepsilon_i+u_i,\delta_2\right)\right)g\left(\varepsilon_i+u_i,\delta_2\right)\right]}$$

6 Empirical Evidence

This section presents an empirical application of the three different approaches of SFM with correlated error components discussed above using much analysed cross-section information on the 123 US electricity firms given in Greene (1990). The stochastic cost frontier model (Greene 1990, pp. 154) estimated is given by

$$In\left(Cost/P_f\right)=\beta_0+\beta_1\ 1n\left(Q\right)+\beta_2\ 1n^2\left(Q\right)+$$

$$\beta_3\ 1n\left(P_l/P_f\right)+\beta_4\ 1n\left(P_k/P_f\right)+u+v$$

where Q is output and P_l, P_k and P_f are prices of three factor inputs labor *(l)*, capital *(k)* and fuel *(f)*. It is assumed that the noise component *(v)* is distributed as N $\left(0,\sigma_v^2\right)$ and the technical efficiency component *(u)* is distributed as $N^+\left(0,\sigma_u^2\right)$. Also, a parametric transformation from $\left(\sigma_u^2,\sigma_v^2\right)\rightarrow\left(\sigma,\lambda\right)$ where $\sigma = \sigma_v\sqrt{1+\lambda^2+2\rho\lambda}$ and $\lambda=\sigma_u/\sigma_v$ is used for the estimation of model under different approaches. (Table 1)

The estimates of the parameters were derived using non-information weight under DSA approach. The model

Table 1: Estimates of Stochastic Cost Frontier of the US Electricity Industry*

Parameter	Estimate of the Parameters			
	Product	DSA	CMA	Copula
β_0	-7.391 (0.293)	-7.413 (0.327)	-7.424 (0.329)	-7.524 (0.316)
β_1	0.405 (0.028)	0.427 (0.031)	0.422 (0.034)	0.418 (0.032)
β_2	0.031 (0.003)	0.030 (0.002)	0.031 (0.002)	0.032 (0.003)
β_3	0.244 (0.065)	0.248 (0.027)	0.244 (0.033)	0.254 (0.043)
β_4	0.061 (0.068)	0.048 (0.049)	0.059 (0.049)	0.062 (0.065)
σ	0.186 (0.029)	0.215 (0.038)	0.209 (0.042)	0.205 (0.057)
λ	1.350 (0.148)	0.905 (0.134)	1.114 (0.174)	1.223 (0.192)
ρ	0	-0.326 (0.157)	-0.366 (0.177)	-0.393 (0.195)
Log-L	67.163	69.276	69.878	70.966

**Figures in the bracket denote the estimated standard errors*

was also estimated under CMA and Copula approaches using the SML method. The bivariate family of FGM copula is chosen for this analysis. The ML estimates of parameters under different approaches, along with their asymptotic standard errors, are reported in Table-1. It can be noted that the first column presents estimates of parameters under the standard SFM with independent error components and next three columns present estimates of parameters under SFM with three different approaches of noise-inefficiency correlation. The result shows that magnitudes of the estimates of the slope coefficients do not differ significantly for each SFM with three different approaches of noise-inefficiency correlation. Also the variance of different SFM with correlated error components have higher values compare to the variance of standard SFM due to correlation structure. The estimates of correlation parameter are consistent with negative dependence between the error components for these data, although the estimated standard error on each is obviously fairly large. Moreover, the presence of the noise-inefficiency correlation have substantial effect on the estimates of the parameters of the distribution of the error components; this effect being most pronounced for the parameter. Table 2 provides descriptive statistics of estimates of cost efficiency for all 123 firms. This shows that the correlated error components have an effect on cost efficiency estimates which is evident from the declining sample means.

7 Conclusions

This paper presents the early developments of the SFM. It discusses the development of SFM with correlated error components developed so far. The modelling of SFM with correlated error components can be classified in three different approaches. Among these approaches DSA assumes a suitable joint distribution function of the error components like the truncated bivariate normal distribution (Bandyopadhyay and Das, 2006; Pal and Sengupta, 1999). In CMA the joint distribution function of the error components can be obtained by combining the marginal distribution of the inefficiency with the conditional distribution of the random noise given the inefficiency (Pal, 2004). In CA, joint distribution function of the error components can be obtained by combining the marginal distributions of noise and inefficiency through a copula function (Smith, 2008). The copula approach is the most attractive one as a variety of different models can be derived changing the marginal distribution of inefficiency and/or copula function.

In addition to further developments of this model, there are a number of other areas of potential research. These include extending the model with an upper bound to inefficiency or a lower bound to the efficiency in a cross-sectional correlated error components context as proposed by Almanidis et al. (2011) for stochastic frontier model with independent error components. Moreover, in these limited study of correlated error components SFM, heteroskedasticity in error components were not tried out. The heteroskedasticity problem is severe in SFM and there have been a number of studies taking heteroskedastic inefficiency in standard SFM structure. This can be extended to correlated error components SFM. The distribution of composite error become more complex in nature under SFM with correlated error components and different estimation procedures should be carried out for comparison.

Table 2: Descriptive Statistics of Estimate of Cost Efficiency

Selected Features	Cost Efficiency			
	Product	DSA	CMA	Copula
Mean	0.8579	0.8349	0.8468	0.8435
Std. Dev.	0.0656	0.0696	0.0687	0.0731
Minimum	0.6532	0.6279	0.5816	0.5622
Maximum	0.9844	0.9653	0.9548	0.9523

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A Conceptual Framework for Eliciting Dealer's Selling-Efforts Through Dealer-Supplier Identification

Sandip Trada and Vikas Goyal

Abstract

Informal ties between a supplier and its dealers can induce the dealers to allocate additional resources and selling-efforts towards the supplier's products, beyond those contractually specified (Murry & Heide, 1998). We develop a conceptual framework for one such tie between a supplier and its independent dealers, i.e. dealers' identification with the supplier (a psychological bond that satisfies dealers' self-definitional needs). Drawing from social identity theory, we develop propositions related to three key antecedents of dealer-supplier identification, i.e. (1) supplier's characteristics, (2) supplier's construed external image, and (3) boundary personnel characteristics. Further we propose the consequences of dealer's identification on their selling-efforts and the relationship quality dimensions between the dealer and the supplier.

Keywords: dealer-supplier identification, independent dealers, dealer's selling efforts.

1. Introduction

Several firms or suppliers[1] distribute their offerings through a network of independent distributors, such as, agents, brokers, resellers, independent retailers, dealers, etc. The independent distributers often sell products from multiple competing suppliers (Gale, 2005). In such a context, a critical factor that influences a supplier's sales is the share of dealer's resources and selling-efforts[2] that are dedicated towards selling its products (Hughes & Ahearne, 2010). Therefore, a major challenge for the suppliers that distribute through independent dealers is to garner a favourable allocation of dealers' resources for selling its products relative to the competitors.

Grounded in agency theory, distribution literature suggests two broad strategies to influence a dealer's behaviour, i.e. (1) ex ante formal contracts, and (2) ex post monitoring and contractual enforcement (Kashyap, Antia & Frazier, 2012), such as, administering reward and punishment (Scheer & Stern, 1992), and output and behaviour based coordination efforts (Celly & Frazier, 1996). However, due to the absence of any formal authority over the independent dealers, suppliers may find it difficult to influence dealers' behaviour and channel activities, via these formal strategies (Hughes & Ahearne, 2010). The strength of informal ties that a supplier develops with its dealer often plays a key role in influencing their actions and behaviour (Ouchi, 1979).

The strength of informal ties between supplier and the dealers are known to result into higher selling-efforts by the dealers (Hughes & Ahearne, 2010). Suppliers can initiate several channel activities to develop favourable relationships with dealers (Anderson, Lodish, & Weitz, 1987) and influence their selling efforts through extra-contractual incentives (Klein & Leffler, 1981). For example, a supplier can offer higher margins to some dealers (Hughes & Ahearne, 2010), offer better sales training, attractive resellers programs, effective communications (Weitz & Jap, 1995), and regular feedback (Anderson et al., 1987) to enrich their relationship with dealers beyond the formal contract. Additionally, suppliers' direct involvement in the day-to-day activities of the dealers can also have favourable influence on their resources allocation towards its products (Anderson et al., 1987).

In this research, we draw upon social identity theory to develop a conceptual framework for eliciting independent dealers' favourable selling-efforts towards a supplier's products relative to the competitors. We study the role of dealer's identification with the supplier and its influence on their selling efforts and resource allocation. We have identified the key determinants of

1 Supplier refers to an organization that sells its products through independent dealers to retailers or consumers.

2 Literature defines 'effort' as the force, energy, or activity by which a work is accomplished (Brown & Peterson, 1994). We conceptualize 'dealer's selling efforts' as the force, energy, or activity devoted toward selling a supplier's products.

dealer-supplier identification and its consequences on the selling efforts of the dealers.

Supplier identification is defined as the extent to which independent dealers perceive themselves and the focal supplier as sharing the same defining attributes (Dutton, Dukerich, & Harquail, 1994). Identification has been viewed as a sense-of-association that dealers perceive with the supplier (Dutton et al., 1994), which act as a primary psychological bond and ties their activities together (Scott &Lane, 2000). Identification can serve as a powerful motivating influence because it aligns the dealer's self-goals with the supplier's goals and make the achievement of the supplier's goals intrinsically satisfying for the dealer (Hughes & Ahearne, 2010).

Although the application of identification in inter-firm relationships such as, distribution channels is limited, the construct of identification finds wide application in organizational behaviour research (Ahearne, Bhattacharya, & Gruen, 2005). For example, firm-employee identification is positively related to employees', trust (Hameed, Arain, Roques, & Peretti, 2011), commitment (Meyer, Becker, & Van Dick, 2006), satisfaction (Riketta, 2005), loyalty (Mael & Ashforth, 1992), and job performance (Ahearne et al., 2005). Satisfying the employee's need for social identity and self-definition (Dutton et al., 1994), firm identification is recognized as one of the important drivers for building employee relationships and enhancing their efforts on the job (Pratt, 1998).

Extending the concept of identification to consumer markets, Bhattacharya and Sen (2003) developed a conceptual framework for customer-company (C-C) identification. They argued that customers have self-definitional needs that can be addressed by the companies they patronize and thus customers may develop strong identification with the company (Pratt, 1998; Scott & Lane, 2000). Additionally, the construct of identification is also found to be important for developing relationships in business markets (Schuh, Egold, & Van Dick, 2012). For example, sales person identification with organization is found to be positively associated with sales person's customers' orientation (Homburg, Wieseke, & Hoyer, 2009), customer identification with sales person (Aherane et al, 2005; Homburg et al., 2009), customers' in-role[3] and extra-role[4] behaviour (Aherane et al., 2005; Schuh et al., 2012), customers' spending (Netemeyer, Heilman, & Maxham, 2012), overall firm performance (Homburg et al., 2009), and the operational performance of the supplier (Corsten, Gruen, & Peyinghaus, 2011).

These findings collectively indicate the critical role that identification can play in building strong inter-firm relationships, such as, distribution channel relationships. Despite this potentially useful route to building stronger dealer relationships (Bhattacharya & Sen, 2003), the research on the role of identification in dealer supplier relationship building is missing. Contributing to the stream of research on dealer relationships, we extend the supplier identification in the dealer context and develop a conceptual framework to study its impact on securing dealer's favourable selling-efforts. Building on prior research, we argue that dealer-supplier identification will play a crucial role in building distribution channel relationships.

In the next section, we conceptualize the dealer-supplier identification. Subsequently, we develop the conceptual framework that identifies the key antecedents of dealer-supplier identification, and its consequences on the dealer's selling-efforts. Next, we present the propositions regarding the antecedents and consequences of the identification on dealer-supplier relationship. Finally, we conclude with a discussion on the potential expansion and application of the framework and the directions for future research.

2. Dealer-Supplier Identification

Social identity theory (Tajfel & Turner, 1985), suggested that while articulating the self-identity, individuals usually go beyond their personal identity to develop a broader social-identity by identifying themselves as a member of various social groups (e.g., ethnicity, occupation, sports teams supporter, etc.).To perceive themselves as a member of a social group, individuals

3 In role refers to expected behaviour from the customer to finish the task, e.g. Product Purchase.

4 Extra role refers to the behavior that is not the part of the consumer's task, but benefit the organization without any self-interest, e.g. Positive Word of Mouth.

do not necessarily need to interact with the group or have strong interpersonal tie with it (Brewer, 1991). Evidence suggest that individuals can develop strong identification with a social group even if they have no direct contact with the group or with any member of the group (Turner, 1982). For example, individuals are found to derive identification with abstract social categories or symbolic groups (Brewer & Gardner, 1996).

Building on preceding discussion, we posit that the independent dealers can develop strong identification with the supplier if they find it to be attractive and capable of enriching their social identity (Bhattacharya & Sen, 2003; Sindhav & Lusch, 2008). This is consistent with research in supplier-manufacturer identification (Pratt, 1998; Scott & Lane, 2000), which suggests that stakeholders associate themselves with manufacturer for identification purposes even when they are not formal members of the organization.

Prior research on identification is centred on the employee-employer relationships (Dutton et al., 1994), and the relationships of non-profit organizations with its members (Bhattacharya, Rao, & Glynn, 1995; Mael & Ashforth, 1992). However, drawing from this stream of research, we define dealer-supplier identification as an active, selective, and volunteer act motivated by the satisfaction of one or more self-definitional needs of the dealer (Bhattacharya & Sen, 2003; Pratt, 1998). In other words, dealer identification is 'the perception of oneness with or belongingness to supplier' (Mael & Ashforth, 1992, p. 104). Additionally, we argue that the strength of dealer-supplier relationships would be positively related to the level of dealer-supplier identification. Higher identification will induce the dealers to engage in favourable supplier-related behaviours (Hughes & Ahearne, 2010).

3. Conceptual Framework for Dealer-Supplier Identification

In this research, we discuss the influence of three critical antecedents for dealer-supplier identification, i.e. (1) the perceived characteristics of supplier, (2) construed external image of the supplier, and (3) the dealer's perception of supplier's boundary personnel.The consequences of dealer-supplier identification have been discussed in terms of its impact on dealer's selling efforts toward the supplier's products relative to the competitors' products.

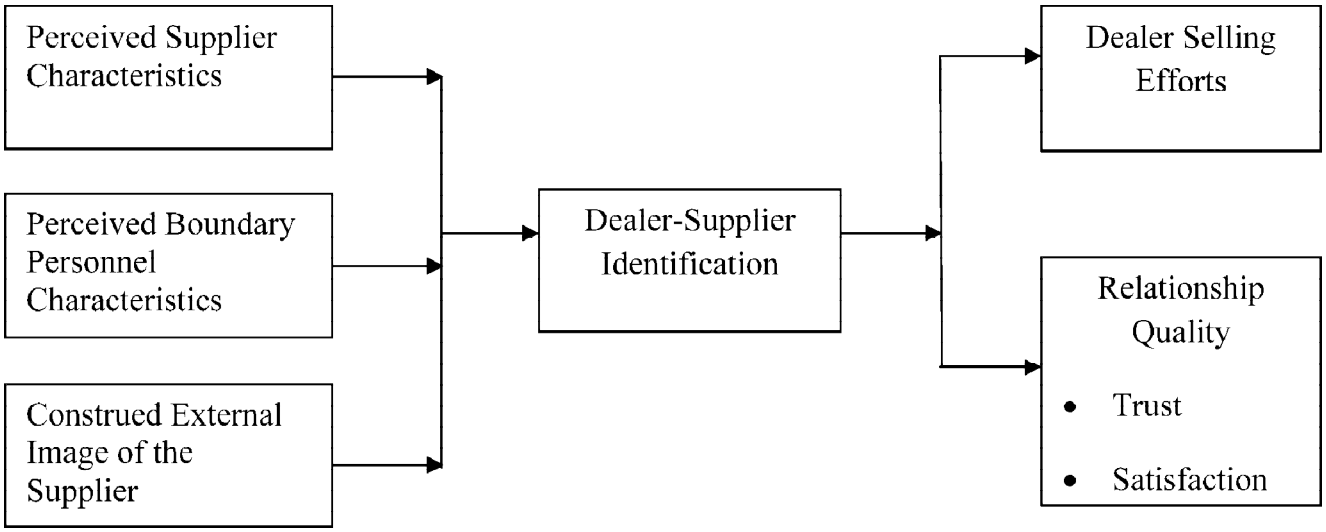

Figure 1: A conceptual framework for dealer-supplier identification

4. Antecedents of Dealer-Supplier Identification

As an active, selective, and volunteer act to define self, dealer-supplier identification would hugely depend on the dealer's perception of supplier characteristics (Bhattacharya & Sen, 2003). Specifically, three distinct dimensions of supplier's characteristics, i.e. (1) dealer's perception about the supplier's core characteristics, (2) construal external image of the supplier, and (3) characteristics of the boundary personnel, will influence the dealer's psychological bond with supplier and impact the degree of dealer-supplier identification.

Dealers' perception about supplier image, reputation, and culture based on personal experience or through other indirect modes would influence their identification with the supplier (Dutton et al., 1994). If a dealer finds the supplier to be attractive on these core characteristics, the dealer-supplier identification is likely to be stronger. Besides its own perception of supplier characteristics, dealers' identification with a supplier is also influenced by what other stakeholders, such as, customers, other dealers of the same supplier or different supplier or related social entities think about the supplier (Aherane et al., 2005; Dutton et al., 1994). The identification is likely to be high, if other stakeholders hold favourable construal image (i.e. dealer's perception of what other stakeholders think about the supplier) of the supplier. Lastly, the role of supplier's boundary personnel in developing identification is also crucial (Ahearne et al., 2005). Boundary personnel, who have frequent interactions with dealers, represent the supplier and reveal critical information about the supplier's policies, character, and values (Ahearne et al., 2005). Dealers' favourable perception about the boundary personnel is subconsciously attributed to the supplier itself, which enhances the degree of dealer identification (Aherane et.al, 2005, Bhattacharya & Sen, 2003).

Dealer-Supplier identification is also found to flourish when the dealer perceives high level of overlap between its own characteristics and that of the supplier (Dutton et al., 1994). These shared attributes help the dealer to promote its self-definition and enhance its self-identity through external validation. In addition to the three factors discussed above, two supplier characteristics may also promote dealer-supplier identification. First, when the dealer perceives the supplier as highly distinctive. As social comparisons are important means to evaluate self- identities, individuals emphasize their distinctiveness in social comparison by identifying themselves with distinctive organization (Bartel, 2001). Second, frequent interaction between the dealer and the supplier, which will give the dealer a feeling of oneness or belongingness with the supplier (Granovetter, 1985).Therefore, dealer supplier identification is likely to advance if there are frequent interactions between the dealer and the boundary personnel of the supplier.

4.1 Perceived Supplier Characteristics

Dealers' perception about the attractiveness of the supplier characteristics is one of the key determinants for developing dealer-supplier identification. The distinctive, enduring, and core characteristics of supplier (Albert & Whetten, 1985) are found to be critical for dealer identification. Three basic characteristics of self-definition i.e. (1) need for self-continuity, (2) need for self-distinctiveness, and (3) need for self-enhancement contributes towards the perceived attractiveness of a supplier which strengthens dealer-supplier identification (Dutton et al., 1994).

The need for self continuity suggests that individuals tend to maintain their self-continuity across contexts and over time periods (Steele, 1988). When individuals find that organization characteristics are similar to their self-concept, they find it attractive and are likely to use this similarity for self-expression (Shamir, 1991). Social identity theory asserted that individuals seek to distinguish themselves from others in the social context (Tajfel & Turner, 1985). As a result, people find an organization attractive for identification when it provides a sense of distinctiveness on the attributes they value. Thus, when dealers find a supplier's characteristics (e.g. culture, strategy) as distinctive and valuable they would be attracted towards the supplier and are likely to develop stronger identification with these suppliers. When people associate with attractive organization identities, they enhance their self-esteem and acquire a more positive evaluation of themselves (Dutton et al., 1994), and these favourable perceptions of organizational

characteristics are likely to lead them towards stronger identification with the organization. Based on preceding discussion, we propose that,

Proposition 1: The more favourable a dealer's perception of the supplier's characteristics, the higher will be the dealer-supplier identification.

4.2 Perceived Boundary Personnel Characteristics

One of the tenets of identification literature is that the stakeholder identification with an organization is based on its perception of the core organizational characteristics (Bhattacharya & Sen, 2003, Dutton et al., 1994). However, in dealer-supplier identification, dealers interact only with supplier's boundary personnel (such as, sales person, customer service employee, channel managers, etc.) who coordinate supplier's activities with its external stakeholders (Bartel, 2001). Therefore, these boundary personnel come to represent the core characteristics of supplier to the external stakeholders, such as, independent dealers.

Dealers' quality of interaction and the frequency of interaction with supplier's boundary personnel will play a significant role in shaping their belief about the supplier's characteristics (Bhattacharya & Sen, 2003). Boundary personnel have frequent interactions with dealers in order to coordinate various activities, such as, promotional activities, taking orders, sharing product and market information, discussing company sales targets, etc. In these interactions, boundary personnel reveal deep insights about the core characteristics of the supplier. Additionally, the personality, knowledge, empathy, responsiveness, reliability and assurance of the boundary personnel are also critical inputs in dealer's perceived supplier characteristics (Aherane et al., 2005). Therefore, the dealer's perception of boundary personnel characteristics can also impact their degree of identification with the supplier. In other words, dealers' favourable perception of the interactions with the boundary personnel of a supplier is likely to enhance the dealer-supplier identification (Aherane et al., 2005; Bhattacharya & Sen, 2003; Scott & Lane, 2000). Thus, we propose that,

Proposition 2: The more favourable the dealer's perception of the boundarypersonnel characteristics, the higher will be the dealer-supplier identification.

4.3 Construed External Image of the Supplier

Construed external image of the supplier refers to its prestige (Bergami & Bagozzi, 2000), which is the dealer's belief about the perception of other stakeholders (e.g. other dealers, customers, etc.) about the supplier in contrast to its own perception of supplier's characteristics. When a dealer finds that the defining attributes of the supplier are valued by other stakeholders, its identification with the supplier is likely to be strengthened because of higher perceived attractiveness of the supplier's construed image.

Dealers strive to maintain a positive social identity through their association with prestigious suppliers, because these associations provide several benefits, such as, social opportunities (Brown, 1969), enhanced social identity (Ashforth & Mael, 1989), increased social interaction (Foote, 1951), etc. Earlier research on image have demonstrated strong positive relationship between the construed image of the supplier and stakeholder's identification. For example, Smidts, Pruyn, and Van Riel (2001) reported positive relationship between construed external image and employee identification. Similarly, positive association has been established between institute and alumni (Mael & Ashforth, 1992), sports club and fans (Fisher & Wakefield, 1998), and customer and company (Aherane et al; 2005). Therefore, building on extant literature, we propose that,

Proposition 3: The more attractive the dealer's 'construed external image' for a supplier is, the higher will be the dealer-supplier identification.

5. Outcomes of Dealer-Supplier Identification

Research on identification has demonstrated various important consequences of identification on the firm-stakeholder relationship. For example, employees' identification is positively related to their extra efforts (Dutton et al., 1994), and customers' identification is directly related to their in-role and extra-role behaviour (Aherane et al., 2005; Bhattacharya & Sen, 2003). Building on this literature, we argue that dealer-supplier identification must directly influence dealer's selling efforts (i.e. promotion, display, shelf space). Additionally,

dealer-supplier identification is expected to improve the relationship quality between the dealer and the supplier, as it is found to be related to some of the dimensions of relationship quality (Ashforth & Mael, 1989; Sindhav & Lusch, 2008). For example, identification can enhance the trust between the parties (Sindhav & Lusch, 2008), and their commitment towards each other (Ashforth & Mael, 1989; Pratt, 1998).

5.1 Identification and Dealer's Selling Efforts

Most independent dealers sell products or services from multiple suppliers (Gale, 2005). Due to several product options and limited resource availability (e.g. finite hours in a day, limited store space, number of sales persons), dealers must make a choice regarding how much effort they should allocate to the products of each supplier's. Higher resource allocation to one supplier's products means availability of lesser resources for other suppliers' products. In such situation, dealers would tend to optimize their resources and selling efforts based on several external factors (e.g. profit margins, supplier's sales support, organizational climate, etc.) and internal factors (e.g. goal alignment, relationship strength, etc.) However, an important internal motivator for dealers to allocate favourable selling efforts to a supplier's product could be the degree of dealer-supplier identification (Hughes & Ahearne, 2010).

Extant literature on identification suggests that a stakeholder's higher identification with an organization leads to its favourable resource and efforts allocation towards that organization. For example, in employer-employee context, it is found that high identification of the employee leads to their better performance on in-role and extra-role behaviour, and higher support to the employer for achievement of their collective goals (Griepentrog, Harold, Holtz, Klimoski, & Marsh, 2012; Van Knippenberg & Sleebos, 2006). In the customer-company context, high identification of customers has been found to result in greater product purchase, positive word of mouth (Aherane et al., 2005), and increased customer franchise[5] (Bettencourt, 1997). Similarly, in company-salesperson context, high identification increases the salesperson efforts to promote the company's products (Hughes & Ahearne, 2010).

Dealer-supplier identification represents the cognitive link between the supplier and the dealer's self-defining attribute, which can lead the dealer to perceive higher overlap between its self-goals and the supplier's goals (Hughes & Ahearne, 2010). Therefore, a dealer's motivation to achieve its self-goals will in turn motivate them to exert higher efforts towards achieving the goals of the suppliers they identify with (Brown, Jones, & Leigh, 2005). Alternatively, when dealer-supplier identification is high, dealers become vested in the success or the failure of the supplier, which should lead to higher selling efforts by the dealer towards the products of the supplier.Thus, we propose that,

Proposition 4: There will be a positive relationship between the dealer-supplier identification and the dealers' selling efforts towards the supplier's products.

5.2 Dealer Identification and Relationship Quality

Relationship quality is proposed as a multidimensional construct that reflects the overall strength of relationship and the extent to which it meets the needs and expectations of the exchanged parties (Smith, 1998). Although, there is no clear consensus on the dimensions that represents relationship quality, the constructs of trust and satisfaction are found to be central to relationship quality (Athanasopoulou, 2009). Bhattacharya, Korschun, and Sen (2009) argued that identification is one of the dimensions of relationship quality itself. On the contrary, several other scholars have indicated that relationship quality and identification are two distinct constructs which may be related (e.g. Ashforth & Mael 1989; Bhattacharya et al., 1995; Sindhav & Lusch, 2008). While, the relationship between identification and relationship quality has not been directly assessed, literature provided evidence for the relationship of identification with some of the dimensions of relationship quality (Pratt, 1998; Sindhav & Lusch, 2008). To further examine the relationship of identification and relationship quality, we have developed prepositions on the influence of identification on the construct of trust and satisfaction.

5 Customer franchise refers to recruitment of new customer for the organization.

5.2.1 Identification and Trust

When dealers identify with a supplier they develop higher confidence in the supplier's positive intentions (Sindhav & Lusch, 2008). This confidence leads to dealer's trust which is derived from its psychological bond with the supplier (Shapiro, Sheppard, & Cheraskin, 1992). It is suggested that high dealer-suppler trust can result into both parties effectively understanding and appreciating each other's implicit wants such that, they start acting on behalf of each other (Lewicki & Bunker, 1996). According to group cooperation theory, psychological and social processes associated with organizational identification can increase an individual's propensity to confer trust on others and also their willingness to engage in trusting behaviour (Kramer, Brewer, & Hanna, 1996).

Earlier research reported strong empirical evidences for positive relationship between the stakeholder's identification with an organization and their trust on the organization. For example, evidences suggest that strong identification with an organization increases the trust of its employees (Dukerich, Kramer, & Parks, 1998; Hameed et al., 2011), its suppliers (Corsten et al., 2011), its retailers (Sindhav & Lusch, 2008), and customers (Bhattacharya & Sen, 2003; Elliott & Wattanasuwan, 1998) in the organization. Building on this stream of research, we propose that,

Proposition 5: Dealer-supplier identification is positively related to dealer's trust toward the supplier.

5.2.2 Identification and Satisfaction

Satisfaction with a relationship is defined as an affective state that results from overall appraisals of the working relationship between a dealer and the supplier (Gaski & Nevin, 1985). Satisfaction is a crucial dimension of successful channel relationships which enhances the coordination between adealer and the supplier (Dwyer & Oh, 1987). Although, literature provides evidence on the relationship between identification and satisfaction, the results are less clear on the direction of this relationship. For example, Mael and Ashforth (1992) suggested that satisfaction of a dealer leads to higher dealer-supplier identification. Contrarily, several other studies suggested that organization identification enhance a members' job satisfaction (Van Dick et al., 2004; van Knippenberg, 2000). Bhattacharya et al. (1995) also indicated that identification over time influences satisfaction, and argued that greater identification with a supplier leads to higher satisfaction with the supplier's products. Therefore, we argue that identification with supplier may also positively affect dealer's satisfaction and propose that,

Proposition 6: Dealer-suppler identification is positively related to dealer's satisfaction with the supplier.

6. Discussion

The paper extends the construct of identification in distribution channels to develop further insights in dealer-supplier relationship. The proposed conceptual framework integrates research from organizational identification, relationship marketing and distribution literature to develop propositions that examine the impact of relevant antecedents and consequences of dealer-supplier identification.

We draw from social identity theory, and conceptualize dealer-supplier identification as a psychological bond that dealers develop with the supplier which satisfies their key self-definitional needs. We identify three key antecedents of dealer-supplier identification, i.e. perceived characteristics of the supplier, construed external image of the supplier, and perceived boundary personnel characteristics. Further we identified the influence of dealer-supplier identification on dealers' selling efforts, and the relationship quality between them.

The extant literature on distribution channel relationships suggests several ways to develop dealer relationships and influence their selling efforts, such as, coercive strategies (e.g. by administering reward and punishment) (Scheer & Stern, 1992), contractual enforcement (Weitz & Jap, 1995), and non-coercive strategies (e.g. effective communications, regular feedback) (Weitz & Jap, 1995, Anderson et al., 1987). However, suppliers may find it extremely difficult to influence dealers' activities through these strategies because they have limited formal authority over the independent dealers (Hughes & Ahearne, 2010).

The proposed framework provides an alternative approach for building relationship with independent dealers and to influence their selling efforts on the basis of a psychological bond with the supplier. We develop theoretical arguments for the proposed dealer-supplier identification framework and indicate that dealer identification can be useful to supplier for developing strong dealer relationships.

In terms of theoretical contribution, we extend the construct of identification into the context of dealer-supplier relationship. We have developed specific propositions to understand the relationship between dealer-supplier identification and the dealer's selling efforts. Organization identification research shows the strong relationship between employees' identification and their effort, but literature about the same relationship is scare in inter-organizational research (Hughes & Ahearne, 2010). Thus, we contribute in the inter-organizational research by providing a direct path for suppliers to influence the selling efforts of the dealers by developing strong psychological associations via identification.

The link between dealer-supplier identification and relationship quality has not yet been addressed in the literature. The findings from the various domains regarding the relationship between identification and relationship quality are rather scattered. We explore this relationship, and argue that dealer-suppler identification is a distinct construct which influence the strength of relationship between the supplier and the dealer. Additionally, the dealer-supplier identification provides the psychology based theoretical explanation for strong relationship between the supplier and the dealer.

The dealer-supplier identification provides new insight for managerial practice, which can emerge as an important tool for building strong relationships with dealers. One of the implications is that managers should integrate the dealer-supplier identification dimension in their relationship marketing strategy to strengthen their relationships with dealers. In addition, empirical findings may also provide insights into the relative contribution of each driver of the dealer -supplier identification. This understanding would be useful for managers to decide their investment priorities towards developing and managing the dealer-supplier relationships.

Channel managers use one or combination of the coercive strategies, contractual enforcement and non-coercive strategies to coordinates various activities and develop relationship with dealers (Weitz & Jap, 1995). The identification based approach provides an alternative approach to channel managers for developing strong and successful relationship with independent dealers. Particularly, the combination of non-coercive and identification based strategies are more complementary in nature as non-coercive strategies create more favourable image of the suppliers. An inquiry in the relative effectiveness of using these strategies (in isolation and in combination with each other) presents an interesting area for future research.

Besides the conceptual contribution, this study opens several directions for future research. Future research should develop or adopt the dealer-supplier identification measurement scale and validate the concept of dealer-supplier identification. In addition, the proposed dealer-supplier identification framework should be empirically tested to conform or reject the proposed propositions. We have not explored the direct link between antecedents of dealer-supplier identification and selling efforts, and relationship quality. Future research should expand the framework to explore the direct and mediating effect of identification and provide insightson the role of dealer-supplier identification as a mediating factor.

Further research, within the context of a distribution channel, should also integrate appropriate moderators to shed light on the conditions in which dealers are more likely to have strong identification with the supplier. For example, dealer's functional and structural roles influence the level of identification with the supplier. Particularly, structural role refers to the relative position of the dealer and how they perceive it-self, including its social status and self-identity. Additionally, scholars can extend the dealer-supplier identification framework to investigate its effects on dealers' performance.

Finally, it is indicated that the Corporate Social Responsibility (CSR) initiatives of the suppliers may

influence the level of dealer identification as it offers psychological benefits and value satisfactions to the stakeholders (Bhattacharya et al., 2009). Although we captured the impact of CSR on dealer-supplier identification indirectly through perceived characteristics of the suppliers and construed external image, the direct impact of CSR initiatives on dealer identification presents a promising avenue for future research.

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Standard Setting in India: Competition Law and IP Issues

Ravikant Bhardwaj

Abstract

The importance of private standard setting is growing in Intellectual Property (IP) management. IP managers have to consider IP laws and antitrust laws as well to avoid the adverse implications in standard setting. The National Telecom Policy (2012) of India intends to increase standardization and intellectual property creation. Standardization has various concerns with respect to competition and IP law. This article analyses the private standard setting organisation's policy in the context of competition law and IP law. It also discusses the role of competition authorities in the standard setting process, IP, the emerging scenarios and suggests an approach for India.

Key Words : Anti-Competitive Agreement, Abuse of Dominant Position, FRAND,Interoperability, Standardization, Telecom sector, IP Policy, National Telecom Policy, GISFI, DOSTI

1. Introduction

Standards are the technical specifications for a new product or process (Hovenkamp, et al., 2003).[i] These are symbol of development and competitiveness in an economy. To analyse the pro-competitive and anticompetitive effects of standards, it is necessary to know the pros and cons of standards in relation to consumer interest and competition in the market. Standards create new markets for standardized products and services. Generally, standards are treated as pro-competitive. In high-tech industry such as telecom, semi-conductor and software etc., competitors sit together across the table to decide the technical specifications of new products, during the standardization process (EC Horizontal Agreement Co-operation Guidelines).[ii]Prima facie it seems an anti-competitive activity per se. However, the competition authorities have realized the pro-competitive effects of standard setting (Schellingerhout and Cavicchi, 2010).[iii] As the definition suggests standards are technical specifications so these are inherently associated with intellectual property rights (IPRs).

Standards help to overcome network effects and problem of patent thickets in network industries (Lemley 2002).[iv] Standards are essential to ensure interoperability. For instance, there are two types of technologies in the telecom industry: the Code Division Multiple Access (CDMA) and Global System for Mobile Communication (GSM) technology. For instance, these products are electronic chips, keypad, microphone, display and software etc. Similarly, several products are part of a laptop such as display, keyboard, mouse, camera, Bluetooth, USB port, motherboard, battery, operating system and other application software etc. Enterprises manufacturing telecom products have to develop inter-operable products so that finally all products can be assembled together. So standard setting ensures vertical and horizontal compatibility. Both technology owners and manufacturers are stakeholders in the standard setting process. A standard is formulated after clearing objection of major stakeholders. So it makes easier to commercialise a product applying a standard (Teece & Sherry, 2002-2003).[v] Working groups/technical committees examine the available state of technological knowledge in the area of technology related to the standard. It helps to identify gaps in research. So members of SSOs can develop the technology in those areas to develop products. Hence, standard setting increases innovation and research and development.

A standard setting process may have anti-competitive effects as well. Standards are created through a technology selection process which results in a selection of one out of many technologies in a standard. Sometimes there are instances of non-disclosure of essential IP by enterprises.[vi] It can give market power to firms by unfair means. Abuse of the standard setting process amounts to anti-competitive behaviour. Standards may lead to

collusion between enterprises in market by imposing price and quantity restrictions. Standardization may lead to the monopoly of a firm in the relevant market which otherwise would not be there in the absence of that particular standard (Anton & Yao, 1995).[vii] Standards may limit the choice of consumers. These may create entry barriers for the new firms. In certain situations there may be interface between competition law and IPRs in standards such as FRAND licensing, patent pools and cross licensing etc.

Members of Standard Setting Organizations (SSOs) discuss and select the technical specifications for a standard. However, all SSOs are not equal in its ownership, function and geography. Standard setting organizations (SSOs) could be governmental, quasi governmental or private. There are international, regional and national standard setting organizations on the basis of geography. International standard setting organizations develop global standards. They work in co-operation with regional and national standard setting organization. Three largest international standard setting organizations are International Telecommunication Union (ITU), the International Electro-technical Commission (IEC) and International Standard Setting Organization (ISO) were founded in 1865, 1906 1947 respectively. ITU is the oldest one.

Regional SSOs are the European Committee for Standardization (CEN),[viii] the European Committee for Electro-technical Standardization (CENELEC),[ix] the European Telecommunications Standards Institute (ETSI),[x] and the Institute for Reference Materials and Measurements (IRMM)[xi] are pan-European SSOs. European SSOs have a common goal to unify the whole European market. The Pacific Area Standards Congress (PASC),[xii] the Pan American Standards Commission (COPANT),[xiii] the African Organization for Standardization (ARSO)[xiv] and the Arabic Industrial Development and Mining Organization (AIDMO) are also regional SSOs.[xv] Most countries have national standard setting bodies also. These national standard setting bodies play a role in standardization at national level. There is comparatively less possibility of anti-competitive activity in public SSOs. Different countries have different models of standard setting. For instance, Germany has adopted the public standard model. US has adopted predominantly private standards model.

For instance in US, various private SSOs compete with each other to develop standards. The American National Standards Institute (ANSI) is the officially entrusted organization for regulating private SSOs in US.[xvi] The private standard setting has various advantages such as less formality and quick adoption of standards. There are several private SSOs in US such as Joint Electronic Devices Engineering Council (JEDEC), Global Standards for Microelectronics Industry. JEDEC works on solid state devices, integrated circuits, electronic modules, various manufacturing support functions. It has one member one vote system.[xvii] Video Electronic Standard Association (VESA) is a standard setting organization in the area of computer graphics.[xviii] Institute of Electrical and Electronic Engineers is the SSO in the area of electronics which has developed standards in varied areas such as power and energy, biomedical and healthcare, Information Technology (IT), telecommunications, transportation, nanotechnology, information assurance etc.

In India, the high level committee headed by S. Raghvan for Enacting Competition Legislation acknowledged the pro-competitive benefits of standards in its report.[xix] However no provision was enacted in the Competition Act (2002) with respect to formulation of standards. In India, current national policy seems to adopt both private and public standards model. The Government policy is to promote research and development (R&D) and standardization generally in all sectors. For instance, Indian National Telecom Policy 2012 proposes to make a national standard setting body for telecom sector. There are two main objectives behind this policy. The first one is to facilitate adaptation and penetration of foreign technology in India. The second objective is inclusion of Indian IPRs in global standards. There are two main private standard setting organizations in India in telecommunication sector: Global ICT Standards Forum of India and Development Organization of Standards for Telecommunication in India (DOSTI).

In order to conduct this study, potential competition law and IP issues were identifies by analysing the

National Telecom Policy 2012 and evolution of private standard setting organisations such as GISFI and DOSTI in India. An anlysis of analysis of the Competition Act 2002 was carried out. Due to lack of sufficientcases on standard setting in India, cases from EU and US jurisdiction were analysed. Various issues were identified by this analysis and tested for possibility of such issues in India. On the basis of this analysis, some policy suggestions were made.

The present study attempts to analyse 'best practice'with respectto competition policy and standardization in public and/or private standardization bodies in India. Second part of the paper deals with an overview of private standard setting organisations in India. Third part of paper deals with competition law and IP issues in private standardisation such as non-disclosure of essential IP in standard, refusal to FRAND licensing and anti-competitive selection of technology.

2. Private Standard Setting in India: GISFI and DOSTI

Indian information and communication technology (ICT) sector is a big market for multinational companies. Every country has its own peculiar technological requirements which can be fulfilled by specific innovation targeting such needs. Over a period it is felt that there was a disparity in Indian technological demand and supply by multinational companies. Due to this multi-national companies and organizations had problem entering into Indian technology markets. Indian high-tech industry wants to participate in the global standard making process for inclusion of Indian IPRs. So there was a need of standard setting bodies to convey Indian demands to the international SSOs. Indian technology could not be adopted in global standards in the absence of SSOs. Due to such reasons GISFI was established in 2010[xx]. It is a non-profit, non-government society[xxi] and consists of academics, policy makers, regulators and the industry. It aims to harmonize standardization in India to increase competitiveness of companies in India.[xxii] It intends to become TSDO conceived under NTP 2012.[xxiii]

There is no comprehensive legal framework and regulatory body to deal with private standard setting in India till now. GISFI is approved by Ministry of Communication and IT, Department of Telecommunications, Government of India on 7th July 2010. Every telecom standard has to be approved by the Ministry of Telecommunication and IT.[xxiv] Currently, GISFI is developing standards of security and privacy, future radio networks, the internet of things, service oriented network, green ICT and spectrum.

GISFI has collaborated with five SSOs: Telecommunication Technology Committee (TTC) Japan,[xxv] Telecommunications Industry Association (TIA),[xxvi] ITU-T,[xxvii] Association of Radio Industries and Business Japan[xxviii] and European Standards Telecommunication Institute (ETSI).

GISFI has five types of memberships: administration, administrative and other standardization bodies, network operators, manufacturers, users and service providers. These are described in its bylaws as corporate premium, corporate, institutional, individual and student members.[xxix] There are two corporate premium members, six are corporate members and seven institutional members. There are total fifteen members. Voting power is one such area which has antitrust implications. Differential voting rights may give discriminatory treatment to different types of companies. For instance in GISFI, each type of member has differential voting power. The governing body has 1000 votes. Corporate premium members have 700 votes, corporate members have 500, institutional members have 200 votes, individuals have two votes and students have half votes.

DOSTI is another private standard setting organization in India. It works on the basis of the public private partnership model. It aims to develop open, consensus based standards developed following due process.[xxx] Its main goals are to develop India specific standards and incorporating Indian standards in global standards.[xxxi]Unlike GISFI it has three types of memberships: primary members; associate members; guest and observer members.

3. Competition Law and IP Issues in Standard Setting

There are various stakeholders involved in the standard setting process such as technology owners, product

manufacturers or service providers. So there is a possibility of horizontal as well as vertical agreements in standard setting. An Agreement is void in the standard setting process, which causes an appreciable adverse effect on competition in India. The agreements relating to the restrictions on standardized product manufacturing, supply of technology to third parties, distribution of standardized products or services, storage, acquisition or control of product or services are void.[xxxii] Horizontal agreements are presumed to have an appreciable adverse effect on competition when directly or indirectly determines purchase or sale prices of technology or standardized product, controls the quantity of goods or services, sharing relevant geographic market and bid rigging. Price fixing between competitors is one of the most serious anti-competitive activities. Technology pools in standard setting may give rise to price fixing. If a patent pool is hampering the technological development, it will be horizontal anti-competitive agreement.

Standardization may affect competition in four probable markets. First, there is an anti-competitive effect on product or service market of standards. Second, the Standard can affect relevant technology markets. When there are many alternative technologies available, their selection of one out of many technologies reduces the scope of alternatives. Third, where there are competing SSOs, their market may get affected by a standard anti-competitively. Fourth testing and certification market may get affected. The relevant market is the central focus of antitrust analysis. Relevant market consists of the relevant product market or the relevant geographic market. Under the Indian competition law for identifying relevant geographic market, it is necessary to consider trade barriers through rules and regulations, local specification requirements, government procurement policies, adequacy of distribution facilities, transportation cost, language, consumer loyalty or necessity of products.[xxxiii] The relevant product market is identified applying the factors, final use of goods, consumer choice, exclusion of in-house production, existence of specialized producers or classification of industries.[xxxiv]

Standards may have unilateral anti-competitive effect as well if one or more of the participants hold dominant position. Holding a dominant position per se is not anti-competitive. When a dominant player imposes discriminatory conditions in sale of goods, price of goods, predatory pricing, limiting production of goods, technical development, monopoly leveraging, arbitrary contract terms and denial of market access then it will be anti-competitive. Proof of appreciable adverse effect on competition is not required for abuse of dominant position. Market power in standardized technology or IPRs is necessary for proving abuse of dominant position.

IPRs do not provide market power per se. If the IP owner discloses the rights only after a standard becomes a commercial success then it may confer market power. In another situation, where FRAND licensing commitment is provided by a member and later it refuses to grant licenses on FRAND basis than it may confer market power.

There is no pertinent case of competition and IP in private standard setting in India till now. However, there is a case in government standardization. Bureau of Indian Standards (BIS) faced allegation of abuse of dominance recently. It was alleged in this case of Shri Ravindra Badgaiyan vs M/s Bureau of Indian Standards that BIS developed a standard to favour a company. The CCI held that generally regulatory standardization body is not subject to competition law. However, if there is a gross violation of competition law then it can be anti-competitive.[xxxv] This case is very important for private standard setting organizations to avoid anti-competitive activities. If a private SSOs develops a standard to give unfair benefits to particular firms by misusing the standard selection process, it can be anti-competitive.

3.1 SSO's IP Policy

As earlier discussed, IP policy has a significant role in competitive treatment of the standard setting process.[xxxvi] Lemley's (2002) study on SSOs reveals that, all SSOs IP policies are not same. Some require disclosing IP and others does not. Generally, IP policy of standard setting organization is pro-competitive because it is designed to handle patent hold up and the problem of anti-

commons.[xxxvii] The IP policy of SSOs should be clear on the members' duties. IPR policy of SSOs is crucial for contractual and antitrust liability. There are several cases where courts have relied solely upon IPR policy of SSOs to ascertain the antitrust liability. In the USA, under Section 5 of the FTC Act and Section 1 of the Sherman Act, violation of rules of IP policy may amount to unfair competition and hence anti-competitive. Article 101 of The Framework for European Union (TFEU) and Section 3 of the Competition Act are the similar provision which can be violated. GISFI has formulated its IPR policy to ensure smooth availability of essential IPR relevant to a standard. There are three objectives of this policy. First, to minimize the risk of its members and those who adopt standards. Second, is to ensure fair royalty to IP owners. Third, is to increase the access of standards to users.

3.1.1 Disclosure of Intellectual Property in Standard Setting

Disclosure of IP in the standard setting process is a complex phenomenon. A standard is worthless if essential IP is not available for its implementation. So keeping in view this factor, IP policy includes the disclosure requirements. Every member has a duty to disclose essential IP to GISFI. Multinational telecom companies are aggressively filing patents in India. It is important to know who holds essential patents in India. According to Clairvolex Study from year 2005 to 2010, Qualcomm is the front runner in patent filing in India. It has filed 1951 patents during 2005 to 2009 followed by Ericson with 1232, Nokia with 1154, Samsung with 1103, Motorola with 626, Research in Motion (RIM) with 558, LG with 403 and Sony Ericson with 363 patents.[xxxviii] Qualcomm has largest patent filing in Electric Communication Techniques and Measurement. Nokia has largest filing in Acoustics and Musical Instruments segment and Ericsson has largest patent filing in Electronic Circuitry segment. Samsung is the largest in filing patent application in the computing segment. Some of these telecom sector multinational companies are members of GISFI also. All the above mentioned companies have an edge over others in some areas of technology. So they hold dominance in some or other technology area.

Members have to disclose the IP of other members also if they are aware that there is any. It does not impose a duty to do IPR searches. The requirement of disclosure under an IP policy is fulfilled if patent in one country is disclosed. There is no need to disclose whole patent family.[xxxix]It is not clear that whether it is one time disclosure or periodical disclosure? Whether it should be disclosed at the time of working group meetings or at some other occasion? Non-disclosure and excessive disclosures both are equally problematic. Whether a patent is relevant or essential to standard is matter of claim construction and interpretation. If more than one IP is relevant in standard in process, it is difficult to classify patents as essential, relevant and non-relevant. Moreover, if a member deceptively claims that its patent as the essential patent then how the issue will be solved. GSIFI IP policy is silent about this issue.

3.1.2 Non-Disclosure of IP by SSOs Members

Non-disclosure of essential IP is a predominant competition issue in standard setting process. IP policies of SSOs should have the strict provisions for non-disclosure of IP.

In the standard setting process, SSOs identify proprietary and non-proprietary technological knowledge available related to a standard. SSOs prefer to adopt non-proprietary technology. In case, only proprietary technology is available then SSOs ensure RAND/FRAND based licenses. Where there is no alternative technology available there is only one option either to adopt the standard with the IP owner technology or to relinquish the standard. Here SSOs can ask for RAND licensing only.[xl] Rules of SSOs are not a defence to avoid anti-trust liability.

Non-disclosure of essential IP may discourage motivation of standard setting and hamper the pro-competitive effects of standards. For instance, in Rambus Inc. v. FTC[xli], the court ruled that a refusal to deal with malice is not anti-competitive until there is a probability of monopolization. Price rise without harming competition is outside the ambit of competition law. Harm to competition is the test rather than deception itself. Only exclusionary deception amounts to anti-competitive activity[xlii]. Where there are perfect

substitutes of patented technology available then patent owner knows that adoption of other technology may hamper market of his technology. Selection of technology increases the demand and market power of IP.[xliii] So free licensing should also be carefully examined for effects on competition. A similar case was initiated against Rambus Inc. in European Union also. Rambus Inc. committed to offer IPRs at reasonable rates to the member of standard setting organization as well as non-members. Rambus Inc. committed that it will not charge any royalty for standards adopted during the Rambus Inc.'s membership of JEDEC. It agreed to charge 1.5% royalty for standards developed during Rambus Inc.'s non membership of JEDEC.

Another such instance is in case of Dell Computer Corp.,[xliv] in the year 1992, Dell became a member of VESA a non-profit standard setting organization. It started developing the process of VESA local bus (VL bus) which was meant for carrying information between a CPU and other computer devices. Dell approved the standard and certified in writing that this standard does not violate its intellectual property. However, when VL bus became a commercial success and it was used in 1.4 million computers, Dell informed the members of VESA about its patent infringement. Dell restrained competition in the market because manufacturers decided not to use VL bus design until the patent issue was resolved. Computer systems using VL system design were avoided due to Dell patent issue. It raised the cost of implementation. It discouraged future participation in the standard setting process. Federal trade commission (FTC) ordered in this case that Dell shall cease and desist all efforts to enforce the concerned patent with VL bus manufacturers. It indicates that where there is evidence of adoption of alternative technology in case of disclosure of proprietary technology by the members, enforcement action is appropriate to prevent harm to competition.

Furthermore, in the case of Union Oil Corp. of Cal. V. FTC[xlv], the California Air Resources Board developed a standard on 'low emissions of gasoline. Union Oil Company of California was the member of the California Air Resource Board. Union Oil Company participated in the standard setting process. Union Oil Company declared that it does not have an essential or relevant IP in the form of patents or patent applications for standard in question. This standard was adopted by California refiners with huge investments. Later, Union Oil Company claimed infringement of its patents and damages from infringers. Union Oil Company committed that it will not enforce its patents related to that standard.[xlvi] Otherwise it would have adversely affected the competition. Analysis of these cases reveals that deceptive non-disclosure of IP at the time of formation of standard and later claiming infringement of IP is an anti-competitive practice.

In India, Section 3 and 4 of the Competition Act 2002 apply to the enterprises and persons. It applies to all government and private standards. It excludes the sovereign function of government including atomic energy, currency, defence and space.[xlvii] Person includes every unit from an individual to artificial juridical persons.[xlviii] So the applicability of Indian competition legislation is very extensive which covers every participant in standard setting.

Non-disclosure of IP in standard setting is bound to affect and cause control of production, supply, markets and technical development. It is presumed to have presumed to have an appreciable adverse effect on competition in the relevant market. Therefore, it may violate Section 3 (3) (b) of the Competition Act. Analysis of violation of horizontal agreements under Section 3 (3) is a three step process. First step is to identify relevant market and establishing horizontal relationships. Next step is to establish liability under four grounds of Section 3(3) in the form of price, quantity, market allocation or bid rigging heads. Last step is to analyse the competitive effects under Section 19 (3) in the form of entry barriers, benefit to consumers and innovation in production, distribution, scientific or technical developments.

3.2 FRAND Licensing Commitments

FRAND policy is fair, reasonable, and non-discriminatory licensing mechanism. Abuse of market power is anti-competitive. Fairness and reasonableness of royalty rate is determined on the basis of probable royalty rate which a patentee could get in the absence of selection of technology in a standard in a competitive market. Reasonable royalty may be fixed on the basis

of competing technologies or expert opinion Shapiro &Varian (1999).[xlix]

Obtaining license is the important step after disclosure of IP. SSOs require the patentee to license its IP on fair, reasonable and non-discriminatory (FRAND) basis. GISFI policy is silent on the issue that who will determine the fairness of licensing terms. Whether it is patentee, court, an infringer or SSOs' administration that will determine reasonableness? The patient has to disclose the FRAND licensing arrangement to assignee or transferee about undertaking given to GISFI. Undertaking for a patent in one country applies to patent on the same invention in other countries as well.

In case of refusal to license essential IP[l], SSOs search for alternative technologies which are non-proprietary. If there is no such alternative technology and patentee is a member, IP owner is asked to review his position. In case of refusal, he is asked to give the written justification within three months. If the patentee is a non member, then members have to use their good offices to get a license if does not succeed, then Director General asks patentee to license the invention. If he does not succeed, DG directs the technical committee to modify the technical specification to avoid the essential IP. Copyright in Standards developed by GISFI remains with it. For other forms of IPRs, GISFI get ownership only when it is created by its employee's. Licensing of third party is very important to maintain competition in the market on a fair and reasonable basis. It has the provision to license its IP to third party on FRAND basis. GISFI's IP is free to its members. The violation of IP policy is the violation of the duty of member towards GISFI. It may take action against its members according to its bye laws.[li]

3.2.1 Refusal to FRAND/RAND Licensing

In case of Re Negotiated Data Solutions, in the year 1993, IEEE was developing fast Ethernet. Ethernet standard is used for LAN connection with a computer. It is one of the most widely implemented LAN standards.[lii]

In 1994, National Co. proposed that the 802.3 Working Group incorporate an auto negotiation technology developed by National Semiconductor, and referred to as "NWay," into the Fast Ethernet standard. National Semiconductor had filed a patent application for that technology. The Working Group considered several alternative technologies to National's "NWay" technology prior to the adoption of the Fast Ethernet standard. It also considered adopting a Fast Ethernet standard without an auto-negotiation feature but could not succeed.[liii] National Semiconductor agreed to FRAND licensing. Later, National Semiconductor transferred its patents to Negotiated Data Solutions. The Federal Trade Commission issued a complaint against Negotiated Data Solutions, under Section 5 of the FTC Act for refusing licensing in RAND terms. The FTC stated that Negotiated Data Solutions behaviour harmed consumers and businesses adversely.

Broadcam Corp. v. Qualcomm Co.[liv], the third Circuit Court held in this case that Qualcomm has acquired legally its intellectual property. Regarding the issue that Qualcomm IP has restricted the competition. The court observed that the inclusion of any technology in the standard would have restricted the competition. In a case where there is industry wide standard monopolization of technology is difficult. Court omitted to look at the issue that whether abuse of the standard setting process is violation of competition law or not?

Analysis of above cases suggests that transferee of IPRs owners is bound by the FRAND licensing commitment made by transferor of IP.

In Magill Case, the European Commission held thatan unjustified refusal to deal is anti-competitive, where the IP owner holds an essential facility in an industry. Similarly in case of standard setting if an IP owner possesses an essential facility it may be treated as anti-competitive. IP owner has a duty to deal otherwise his conduct could restrict a new product entry into the market.[lv] Some standards lose relevance in the absence of important intellectual property rights. When the key IP of a standard is held by one member, SSOs take measures to ensure the availability of that IP. This ensures adoption and application of the standard. Refusal to license can be anti-competitive conduct by the IP owner due to market power. There is a possibility of an unfair

licensing mandate by SSOs as a result of unfair IP policy also. This act itself has the potential of being anti-competitive by creating a barrier in level playing field to IP owners. It is important to analyse what the stance competition law should take in such situations. Overzealous application of competition laws could restrict standardization and innovation.

3.3 Anti-competitive Selection of Technology

Usually, when a standard is developed, alternative technologies compete for inclusion. Once a technology is chosen, if the standard is successful then it may become entry barriers to other technologies. Where there are alternative technologies available that it is likely that one will be adopted. Therefore, unfair and biased technology selection has the potential of being anti-competitive.[lvi] IP owners indulge in unfair competition to include their technology in standard. As in Allied Tube & Conduit Corp. v. Indian Head, Inc.,[lvii]Allied Tube and Conduit Corp. Manipulated the standard setting process by recruiting more than 200 people to vote in its favour during the standard setting process. So in this way Allied Tube and Conduit Corporation managed to pass steel pipes standard instead of plastic pipes. It is relevant for the fairness of the standard - setting process. There is no doubt that the members of SSOs' have economic benefit in restricting competition. Such selection of technology may have anti-competitive effect. Agreement on a product standard is, after all, implicitly an agreement not to manufacture, distribute, or purchase certain types of products. Accordingly, private standard-setting associations have been subject to antitrust law. In case of Radiant Burners Inc. v. Peoples Gas Light & Coke Co[lviii] US Supreme Court held that Standards which are objective, unbiased and un-biased, definitely pro-competitive. These types of decision by courts led to apply 'rule of reason' approach on standards.

Similarly in American Society of Mechanical Engineers v. Hyderolevel Corp., the American Society of Mechanical Engineers, Inc. (ASME) is a non-profit organization which builds standards. Its Boiler and Pressure Vessel Code standard was adopted by 46 states in the US. It dealt with low water fuel cutoff which blocked the flow of fuel to water boilers. The firm dominating the market was also dominating the standard setting process. The vice president of committee interpreted the code in such a way that it gave the impression that competitor's product was unsafe.[lix]

The important point here is that dominant players may abuse the process to include their technology. Selection of particular technologies in standard gives market power to that technology. Hence the technology owner acquires dominant position due to the selection of its technology in the standard. So competition authorities should look into the process of standard setting. It is advisable that selection of technology out of alternative technologies should be based on expert opinion.

4. Conclusion

Standardization is essential for economic development. There is need of standards based on consensus, openness, due process and transparency. India needs to develop a comprehensive strategy on standards by coordination with government, industry, SSOs, consortia, consumer groups and academia. International standards are must for international trade. The active involvement of government in central and state level is key to successful standards.

As we discussed, there can be anti-competitive activities in standard setting such as patent holdup, non-disclosure of essential IP, refusal to oblige RAND commitment subsequently and fraud in the standard setting process. The IP policy of SSOs is crucial in reducing anti-competitive activities. There is diversity in IP policies of SSOs. SSO's IP policy should be standardized incorporating the best practices. As NTP 2012 aims to develop standards and creation of IP, there is a need that competition authority should put the standard setting on the priority list like competition authorities in the US and EU. The present competition legislation is not enough, in order to develop pro-competitive standards competition authority should develop guidelines on anti-competitive agreement in standard setting. To deal with anti-competitive activities effectively,competition authority can become an institutional member of GISFI. It will ensure pro-competitive standard setting in India.

To develop pro-competitive standards, the following conditions should be considered.

1. No compulsion to apply standard on its members by SSOs.[lx]
2. Transparency in standard setting process.[lxi]
3. Equal opportunity of participation in standard setting to all competitors in relevant market.[lxii]
4. No discrimination in favour of dominant player in market.
5. IP policy to require disclosure of IP requiring patent, patent applications and amendment in the patent application.
6. Ex ante FRAND commitment from IP owners.(Microsoft Corp. v. Motorola, Inc., No. 10-1823, 2013 WL 2111217 (W.D. Wash. Apr. 25, 2013) (referring to Georgia-Pacific Corp.v. US Plywood Corp., 318 F. Supp. 1116 (S.D.N.Y. 1970).
7. Fair and non-discriminatory licensing is construed according to valuation of patents.[lxiii]
8. Ex-ante disclosure of most restrictive rule to its members by SSOs.[lxiv]

The predominant issues in standard setting are non-disclosure of IP, FRAND licensing mechanism, manipulation of the standard setting process and fairness of IP policy. Non-disclosure of IP can be taken care of by a carefully drafted IP policy. FRAND model is the one of complex areas in the standard setting process because there is no uniform practice relating to it.

End Note

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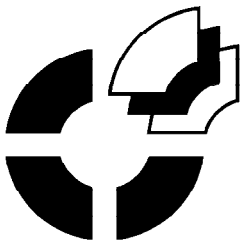

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