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Articles

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TSM Business Review

INTERNATIONAL JOURNAL OF MANAGEMENT

(A Double Blind, Peer Reviewed Bi- Annual Journal)

Volume 5 **Number 1** **June 2017**

Chief Editor

Prof. Gautam Ghosh

THIAGARAJAR SCHOOL OF MANAGEMENT (Autonomous)

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TSM Business Review

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EDITORIAL

This volume is a collation of five research articles with topics from marketing, human resource and macroeconomics. Rajamohan and Vethamanikam in their paper talk about future trading of gold performance in Multi Commodity Exchange of India and discusses the evolution and performances of commodity market. Nishithkumar and Nikita have worked on services marketing, approaches and measures of service quality. An empirical study aimed at evaluating effectiveness of Web Based Training (WBT) was studied by Ramakrishnan. His study supported that learning outcome from using WBT method , by and large, affected by factors like mental focus of trainees, technical difficulties encountered during learning and to a lesser degree dimensions like self efficacy of trainees, negative thoughts had an impact on learning outcome.

Satyanarayana, Byram and Majid studied the influence of institutional reforms on the export efficiency of Indian pharmaceutical industry after India became a signatory to the provisions of World Trade Organisation (WTO) from 1st January, 1995. An econometric approach to foreign direct investment and gross domestic product was explained by Sharmiladevi. With this note, I take pleasure in congratulating contributors of this issue.

I wish you a happy scholarly reading.

Gautam Ghosh

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Articles….

Emerging Commodity Exchanges in Globalized Economy

S. Rajamohan and G. Hudson Arul Vethamanikam

Digital Object Identifier: 10.23837/tbr/2017/v5/n1/149496

Abstract
This research paper focuses on future trading of gold performance in MCX and discusses the evolution and performances of commodity market.

Keywords: *Commodity, Commodity markets, Emerging commodity exchange, Demand of Gold*

1. Introduction

A fall in the value of a currency is predictable from movements of gold price. Commodity prices are also compared with that of gold prices. Gold price started increasing in 2011 and in 2013 it grew by another 15 percent. Ranson (2005) found that global commodity prices also respond to economic growth in the short run. But these price changes are infrequently sustained over the time. Demand and supply, existing inventories are not able to explicate the long-run behavior of prices in the commodity. Over the long term, commodity prices are part of a general movement in the prices of tangible assets including commercial real estate, precious metals and collectibles. All these prices are driven predominantly by the changing values of the US. There is a common faith that the price of commodities tends to move in unity. They are influenced by common macroeconomic factors such as Oil and gold price, inflation and exchange rates, interest rate and so on. These are the two strategic commodities which have received much attention in recent. Crude oil is the world's most commonly traded commodity and its price is the most volatile in the commodity market. Gold is considered as a leader in the bullion market of precious metals as increases. It is price seem to lead to parallel movements in the price of other precious metals on the commodity market (Hammoudeh, 2008).

Soytas (2009) in his research paper concentrated on the gold performance of commodity markets in national as well as international commodity markets. According to his study, gold is also an investment of assets and commonly known as a "safe haven" to avoid the increasing risk in financial markets. Using gold is one of risk management tools in hedging and diversifying commodity portfolios. Investors are investing the money in both advanced and emerging markets often switch between oil and gold to diversify their portfolios.

2. Review of Literature

Lakshmi, Visalakshmi and Padmavathy (2017) has explored the nexus between spot returns and futures contracts for crude oil and gold. The study examines whether future trading volume react faster to news and help to predict in spot returns. The researcher founded the effect in the Indian context using data from the Multi Commodity Exchange (MCX) of India from January 2005 to May 2012. The Vector Autoregressive model (VAR), Granger causality Wald test, variance decomposition and impulse response function are applied to the data collected. The results exhibited that for both crude oil and gold

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is influenced by its own past than the past spot returns. Further, bidirectional causality runs from gold spot returns to gold futures trading volume. Contrarily, we do not have sufficient evidence to support that crude futures trading volume aid in the forecast of crude spot returns in India. Overall, the finding implies that gold futures trading volume react faster to information and help to predict the gold spot returns than crude oil in the Indian commodity markets.

Bansal and Kaur (2017) denoted that global commodity markets have gone through a long journey. In India, the emergence and augmentation of the organized commodity derivative market is relatively a recent phenomenon. Since its inception in June 2000, derivative exchanges have exhibited exponential growth in terms of volume and value of trade. The setting up of the three exchanges was the turning point in the history of commodity market of India. Hence, the study is undertaken to analyze the trends and progress of the national commodity exchanges of India and comparing the value of the trade of the selected non-agricultural commodities. Data for the commodities under study covers period from the year 2004-2005 till the year 2014-2015. The study is based on the secondary data related to exchanges such as MCX, NCDEX and NMCE.

Dhole (2014) investigated that the antiquity of a commodity futures market in India epoch back to the ancient times cited in *Kautialya's Arthasastra*. It has been commodity heard in Indian markets for centuries, seems to be coined in 320 BC, referred in Forward Contracts (Regulation) Act, 1952. They found the markets have made enormous advancement in terms of technology, transparency and the trading activity. It has happened after the Government protection was removed from a number of commodities and market forces were allowed to play their role. Rational Government policies and the plinth of effective laws have benefited in many ways like credit accessibility, improved product quality, predictable pricing, Import-export competitiveness, and price risk management and price discovery.

3. Objectives of the Study

The investor's revenue based invests the money due to commodities for framing the valuables objectives such as given below.

1. To analysis future trading of gold performance in MCX.
2. To evaluate the performance and demand of commodities markets in the worldwide.
3. To measure the dispersion and descriptive analysis of commodity markets in world wide.

4. Commodity Markets/Exchanges

A commodities exchange is an exchange where various commodities and derivatives products are traded. Most commodity markets across the world trade in agricultural products and other raw materials such as barley, wheat, sugar, maize, coffee, cotton, cocoa, pork bellies, milk products, oil, metals, and so on and contracts based on them. These contracts can include spot, forwards, futures and options on futures. Other sophisticated products may include interest rates, environmental instruments and swaps.

Commodity exchanges usually trade futures contracts on commodities such as trading contracts to receive something, say corn, in a certain month. A farmer raising corn can sell a future contract on his corn. It will not be harvested for several months and guarantee the price. It protects the farmer from price drops and the buyer from price rises. Speculators and investors also buy and sell the futures contracts in an attempt to make a profit and provide liquidity to the system. However, due to the financial leverage provided to traders by the exchange, commodity futures traders face a substantial risk.

Chicago Board of Trade (CBOT) is established in 1848, ranked as one of the oldest futures/options trading exchange in the world. The exchange offers more than 50 different futures and option contracts for investors stretching across a number of asset classes. As of 2007, the CBOT operates as a subsidiary of the CME group.

New York Mercantile Exchange (NYMEX) is the world's largest physical commodity futures exchange, offering exposure to a wide variety of products. The commodity exchange (COMEX) also operates as a division of the NYMEX and is best known for offering exposure to various metals contracts. The two divisions joined in later of 2006, and were acquired by the CME group in the year of 2008.

London Metal Exchange (LME) is a major exchange that offers exposure to futures and options of a wide variety of base metals and other commodity products. Some of the metals traded includes such as aluminum, copper, tin, nickel, zinc, and lead. Though founded in 1877, the exchange can trace its roots all the way back to 1571, when the royal exchange in London was opened with only trading copper at that time.

The Intercontinental Exchange (ICE) is a U.S. based company that operates futures and over-the-counter contracts via internet marketplaces. The company was originally focused on energy contracts, but has widened its scope by offering exposure to a number of commodities, including cocoa, cotton, sugar, iron ore, natural gas and crude products. The platform is much more focused on just a select few commodities and may be a good fit for traders looking to single out just one or two commodities.

Multi Commodity Exchange (MCX) is a private commodity exchange located in Mumbai, India. The company was founded in 2003 and ranks as one of the top 10 commodity exchanges in the world. Traders can gain access to a number of the usual suspects like gold and silver. But also have the option to trade a number of commodities focused on the Indian economy like pepper, cashew kernel, and yellow peas and so on.

5. The Performance of Commodity Market in Global Market

Chicago Mercantile Exchange (CME) is a financial and commodity derivatives trading platform headquartered in Chicago. Originally founded in 1898 as the Chicago Butter and Egg Board, it has one of the largest options and future line-up of any exchange in the world. The CME offers contracts of all kinds, including agriculture, credit, economic events, equity index, Foreign Exchange, interest rates and other futures/options investments. The CME is owned and operated under the CME Group.

Africa's most active and vital commodity exchange is the South African Futures Exchange (SAFEX). It was informally launched in 1987 and has evolved into one of the leading emerging markets. The Johannesburg Securities Exchange acquired it. SAFEX only traded financial futures and gold futures for a long time, but the creation of the Agricultural Markets Division (as of 2002, the Agricultural Derivatives Division) led to the introduction of a range of agricultural futures contracts for commodities. Trade was liberalized such as white, yellow maize, bread milling wheat and sunflower seeds. SAFEX traded 30 million futures and option contracts in 2001, making it the world's 14th largest exchange.

Mergers were also the result of regulatory pressure. This was the case, for illustration, in Japan and particularly, China. In Japan, several exchange mergers took place, from 17 exchanges in September 1993, the number went to 8 in 1997. In the United Kingdom, LIFFE merged with the London Commodity Exchange in September 1996 and now trades a range of soft commodity and agricultural contracts, including futures and options on cocoa, robusta coffee, white sugar, grain and potatoes. In the United States, NYMEX, the world's premier energy futures exchange, merged in 1994 with COMEX, which

operates today as its subsidiary, and NYCE (created in 1870) and CSCE (founded in 1882) to merge and form in 1998 the "Board of Trade of the City of New York" (NYBT).

In Europe, the world's second largest exchange, Eurex, resulted from the merger of the German DTB Deutsche Terminbörse and the Swiss Exchange SOFFEX in the autumn of 1998. That year also bore witness to the creation of Euronext, a pan European "one company, three centers" structure, merger between Amsterdam Exchanges (AEX), Brussels Exchanges (BXS) and the Paris Bourse, which created the first totally integrated cross-border single currency derivatives market. In February of 2002, Portugal's Bolsa de Valores de Lisboa e Porto exchange merged with Euronext to become the Euronext Lisbon.

In Latin America, the Bolsa de Mercadorias & Futuros (BM&F) became in 2001 a member of the Globex Alliance, looking ahead with other member exchanges to a less costly, more competent, stronger and united international marketplace. In Asia in 2001 the Malaysia Derivatives Exchange was created out of the merger of Commodity and Monetary Exchange of Malaysia (COMMEX) and Kuala Lumpur Options and Financial futures Exchange (KLOFFE).

Chart-1

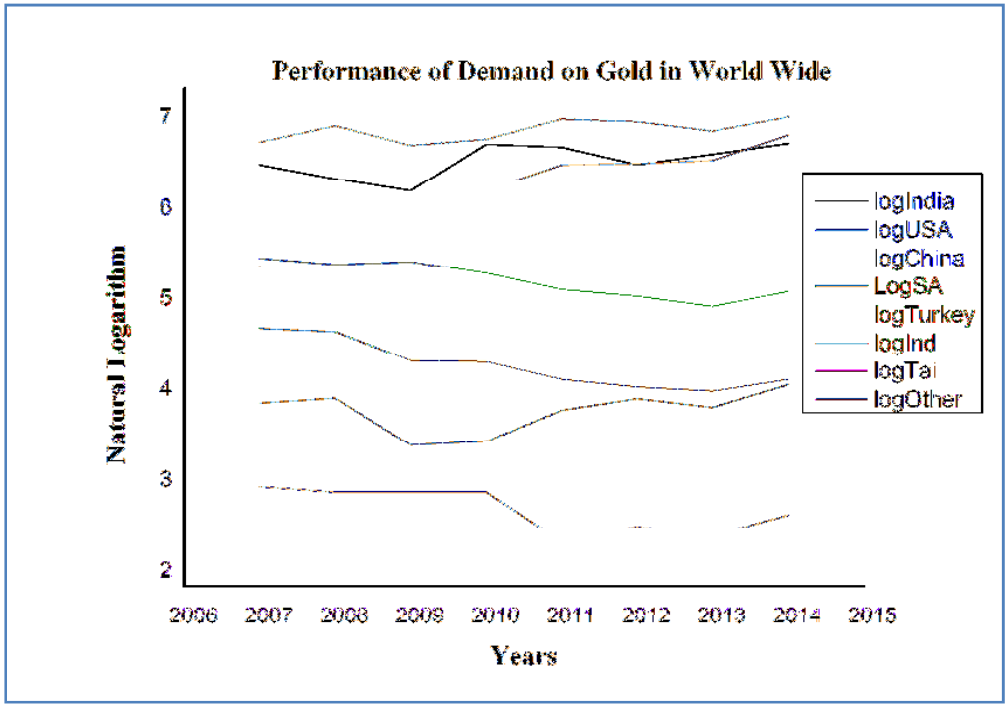


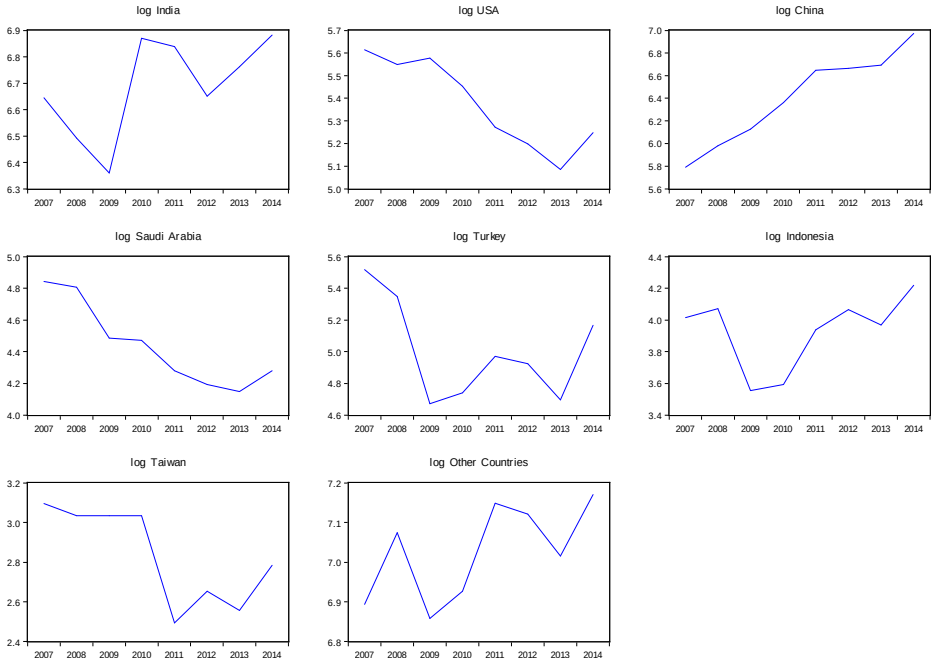
Table – 1 The Demand of Gold In Commodity Market

Year	Countries								Total
	India	USA	China	Saudi Arabia	Turkey	Indonesia	Taiwan	Others	
2007	769.2 (27.36)	274.5 (9.76)	327.8 (11.66)	126.9 (4.51)	249.3 (8.86)	55.5 (1.97)	22.1 (0.78)	985.6 (35.06)	2810.9 (100)
2008	660.2 (22.7)	256.9 (8.8)	395.6 (13.6)	122.4 (4.2)	210.3 (7.2)	58.7 (2.0)	20.8 (0.7)	1181.9 (40.7)	2906.8 (100)
2009	578.5 (23.1)	264.5 (10.6)	457.7 (18.3)	88.7 (3.5)	107.0 (4.3)	35.0 (1.4)	20.8 (0.8)	951.7 (38.0)	2503.1 (100)
2010	963.1 (31.5)	233.3 (7.6)	579.5 (19.0)	87.5 (2.9)	114.6 (3.8)	36.4 (1.2)	20.8 (0.7)	1019.4 (33.4)	3054.6 (100)
2011	933.4 (27.1)	194.9 (5.6)	769.8 (22.3)	72.2 (2.1)	144.2 (4.2)	51.3 (1.5)	12.1 (0.4)	1272.1 (36.9)	3450 (100)
2012	773.5 (23.8)	181.0 (5.6)	782.8 (24.1)	66.3 (2.0)	137.6 (4.2)	58.3 (1.8)	14.2 (0.4)	1237.5 (36.9)	3251.2 (100)
2013	864.2 (27.1)	161.8 (5.1)	806.8 (25.3)	63.4 (2.0)	109.5 (3.4)	52.9 (1.7)	12.9 (0.4)	1113.7 (35.0)	3185.2 (100)
2014	974.8 (25.2)	190.3 (4.9)	1065.8 (27.6)	72.2 (1.9)	175.2 (4.5)	68.0 (1.8)	16.2 (0.4)	1301 (33.7)	3863.5 (100)
Mean	302.45	252.59	245.08	239.51	186.73	174.58	106.24	1028.3	2535.48
Median	301	253	237.35	239.9	186.9	172.5	95.7	986.1	2477.2
Maximum	420	289.9	281.3	363.2	233.5	207	167	1293	2907.8
Minimum	218.9	225	216	145	145	150	59	817	2256
Std. Dev.	68.89545	18.47072	19.95872	64.21136	32.74179	18.52433	37.75768	189.1869	212.0242
Skewness	0.475197	0.291309	0.37914	0.31871	0.069435	0.635172	0.517088	0.232169	0.414846
Kurtosis	2.169255	3.144164	2.153871	2.6679	1.388414	2.340839	2.249244	1.421335	1.942889
Jarque-Bera	0.663911	0.150095	0.537885	0.215248	1.090206	0.853445	0.680482	1.128247	0.752447
Probability	0.717519	0.9277	0.764187	0.897965	0.579782	0.652645	0.711599	0.568859	0.686449
Sum	3024.5	2525.9	2450.8	2395.1	1867.3	1745.8	1062.4	10283	25354.8
Sum Sq. Dev.	42719.24	3070.509	3585.156	37107.89	9648.221	3088.356	12830.78	322125.1	404588.3
Observations	10	10	10	10	10	10	10	10	10

Source: World Gold Council

Above the table 1 shows that the countries are more investing the money to selected commodities of gold. The gold is a one of the commodity which is in demand and in supply more than other commodities. In 2007, India was at first (27.36) place in consumption of gold followed by other countries. China is a third place and out of 100 very low consumption of the gold is Taiwan (0.78). Taiwan people are not much interested to invest the money on gold commodity markets. The Indian commodity trading activities were on increasing trend before 2010 and after that went declining. Out of 100, USA (39.4) and Saudi Arabia (14.4) were initially at a growing stage and later went on reclining mode. India, China, Turkey and Indonesia are standard positions to consume as well as make it demand in the worldwide usages regarding the years of 2010-2014. Except the Taiwan are usages and demand of a commodity of gold is up and down. Taiwan is a one of the countries which means a standard growth of gold in commodity market in the world. The other developing countries performed well in the past eight years.

Chart-2 The Performance of Gold in World Wide



The average values (2007-2014) are up and down India (302.45), USA (252.59), China (245.08), Saudi Arabia (239.51), Turkey (186.73), Indonesia (174.58) and Taiwan (106.24) and so on. The values are higher deviation of standard deviations from India and Saudi Arabia compared to other countries. Other countries of the standard deviations are normally like USA (18.47072), China (19.95872), Turkey (32.74179), Indonesia (18.52433), and Taiwan (37.75768). The Taiwan and Turkey are high deviation from other countries. Hence the growth is low when compared to previous years of the gold.

Karl Pearson's Skewness values are three types such as Positive, Negative and Symmetric. All the countries values are maximum zero value which is called symmetric such as India (0.475197), USA (0.291309), China (0.37914), Saudi Arabia (0.31871), Turkey (0.069435), Indonesia (0.635172) and Taiwan (0.517088). Hence, all the demand values of gold are less than the zero which means symmetric skewness. Therefore, all the countries are normally distributors of the data proved through Pearson's skewness.

Karl Pearson's Kurtosis values are little different from one country to another such as India (2.169255) USA (3.144164), China (2.153871) Saudi Arabia (2.6679) Turkey (1.388414) Indonesia (2.340839) and Taiwan (2.249244). Hence, all the demand values of gold are less than the three co-efficient values, which is called Platy Kurttic Distribution. The Jarque-Bera test display that the performance of gold values which are less than the critical values 18.73. Hence the null hypothesis that , there is non-stationary data of gold in worldwide is not accepted. The alternative hypothesis of stationary of data of Gold in worldwide is accepted. Therefore the data is normally distributed as well as stationary data. This data may useful to do a further analysis.

6. Conclusion

The costs of modern metals are related to gold. It requires significant investment to react completely to developments in gold costs. At the point when the gold dove in April 2013, mechanical metals costs dropped too. The reason was not a matter of supply and request in the standard sense. They measure all these costs in U.S. dollars, and the estimation of the dollar essentially climbed. Since, the dollar has been

falling, the cost of gold has been bouncing back and metals costs have started to move back as well. While lingering behind gold, mechanical metals costs perform ahead of time of swelling. The role of gold as a hedge against inflation is strengthened. The implication for those investors who include US dollar denominated assets in their portfolios is that oil and gold could be close substitutes as safe havens from fluctuations in the US dollar's value. The oil price does nonlinearly cause the gold price and can be used to predict the gold price. This would significantly help monetary authorities and policy makers in monitoring the price of major commodities in markets.

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Approaches for Measuring and Improving Service Quality – A Critical Review

Nishithkumar H. Bhatt and Nikita Patel

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Abstract

It's a prime concern for service provider to improve quality of their services on continuous basis to achieve sustainable competitive advantage, higher market share and profitability. Service quality can be measured through how well services meet up customers' expectations. The purpose of this paper is to review the literature and pin point different approaches available such as SERVQUAL, Kano model and Quality function deployment model. The review will highlight characteristics; application and limitation of these models through analysis of various studies conducted across the world and will suggest an extended model to improve service quality.

Key words: *Service quality, SERVQUAL, Kano model, Quality function deployment*

1. Introduction

According to Parasuraman *et al*. (1985) service quality is the difference between predicted, or expected service that is customer expectations and perceived serviced that is customer perceptions. In addition to that they also mentioned that service quality is the degree of discrepancy between customers' expectation from the service and their perception of service performance. Researchers are having opinion that service quality plays an important role in achieving higher patronage, competitive advantage, sustained profitability (Brown & Swartz, 1989; Headley & Miller, 1993); corporate marketing, enhancing financial performance (Buttle, 1996); and acts as a determinant of demand of goods and services (Pai & Chary, 2013).Studies have proved that there is a direct link between service quality and increased market share, profit and savings (Devlin & Dong, 1994).

The Gap Model

A conceptual framework for service quality was propounded by Parsuraman, *et al*. (1985) and it was known as "Gap Model". This model was based on the interpretation of qualitative data from extensive exploratory research method such as focus group interview of consumers and in depth executive interviews, carried out in four service categories: retail banking, credit card, securities brokerage, and product repair and maintenance (Parsuraman, *et al*. 1985). They identified four distinctive gaps as shown in Figure1 on the service provider's side. These gaps can be major obstacles in attempting to deliver a service which consumer would perceive as being high quality.

Gap 1: Consumer expectation- Management perception gap

This gap revealed differences between customers' expectations and management perceptions of consumers' expectations. This gap arises because of lack of proper market/customer focus such as management processes, market analysis tools and attitude.

Gap 2: Management perception- Service quality specification gap

This gap revealed management's inability in to translate customer expectations into service quality specifications.

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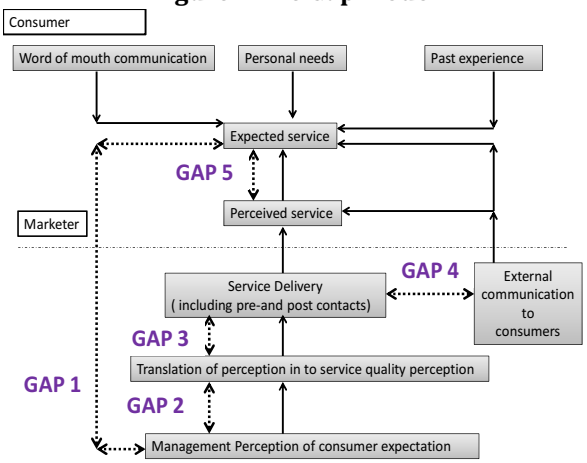
Gap 3: Service quality specification- Service delivery gap
Preparing or setting standards/guidelines do not guarantee high-quality service delivery or performance but it also requires proper implementation of the same by frontline staff.

Gap 4: Service delivery –External communication gap
This gap explains the difference between service delivery and what is communicated about the service to consumer through external communication. A Firm must ensure that its marketing and promotion campaign matter accurately depicts the service they offer and the way it is delivered.
These four gaps cause a fifth gap that is Gap 5.

Gap 5: Expected Services-Perceived Services gap
The size and direction of above four gaps are determinant of expected services-perceived services gap.

Gap5 = f (Gap1, Gap2, Gap3, Gap4)

Figure1-The Gap Model



Source: Reproduced from Bedi (2011)

2. SERVQUAL

Parsuraman, *et al*. (1985) through their investigation, come to the conclusion that consumer basically used ten service quality dimensions in evaluating service quality such as "Reliability: Ability to execute services as per the promise, Responsiveness: Eagerness to help customers and providing fast service, Access: approachability and ease of contact, Courtesy: politeness, respect, consideration, and friendliness of contact personnel , Communication: effective listening to customer and make them well informed in a language they understand, Credibility: trustworthiness, honesty and customers' best interest at heart, Security: freedom from danger, risk or doubt, Understanding/knowing customer: making an effort to understand the customer's needs, Tangibles: physical evidence of the service. Further in their study in 1988, they collapsed these service quality dimensions in to the five dimensions as defined in the Table 1.1 by keeping service quality dimensions reliability, responsiveness and tangibles as it is and collapsed rest of the service quality dimensions in to two dimensions that is assurance and empathy. SERVQUAL is a concise multi item scale (22 item scale) with good reliability and validity. It has been designed as a generic measure, to be applicable across a broad spectrum of service to measure service quality. When necessary it can be modified or supplemented to fit the characteristics of particular service (Parsuraman, *et al*. 1988). This instrument was administered twice in different form, first to measure expectation and second to measure perceptions for each of the five service quality dimensions like Assurance, Reliability, Tangibility, Responsiveness and Empathy. Seven-

point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree) was used to rate respondents expectations and perceptions of performance and the results were then used to identify positive or negative gaps (Parsuraman, *et al*. 1988). SERVQUAL is extensively used in various private and public sectors such as retailing, healthcare, education, tourism and hospitality, financial services, B2B, real estate and government as well. (Buttle, 1996)

Table 1. SERVQUAL service quality dimensions

1	Tangibles	Infrastructural aspects of services and aesthetic of personnel
2	Reliability	Ability to execute services as per the promise
3	Responsiveness	Eagerness to help customers and providing fast service
4	Assurance	Trust and confidence generating ability of knowledgeable and courteous employees
5	Empathy	Care and personal attention provided to the customers

Source: Reproduced from Parsuraman, *et al*. (1988)

Application of SERVQUAL

If applied periodically, SERVQUAL can provide better understanding about prevailing service quality trends (Parsuraman, *et al*. 1988; Tan & Pawitra, 2001).

- It is used in categorising a firm's customers into several perceived quality segments (e.g., High, Medium and low) on the basis of their individual SERVQUAL scores. These segments can then be analysed on the basis of their demographic, psychographic and/or other profiles, relative importance of the five dimensions in influencing service quality perception and the reason behind perceptions of customers (Parsuraman, et al. 1988).
- It alters management to consider the perception of both management and customers (Tan & Pawitra, 2001).
- It is used to identify and priorities the areas of excellence and improvement through service gap, which will provide a basis for formulating strategy and tactics to ensure the fulfillment of expectation (Tan & Pawitra, 2001).

Criticism of SERVQUAL

Despite its popularity and wide use of SERVQUAL, it has been criticized for number of theoretical and operational aspects (Carman, 1990, Cronin & Taylor, 1992, 1994, Lee *et. al*, 2000, etc..). Following are the criticisms identified in theoretical and operational aspects (Buttle, 1996).

- ✓ Theoretical
  - Model objections: SERVQUAL is based on a disconfirmation model rather than an attitudinal model; and SERVQUAL fails to come out with acceptable economic, statistical and psychological theory.
  - Gaps model: It is found that customers' assess service quality in terms of P – E gaps very rarely.
  - Process focused: SERVQUAL focuses more on the process of service delivery, rather than the outcomes of the service encounter.
  - Dimensionality: Five dimensions of SERVQUAL's are not universal in nature; the number of dimensions comprising Service Quality is contextualized; items do not always load on to the factors according to one's expectation, and high degree of intercorrelations is observed between the five dimensions.
- ✓ Operational
  - Expectations: the term expectation is ambiguous in nature; to evaluate service quality, consumers use standards other than expectations; and SERVQUAL fails to measure absolute Service quality expectations.

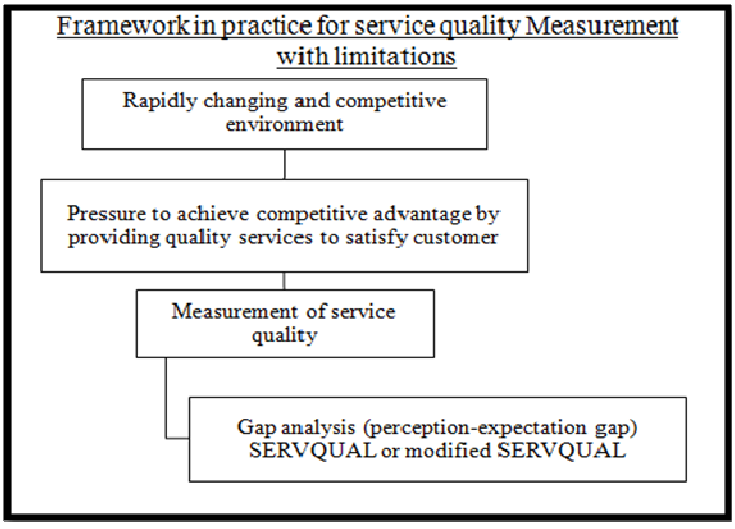
- Item composition: It is observed that four or five items are not able to justify the variability within each Service quality dimension.
- Moments of truth (MOT): Assessments of Service quality by customers may vary from MOT to MOT.
- Polarity: There are chances of occurrence of respondent error because of reversed polarity of items in the scale.
- Scale points: SERVQUAL uses the seven-point Likert scale which is flawed.
- Two administrations: two administrations of the instrument create boredom and confusion for respondent.
- Variance extracted: the overall SERVQUAL score explains only a minor proportion of item variances.

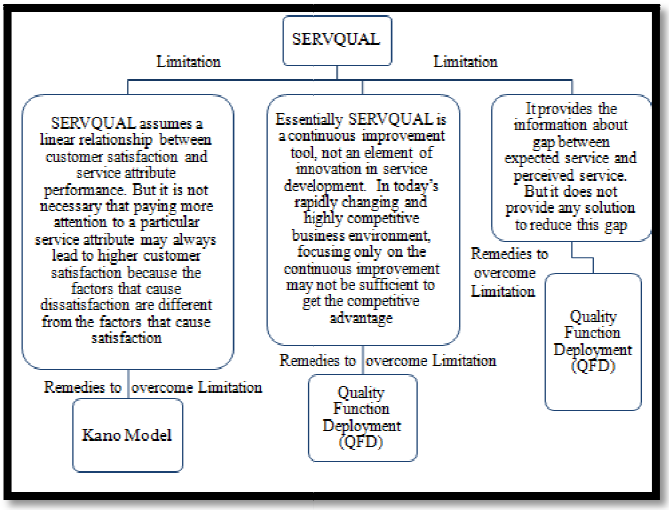
Areas for further improvement in SERVQUAL

- SERVQUAL assumes a linear relationship between customer satisfaction and service attribute performance. But it is not necessary that paying more attention to a particular service attribute, may always lead to higher customer satisfaction (Tan & Pawitra, 2001) because the factors that cause dissatisfaction are different from the factors that cause satisfaction (Herzberg et al. 1993)
- Essentially SERVQUAL is a continuous improvement tool, not an element of innovation in service development. In today's rapidly changing and highly competitive business environment, focusing only on the continuous improvement may not be sufficient to get the competitive advantage (Tan Pawitra, 2001). To get the competitive advantage timely design, development and marketing of new services with creative and innovative features are essential for organization (Shen et al. 2000), so many organization are strategically moving towards innovation (McAdam et al. 2000)
- It provides the information about gap between expected service and perceived service. But it does not provide any solution to reduce this gap (Tan & Pawitra, 2001).

These areas can be improved by integrating SERVQUAL with Kano and/or Quality function deployment for developing service excellence (Tan & Pawitra, 2001). So integrated approach has been applied in different industry by many researchers such as: tourism (Tan & Pawitra, 2001), health care (Lim *et al.* 1999; Akdag *et al*. 2013), logistic services (Birdogan *et al.*2009) etc.

Theoretical framework




SERVQUAL
Limitation
Limitation
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Remedies to overcome Limitation
Quality Function Deployment (QFD)
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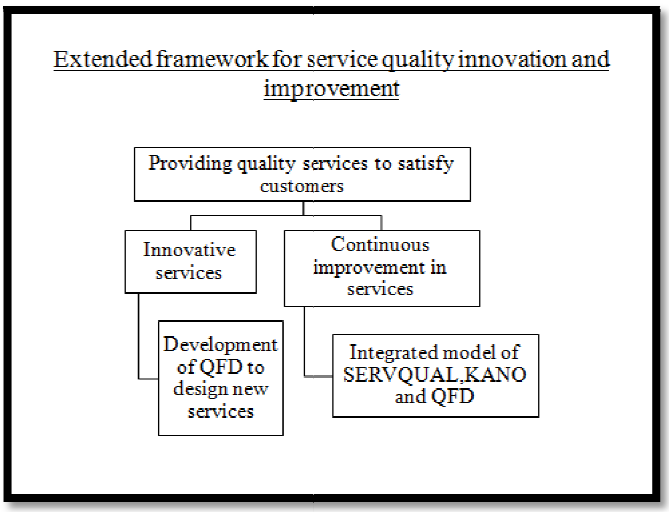
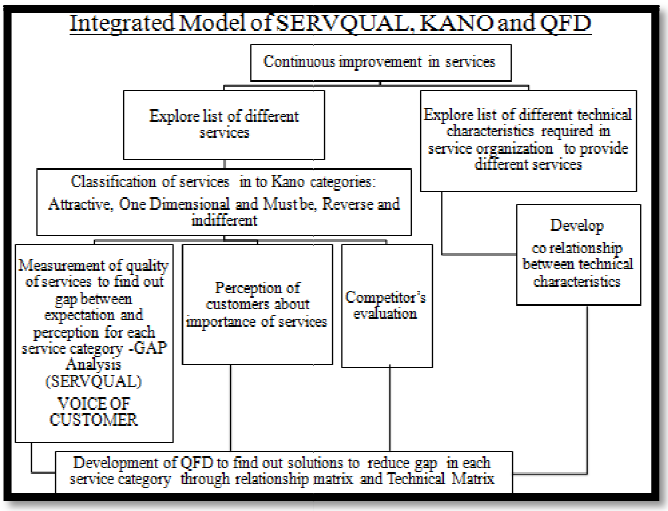
Kano Model


Extended framework for service quality innovation and improvement
Providing quality services to satisfy customers
Innovative services
Continuous improvement in services
Development of QFD to design new services
Integrated model of SERVQUAL,KANO and QFD


Integrated Model of SERVQUAL, KANO and QFD
Continuous improvement in services
Explore list of different services
Explore list of different technical characteristics required in service organization to provide different services
Classification of services in to Kano categories: Attractive, One Dimensional and Must be, Reverse and indifferent
Develop co relationship between technical characteristics
Measurement of quality of services to find out gap between expectation and perception for each service category -GAP Analysis (SERVQUAL) VOICE OF CUSTOMER
Perception of customers about importance of services
Competitor's evaluation
Development of QFD to find out solutions to reduce gap in each service category through relationship matrix and Technical Matrix

The Kano Model

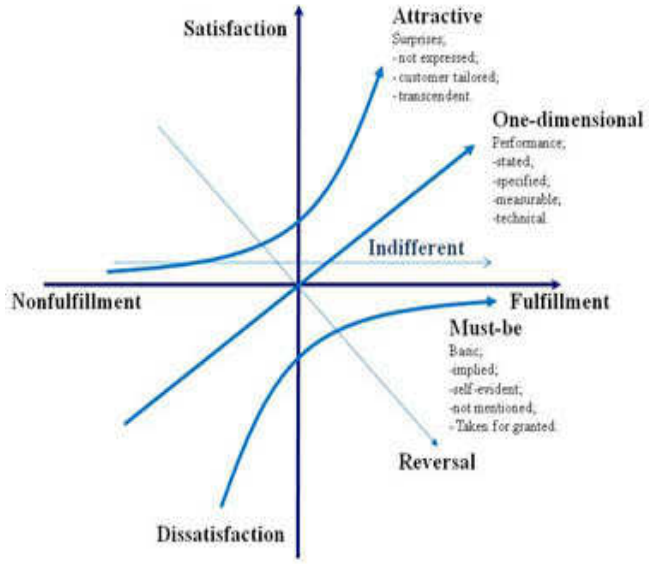
Theory of Attractive Quality-The Kano Model

A Distinction between satisfaction and dissatisfaction was first introduced in Herzberg's "Motivator-Hygiene Theory (M-H Theory) and it stated that the factors that cause job dissatisfaction are different from the factors that cause job satisfaction (Herzberg *et al.* 1993). The Kano model was first developed by Dr. Noriaki Kano of Tokyo Rika University and his colleagues from Japan in 1984(Kano *et al.* 1984) to categorise the attributes of a product or service, based on how well they are able to satisfy customers' need (Berger *et al 1993;* Witell & Lofgren 2007; Chen & Su 2006). The main inspiration for developing a Kano model was Herzberg's "Motivator-Hygiene Theory (M-H Theory)". This model is also called as 'Kano's theory of attractive quality' (Kano *et al.* 1984). Professor Kano contradicted traditional view that is linear and one dimensional relationship between quality attributes and customer satisfaction (Herzberg *et al.* 1993; Huiskonen & Pirttila, 1998) and proposed that sometimes quality attributes may reveal non linear and two dimensional relationship with customer satisfaction (Kano *et al*. 1984; Birdogan *et al.*2009; Witell & Lofgren, 2007). Day by day Kano's model has gained increased exposure and acceptance and it has been applied within quality management, product development, strategic management, and employee management, business planning and service management (Witell & Lofgren, 2007). Kano model has been widely applied in service sector to investigate various services such as superstores (Ting & Chen, 2002), web page design (Tan *et al*., 1999), health-care services (Jane ´ & Domı´nguez, 2003), financial services (Bhattacharyya & Rahman, 2004), and electronic services (Fundin & Nilsson, 2003).

To understand the role of quality attributes, Kano *et al*. (1984) developed a model that evaluated patterns of quality, based on customers' satisfaction with specific quality attributes and their degree of sufficiency. Horizontal axis in the Kano diagram as shown in the Figure 2. shows the physical sufficiency of a certain quality attribute and the vertical axis shows the satisfaction with a certain quality attribute (Kano et al., 1984). As per the Kano model Quality attributes were classified in Five Categories: "attractive quality", "one-dimensional quality", "must-be quality", "indifferent quality" and "reverse quality"(Witell & Lofgren, 2007).

- Attractive quality attributes can be described as surprise and delight attributes (Kano *et al*. 1984). (Tan & Pawitra, 2001). When attractive quality attributes achieved fully, customer satisfaction increases super linearity with increasing attributes performance. There is, however, no corresponding decrease in customer satisfaction with decrease in attribute performance (Kano *et al*. 1984, Tan & Pawitra, 2001; Witell & Lofgren ,2007).These attributes are neither demanded nor normally expected, but when properly delivered they bring satisfaction. So they are a sufficient, but not a necessary condition for satisfaction (Kano 2001; Lilja & Wiklund, 2006; Busacca & Padula, 2005; Birdogan *et al.*2009). To attract competitors' customer, attractive attributes can be used as an element of an aggressive marketing strategy (Birdogan *et al.*2009).

Figure 2. The Kano Diagram



Source: Reproduced from Berger, C., et al. (1993)

- One-dimensional quality attributes result in satisfaction when fulfilled and result in dissatisfaction when not fulfilled (Kano *et al*. 1984; Witell & Lofgren, 2007). There is a linear relationship between these attributes and customer satisfaction (Shen *et al* 2000). They are called as spoken and are the ones with which companies compete (Gustafsson, 1998) and so they are both a necessary and sufficient condition for customer satisfaction (Busacca & Padula, 2005).
- Must-be quality attributes are taken for granted when fulfilled but result in dissatisfaction when not fulfilled (Kano et al., 1984). However customer satisfaction does not increase above neutral level even if these attributes fulfilled fully (Tan & Pawitra, 2001). These quality attributes are generally expected by customers' and they view them as basic, so it is possible that they are not going to tell the company about these quality attributes when asked about their expected quality attributes (Watson, 2003; Witell & Lofgren, 2007).
- Indifferent quality attributes: these quality attributes are neither good nor bad, and thus they do not result in either customer satisfaction or customer dissatisfaction (Kano et al.1984; Witell & Lofgren, 2007).
- Reverse quality attributes: High degree of achievement of this quality attributes results in dissatisfaction and vice versa; a low degree of achievement results in satisfaction with consideration of the fact that not all customers are alike. (Kano et al.1984; Gustafsson, 1998; Witell & Lofgren, 2007)
- The theory of attractive quality also proposes that product and service attributes are dynamic in nature, that is, over the time an attribute changes from being "indifferent", to "attractive", to "one-dimensional", and, finally, to being a "must-be" item. According to Kano (2001), "successful" quality attributes follow such life-cycle from "indifferent" to "must-be". Thus, the timely and continual development /improvement and introduction of products or services with innovative and novel attributes are important to get competitive advantage (Shen et al. 2000; Tan & Pawitra, 2001).

Managerial Implication of Kano Model

- It is useful tool in product or service development and it provides greater decision support during the design of products/services (Witell & Lofgren, 2007).

- With the help of Kano model, one can get better understanding about products or services quality attributes expected by customers and identify which have greater impact on customer satisfaction (Matzler & Hinterhuber, 1998; Tan & Pawitra, 2001; Witell & Lofgren, 2007).
- Because of technical or financial reasons, sometimes, it is not possible for the company to implement or promote each and every quality attributes. With help of Kano model, company can determine the quality attributes which have greater influence on customer satisfaction. Thus it plays important role in trade off situations (Matzler & Hinterhuber, 1998; Tan & Pawitra, 2001; Witell & Lofgren, 2007).
- Kano model claims to fulfill must be quality attributes, it emphasizes on one dimensional quality attributes to be competitive with market leaders and focuses on attractive quality attributes in order to delight customers (Witell & Lofgren, 2007).
- It can point out opportunities for service differentiation. (Matzler & Hinterhuber, 1998).

Limitations of Kano Model

- Kano model does qualitative assessment of quality attributes but does not quantify the extent to which the customer is satisfied (Berger et al. 1993; Bharadwaj & Menon. 1997; Erto et al. 2011).
- Kano model focuses on the customer and market perspective only. It does not consider the capacity of producer/ service provider to meet customer needs. (Xu et al. 2008; Erto et al. 2011).
- Kano model does not focus on what derives customer perception (Bharadwaj & Menon 1997, Tan & Pawitra , 2001).

Approaches to the classification of quality attributes

There are four approaches for the classification of quality attributes. (Witell & Lofgren, 2007)

Five level Kano Questionnaire

The original process of classification of quality attributes is basically following a survey method using a Kano questionnaire. The Kano questionnaire is constructed through pairs of customer requirement questions. Each question consequently has two parts, first part of is a function form and that is on how do you feel if that feature is present in the product or service while second part is a dysfunctional form and that is on how do you feel if that feature is not present in the product or service (Kano *et al*. 1984; Berger *et al*.1993). For each part of the questions, there were five alternative answers illustrate as "like"; "must-be"; "no feeling"; "give up"; and "do not like". Customer selects any one out of five alternative answers for each part of the questions and subsequently customers' perceptions were evaluated into quality dimensions (Kano. 1984). The five-level Kano classification approach is shown in the figure 3 through the example of study on e-service of ordering cinema tickets online (Witell & Lofgren, 2007). The five-level Kano classification approach thus had 25 possible outcomes, which were spread over five different quality dimensions such as Attractive quality (A), One-dimensional quality; (O), Must-be quality (M), Indifferent quality (I), and Reverse quality (R). "Skeptical evaluation" S, is used for representing responses in which it is unclear whether the respondent has understood the question or not (Kano *et al*., 1984).

Then next step is to make overall classification of the quality attributes for all respondents. Statistical mode and a t-test are used to compare the proportions of customers classifying a quality attribute to a specific quality dimension (Witell & Lofgren, 2007).

Figure 3. Classifications through five level Kano questionnaire

If you can order cinema tickets online, how do you feel? (Functional Form)	(1) I like it that way. 2. I am expected to be that way. 3. I am neural. 4. I can accept it to be that way. 5. I dislike it that way.
If you can not order cinema tickets online, how do you feel? (dysfunctional Form)	1. I like it that way. 2. I am expected to be that way. 3. I am neural. (4) I can accept it to be that way. 5. I dislike it that way.

Customer Requirement → / ↓		Dysfunctional				
		Like	Expect	Neutral	Accept	Dislike
Functional	Like	S	A	A	(A)	O
	Expect	R	I	I	I	M
	Neutral	R	I	I	I	M
	Accept	R	I	I	I	M
	Dislike	R	R	R	R	S

Customer requirement	A	M	O	R	S	I	Total	Grade
1	1						1	A
2								
3								
.....								

Source: Reproduced from Witell and Lofgren (2007)

Three level Kano questionnaire

According to Kano (2001), in English language, a customer's perception about a quality attribute could be described by only three levels as "Satisfied", "Neutral" and "Dissatisfied". Kano (2001) also believed that these three levels should be sufficient to capture the quality dimensions in the Kano model (theory of attractive quality). Thus in 2001, Kano (2001) introduced simplified version of original five-level Kano questionnaire, consist of three alternative answers as "Satisfied", "Neutral" and "Dissatisfied" instead of five, in each part of the questions. The Three-level Kano classification approach followed the procedure of the original Five-level Kano Classification approach but it had 9 possible outcomes instead of 25, which were spread over five quality dimensions. Three-level Kano classification approach is shown in the figure 4 through the example of study on e-service of ordering cinema tickets online (Witell & Lofgren, 2007). This approach also facilitates completion of the questionnaires and the classification of quality attributes (Witell & Lofgren, 2007).

Figure 4. Classifications through three level Kano questionnaire

If you can order cinema tickets online, how do you feel? (Functional Form)	❶ I am Satisfied. 2. I am neural. 3. I am dissatisfied .
If you can not order cinema tickets online, how do you feel? (dysfunctional Form)	1. I am Satisfied. ❷ I am neural. 3. I am dissatisfied .

Customer Requirement → ↓		Dysfunctional		
		Satisfied	Neutral	Dissatisfied
Functional	Satisfied	S	A	O
	Neutral	R	I	M
	Dissatisfied	R	R	S

Customer requirement	A	M	O	R	S	I	Total	Grade
1	1						1	A
2								
3								

Source: Reproduced from Witell and Lofgren (2007)

Classification through direct questions

This approach was suggested by Emery and Tian (2002).They suggested that the researcher should explain the theory of attractive quality to the respondents and then ask them to classify each attribute

directly. Figure 5 shows the Classification of Direct Questions through the example of study on e-service of ordering cinema tickets online (Witell & Lofgren, 2007).

Figure 5 Classifications through Direct Question

How would you classify the ability to watch movie trailers online?
A. Attractive quality
B. One dimensional quality
C. Must-be quality
D. Indifferent Quality
E. Reverse Quality
F. Other

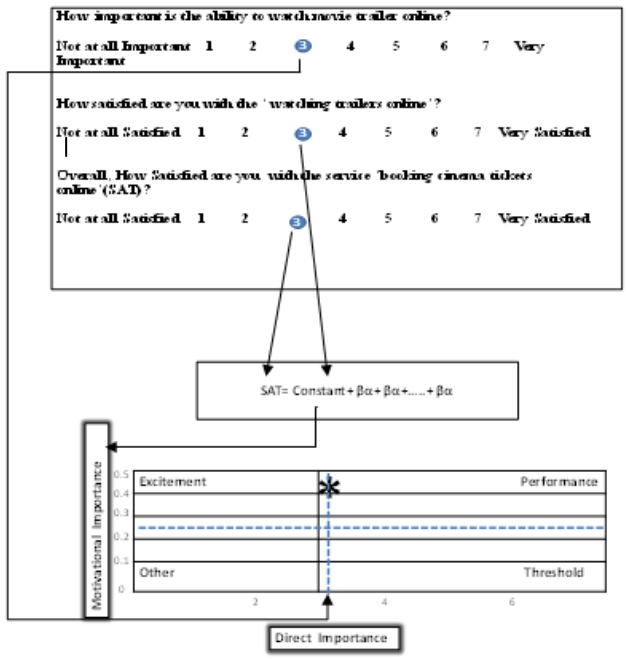
Customer requirement	A	M	O	R	S	I	Total	Grade
1	1						1	A
2								
3								
.....								

Source: Reproduced from Witell & Lofgren (2007)

Classification via importance

Jacobs (1999) came up with an approach that classified quality attributes based on the respondents' perceptions of importance as shown in the figure 6. This approach is also known as the "dual – importance grid" and it is basically focused on following three measurements; "overall satisfaction", "stated importance", and "motivational importance". First and second measurement that are "Overall satisfaction" and "Stated importance" were measured through numerical rating scale "very dissatisfied" to "very satisfied" and "not at all important" to "extremely important" was used respectively. ". The third measurement "Motivational importance" was measured by deriving a relationship between the attribute performance ratings with measures of "overall satisfaction" through statistical analysis (Jacobs, 1999) such as correlation analysis (Jacobs, 1999), a regression analysis, or partial least squares (Martensen & Gronholdt, 2001).

Figure 6. Classification through dual- importance grid



Source: Reproduced from Reproduced from Witell & Lofgren (2007)

Quality Function Deployment (QFD)

Introduction of QFD

A concept of Quality function deployment (QFD), is a design approach or a planning process of innovation (Brown 1991; shen *et al*. 2002) was introduced in Japan in the late 1960s (Akao 2004; Romeo *et al*. 2014) and then it was first brought in to practice in kobe shipyard of Mitsubishi industry in Japan by Dr. Yoji Akao In 1972 (Oakland, 2003; Iris 1996; Tan & Pawitra, 2001). QFD Called as *hin shitsu kino ten kai* in Japanese words and translated in English language as Quality Function Deployment where, *hin shitsu* means quality or features or attributes, *kino* means function or mechanization and *ten kai* means deployment, diffusion, development or evaluation (Lockamy & Khurana, 1995; Tan & Pawitra, 2001). QFD is a very useful planning process to design new products or services and also to improve an existing products or service (Hauser & Clausing, 1988 ; Iris Mohr-Jackson, 1996).

Definition of QFD

QFD is a technique for converting the customers' demands into "quality characteristics'' and developing a design quality for the finished Product by systematically deploying the relationship between the demands and the characteristics, starting with the quality of each functional component and extending the deployment to the quality of each part and process (Akao, 1990). QFD is a system for translating consumer requirements into appropriate company requirements at every stage of a product's life cycle from research to sales to service (Slabey, 1990). QFD is a set of planning and communication routines to focus and co-ordinate the skills of an organisation, first in design, and then in manufacturing and later in the marketing of the goods that customers want to purchase (Hauser & Clausing, 1988). QFD is a process that provides structure in the development cycle to focus on customer requirements (Bossert, 1991). QFD is a technique that identifies the true voice of the customer and ensures that this information goes through all stages of the product life cycle (Burn, 1991).QFD is a systematic planning process created to help a project team bring together and manage all elements needed to define, design, and produce a product (or deliver a service) that would meet or exceed customer expectations (Daetz *et al.* 1995).Mazur (1993) defined QFD for application in the service industries. According to Mazur, QFD consists of a system and a set of procedures to aid in the planning and development of services.

QFD Methodology

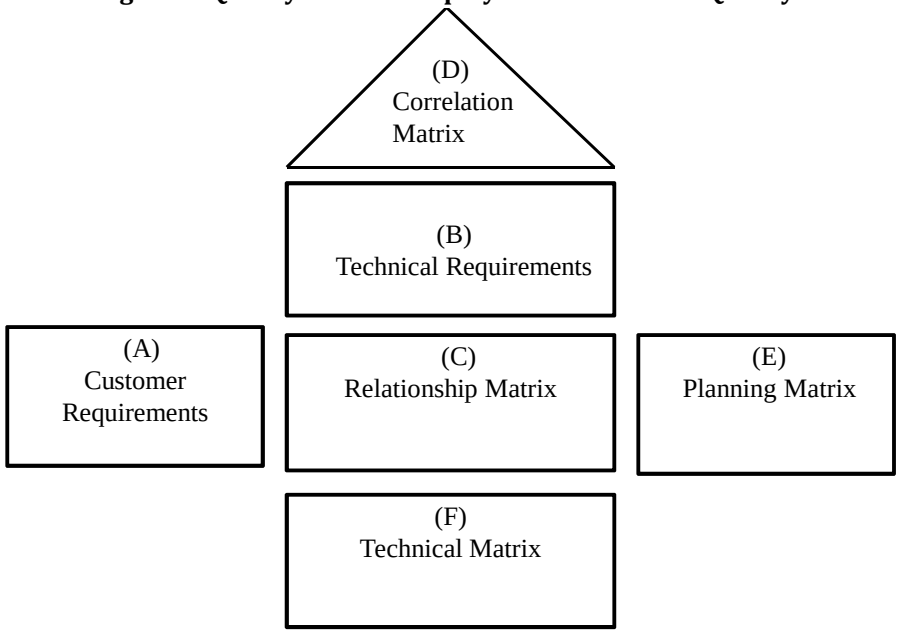
There are four key phases involved in QFD methodology (Romeo *et al*. 2014; Shen *et al*. 2000; Sullivan 1986).

Phase 1: Planning phase

This phase is called House of Quality (HOQ) and it is most commonly used part in QFD (Cohen, 1995). House of quality is a matrix style chart and conceptual map that correlates needs and wants of customers (customers' requirement) called "Whats" with technical requirement called "Hows" which fosters overall planning and communication among different functional areas of organization (Hauser & Clausing, 1988; Shen *et al*. 2000).

House of Quality includes following six sub matrices as shown in the figure 1.9 (Cohen, 1995; Bedi, 2011; Evans & Lindsay, 2009).

Figure 7. Quality function deployments - House of Quality



Source: Reproduced from Cohen (1995)

- Identifying Customer Requirement "Whats" (voice of customer or Customer need and wants)

Primary input in QFD process is voice of customer that is what are the needs and wants of customer from a product or a service. Proper marketing research has to be conducted to collect information from customer using focus group interview, personal or telephonic interview/survey or mail questionnaire etc.

- Identifying Technical Requirement "Hows"

Technical requirement provides bases for the design of product or service. Technical requirement are the design characteristics "Hows" by which organization respond to customer requirements "whats". Main Purpose of identifying Technical requirement "Hows" is to translate customer requirements "whats" into the terms that are measurable.

- Relationship matrix : Relationship between "Whats" and "Hows"

In this step relationship between "whats" and "Hows" is determined. This matrix shows whether technical requirement adequately addresses customer requirements. Experts' interviews or controlled experiments are carried out to determine theses relationship. Degree of relationship is represented by numbers 1, 3, and 9. 1, 3, and 9 represents weak, moderate and strong relationship respectively.

- Correlation matrix: Correlation between "Hows"

It is also called roof of House of Quality. It shows interrelationship between various technical requirements. This interrelationship indicates "How a change in a technical requirement does affect others?" Level of interrelationship is represented through following codification: Strong positive = +9, Positive = +3, Negative = -3, Strong Negative = -9

- Planning Matrix

In this step survey of customers is carried out to identify importance rating for each customer requirement "what" and evaluates company's products or services (In the case existing products or services improvements) and competitors' product or services for each customer requirement. Importance rating is the area of utmost interest and expectations uttered by customers and competitive evaluation involves strengths and weaknesses in competitors' products or services.

Through these steps areas of improvement, key selling point and priorities for design process can be identified.

- Technical Matrix

In this matrix evaluation of technical requirement of competitive products and services is carried out and targets for each technical requirement are developed and selected to deploy.

Phase 2: Design Phase (Romeo et al. 2014)

In this phase, with the help of brainstorming activity and through creative and innovative team ideas from design department of organization, numbers of design options are identified to satisfy customers' needs and wants.

Phase 3: Process Planning (Romeo et al. 2014)

Plans are prepared in this phase to implement identified design options.

Phase 4: Process Control (Romeo et al. 2014)

In this phase, performance measures are defined to measure the effectiveness of the processes involved in production of a certain product or service.

Benefits of QFD

- QFD lead to significant reduction up to 30% in start up and engineering cost (ReVelle et al.1998).
- In advance one can find out high risk areas during the design phase only and production process requirement (ReVelle et al.1998).
- Resource allocation will be more efficient (ReVelle et al.1998).
- Development time reduction (ReVelle et al.1998).
- Increase customer satisfaction level (ReVelle et al.1998).
- It assists team work and improves cohesiveness of team (ReVelle et al.1998).
- Spoken and unspoken needs and wants can be identified and prioritised through QFD model (King 1994; Einspruch et al. 1996; Hallberg et al. 1999; Lim et al. 1999; Chou 2004; Omachonu & Barach, 2005; Rahman & Qureshi, 2008; Aghlmand *et al*. 2010; Kuo *et al*. 2011; Raharjo &I. G, 2013; ReVelle *et al*.1998).
- It focuses on whole system rather than isolated product or service. (Lim & Tang 2000; Chaplin & Akao, 2003; Raharjo & I. G, 2013).

Limitations of QFD

(Bouchereau & Rowlands 1999; shen *et al*. 2000; Tan & Pawitra, 2011)

- Voice of customers can be ambiguous in nature.
- More subjective data and their analysis are involved.
- Manual Incorporation of customer survey information is difficult and time consuming.
- It assumes linear relationship between customer satisfaction and quality attributes

3. Research Gap

In competitive business environment, it is necessity for an organization to focus on providing quality services to satisfy the customers. This needs not only measurement of service quality but also to improve the existing service and adding innovative services. All past and most of the current research have focused on measuring the service quality through SERVQUAL or modified SERVQUAL scale that measure gap between Perception and expectation in different sectors. Even though there are some areas for further improvement in SERVQUAL such as, First, in certain cases SERVQUAL's use of a linear scale in its assignment of prioritization for improving service attributes may not be appropriate, second, SERVQUAL was not designed to address the element of innovation and third, SERVQUAL is not able to address how the gap can be closed. SERVQUAL is proved to be a very useful scale for assessing and

improving service quality, but it does not provide any solution to improve services. SERVQUAL gives more better result when it is used frequently to track service quality trends and used in combination with other forms of service quality measurement tools like Kano model, QFD etc., to overcome the causes underlying a key problem areas or gap identified by SERVQUAL. There is scope for integrating SERVQUAL with Kano model and Quality Function Deployment to achieve excellence in service quality. Very few researches have been carried out on this integration, this shows scope for integrated model that will help service provider to target and improve technical areas. These technical areas include technical characteristics which can strongly affect the customer's expectation and satisfaction level.

4. Conclusion

SERVQUAL is a concise multi item scale with good reliability and validity and it has been designed as a generic measure, to be applicable across a broad spectrum of service to measure service quality. When necessary, it can be modified or supplemented to fit the characteristics of particular service. It is used to identify and priorities the areas of excellence and improvement through service gap, which will provide a basis for formulating strategy and tactics to ensure the fulfillment of expectation. Despite its usefulness there are some areas which calls for improvement in SERVQUAL such as, linearity assumption, not being a tool for innovation and inability to provide solution for closing the gap. SERVQUAL can be further improved by using it in conjunction with other forms of service quality approaches like Kano model, QFD etc. There is scope for integrating SERVQUAL with Kano model and Quality Function Deployment to achieve excellence in service quality.

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An Empirical Study on Effectiveness of Web Based Training Methods

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Abstract

In the globalised corporate world, web based technology is being used as tool for imparting training to employees beyond geographical boundaries of the organization at a minimal cost. This study is aimed at evaluating effectiveness of Web Based Training (WBT) and also explored the effect of selective demographic variables such as age, team size, education and income. Empirical analysis supported that learning out come from using WBT method , by and large, affected by factors like mental focus of trainees, technical difficulties encountered during learning and to a lesser degree dimensions like self efficacy of trainees, negative thoughts had an impact on learning outcome.

Key words*: Technical difficulties, Self efficacy, Negative thought, Mental focus, Meta focus.*

Introduction

Advent of globalization of Indian corporate has created enormous thrust to improve the competency levels of people at all levels in line with multinational organizational standards of performance. Human, as an element of key resource in any business, has been emerging in a fast phase as critical differentiator of business outcome. This trend is observed not only in IT / ITES sectors but also in manufacturing industries look for competent workforce for improving business results. Web Based Training (WBT) has come handy for the professional trainers to cover up infinite population with a least cost and use this method as an effective approach. It is necessary to understand impediments in implementation of WBT methods for imparting knowledge and skills. In India, web based learning are offered by many lead institutions, professional associations and corporate spreading its units globally at different locations for enhancing levels of competency. However very little attempt has been made by the scholars to examine effectiveness of web based approach in delivering training. There are many successful studies on web-based training reported in the literature but most of these evaluated students in a special environment such as university campuses or were restricted to computer-savvy professionals in certain specialties or settings. Hence this study is undertaken to investigate and find solutions for enhancing usage of web based approach as an effective training tools since multiple locations employees would be main source true challenges for training professionals.

Review of Literature

Future of training instructional model hinges on virtual classrooms using web based training instructions. Technology takes a centre stage of delivering of training instructions and trainees / learners through web enabled programmes confront with a variety of workplace and technological interruptions. It is quite often found that web based instructions to learner adopts simulation techniques to impart training. In the whole process of imparting knowledge, technology occupies core control determinant of quality deliverables. Technological interruptions significantly relate with some of the dimensions such interruption (frequency, duration and timing) content (relevance and complexity). In general, interruption frequency affects the mental focus, meta cognitions and learning

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speed of the trainees and at times technical interruptions might lead to more attrition (dropping out or withdrawing from programs) of trainees and at times technical interruption causes dissociation of trainees from the effective learning process. Some of the notable scholars on the subjects are reviewed briefly with a view to gain right perspectives in to web based training related stream research and related literature.

Noe (2011) suggests that many new technologies have features which ensure perfect learning and transfer of learning at work place. Present technologies provide variety of options to the trainers such as Computer based training, CD-ROM, Internet, Intra net, E-learning, Distance Learning, Intelligent tutoring, simulations and virtual reality. Training related to operation of machineries, tools and equipment can be best imparted using Virtual reality and intelligent tutoring. Technologies like CD-ROM, internet, intranet and E-learning are best suited for teaching facts, figures, cognitive strategies and interpersonal skills. Training delivered on public or private computer networks and displayed by web browser or in other word Internet based training. Baldwin-Evans (2004) selected a sample of 200 employees across 16 organizations and 14 countries to examine what percentage of trainees complete web based training programs. The study findings confirm that 77 percent of those surveyed expressed their inability to complete courses in one attempt due to various interruptions such as time constraints, work place interruptions etc., Welsh, Wanberg, Brown and Simmering (2003) found that technical difficulties are considered as one of the main causes for higher attrition rate in web based training and poor levels of learning while comparing with traditional methods of training. North, Strain and Abbolt (2000) viewed that trainees experienced frustrations arising from technical difficulties in the web based training and that led to have negative impact on satisfaction levels with the instructional experience(Wentling, Park and Pieper, 2007). Yeo and Neal (2004) argued that self efficacy of trainees is another important dimension in learning process. It is found from growing body of research that individual differences influence trainees self regulatory processes and learning ability over a period of time. Specier et.al., (2003) identified technological difficulties, self efficacy, negative thoughts, mental focus,metacognition are some of the broader issues influence learning through web based training. Above review provides a scope for selecting appropriate variables for undertaking effectiveness study in web based training and hypotheses are framed on the basis of reviewed literature.

Operational Definitions of Variables

The following variables are selected for the purpose of understanding WBT influence on learning outcome from the web based training.

Technical difficulties: It is an interruption that occurs while learning through web based training which brakes continuity of cognitive process on a learning.

Self Efficacy: Trainees confidence levels in both their computer skills and their ability to overcome technical difficulties for enhancing learning values.

Negative thoughts: Trainees' thought process while undergoing WBT arising from technology, lack of clarity on training content, and the like.

Mental focus: Trainees' ability to concentrate and absorb in to learning through WBT.

Meta Cognition: Trainees' knowledge levels and control over learning process

Learning: Knowledge acquired from WBT is assessed at the end of each learning event by making trainees to respond for specific multiple choice assessment tools based on the contents of training.

Objectives

This study id intended to explore the following research areas:

(a) Assess the levels of effectiveness of web based learning

(b) Examine demographic impact on learning ability through web based learning.

Hypotheses

Ho_1 There is no significant perceptual differences that exist towards study dimensions such as technological difficulties, self efficacy, negative thoughts, mental focus, meta cognition and learning on the basis of selective demographic variables like age group, team size, education and income.

Ha_1: There is significant perceptual differences that exist towards study dimensions such as technological difficulties, self efficacy, negative thoughts, mental focus, meta cognition and learning on the basis of selective demographic variables like age group, team size, education and income.

Ho_2: Study dimensions such as technological difficulties, self efficacy, negative thoughts, mental focus, and Meta cognition are not significantly related by explaining variance in Learning from WBT.

Ha_2: Study dimensions such as technological difficulties, self efficacy, negative thoughts, mental focus, and Meta cognition are significantly related by explaining variance in Learning from WBT.

Methods

This study was conducted in manufacturing organization having manufacturing units at multiple locations globally. The organization offered one specific web based training programs recently with an objective of imparting knowledge to their staff members in Integrated management system (ISO – standards meant for QMS,EMS & OSHAS) and the same was taken for assessment of effectiveness of web based training. A total of 457 questionnaire instruments were administered and 307 responded. Out of this valid 300 questionnaires were used for this study. The response rate was 67 percent. All employees of the organization, who had participated in the said web based training program, received instruments. The decision to include all participants of the program was made in anticipation of a low response rate and the paucity of time to follow up for a better response rate.

Measurement

Based on literature review, the questionnaire was designed and each study dimensions had specific items for measurements viz., technological difficulties (5 items), self efficacy (7items), negative thoughts (5 items), mental focus (6 items), and meta cognition (6 items). All these predictor variables of learning were measured with five point scale

(1= strongly disagree, 2= disagree, 3 = neutral, 4 = agree, 5 = strongly Disagree).Learning, as dependent variable, was assessed by administering 20 items as memory recall test after completion of training and scores were taken and graduated as 0-100 percent. The reliability and validity of questionnaire was ensured through cronbatch alpha values and eliciting views from specialist professional trainers. Further Pilot study has provided for making necessary changes in questionnaire.

Analysis

The descriptive statistics such as mean and standard deviation computed values are given in the table no 1. These mean values are presented in reference to the five point scale used in the questionnaire for a meaningful analysis. The scores of the negative statements (reverse) in the questionnaire are reversed for computing the mean values. Analysis of the data provided in Table No.1 reveals that the over all mean score of technological difficulties occupy first position in relative ranking and other variables are placed in descending orders of self efficacy, learning, mental focus, negative thoughts, and meta cognition on the basis of computed mean values. The mean ranking indicated that the technological difficulties, self efficacy, and learning occupy more towards positive higher end of scale continuum comparatively and rest of the study variable viz. mental focus, negative thoughts, and meta

cognition are placed more or less around middle point of scale of continuum in terms of its computed mean values.

Table No. 2 presents the results of the ANOVA for significant difference in study variables and its influencing ability based on age group of respondents. It is summarized from table that age group as demographic variable showed significant differences in the negative thoughts (F = 3.417, p = < 0.001), mental focus (F = 7,506, p = < 0.001) and meta cognition (F = 7.750, p = < 0.001). However results of ANOVA showed insignificant relationship in respect of technological difficulties, self efficacy, learning with in age group. All the study dimensions viz., technical difficulties (F = 5.133, p = <0.001), self efficacy (F = 12.282, p =< 0.001), negative thoughts (F= 9.789, p = ,0.001), mental focus (F = 8.073 , p = < 0.001), metal cognition (F = 12.033, p = <0.001), and learning (F = 15.263, p = < 0.001) showed significant relationship with education. Similarly Income also exhibited significant relationship with study dimensions viz., technical difficulties (F = 5.603, p = <0.001), self efficacy (F = 12.962, p =< 0.001), negative thoughts (F= 11.364, p = ,0.001), mental focus (F = 19.894 , p = < 0.001), metal cognition (F = 25.668, p = <0.001), and learning (F = 7.854, p = < 0.001) and hence the null hypothesis was rejected in respect demographic variables education and income. Number of members in the team showed no statistical difference with any of the study dimensions and the null hypotheses was accepted.

Second hypothesis of this study put in to test using hierarchical regression model and results are narrated in the table no 3. The linear regression output as a model reveals that the entire study variables contribute for explaining variance in the learning. The R^2 value is indicator measure of how much of the variability in the learning, is accounted for by the each predictor's variable. In summary, impact is found in the relative order of the mental focus (multiple R=0.948, R2 =0.898, p=<0.001), technological difficulties (multiple R = 0.540, R2 = 0.292, p =0.001 self efficacy (multiple R=0.628, R2=0.394, p=<0.001). meta cognition (multiple R=0.994, R2=0.987, p=<0.001) and finally negative thoughts (multiple R=0.656, R2=0.431, p=<0.001). Further it is inferred that relative explanatory power of the variables are listed in the order of descending viz., mental focus (MF), technological difficulties (TD), self efficacy (SE), meta cognition (MC),and negative thoughts (NT). As an aggregate regression model, all the independent variables together have explained variance to the extent of 98.7 Percent in the dependent variable learning. This finding is clearly confirm this the research work had chosen most appropriate impacting variables as predictors and thus established predictors impact on the dependent variable significantly. Hence, the alternative hypotheses are accepted and accordingly it is concluded that all five predictors impacted the web based learning outcome significantly and thereby it is conclusively established that learning as an outcome of WBT are critical determinants of effectiveness of web based training.

Findings and Discussion

One of the main strength of this study is that sample covered a broad spectrum of employees with varying levels of age, education, income and team size. Findings of the study reveal that all study dimensions exhibited statistically significant variance in learning and confirm that the effectiveness of WBT relays on the factors like Technical difficulties, self efficacy, Negative thoughts, mental focus, and Meta cognition.

In summary, it is found from the results of regression analysis that technical difficulties and mental focus are most influencing variables on WBT outcome. Comparing differences in the effects of technical difficulties on learning processes and its

Out comes provide strong evidence for the importance of accounting for trainees losing interest for focused learning. Trainees may even eventually drop from the training if the option is provided to them. It is natural response for any trainees, with low self efficacy, to the situation of encountering technical

difficulties may lead to increased negative thoughts and decreased learning. Conversely, in the investigated samples there was no such scope for trainees to withdraw from the training as such as it is training of Integrated Management system certification program and main objective of the training is to make them to implement ISO system by interpreting standards learned from WBT. The vast majority of Web-based training research focuses exclusively on trainees who complete the course (e.g., Johnson et al., 2000; O'Neil & Poirier, 2000) and interestingly this study is also focused on completed trainees of WBT.

In this study, negative thoughts as predictor had very negligible percentage of explanatory variance in learning .Chen, Gully, and Eden (2004) found negative affectivity had a detrimental effect on learning. Resource allocation theory (Kanfer & Ackerman, 1989) provides a sound theoretical basis for understanding these results. Individuals have a limited pool of attentional resources, which can be directed towards on-task thoughts, off-task thoughts, or regulatory functions (Kanfer & Ackerman). These attentional foci all draw from the same resource pool. Thus, as more resources are directed towards off-task thoughts (e.g., negative thoughts), there are fewer remaining resources to be directed towards on-task thoughts (i.e., learning the training material).

Study findings indicate that age as a demographic variable influenced negative thoughts, mental focus and meta cognitions of trainees. Levels of maturity relates with the age in many psychological stream of research (Welsh et.al. 2003). It is evident from such studies that age could be a factor to be reckoned for its influencing ability in learning from WBT. In this study, education and income had statically significant relationship with all independent variables. It is confirmed from results of ANOVA that the effectiveness of WBT can also be influenced by demographic variables like education and income levels of trainees. Further it is inferred that mere robust design and delivery mechanism of WBT alone not sufficient enough to enhance the learning levels of trainees from WBT and some of the demographic variables have also influenced the training outcome. It is pertinent to look at studies of Debourgh (2003) and Cook (2005) .In their studies, findings evidenced that education of trainees has greater impact on WBT learning and satisfaction there from. This study findings are also fully echoed views of these scholars. Results on education with that of study dimensions concludes that even employees who are not computer naïve can successfully complete their WBT (Blair, 2003).

Conclusion

At present, the literature on web-based training in manufacturing setting is limited. Our study systematically evaluated the use of web-based training across a broad spectrum of

Employees in a large integrated delivery network at multiple international locations. The results suggest that web-based training can serve as a primary method of training to impart organizational initiatives like ISO standards for implementation at their geographically dispersed respective work sites. Demographic factors such as education and income levels of trainees had totally influenced on all study dimensions and WBT is not influenced by the team size. Age of the trainees showed significant relationship with some of the predictors viz., negative thoughts, mental focus and meta cognition.

Based on the empirical evidence it is concluded that learning as an outcome of WBT is largely statically significantly affected by factors like mental focus of trainees, technological difficulties encountered while learning, and to lesser degree learning affected by self efficacy of trainees, meta cognition and negative thoughts.

Research Limitation

This study has all limiting factors of exploratory research and confined its data collection and interpretations to single organizations using one WBT programs. The longitudinal studies with specific focuses on multiple organizations with different WBT programs may provide greater insight in to effectiveness of WBT as means of training delivering method.

Implications

The present study is made in the organizational setup functioning at multiple locations globally and predictors chosen for investigations would be more appropriate for using in similar study field. This study is also made an attempt to provide constructs description which would enable future researchers to frame the tools of investigation with ease. Any organizational need based training imparted through WBT method can relay on this research works.

Future Research

The study findings indicate technical difficulties as most critical variable in learning besides mental focus. It is suggested that technical difficulties alone can be taken as variable for understanding its influence at various stages of learning would provide in depth evidence on effectiveness of WBT methods. Research investigation on paid training programs of WBT methods might provide different outcome in the matter relating to trainees self efficacy levels, mental focus and meta cognition.

Tables

Table No: 1. Descriptive Statistics of Study Variables

n =300

Sl. No.	Study Variables	Mean	Mean Rank	Standard Deviation
1.	Technological Difficulties (TD)	41.02	1	4.84
2.	Self Efficacy (SE)	39.69	2	5.69
3.	Negative thoughts (NT)	26.59	5	3.73
4.	Mental Focus (MF)	28.88	4	5.70
5.	Meta Cognition (MC)	24.44	6	4.57
6.	Learning (L)	32.25	3	3.50

Table : 2 ANOVA Results of Study Dimensions and Demographic Variables

Independent Variables		Dependent variable	Dependent variable	Dependent variable	Dependent variable	Dependent variable	Dependent variable	N =300
Frequency		TD	SE	NT	MF	MC	L	
		Mean	Mean	Mean	Mean	Mean	Mean	
1. Age	Young (35 or less)	40.87	39.26	26.20	27.94	23.72	31.97	183
	Lower Middle (36-45)	41.03	40.01	27.01	30.08	25.24	32.54	99
	Upper Middle (46 +)	42.50	42.28	28.22	31.89	27.33	33.56	18
	F – Ratio, p – Level	0.922 NS	2.575 NS	3.417 0.001	7.506 0.001	7.750 0.001	2.170 NS	
2.Size of team	Small (3 or less)	41.16	39.50	26.58	29.14	24.75	32.09	160
	Medium (4-5)	40.96	39.98	26.66	28.85	24.29	32.36	121
	Larger (6 +)	40.26	39.37	26.21	26.95	22.74	32.89	19
	F – Ratio, p – Level	0.309 NS	0.279 NS	0.121 NS	1.259 NS	1.759 NS	0.543 NS	
3.Education	High School & HSC	40.74	38.76	26.08	28.05	23.22	31.61	74
	UG or Equivalent	39.59	37.40	25.21	27.04	23.01	30.71	68
	PG and above	41.77	41.11	27.42	30.06	25.62	33.22	158
	F – Ratio, p – Level	5.133 0.001	12.282 0.001	9.789 0.001	8.073 0.001	12.033 0.001	15.263 0.001	
4.Income	Rs. 20000 or less	40.26	38.09	25.61	26.86	22.68	31.45	155
	Rs. 20001 - 30000	41.04	40.28	26.92	30.05	25.30	32.54	79
	Rs. 30001 - 40000	41.46	41.27	27.50	30.42	25.77	33.50	26
	Rs. 41000 +	43.68	43.68	29.10	33.42	22.68	34.00	40
	F – Ratio, p – Level	5.603 0.001	12.962 0.001	11.364 0.001	19.894 0.001	25.668 0 .001	7.854 0.001	

Table No: 3 Results of Linear Regression analysis of Independent Variables with Learning (Dependent Variables)

Independent variables	Std. Coefficient Beta	t	R	R2	p	F
Technical Difficulties	0.540	11.077	0.540	0.292	0.000	0.000
Self efficacy	0.597	7.079	0.628	0.394	0.000	0.000
Negative thoughts	0.540	4.389	0.656	0.431	0.000	0.000
Mental focus	0.968	36.858	0.948	0.898	0.000	0.000
Meta cognition	0.896	45.274	0.994	0.987	0.000	0.000

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Institutional Reforms and Export Efficiency of Indian Pharmaceutical Industry – A Comparative Analysis of Transitory-TRIPS and Post-TRIPS Periods

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Abstract

The impact of institutional reforms on the performance of various industries in many emerging economies had been a growing area of research in the recent times. In this context, we investigate the influence of institutional reforms on the export efficiency of Indian pharmaceutical industry after India became a signatory to the provisions of World Trade Organisation (WTO) from 1st January, 1995. India had been given a transition period of 10 years till 31st December, 2004 to fully comply with Trade Related Intellectual Property Rights (TRIPS) as per the provisions of WTO agreement. Accordingly, India has completely transitioned to a product-patent regime from a process-patent regime effective from 1st January, 2005. Many researchers and industry professionals of the Indian pharmaceutical industry postulated that the institutional reforms would have a negative effect on the growth prospects of the industry. Contrary to the predictions, Indian pharmaceutical industry has capitalized on the export opportunities in various developed and emerging economies in the world. In this backdrop, we measure the export efficiency of Indian pharmaceutical industry during transitory-TRIPS (1995-2004) and post-TRIPS (2005-2014) periods using data envelopment analysis (DEA). The analysis of our research indicates that the export efficiency of the Indian pharmaceutical industry was higher in the post-TRIPS period.

Key Words: *Export efficiency, Indian pharmaceutical industry, Institutional reforms, Post-TRIPS, Transitory-TRIPS*

Introduction

The primary focus of many studies in strategic management research pertains to measuring corporate performance in terms of financial measures alone. In this process, earlier research neglected the significance of efficiency measurement in determining corporate performance (Chen, Delmas & Lieberman, 2015). Measuring efficiency using frontier methodologies like data envelopment analysis (DEA) and stochastic frontier analysis (SFA) can help to bridge this gap (Chen, Delmas & Lieberman, 2015).

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Though measuring efficiency of firms in different industries has earlier been attempted, very few studies (Pusnik, 2010; Saranga, 2007) have considered export efficiency as a measure of firm performance. In this research we attempt to contribute to this nascent area of research in the context of emerging economies by comparing the export efficiency of Indian pharmaceutical industry (IPI) in two different time periods of institutional reforms – transitory-TRIPS period (1995-2004) and post-TRIPS period (2005-2014). Some of the earlier studies have analysed the export efficiency of Indian pharmaceutical firms either during the transitory-TRIPS period (1995-2004) or during post-TRIPS period (2005-2014). The unique contribution of our research lies in the fact that it analyses and compares the export efficiency of IPI across two different periods and discusses how the export efficiency of the industry varied during transitory-TRIPS and post-TRIPS periods.

In this research, we have made an attempt to examine the export efficiency of the IPI during the transitory-TRIPS and post-TRIPS periods using Data Envelopment Analysis (DEA). Very few earlier studies examined the export efficiency of firms in the context of various nations and their constituent industries. Saranga (2007) studied the export efficiency of Indian pharmaceutical firms during the transitory-TRIPS period. Naude and Serumaga-Zake (2003) investigated the export efficiency of multiple South African industries. Pusnik (2010) examined the export efficiency of various Slovenian industries.

In view of the variables considered in the earlier studies, we measured export efficiency by taking export sales as output variable in this study. We have used R&D expenses, import of raw materials, compensation paid to employees and marketing expenses as input variables for employing DEA. We investigated export efficiency through calculation of Constant Returns to Scale Efficiency (CRSTE) and Variable Returns to Scale Efficiency (VRSTE) and Scale Efficiency (CRSTE/VRSTE) during transitory-TRIPS and post-TRIPS periods.

Export efficiency is measured by using data envelopment analysis (DEA). DEA has received increasing importance as a tool for evaluating and improving the performance of manufacturing and service operations (Talluri, 2000). It has been extensively applied in performance evaluation and benchmarking of schools, hospitals, bank branches, production plants, etc. (Charnes, Cooper, Lewin & Seiford, 1994). DEA is a multi-factor productivity analysis model for measuring the relative efficiencies of a homogenous set of decision making units (DMUs). Charnes, Cooper and Rhodes (1978) coined the term data envelopment analysis (DEA) by proposing an input orientation with constant returns to scale (CRS) model. Banker, Charnes and Cooper (1984) proposed the variable returns to scale (VRS) model.

As mentioned earlier, we measured export efficiency by taking export sales as output. Research and development (R&D) expenses, import of raw materials expenses, compensation paid to employees and marketing expenses are taken as inputs. Using data envelopment analysis, we measured export efficiency through calculation of CRSTE (constant returns to scale technical efficiency) and VRSTE (variable returns to scale technical) efficiency. Additionally Scale Efficiency (CRSTE/VRSTE) was measured for the sample firms during transitory-TRIPS and post-TRIPS periods.

Theoretical Framework, Model Specification and Review of Literature

Theoretical Framework

Data Envelopment Analysis (DEA) is a relatively new "data oriented" approach for evaluating the performance of a set of peer entities called Decision Making Units (DMUs) which convert multiple inputs into multiple outputs. The definition of a DMU is generic and flexible. Recent years have seen a

great variety of applications of DEA for use in evaluating the performances of many different kinds of entities engaged in many different activities in many different contexts in many different countries.

DEA has been used in many disciplines to evaluate the performance of entities such as operations research, management control systems, organization theory, strategic management, economics, accounting & finance, human resource management and public administration including the performance of countries and regions (Rouse, 1997). Because it requires very few assumptions, DEA has also opened up possibilities for use in cases which have been resistant to other approaches because of the complex (often unknown) nature of the relations between the multiple inputs and multiple outputs involved in DMUs.

Data envelopment analysis (DEA) is a mathematical method based on production theory and the principles of linear programming. DEA was initiated in 1978 when Charnes, Cooper and Rhodes (1978) demonstrated how to change a fractional linear measure of efficiency into a linear programming (LP) format. As a result, decision- making units (DMUs) could be assessed on the basis of multiple inputs and outputs, even if the production function was unknown. It enables one to assess how efficiently a firm, organization, agency, or such other unit uses the resources available inputs to generate a set of outputs relative to other units in the dataset (Ramanathan 2003; Silkman 1986).

This non-parametric approach solves an LP formulation per DMU and the weights assigned to each linear aggregation are the results of the corresponding LP. The weights are chosen so as to show the specific DMU in as positive a light as possible, under the restriction that no other DMU, given the same weights, is more than 100% efficient.

Since DEA in its present form was first introduced in 1978, researchers in a number of fields have quickly recognized that it is an excellent and easily used methodology for modelling operational processes for performance evaluations. DEA's empirical orientation and the absence of a need for the numerous a priori assumptions that accompany other approaches (such as standard forms of statistical regression analysis) have resulted in its use in a number of studies involving efficient frontier estimation in the governmental and non-profit sector, in the regulated sector, and in the private sector.

In their originating study, Charnes, Cooper and Rhodes (1978) described DEA as a *'mathematical programming model applied to observational data [that] provides a new way of obtaining empirical estimates of relations - such as the production functions and/or efficient production possibility surfaces – that are cornerstones of modern economics'.*

Model Specification

Data envelopment analysis (DEA) is a non-parametric tool because it requires no assumption on the shape or parameters of the underlying production function. DEA is a linear programming technique based on the pioneering work of Farrell's efficiency measure (1957), to measure the different efficiency of decision-making units (DMUs). Assuming the number of DMUs is s and each DMU uses *m* inputs and produces *n* outputs. Let DMU_k be one of s decision units, $1 \leq k \leq s$. There are *m* inputs which are marked with X_i^k (i = 1, ..., m), and n outputs marked with Y_j^k (j = 1,...., n). The efficiency equals the total outputs divide by total inputs. The efficiency of DMU_k can be defined as follows:

$$\text{The efficiency of DMUk} = \frac{\sum_{j=1}^{n} u_j y_j^k}{\sum_{i=1}^{m} v_i x_i^k} \quad (1)$$

$$X_i^k, Y_j^k \geq 0, i = 1,\ldots,m,\ j = 1,\ldots,n, k = 1,\ldots,s$$

$$u_j\ v_i \geq 0, i = 1,\ldots,\ j = 1,\ldots,n$$

The DEA program enables one to find the proper weights which maximise the efficiency of DMU and calculates the efficiency score and frontier. The CCR model originated by Charnes *et al.*, (1978), has led to several extensions, most notably the BCC model by Banker, Charnes and Cooper (1984). The CCR and BCC models can be divided into two terms; one is the input oriented model; the other is the output oriented model. The input orientation seeks to minimize the usage of inputs given a fixed level of output while the output orientation maximizes the level of output for a given level of inputs. The CCR model assumes constant returns to scale (CRS) which means one unit input can get fixed value of output. The BCC model assumes variables returns to scale (VRS).

In this research the input oriented model had been chosen and a dual problem model was used to solve the problems. The CCR dual model is as follows:

$$Min\theta - \varepsilon \left[\sum_{i=1}^{m} S_i^- + \sum_{k=1}^{n} S_j^+\right] \quad (2)$$

$$s.t. \sum_{i=1}^{s} \lambda_r X_i^r - \theta X_i^k + S_i^- = 0\ i = 1,\ldots,m$$

$$\sum_{i=1}^{s} \lambda_r Y_j^r - S_i^+ = Y_j^r\ \ j = 1,\ldots,n$$

$$\lambda_r \geq 0 \quad r = 1,\ldots,s$$

$$S_i^- \geq 0 \quad i = 1,\ldots,m$$

$$S_J^+ \geq 0 \quad j = 1,\ldots,n$$

Where

θ is the efficiency of DMU

S_i^- is the slack variable which represents the input excess value,

S_J^+ is the surplus variable represents the output shortfall value,

ε is a non-Archimedean number which represents a very small constant,

λ_r means the proportion of referencing DMUr when measure the efficiency of DMUk.

If the constraint below is adjoined, the CCR dual model is known as the BCC model.

$$\sum_{i=1}^{s} \lambda_r = 1 \quad (3)$$

Equation (3) frees CRS and makes the BCC model to be VRS. For the measurement of efficiency, the CCR model measures overall technical efficiency (OTE) of a DMU and the BCC model can measure both the pure technical efficiency (PTE) and scale efficiency (SE) of the DMU. The relationship of OE, PTE and SE is as the equation (4) below.

SE = OTE/PTE (CRS technical efficiency / VRS Technical Efficiency) (4)

Accordingly in this research, export efficiency of the IPI was examined by estimating CRS technical efficiency, VRS technical efficiency and scale efficiency.

Review of Literature

Mukherjee, Nath and Pal (2003) developed a framework to measure the efficiency of Indian banking sector using 'resource-service quality-performance' triad for 27 public sector banks. Out of the 27 banks included in the study, only nine banks were found to be completely efficient. The same banks were also found to be efficient with respect to return to quality efficiency as well. It was concluded that banks that deliver better service were found to be using their resources more efficiently to deliver superior performance.

Subbanarasimha, Ahmad and Mallya (2003) investigated the technological knowledge efficiency of 29 US pharmaceutical firms for the period 1967-1972 using DEA. Return on capital (ROC) and sales growth were considered as output variables while breadth of technological knowledge and depth of technological knowledge were considered as input variables. It was found that only 6 firms were found to be efficient using ROC as output while only one firm was found be efficient using sales growth as the output.

Chen, Chien, Lin and Wang (2004) evaluated the R&D performance of 31 Taiwanese computer firms using DEA for the period 1997. Age of the firm, paid-in capital, R&D expenses and number of R&D employees were considered as input variables. Two output variables – annual sales and number of patents approved for each firm were included as output variables. 13 firms out of the total sample of 31 firms were found to be totally efficient. 17 firms were found to be technically efficient while 13 firms were concluded to be scale efficient.

Galagedera and Edirisuriya (2005) investigated the performance of Indian commercial banks for the period 1995-2002 using DEA. Total deposits and operating expenses were included as inputs while loans & other earning assets were considered as outputs. The sample included 17 public sector banks and 23 private-owned banks. The study concluded that smaller banks were found to be less efficient while highly efficient banks were found to have high equity-assets ratios and high return to average equity ratios.

Theodoridis, Psychoudakis and Christofi (2006) employed DEA to analyse the efficiency of 108 sheep-goat farms in Greece for the year 2001-2002. Gross output (in Euros) was used as the output whereas nine variables were used as inputs – number of sheep in the herd; number of goat in the herd; acreage on irrigated land; acreage on non-irrigated land; labour used in hours; machinery expenses in Euros; buildings expenses in Euros; variable cost in Euros and feed purchased in terms of tons. It was found that the mean technical efficiency was 0.944 and 67 firms in the entire sample were found to be technically efficient.

Sahoo, Sengupta and Mandal (2007) estimated the productivity performance of Indian (public & private) and foreign banks operating in India for the period 1997-98 till 2004-05. 33 banks (11 public; 8

private; 14 foreign) were included in the study. Efficiency was examined using three measures – technical efficiency; cost efficiency and scale elasticity. The study concluded that technical efficiency was found to improve among all types of banks during the period of study. Foreign banks were found to be more cost efficient in comparison to Indian public and private sector banks.

Saranga (2007) analysed the efficiency of firms belonging to IPI using multiple objective DEA for the period 1992-2002. A sample of 44 firms was considered for the study considering the continuous availability of data for the inputs and outputs included in the study. The regular inputs considered were production cost, material cost and man power cost. The regular outputs considered were net sales and profit margins. Additionally, R&D expenditure and export sales were considered as special outputs. The findings indicated that firms with higher exports as output emerged as more efficient firms in comparison to firms with lower export sales.

Afonso and Santos (2008) used DEA to measure the relative efficiency of 52 public universities in Portugal for the year 2003. The total sample of universities has been sub-divided into smaller groups depending upon the type of university and data availability. Full-time teachers to student ratio and spending per student were taken as inputs. Success rate of students and number of doctorate certificates awarded by the university were taken as outputs. It was found that only six universities were operating at full efficiency by examining the variable returns to scale technical efficiency (VRSTE) scores.

Feroz, Goel and Raab (2008) measured the performance of 26 pharmaceutical companies in USA using DEA during the period 1994-2003. In this study, the authors used an 'income efficiency' measure which considered revenues to be maximized while minimizing factors like long term debt, common equity, selling & administrative expenses, interest & tax expenses, cost of goods and firm specific risk. All the firms have been ranked every year based upon their income efficiency scores. It was found that firms like Pfizer and Allergan improved their rankings while five firms (Glaxo Smithkline; Johnson & Johnson; Schering-Plough; Genentech & Bristol-Myers-Squib) have experienced sharp decline in their rankings. The authors concluded that the results of the study can be beneficial to financial analysts to assess the performance of pharmaceutical firms. The results can help analysts to evaluate the top management teams in terms of their corporate governance practices which in turn impact the business performance of firms. Bhagavath (2009) measured the efficiency of transportation of various state-owned transport corporations in India using DEA. The author analysed the technical efficiency of 44 state-road-transport corporations in India for the period 2000-2001. Fleet size, average distance travelled by a bus per day and cost of running the bus per day were considered as the input variables while revenue generated per day per bus was considered as the output variable. It was found that only eight out of the 44 transport corporations included in the study were found to be technically efficient. (ASRTU and CRT)

Ozbek, Garza and Triantis (2009) analysed the efficiency of six departments of transportation (DOT) in six states of USA using DEA. Cost of highway maintenance was included as input whereas level of service score and timeliness-of-response score were considered as outputs. The results obtained using Charnes-Cooper-Rhodes Model (CCR Model) concluded that only three out of the six state departments of transportation considered for the study were efficient.

Saranga (2009) estimated the operational efficiency of India auto components industry using DEA. A set of 50 firms was included in the study for the year 2003. Raw material costs, labour costs, cost of capital and sundry cost were included as input variables while gross income was considered as the output variable. It was found that out of the 50 sample firms, 14 firms were found to be efficient while 36 firms

were reported to be inefficient using constant returns to scale (CRS) model. Similarly, 21 firms were found to be efficient and 29 firms were concluded to be inefficient using variable returns to scale (VRS) model. The author has further used the efficiency scores as the dependent variable and investigated the determinants of efficiency by considering capital employed, average inventory, net working capital cycle and royalty payments as independent variables. Multiple regression analysis method was employed to examine the determinants of efficiency of auto components industry.

Saranga and Phani (2009) investigated the determinants of operational efficiencies of 44 Indian pharmaceutical firms using DEA for the period 1992-2002. Cost of production & selling, raw material cost and wages & salaries were considered as inputs whereas net sales were considered as the output variable. The study found that out of 44 sample firms, only 8 firms were found to be efficient during the period considered for the study. The eight firms were identified as those firms which were found to be efficient in at least five or more years out of the eleven year period considered for the study. The remaining 36 firms were found to be efficient only in four years or less during the entire period of study.

Tahir and Memon (2011) examined the efficiency of 14 top manufacturing firms in Pakistan using DEA for a five year period (2006-2010). Total expenses and total assets were included as input variables while sales and profit before tax were considered as output variables. Only one firm was found to be technically efficient in all the five years using the constant returns to scale (CRS) model.

Hoque and Rayhan (2012) estimated the efficiency of 24 banks in Bangladesh using DEA for the year 2010. Operating profit was included as the output variable while operation income, operation cost, total assets and deposits were considered as input variables. It was concluded that out of the 24 banks included in the study only three banks were found to be efficient using constant returns to scale technical efficiency (CRSTE) while 12 banks were efficient using variable returns to scale technical efficiency (VRSTE). Three banks were found to be scale efficient among all the banks considered for the study.

Kumar and Kumar (2012) investigated the efficiency of 27 Indian public sector banks for the period 2008-2009 using Reserve Bank of India (RBI) data base. CCR Model and BCC Model of DEA were used for the study. Interest expended and operating expenses were considered as inputs whereas net interest income and non-interest income were taken as output measures. Out of the total sample of 27 banks, 10 banks were found to be efficient using BCC Model (VRS) while only 6 banks were found to be efficient using CCR Model (CRS).

In another study on the Indian banking industry, Singh, Kedia and Singh (2012) have examined the efficiency of 18 public and private sector banks over a ten year period (2001-2011) using DEA. The study included deposits, assets and profits as output measures and various factors related to employees, factors related to each branch, issues related to operations, factors impacting liquidity and profitability of the banks as input measures. The study concluded that out of all the 18 banks considered for the study, only four banks were found to be highly efficient (SBI; Canara Bank; IDBI and ICICI).

Memon and Tahir (2012) compared the efficiency scores of 49 Pakistani firms belonging to various industries. The efficiency scores were calculated using DEA for a three-year period (2008-2011). Cost of raw materials, salary and wages, plant & machinery and cost of goods sold were included as inputs while net sales and earnings after tax were considered as output variables. The research concluded that only eight firms were efficient during the period of study. Further, 13 firms were concluded to be star performers when all the sample firms have been analysed with the help of performance-efficiency matrix.

Minh, Long and Hung (2013) estimated the efficiency of 32 commercial banks in Vietnam using DEA during the period 2001-2005. In this study - received income, other operating income and total loans were included as outputs whereas personnel expenses, net total assets, all deposits and labour were included as inputs. It was found that 12 banks were efficient in 2001, 11 banks were efficient in 2002, 10 banks were efficient in 2003, 12 banks were efficient in 2004 while 11 banks were efficient in 2005 using the Banker, Charnes and Cooper Model (BCC Model).

In a very unique and interesting study, Tripathy, Yadav and Sharma (2013) compared the efficiency and productivity of IPI during the process patent (2001-02 to 2004-05) and product patent (2005-06 to 2008-09) regimes. A sample of 81 large Indian pharmaceutical firms was included in the study. Efficiency of the industry was measured using DEA and productivity was measured using Malmquist Productivity Index (MPI). Domestic sales values and export sales of the firms were considered as output variable while cost of materials, cost of energy, wages & salaries and advertising costs were included as inputs. Using VRSTE method, 28 firms were found to be efficient in the process patent regime in comparison to 19 firms in the product patent regime. In terms of scale efficiency, 14 firms were found to be scale efficient in the process patent era in comparison to 20 firms in the product patent era. It was finally concluded that technical efficiency and productivity of IPI has increased had comparatively increased in the product patent regime than in the process patent regime.

Mahajan, Nauriyal and Singh (2014a) presented an analysis of the technical efficiency of IPI using DEA. The authors investigated a sample of 50 Indian pharmaceutical firms for the period 2010-2011. Net sales revenue was included as the output variable while raw material cost, salaries & wages, advertising & marketing cost and capital usage cost were considered as the inputs. The results indicated that out of the 50 sample firms, only 9 firms were found to scale efficient while the remaining 41 firms were reported to be scale inefficient.

Mahajan, Nauriyal and Singh (2014b) examined whether type of ownership has an impact on the efficiency of the top 50 Indian pharmaceutical firms using DEA for the period 2010-2011. Raw material costs, salaries & wages paid, advertising and marketing expenses and capital usage cost were included as input variables. Net sales value has been considered as the output variable. Out of the 50 firms investigated, only 9 firms were found to be overall technically efficient while 19 firms were found to be pure technically efficient. In terms of ownership, out of the nine overall technically efficient firms, four firms were reported to be privately-held Indian firms and three firms were privately-held foreign firms while the remaining two firms belonged to group-owned Indian firms. In terms of scale efficiency measurement, only nine firms in the entire sample were found to be scale-efficient.

Chen, Delmas and Lieberman (2015) investigated the efficiency of 11 automobile firms in USA and Japan during the period 1977-1997 by comparing the results from DEA, stochastic frontier analysis and profitability returns. Value-added was included as the output variable while capital and number of employees were included as input variables. It was concluded that the Japanese automobile firms were found to be significantly higher in efficiency scores in comparison to their financial returns while the opposite was true for the automobile firms in USA.

Data and Methods

Data Source and Variables

In this research we extracted data from Centre for Monitoring Indian Economy (CMIE) Prowess database. Since the results of DEA analysis are affected by sample size, we applied two rules of thumb – a) the number of decision making units (DMUs) should be higher than the number of variables taken as

inputs and outputs and b) the number of DMUs need to be at least three times the addition of number of inputs and outputs (Mahajan, Nauriyal & Singh, 2014a). Additionally, continuous availability of data is required to perform DEA. There are 615 pharmaceutical firms listed in Prowess database. We have observed that among all these firms only in case of 40 firms, continuous data was available for all the inputs and output variables in the transitory-TRIPS period (1995-2004). Similarly, during the post-TRIPS period (2005-2014), continuous data was available for only 59 firms. The sample size is in accordance with the two rules of thumb mentioned above.

Table 1 and Table 2 give a Summary of the Descriptive Statistics of the Sample Considered for this Research During Transitory-TRIPS and Post-TRIPS Periods Respectively

Table 1: Descriptive Statistics (Sample=40 firms) for Output and Inputs during Transitory-TRIPS period (1995-2004) – values in Rs. millions

	Minimum	Maximum	SD	Mean	Best Firm
Output Variable					
Export Sales	9.07	8775.3	248.8	775.8	Ranbaxy
Input Variables					
R&D Expenses	0.32	724.2	22.5	67.4	Ranbaxy
Import of Raw Materials	1.836	3111.8	92.7	356.7	Ranbaxy
Marketing Expenses	0.79	2109.6	58.5	248.8	Ranbaxy
Compensation	9.38	1242.2	46.7	286.5	Ranbaxy
Source: Authors' compilation based on CMIE data					

Table 2: Descriptive Statistics (Sample=59 firms) for Output and Inputs during post-TRIPS period (2005-2014) – values in Rs. millions

	Minimum	Maximum	SD	Mean	Best Firm
Output Variable					
Export Sales	8.2	35143.69	8049.9	4830.2	Dr. Reddy's
Input Variables					
R&D Expenses	0.1	4901.3	1050.2	541.9	Dr. Reddy's
Import of Raw Materials	4.3	12291.0	2310.6	1470.8	Aurobindo
Marketing Expenses	1.3	7741.1	1312.5	825.1	Ranbaxy
Compensation	3.6	6438.9	1371.6	1074.0	Ranbaxy
Source: Authors' compilation based on CMIE data					

We investigated the export efficiency of the IPI using data envelopment analysis. We have used the following variables for the analysis.

1) Output Variable:

Export Sales

2) Input Variables:

a) R&D Expenses

b) Import of Raw Materials Expenses

c) Compensation Paid to Employees

d) Marketing Expenses (Advertising + Distribution + Promotional Expenses)

Results and Discussion

The figures in Table 3 and Table 4 represent the number of years in which a firm is efficient using either CRSTE or VRSTE scores during the transitory-TRIPS and post-TRIPS periods respectively.

Table 3: Number of Efficient Firms using CRS and VRS Models during Transitory-TRIPS Period

Company Name	CRS Model	VRS Model
Alpha Drug	2	8
Ambalal Sarabhai	2	3
Brabourne Enterprises	1	1
Capsugel Healthcare	6	10
Cipla	1	3
Dr. Reddy's	0	4
F D C Ltd.	2	2
Glenmark	2	2
Ipca Laboratories	2	9
Krebs Biochemicals	10	10
Lyka Labs	0	3
Natco Pharma	5	6
Orchid Pharmaceuticals	10	10
Ranbaxy	0	10
Raptakos, Brett & Co.	0	1
Resonance Specialties	3	9
Shasun Pharmaceuticals	2	6
Span Diagnostics	0	1
Suven Life Sciences	9	9
Themis Medicare	0	1
Twilight Litaka Pharma	0	2
Unichem Laboratories	0	1
Wintac Ltd.	1	5
Total Firms	**15**	**23**

Source: Authors' analysis based on DEA results

Table 4: Number of Efficient Firms using CRS and VRS Models during post-TRIPS Period (2005-2014)

Company Name	CRS Model	VRS Model
Aarti Drugs	5	5
Ajanta Pharma	5	7
Arch Pharmalabs	2	2
Aurobindo	0	10
Avon Organics	6	6
Biocon	0	1
Cipla	0	8
Claris Lifesciences	3	3
Dishman Pharma.	8	9
Divi's Laboratories	9	10
Dr. Reddy's Laboratories	1	9
Emami	4	5
Fermenta Biotech	2	2
Fresenius Kabi Oncology	2	5
Glenmark	2	3
Ind-Swift Laboratories	7	8
Ipca Laboratories	0	1
Ishita Drugs	3	10
J B Chem. & Pharma.	4	10
Lupin	0	1
Morepen Laboratories	1	1
Mylan Laboratories	6	6
N G L Fine-Chem	9	10
Natco Pharma	4	9
Orchid Pharmaceuticals	0	3
Ranbaxy Laboratories	0	4
S M S Pharmaceuticals	1	1
Sanofi India	0	1
Sequent Scientific	1	1
Shasun Pharmaceuticals	1	3
Smruthi Organics	2	2
Strides Arcolab	2	3
Sun Pharmaceuticals	1	1
Suven Life Sciences	6	6
T T K Healthcare	0	1
Themis Medicare	1	1
Unichem Laboratories	1	1
Total Firms	**28**	**37**

Source: Authors' analysis based on DEA results

We can observe from Table 3 that out of 40 firms, only 15 firms were found to be efficient in at least one year during transitory-TRIPS period using CRSTE scores. Similarly, it can be noted from Table 4 that only 23 firms were found to be efficient in at least one year during the same period using VRSTE scores. It can be seen that only two firms – Krebs Biochemicals and Orchid Chemicals and Pharmaceuticals - were found to be efficient in all the ten years on the basis of both CRSTE and VRSTE scores.

Using CRSTE scores alone it is observed that Krebs Biochemicals and Orchid Pharmaceuticals were found to be efficient during the entire period of research. On the basis of VRSTE scores alone, only four firms (Capsugel Healthcare; Krebs Biochemicals; Orchid Pharmaceuticals and Ranbaxy) were found to be efficient during the transitory-TRIPS period. Overall it is noted that more firms were efficient on the basis of VRSTE scores.The figures in Table 4 represent the number of years in which a firm is efficient using either CRSTE or VRSTE scores during the post-TRIPS period.

It is seen that out of 59 firms, only 28 firms were found to be efficient in at one at least one year during post-TRIPS period using CRSTE scores. Similarly, only 37 firms were found to be efficient during the same period using VRSTE scores. It can be seen that none of the firms were found to be efficient in all the ten years on the basis of both CRSTE and VRSTE scores.

Using CRSTE scores alone it is observed none of the firms were found to be efficient during the entire post-TRIPS period. On the basis of VRSTE scores alone, only five firms – Aurobindo, Divi's, Ishita Drugs, JB Chem & Pharma & NGL Fine Chem. - were found to be efficient during the entire post-TRIPS period. Overall it is noted that more firms were efficient on the basis of VRSTE scores.

Table 5 presents the list of firms that were efficient for all 10 years; more than 5 years; less than 5 years and none of the years using CRS model during the transitory-TRIPS period. It is seen that only five firms were efficient for more than 5 years during transitory-TRIPS period. 24 firms were found to be inefficient during the entire period of research.

Table 5 : Transitory-TRIPS Period - List of Efficient Firms – CRS Model

	All 10 Years	**≥ 5 Years**	**< 5 Years**	**None of the Years**
CRSTE (40)	**2**	**3**	**11**	**24**
List of Firms	1) Kreb's 2) Orchid	1) Capsugel 2) Natco 3) Suven	1) Alpha 2) Ambalal 3) Brabourne 4) Cipla 5) FDC 6) Glenmark 7) Ipca 8) Lyka 9) Resonance 10) Shasun 11) Wintac	1) Abbot 2) Albert David 3) Amrutanjan 4) Anglo-French 5) Cadila 6) Dr. Reddy's 7) GlaxoSmithKline 8) Lupin 9) Merck 10) Novartis 11) Panacea 12) Pfizer 13) Piramal Ent. 14) Ranbaxy 15) Raptokas Brett 16) Sanofi 17) Span Diagnostics 18) Sun Pharma. 19) TTK Healthcare 20) Themis 21) Twilight Litaka 22) Unichem 23) Wockhardt 24) Wyeth

Source: Authors' analysis based on DEA results

Table 6 presents the list of firms that were efficient for all 10 years; more than 5 years; less than 5 years and none of the years using VRS model during the transitory-TRIPS period.

Table 6: Transitory-TRIPS Period - List of Efficient Firms – VRS Model

	All 10 Years	≥ 5 Years	< 5 Years	None of the Years
VRSTE (40)	**4**	**7**	**12**	**17**
List of Firms	1) Capsugel 2) Kreb's 3) Orchid 4) Ranbaxy	1) Alpha 2) Ipca 3) Natco 4)Resonance 5) Shasun 6) Suven 7) Wintac	1) Ambalal 2) Brabourne 3) Cipla 4) Dr. Reddy's 5) FDC 6) Glenmark 7) Lyka 8) Raptokas Brett 9) Span 10) Themis 11) Twilight 12) Unichem	1) Abbott 2) Albert David 3) Amrutanjan 4) Anglo-French 5) Cadila 6)GlaxoSmithKline 7) Lupin 8) Merck 9) Novartis 10) Panacea 11) Pfizer 12) Piramal Ent. 13) Sanofi 14) Sun Pharma. 15) TTK Healthcare 16) Wockhardt 17) Wyeth

Source: Authors' analysis based on DEA results

It is seen that only 11 firms were efficient in more than 5 years. 17 firms were found to be inefficient during the entire transitory-TRIPS period. Table 7 presents the list of firms that were efficient for all 10 years; more than 5 years; less than 5 years and none of the years using CRS model during the post-TRIPS period.

Table 7: Post-TRIPS Period - Number of Efficient Firms – CRS Model				
	All 10 Years	**≥ 5 Years**	**< 5 Years**	**None of the Years**
CRSTE (59)	**0**	**9**	**19**	**31**
List of Firms		1) Aarthi Drugs 2) Ajantha 3) Avon Organics 4) Dishman 5) Divi's Labs 6) Ind-Swift Labs 7) Mylan 8) NGL 9) Suven	1) Arch Pharma 2) Claris 3) Dr. Reddy's 4) Emami 5) Fermenta 6) Fresenius 7) Glenmark 8) Ishitha 9) J B Chem 10) Morepen 11) Natco 12) SMS 13) Sequent 14) Shasun 15) Smruthi 16) Strides 17) Sun 18) Themis 19) Unichem	1) Albert David 2) Amrutanjan 3) Anglo-French 4) Aurobindo 5) Bal Pharma 6) Biocon 7) Cadila 8) Cipla 9) Elder 10) FDC 11) GlaxoSmithKline 12) Ind-Swift Ltd. 13) Indoco 14) Ipca 15) Jagsonpal 16) Lupin 17) Merck 18) Neuland 19) Novartis 20) Orchid 21) Panacea 22) Pfizer 23) Piramal Ent. 24) Ranbaxy 25) Sanofi 26) Span 27) TTK Healthcare 28) Torrent 29) Wanbury 30) Wockhardt 31) Wyeth

Source: Authors' analysis based on DEA results

It is seen that only nine firms were efficient for more than 5 years during post-TRIPS period. 31 firms were found to be inefficient during the entire period of research.

Table 8 presents the list of firms that were efficient for all 10 years; more than 5 years; less than 5 years and none of the years using VRS model during the post-TRIPS period

Table 8: Post-TRIPS Period - Number of Efficient Firms – VRS Model				
	All 10 Years	**≥ 5 Years**	**< 5 Years**	**None of the Years**
VRSTE (59)	**5**	**12**	**20**	**22**
List of Firms	1) Aurobindo 2) Divi's Labs 3) Ishitha 4) JB Chem. 5) NGL	1) Aarti 2) Ajantha 3) Avon 4) Cipla 5) Dishman 6) Dr. Reddy's 7) Emami 8) Fresenious 9) Indswift Labs 10) Mylan 11) Natco 12) Suven	1) Arch 2) Biocon 3) Claris 4) Fermenta 5) Glenmark 6) Ipca 7) Lupin 8) Morepen 9) Orchid 10) Ranbaxy 11) SMS 12) Sanofi 13) Sequent 14) Shashun 15) Smruthi 16) Strides 17) Sun 18) TTK 19) Themis 20) Unichem	1) Albert David 2) Amrutanjan 3) Anglo-French 4) Bal Pharma 5) Cadila 6) Elder 7) FDC 8) GlaxoSmithKline 9) Indswift Ltd. 10) Indoco 11) Jagsonpal 12) Merck 13) Neuland 14) Novartis 15) Panacea 16) Pfizer 17) Piramal 18) Span 19) Torrent 20) Wanbury 21) Wockhardt 22) Wyeth

Source: Authors' analysis based on DEA results

It is seen that only 17 firms were efficient for more than 5 years during post-TRIPS period. 22 firms were found to be inefficient during the entire period of research.

Table 9 presents a summary of the number of firms that were efficient for different years during transitory-TRIPS and post-TRIPS periods.

Table 9: Number of Efficient Firms – CRS and VRS Models				
	All 10 Years	**≥ 5 Years**	**< 5 Years**	**None of the Years**
Transitory-TRIPS Period				
CRS Model (40)	2	3	11	24
VRS Model (40)	4	7	12	17
Post-TRIPS Period				
CRS Model (59)	0	9	19	31
VRS Model (59)	5	12	20	22

Source: Authors' analysis based on DEA results

It is seen that more firms were efficient in export performance during the post-TRIPS period in comparison to the transitory-TRIPS period using CRS and VRS models.

Table 10: Mean CRSTE and Mean VRSTE Scores – Transitory-TRIPS and Post-TRIPS Periods										
Transitory-TRIPS Period (1995-2004)										
	1995	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
Mean CRSTE	0.35	0.40	0.37	0.35	0.39	0.38	0.32	0.34	0.48	0.51
No. of Firms	6	6	6	5	7	5	6	4	7	7
Mean VRSTE	0.49	0.58	0.54	0.54	0.57	0.52	0.56	0.51	0.61	0.68
No. of Firms	9	12	9	9	12	14	14	11	14	13
Post-TRIPS Period (2005-2014)										
	2005	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
Mean CRSTE	0.47	0.58	0.60	0.54	0.53	0.56	0.54	0.56	0.57	0.54
No. of Firms	5	16	13	7	9	11	9	9	11	9
Mean VRSTE	0.59	0.63	0.63	0.59	0.60	0.65	0.64	0.65	0.68	0.63
No. of Firms	17	24	18	14	13	17	17	18	19	14

Source: Authors' analysis based on DEA results

Table 10 presents a summary of the mean CRSTE scores and mean VRSTE scores during transitory-TRIPS and post-TRIPS periods.

Overall, it is seen that the export efficiency of Indian pharmaceutical industry was better in the post-TRIPS period in comparison to transitory-TRIPS period using both CRS and VRS models.

Table 11 presents a summary of the scale efficiency (SE) scores of the sample firms during transitory-TRIPS and post-TRIPS periods.

Table 11: Scale Efficiency Scores – Transitory-TRIPS Period and Post-TRIPS Period										
Transitory-TRIPS Period										
	199	**199**	**199**	**199**	**199**	**200**	**200**	**200**	**200**	**200**
Mean of Scale Efficient	0.75	0.66	0.65	0.59	0.63	0.69	0.53	0.66	0.78	0.72
No. of Scale Efficient Firms	9	6	6	5	7	5	6	4	7	7
Post-TRIPS Period										
	200	**200**	**200**	**200**	**200**	**201**	**201**	**201**	**201**	**201**
Mean of Scale Efficient	0.81	0.90	0.94	0.86	0.86	0.85	0.82	0.84	0.82	0.85
No. of Scale Efficient Firms	6	19	15	10	10	11	9	10	12	10

Source: Authors' analysis based on DEA results

It is seen that the SE scores were comparatively better during the post-TRIPS period. It is observed that the mean of scale efficient firms decreased during transitory-TRIPS period while it increased during post-TRIPS period.

The results of the analysis highlight that the export efficiency of the Indian pharmaceutical industry was higher in the post-TRIPS period in comparison to the transitory-TRIPS period.

Conclusions

The Indian pharmaceutical industry has experienced a rapid growth in exports after India became a member of WTO on 1st January, 1995. The growth of the exports has been marginally lower in the transitory-TRIPS period (1995-2004) in comparison to the post-TRIPS period (2005-2014). We attribute this phenomenon to the uncertainty that prevailed over the future in the Indian pharmaceutical industry during the period immediately after India became a signatory to WTO agreement. Despite the initial apprehensions, the industry has gradually captured a growth trajectory, largely due to exploitation of export opportunities in global markets.

This had been possible due to the fact that the industry was able to offer high-quality products at competitive prices. In this research, we examined the efficiency of Indian pharmaceutical exports during the transitory-TRIPS and post-TRIPs periods. Our research was aimed to investigate whether the industry was able to increase its export efficiency while it aggressively exploited global export opportunities.

The results of our research indicate that the export efficiency of Indian pharmaceutical industry has increased progressively after India became a member of WTO. We also conclude that the efficiency of the industry was higher in the post-TRIPS period. Future researchers can use this approach to understand the export efficiency of other Indian industries in the back drop in institutional reforms in India.

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Understanding the Impact of Inward FDI and Economic Growth

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Abstract

With liberalization of trade and markets nations across globe are able to overcome capital scarcity with inflow of Foreign Direct Investment (FDI). FDI is an important factor in the globalization process as it provides opportunities and financial challenges around the world promotes stable and lasting economic links between countries through direct access to investors in home economies to production units of the host economies. Understanding the influence/impact of inward FDI on economic growth is a dynamic area to study for researchers, as the empirical evidence on impact of FDI inflow on and economic growth are mixed, which deserves fresh enquiry. Objective of this paper is to identify the long term equilibrium relationship among inward FDI and gross domestic product, which will help one to understand the impact of inward FDI on economic growth. Gross Domestic Product (GDP) is proxied for economic growth. This is an empirical research and the research design is longitudinal in nature. Results of this study indicate that there exist a long run cointegrating relationship between inward FDI and GDP, the two variables for the study period from 1970-2010. 1% change in GDP will raise FDI inflow by 4.37%. The adjustment coefficient of the Error Correction Term (ECT) is negative and statistically significant indicating positive adjustment effect, which ensures, that in case of any external shocks, the long term equilibrium can be reverted back, and will re-ensures equilibrium between FDI inflow and GDP.

Keywords*: Foreign Direct Investment, Economic growth, Gross Domestic Product, Cointegration, Vector Error Correction*

Introduction

In the last two decades, Foreign Direct Investment (FDI) has emerged as one of the major source for globalization and a significant catalyst for economic growth, transferring technology and knowledge among participating countries. The liberalization of trade, easing of business barriers, advancement in technology, accompanied with growing internationalization of goods, services and ideas over the past two decades made the world economies a globalized one. Emergence of large domestic markets, availability of skilled labour accompanied with economical wages, high returns to investment, developing countries now have a significant impact on the global economy, particularly in the economics of the industrialized states. Deregulation of markets, technological innovations and cost effective communication tools have allowed investors to diversify further their participation in competitive markets overseas. FDI is a significant factor in globalization process as it intensifies and enhances the interaction between states, regions and firms. Currently, the growth of international production is driven by liberalization of FDI and its related trade policies oriented towards economic and technological forces. FDI provides opportunities as well as challenges across the world, promotes stable and long-lasting economic links between countries through direct access to investors in home economies to production units of the host economies (i.e. the countries in which they are resident). Within a proper policy framework, FDI assists host countries in developing local enterprises, promotes international trade through access to markets and contributes to the transfer of technology and know-how. In addition to its direct effects FDI creates an impact on the development of labour and financial markets, and influences many aspects of economic performance through its multiple spill-over effects.

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The role played by FDI in the growth process has been a burning topic of debate in several countries including India

The amount of FDI which India receives is increasing considerably with time, even though it is not consistent. Many factors play a significant role in influencing the amount of FDI which a nation receives. The impact study of FDI is a dynamic area for many researchers. The benefits which a nation receives through FDI can be studied by examining the impact, which FDI created upon the macro and micro structures of an economy. Among them, understanding the influence/impact of inward FDI on economic growth is a dynamic area to study for researchers in the faculty of international business. This research studies the methodology involved in examining the impact of inward FDI on economic growth. The large increase in the inward and outward flow of FDI across the globe in the past two decades provides a strong incentive for research on this phenomenon. The choice of research topic has been made in order to allow for the possibility of finding results that can provide knowledge about the impact of FDI that may help policy makers of both home and host country to take appropriate decisions

Review of Literature

During the last decades, the relationship between FDI and economic growth has been extensively discussed in literatures of international business, which ranges from an unreserved optimistic view to a systematic pessimism. Many researchers and policymakers believe that FDI boosts growth for host countries through different development channels. Regarding causality of FDI and economic growth, it is an ongoing, unsettled and highly debatable/debated issue. The cointegrating and causality of FDI and economic growth are heterogeneous across countries, and an application of different econometric methodologies creates variations in test results. Therefore, it is critical to understand these variations when examining the relationship and causality between FDI and economic growth.

De Mellow (1992) indicates that, though FDI boosts long run growth through technological up gradation and knowledge spillovers, the extent to which FDI is growth- enhancing depends on the degree of complementarities and substitution between FDI and domestic investment. Results of this research conducted in OECD and non OECD countries shows that, impact of FDI on growth depends inversely on the technological gap between the leaders and followers, although there is sufficient evidence available to prove that bulk of FDI occurs across technologically advanced economies. His study concluded that FDI had significantly positive effect on economic growth for countries with high income, facilitates transfer of advanced technologies and provides resources for training labour force to get new skills. De Gregorio (1992) studied and identified that technologies and knowledge which are not readily available to host country investors, are made available, as a result of FDI, and in this way FDI led to productivity growth throughout the economies. FDI facilitates to create expertise that the country does not possess, and foreign investors may get access to global markets. Through empirical studies he found that increasing aggregate investment by 1 percent point of GDP increased economic growth of Latin American countries by 0.1percent to 0.2 percent in a year, but increasing FDI increased growth by approximately 0.6 percent a year during the period 1950-1985, thus indicating that FDI is three times more efficient than domestic investment.

Borensztein et al (1998) examine the effects of FDI on economic growth at the cross country level using regression framework, taking data on FDI outflows from OECD countries as well as sixty-nine developing countries from 1970-1989. They found that FDI is an important vehicle for adopting new technologies, contributing relatively more to growth than domestic investment. In addition, they also found that FDI contributes to economic growth to countries when the labor force has attained certain level of educational standard. Boon (2001) investigates the causal relationship between FDI and economic growth for Malaysia. His findings indicate that bidirectional causality exists between FDI and

economic growth besides contributing to an increase in output. Choe (2003) examines the causality of FDI and gross domestic investment and economic growth by applying the panel VAR model. He argues that GDI rates and FDI play catalyst role for economic growth through capital accumulation, which is necessary for long run growth, he analyzes GDI rates and FDI inflows in terms of their relationship to economic growth, in his empirical study, and he tests Granger causality between FDI inflow and GDI rates and GDP growth. From a sample of 80 countries comprising high income OECD countries and developing countries for the period of 1971 to 1995, he concludes that overall causality of FDI and GDI is bi-directional.

Chowdhury &Mavrotas (2003) examines the causal relationship between FDI and economic growth for three developing countries, namely Chile, Malaysia and Thailand from 1969-2000. Their empirical findings suggest that GDP causes FDI in the case of Chile but FDI does not cause GDP. Anderson (2004) discusses the potential of FDI inflows to affect host country economic growth. He argues that FDI should have a positive effect on economic growth as a result of technology spillovers and physical capital inflows. Performing both cross-section and panel data analysis on a data set covering 90 countries during the period 1980-2002, the paper finds that FDI inflows enhance economic growth in developing economies but not in developed economies. Dritsaki et al (2004) investigates the relationship between Trade, FDI and economic growth in Greece over the period 1960-2002, they found the existence of cointegrating relationship among the three tested variables. Results of Granger causality test showed that there is a causal relationship between the examined variables. Hansan and Rand (2005) analyze the causal links between FDI and GDP in a sample of 31 developing countries in Asia, Latin America and Africa for the period of 1970-2000. They identified existence of strong causal link running from FDI to GDP. Their results point out that FDI promotes gross capital accumulation as well as that a higher ratio of FDI in gross capital formation creates a positive effect on GDP growth. Moreover, FDI has a lasting impact on GDP, while GDP has no long run impact on the FDI. In that sense FDI causes growth, and they also found long-run effects from FDI to GDP.

Li and Liu (2005) investigates whether FDI affects economic growth based on panel data of 84 countries from 1970-1999. They identified a significant endogenous relation between FDI and economic growth from mid-1980 onwards. Besides, FDI also promotes economic growth with its interaction with human capital in developing countries. Using partial adjustment and time series data for the period 1976 to 2004, Do (2005) examines the impact of FDI on Vietnamese economy. He found the existence of short run and long run relationship between FDI and gross domestic product. FDI is shown to have not only short run but also long run effect on GDP of Vietnam. Daniele and Marani (2007) analyze the underlying factors of FDI and concluded that FDI plays a positive role in enhancing the economic growth of MENA countries. Dash and Sharma (2007) found evidence that there is bi-directional causality between FDI and economic growth. Findings of the study of Adams (2009) are FDI in developing and Sub- Saharan African countries contributes to economic development by, augmenting domestic capital and enhancement of efficiency through transfer of new technology, marketing and managerial skills, innovation and best practices. Further, FDI has both benefits and costs and its impact is determined by the country specific conditions in general and the policy environment in particular in terms of the ability to diversify, the level of absorption capacity.

Jayachandran and Seilan (2010), suggest that there exist a long term cointegration and causality relation between FDI inflow, GDP and trade. Bhattacharya and Bhattacharya. S (2011) observed the existence of long-run relationship between GDP and FDI Inflows. Georgantopoulos and Tsamis (2011) suggest, the existence of long-run equilibrium relationship among FDI and gross domestic product, but, there is a one-way causality running from gross domestic product to FDI, indicating that foreign capital penetration Granger-causes economic growth in Greece. Zhang (2001), examined 11 countries of Asia

and South America and found no uniform pattern of direction with regard to FDI and economic growth. Carkovic and Levine (2002) found that FDI inflows do not exert an independent influence on economic growth, but, the authors indicates that, while sound economic policies may spur both growth and FDI, the results are inconsistent with the view the FDI exerts a positive impact on growth that is independent of other growth determinants. Salisu (2004) in his case study examined the impact of FDI on economic growth in Nigeria. The study concluded that the contribution of FDI to economic growth in Nigeria was very low even though FDI happened to be a significant factor influencing the level of economic growth in Nigeria. Kholdy and Sohrabian (2005) found no causal link between FDI and economic growth. Bilgic (2006) examines the possible causal relationship between FDI and Economic Growth in Turkey. The study found that there is neither a long run nor a short run effect of FDI on economic growth. Rao and Dhar (2011) found that FDI inflows do not exert an independent influence on economic growth for India.

The empirical evidence on the causal link between FDI and economic growth and FDI are mixed and unsettled which deserves fresh enquiry using different data sets.

Research Methodology

Cointegration between FDI Inflow and Economic Development is studied here**.** Long run equilibrium relationship among variables can be established by following cointegration. If two or more than two variables are integrated of the same order *d* where $d > 0$, there exists a stationary linear combinations of these variables, the variables are said to be cointegrated**.**

Steps in cointegration

- If the data is non stationary, it should be converted into stationary
- If the data has got unit roots, it should be removed
- Check for the order of integrity of variables. Variables must be integrated of the same order. If the variables are not integrated of the same order the data should be made first difference I (1) or second difference I (2) or I (3). Very rarely data are differenced more than twice. If the variables are integrated of the same order cointegration can be carried out
- If there is evidence of cointegration, use the residual to form the error correction term in the corresponding Error Correction Model (ECM)
- Add in a number of lags of both explanatory and dependent variables to the ECM

Johansen-Juselius Method of cointegration is studied in this research.
Vector Error Correction Model

An Error Correction Model (ECM) reinstates the existence of long run relationship. An error correction model is a statistical specification of economic dynamics through which the variables restore the equilibrium relationship whenever disequilibrium takes place. ECM captures both the short-term and the long-run dynamics of cointegrating variables. Error Correction Models are a category of multiple time series models that directly estimate the speed at which a dependent variable - Y - returns to equilibrium after a change in an independent variable - X. ECMs are useful for estimating both short term and long term effects of one time series on another.

Present study, therefore, tries to reexamine the role of FDI in promoting India's economic development for a relatively longer period of data, from 1970 to 2010. Natural log values of the variables are taken for analysis to overcome the problem of stationarity. Period of study is from 1970 to 2010. Variables examined are inward FDI and gross domestic product (GDP). In this study GDP is proxied for economic

growth as seen in many literatures. Secondary data is collected from Reserve Bank of India and UNCTAD.

Hypotheses

H_0: There is no cointegration between FDI inflow and GDP
H_1: There is cointegration between FDI inflow and GDP

Test for Stationarity and Unit Root- Augmented Dickey Fuller

When dealing with time series data many econometric issues can influence the variables. Most of the macro economic data are non-stationary which means they tend to exhibit a deterministic and/or stochastic trend. Therefore, it is recommended that a stationarity (unit root) test be carried out to test for the order of integration. A series is said to be stationary if the mean and variance are time-invariant. A non-stationary time series will have a time dependent mean. Therefore, a stochastic process that is said to be stationary simply implies that the mean [(E(Yt)] and the variance [Var (Yt)] of Y remain constant over time for all t, and the covariance [covar (Yt, Ys)] and hence the correlation between any two values of Y taken from different time periods depends on the difference apart in time between the two values for all t≠s. the data shows non stationarity property, and after making first difference , the data is made stationary, which makes the time series data useful for further analysis. Augmented Dickey Fuller Test (ADF) is used widely for testing stationarity and unit roots.

Table 1 Results of ADF Test

Variable	At Levels			At First Difference		
	None	Intercept	Trend & Intercept	None	Intercept	Trend & Intercept
FDII	0.8196	0.7717	0.0182	0.000	0.000	0.0015
GDP	1.000	1.000	0.8544	0.6269	0.000	0.000

After selecting the order of integrating, next step is to test for the existence of long run cointegrating equilibrium relationship among the variables. This step involves testing for the appropriate lag length of the system. In this model lag length has been taken as two as suggested by Akaike Information Criterion, Schwarz Information Criterion and Hannan-Quinn Information Criterion. This follows a Vector Error Correction Model in order to establish the dynamic short run equilibrium. Cointegration Trace Test and Maximum Eigen value test have been applied to check the cointegration relationship. Results of these tests have been reported in Table 22and in Table 23, which shows three cointegrating vectors.

Table 3 Results of Johansen Cointegration Test Results (Trace)

Hypothesized No of CE(s)	Eigen Value	Trace Statistics	5% Critical Value	Probability
None*	0.426	33.47	15.49	0.00
At most 1*	0.244	11.20	3.84	0.00

Table 4 Results of Johansen Cointegration Test Results (Maximum Eigen Value)

Hypothesized No of CE(s)	Eigen Value	Max Eigen Statistics	5% Critical Value	Probability
None*	0.42	22.27	14.26	0.00
At most 1*	0.24	11.20	3.84	0.00

The Johansen approach can determine the number of cointegrating vectors for any given number of non-stationary variables of the same order. The results reported in table 3 and 4, suggest that the null hypothesis of no cointegrating vectors can be rejected at the 1% level of significance. It can be seen from

the Trace Statics that we have two cointegration equations. In other words, there exist two linear combinations of the variables.

Results of Vector Error Correction Model between FDI inflow and GDP (VECM)

The coefficient of Error Correction Term gives information about whether the past values affect the current values of the variables studied. A significant coefficient implies that past equilibrium errors play a role in determining the current outcomes. The information obtained from the ECM is related to the speed of adjustment of the system towards long-run equilibrium. The short-run dynamics are captured through the individual coefficients of the difference terms. The adjustment coefficient on *EC* equation must be negative and statistically significant, which also supports the existence of long term relationship. When coefficient of ECT is negative, then the model is stable.

Table 5 Results of Estimated Cointegrating Relationship

Equation	Independent Variable	Impact on FDI
1	LGDP(-1)	4.370 (-10.93)

VECM has been applied to obtain the final results of the analysis which are reported in the Table No 5. The results of this analysis have also been represented in equation given as below:

$FDI=35.84+4.37+u_t$ (10.93)

The analysis shows that GDP is found to be statistically significant for India. Here X coefficients (elasticities) show the percentage change in FDI due to one percentage change in FDI. X coefficient of GDP is estimated to be 4.37 found to give positive and statistically significant impact indicating 1% change in GDP will raise FDI by 4.37%. Market size (GDP), faster economic growth and higher degree of economic development ensures better opportunities for the foreign investors to expand and exploit resources for getting economic advantages.

As per the analysis results, the Error-Correction Term is -0.851, which is statistically significant and has a negative sign, which confirms that there isn't any problem in the long-run equilibrium relation between the independent and dependent variables. If their relative price 0.851 (-4.15) denotes a satisfactory convergence rate to equilibrium point per period. Error Correction Coefficient of -0.851, suggests 85.1% movement back towards equilibrium following a shock to the model, one time period later.

Table 6 Results of Vector Error Correction Model for FDI Inflow and GDP

Error Correction:	Model 1	Model 2
CointEq1	-0.851665	0.000395
	(0.20495)	(0.00598)
	[-4.15558]	[0.06604]
D(LNFDI(-1))	0.328507	-0.004960
	(0.17619)	(0.00514)
	[1.86446]	[-0.96419]
D(LNFDI(-2))	0.055025	0.011870
	(0.15150)	(0.00442)
	[0.36319]	[2.68372]
D(LNGDP(-1))	1.291438	0.044604
	(4.96624)	(0.14498)
	[0.26004]	[0.30765]
D(LNGDP(-2))	-13.10415	0.272958
	(4.93981)	(0.14421)
	[-2.65276]	[1.89278]
C	0.743624	0.037772
	(0.38715)	(0.01130)
	[1.92076]	[3.34195]
R-squared	0.453884	0.311681
Adj. R-squared	0.371139	0.207391

Findings and Conclusion

The objective of this paper is to identify the impact of inward FDI on economic growth. The variables taken for studying Causality of FDI inflow are FDI inflow, Gross Domestic Product (GDP) proxied for economic growth. All the data are checked for stationarity and unit roots. Results of the Johansen Jesulius Cointegration Test between FDI inflow and GDP indicates that the null hypothesis of no cointegration have been rejected at 5% level of significance. As per the results of the trace test statistics and maximum eigen statistics value, more than one cointegrating equation between FDI inflow and GDP is ensured. Cointegration coefficient of GDP is estimated to be 4.37 which is positive and statistically significant impact. This indicates 1% change in GDP will raise FDI inflow by 4.37%. The adjustment coefficient of the Error Correction Term (ECT) is negative and statistically significant at 1 % level. This phenomenon indicates that the error correction term has an opposite adjustment effect, which ensures, that in case of any external shocks, the long term equilibrium can be reverted back, and will re-ensures equilibrium between FDI inflow and GDP. The value of the ECT 0.890 (-4.155) denotes a satisfactory convergence rate to equilibrium point per period. The cointegration and error correction test indicates that there exist a long term equilibrium relationship between FDI inflow and GDP. As there is a possibility of more than one cointegration equation the direction of causality is expected to move from FDI inflow to GDP and from GDP to FDI inflow. Results of the Johansen Jesulius Cointegration Test between FDI inflow and Exports indicates that the null hypothesis of no cointegration have been rejected at 1% level of significance. The results of this research study are consistent with the already existing research studies done in India by researchers like Jeyachandran and Seilan, Sarbapriya ray. This study adds to the existing literature on FDI inflow in India. As a strategic component of investment, India needs FDI for her sustained economic growth and development.

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REVIEW BOARD

Name	Area of interest	Institute
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Dr. S.S. Ganesh	Organisational Behaviour and Human Resources Management	Professor and Chairperson, OB and HR Area Amrita School of Business, Amrita University, Coimbatore
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About Thiagarajar School of Management

Thiagarajar School of Management (TSM), Madurai has established itself in the Southern part of India as one of the premier citadels of learning, rendering creditable service to the cause of higher education. TSM was founded in 1962 by the doyen of the South Indian textile industry, Mr. Karumuttu Thiagarajar Chettiar - a great philanthropist who also founded several engineering and arts colleges, polytechnics; teacher's training institutes, and primary and secondary schools.

TSM offers a choice of management education streams: All India Council of Technical Education (AICTE) approved PGDM (Post Graduate Diploma in Management) programme which was launched in 2011 and the MBA (Master of Business Administration) programme - approved by AICTE, accredited by National Board of Accreditation (NBA), autonomous status granted by UGC and affiliated to Madurai Kamaraj University. Both the programmes are 2-year full-time, fully residential. PGDM is the flagship programme of TSM.

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TSM is run by the Manickavasagam Charitable Foundation - an organization that has been actively involved in several primary and higher educational projects. Mr. Manickavasagam Chettiar, the prime mover behind TSM, was its Founder Correspondent. TSM prides itself on being one of the few institutions that does not accept any capitation fees from students seeking admission. The school is fully supported and funded by the Loyal Textiles Group. The Chairman & Managing Director of the group, Mr. Manikam Ramaswami, a Gold Medalist from IIT Chennai, is the present Correspondent of TSM.

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