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INTERNATIONAL JOURNAL OF BUSINESS FROM BHARATIYA VIDYA BHAVAN'S
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आ नो भद्रा : क्रतवो यन्तु विश्वत : ।

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- Rig Veda 1-89-1

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Prospective authors should follow the guidelines provided at the end of this issue while preparing the manuscripts.

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Editorial Board

EDITORIAL

The present issue of the journal has papers from different areas of business. In addition, two additional write up are in the areas of social justice and on the power of giving.

The power of giving is thought of as a life style which corporates should emulate. The idea is in helping others. There are narratives drawn from real life; the one being from Justice Zondu's personal experience. There is a surprise continuity advised by the Indian business man who wanted the justice to continue what he did. Happiness is derived by helping others. Indian corporates are now recapitulating the value inherited.

Dr. B.R. Ambedkar positioned 'compulsions of social justice' by incorporating them as mandatory effort under constitutional positioning. The paper presents the conflicting situation after seven decades of Indian Independence by pointing towards criticality of justice.

Sampling methods help in solving problems of a larger group by observing a few. Sampling under audit situations need key unit sampling or monetary unit sampling when specified objectives are to be met. Objective based approach is stressed in the paper presented. Another paper is on performance of UPA and NDA Governments for two time periods 2010-14 and 2014-18. The paper concludes that there are no critical differences in performance between UPA and NDA time periods but for consistent increase in production and on the increase in the nominal money value.

The synopsis of the awarded thesis is on a topic of organizational service quality by confounding the concept of TQM and service quality which is tested for the public service health project-Yeshasvini in Karnataka State.

Editor-in-Chief

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The Power of Giving: From Intuition to Reality*

Krishnakumar Natarajan**

Back Drop

The M.P. Birla Institute of Management graduates around 160 students in Management and Indian industry has a lot of trust and recognition of the type of talent built at the institute. Around 63 reputed companies have recruited from this institute. No wonder it has had 95% in placement amongst people who opted for placement and the highest salary of outgoing class is continuously increasing and now stands at Rs.8/- lakhs/annum. The Students, Faculty and administration are to be complimented for their efforts to get the institute ranked 21st amongst the Top 100 Business Schools in India and achieving a high impact thru your Mission and Values.

As you leave the corridors of this Institute, it is clear to me that many of you have high ambitions and lots of hope and dreams. Some of you are looking forward to getting your first pay cheque, many dream about owing your first vehicle and of course the enjoyable week ends with entertainment and eating out. Enjoying the fruits of your success is certainly an essential part at this stage of your life. Partly you are driven by the two markers by which the external society judges you- Money and Position and soon the conversation amongst friends is how good the offer a classmate of yours has got and the title and perks associated with the role the person has landed.

As a close observer of groups like you for the last 40 years - believe me the conversation has not changed- the change is in the quantum. When I entered the workforce thirty seven years back with an MBA the demand for MBA was high with a limited pool of MBA's. Still on an inflated adjusted basis your entry levels compensations are at least four times higher. It is important that you recognize that you have a great platform and the opportunity to be in the right place to create an impact, which will go beyond you and that, is what I would talk to you today.

As you exit out of this Institute there is a danger of falling into this trap of judging success based on a two-legged stool - Money and Position. What Physics has taught us very early in life is that two legged stools always have a stability problem and hence the disillusion sets in soon that you have nothing more to achieve. Hence, there is a need to adopt to a more stable option of a three legged stool and maintain stability. Your career will not be judged over a short period. It is what you do and how you create impact over a long period, which is important. Your career and success metrics should not

This is an edited version of Convocation address delivered at Annual Convocation of M.P.Birla Institute of Management: Associate, Bharatiya Vidya Bhavan, Bengaluru 560 001 on Saturday, 9th of June 2018.

**Executive Chairman, Mindtree Ltd, Global Village, RVCE Post, Mysore Road, Bangalore-560059*

be like a T20 but more like a Test match. I will share with you what I see as a "Stewardship" role, which each of you have to practice to adopt a more stable outlook on your career and life.

Mother Theresa said: ***"At the end of life we will not be judged by how many diplomas we have received, how much money we have made, how many great things we have done. We will be judged by 'I was hungry and you gave me to eat, I was naked and you clothed me, I was homeless and you took me in.' Hungry not only for bread — but hungry for love. Naked not only for clothing — but naked for human dignity and respect. Homeless not only for want of a room of bricks — but homeless because of rejection".***

Many times experiences prompt you to take a different course. The power of Right Role Models need to be recognized. The powerful impact, which role models have made with successful business people, sportspersons and people creating an impact in every occupation is being seen.

The Role Model

Let me share with you the true story of Justice Raymond Zondo who rose to become the Deputy Chief Justice of South Africa. Justice Zondo was born in a poor family of nine children, which did not have the support of his father. His mother worked hard to get them food and basic shelter. Because of his perseverance and support of some good Samaritans Justice Zondo completed his schooling, and was keen to pursue Law. His mother by then had exhausted all her savings and the choice before him was to take up work to support his family or pursue his dream. He did not lose hope and went to town to meet an Indian businessperson called Moosa to request him to extend a loan. Without questioning him, Mr. Moosa told him that he will help him but will not give him money. He said that he will give him a Voucher of certain value and every month his mother can come to his store and pick up the provisions she wanted. He will maintain an account of what she has taken and he can pay him back later. For three years this arrangement went off well, Justice Zondo completed his Law Degree, and got his first job. He went back to Mr. Moosa to ask him what he had to repay. Mr. Moosa told him that he owes him nothing and his only request was that he must do for others what he had done to him. There are very powerful messages in this anecdote- First the perseverance to dream and achieve what you dream. How you can you help a stranger without asking questions when there is a genuine need and more than that how do you motivate him to amplify the message of Voluntary help to others. Can we in our lifetime follow the great examples of Mr. Moosa and Justice Raymond Zondo and amplify the Joy the Giving. This is the power of Daana-an Indian Concept-practiced since generations through denominational institutions.

At your stage in life, many times you will be conflicted with the desire to give, but constrained by your mental barrier of feeling that you do not have the resources to give. It is important that you get over the 'fear" of inadequate resources and start in whatever manner you feel fit. In order to help you navigate that phase, a set of tips are shared, which was covered in an article by Jenny Santi, and was published in Time magazine in March 2017.

Find Your Passion

Your passion should be the foundation for your giving. It is not *how much* you give, but *how much* love you put into giving. It's only natural that you will care about this and not so much about that, and that's OK. It should not be simply a matter of choosing the right thing, but also a matter of choosing what is right for you.

Give Your Time

The gift of time is often more valuable to the receiver and more satisfying for the giver than the gift of money. We don't all have the same amount of money, but we all do have time on our hands, and can give some of this time to help others—whether that means we devote our lifetimes to service, or just give a few hours each day or a few days a year.

Give to Organizations with Transparent Aims & Results

According to Harvard scientist Michael Norton, "Giving to a cause that specifies what they're going to do with your money leads to more happiness than giving to an umbrella cause where you're not so sure where your money is going."

Find Ways to Integrate Your Interests & Skills with the Needs of Others

"Selfless giving, in the absence of self-preservation instincts, easily becomes overwhelming," says Adam Grant, author of Give & Take. It is important to be "otherish," which he defines as being willing to give more than you receive, but still keeping your own interests in sight.

Be Proactive, Not Reactive

We have all felt the dread that comes from being cajoled into giving, such as when friends ask us to donate to their fundraisers. In these cases, we are more likely to give to avoid humiliation rather than out of generosity and concern. This type of giving doesn't lead to a warm glow feeling; more likely it will lead to resentment. Instead we should set aside time, think about our options, and find the best charity for our values.

Don't be Guilt-tripped into Giving

I don't want to discourage people from giving to good causes just because that doesn't always cheer us up. If we gave only to get something back each time we gave, what a dreadful, opportunistic world this would be! Yet if we are feeling guilt-tripped into giving, chances are we will not be very committed over time to the cause.

The key is to find the approach that fits us. When we do, then the more we give, the more we stand to gain purpose, meaning and happiness–all of the things that we look for in life but are so hard to find.

Let me share with you my own example - When I graduated from Business school I was driven by the same criteria which is possibly in the minds of many of you- I was wanting the job which pays the best and the role had to be something exciting. These were the two legs, which I was chasing, and once you get into the chase there is no looking back. However, at a certain point and time you reach a stage where you start wondering what next. In a way, the founding of Mindtree addressed some of these questions and one of the founding ethos of Mindtree is that we will be an organization admired for its focus on social consciousness and until date, we have not deviated on this. Not only as an organization we are very conscious of the impact we create on the society but we help Mindtree minds find their passion in contributing back to Society and this is a very basic fabric of the organization which is binds us together. We encourage Mindtree Minds thru Individual Social responsibility goals to contribute back to Society in areas where they are passionate about.

There is a Chinese saying that goes: "If you want happiness for an hour, take a nap. If you want happiness for a day, go fishing. If you want happiness for a year, inherit a fortune. If you want happiness for a lifetime, help somebody." For centuries, the greatest thinkers have suggested the same thing: Happiness is found in helping others.

Make what change you are able to make now, and let the 'giving spirit' spread like a virus, infinitely touching the lives of people you may never meet, across boundaries you may never cross, in ways you may never imagine. That is the power of giving and your ticket to changing the world.

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Constitutional Compulsions for Social Justice

S. Bisaliah*

1. Backdrop to the Theme: A Prophetic Warning

On November 26, 1949, the Constituent Assembly of India adopted and enacted the Indian Constitution. A day before, i.e., on November 25, 1949, Dr. Ambedkar addressed the Constituent Assembly. An extract from this address is given below:

"On 26th of January, 1950 we are going to enter into a life of contradictions: In politics, we will have equality, and in social and economic life we will have inequality. In politics, we will be recognising the principle of one man-one vote, and one-vote-one value. In our social and economic life, we shall by reason of our social and economic structure, continue to deny the principle of one-man one-value".

"How long shall we continue to live this life of contradiction? How long shall we continue to deny equality in our social and economic life? If we continue to deny it long, we will do so only by putting our political democracy in peril. We must remove these contradictions at the earliest possible moment, or else those who suffer from inequality will blow up the structure of our political democracy".

The extract of this address sets the tone for what consequences would follow if the country ignores the domain of social and economic justice by placing emphasis only on political democracy.

Against this backdrop of prophecy, the issues examined in this paper are as detailed below:

- Why was India said to be entering into a life of contradictions on January 26, 1950?
- Why not to cast the inclusive and exclusive development paradigms in the perspective of Development Economics?
- How are the major domains of our Constitution erected to ensure social and economic justice?
- What are the evidences on the use of major domains of our Constitution to ensure social and economic justice?
- Does 21st Century belong to the deprived? What evidences to contrary? What could be the rationale for social and economic justice?
- What could be the components of a larger canvas for social and economic justice to the deprived?

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2. Development of the Laggards: Paradigms on Inclusive and Exclusive Development

The major challenge of the present century is to bring the laggards (the bypassed social groups, sectors, regions and so on) into the main stream of development orbit. In fact in addition to the emphasis on "Build on the Best", the development focus should be more on the strategy of "Build on the Rest". This is the theme of inclusive and exclusive development. The discipline of development economics would provide some insights into the theme of inclusive and exclusive development paradigms.

- **Paradigm 1:** Boeke's Riddle on development inclusion of Portuguese and exclusion of Indonesians has been explained in terms of cultural differences between these two nationals.
- **Paradigm 2:** Development is always gradual, continuous and smooth, and development benefit groups, sectors and regions. Development exclusion is only a temporary aberration, and bound to diminish over a period of time.
- **Paradigm 3:** Development is neither smooth nor uniform. It is a process of disequilibrium, involving jolts, shocks and breaks. Backwash effects are said to be more dominant than trickledown and spread effects. Because of backwash effects, the exclusion of the already excluded gets reinforced.
- **Paradigm 4:** Development is always selective. Hence development dualism is stubborn, persistent and pervasive, if development interventions through policy instruments are not made. Ghetto development strategies are needed to lead the excluded to inclusive development orbit. Hence the need for Constitutional compulsions for positive decimation and affirmative action.

3. Major Domains of Constitutional Commitment to Social and Economic Justice

The premise that Indian Constitution has committed to social and economic justice in addition to political democracy is quite evident from its three domains.

3 A. This first domain is the very Preamble of the Constitution, where it is adumbrated that we the people of India having solemnly resolved to constitute India into a Sovereign, Socialist, Secular, Democratic Republic and to secure all its citizens:

Justice: Social, Economic and Political

Liberty

Equality

Fraternity

With these noble causes, the Constituent Assembly adopted and enacted the Constitution on November 26, 1949.

Two elaborations on this Preamble are relevant:

- Political democracy is only a means. But the ends are social and economic justice.
- Amartya Sen defines justice as elimination of injustice in the areas of food, health, education, women, Dalits and minorities. In fact, elimination of injustice is a part of inclusive development.

3 B. The Second domain is the Directive Principles of State Policy with its Nobility and Promise. Two examples would illustrate the promise of Directive Principles to ensure economic and social justice. The first one: The opera of the economic system does not result in concentration of wealth and income. The second one: As per Article 41, it is states' obligation to ensure the provision of adequate means of livelihood to its people. Article 47 stipulates: The state shall regard the raising of the level of nutrition and standard of its people, its primary duty among others.

Even though the Directive Principles cannot be enforced in the Court of Law, but these are fundamental in the Governance of the Country.

3 C. The third Domain is the Fundamental Rights: These Fundamental rights are the building blocks of political democracy. The basic question is: Could these Fundamental rights which are enforceable in the Court of Law be interpreted in support of social and economic justice. However, it depends

on mobilizing the concept of radical jurisprudence. Further the disaggregate reading of the Constitution should be avoided, the spirit of the Constitution in its totality should be kept in view, and the adjudication authority should go all out for transformative constitutionalism to ensure social and economic justice.

Again the pertinent question is how to interpret the spirit of our Constitution. The spirit of Indian Constitution could be understood by reading the proceedings of the Constituent Assembly. One could recapture the romance, the conflicts, the clashes, the diversities, the turbulence, the candour, the contradictions and the quality of the debate in making our constitution.

Two observations of the Members of the Constituent Assembly could provide perspectives into the spirit of our Constitution. First, after all, a Constitution cannot be judged merely by its texts. So, it is not the Constitution that matters, but it is the men who work with the Constitution, and the spirit with which they work. Second, what is after all a Constitution? It is a grammar of politics, if you like it. It is a compass to the political mariner. However good it may be, by itself, it is inanimate, it is insensitive and it cannot work by itself. It is for us to work with it, but also use it not merely in letter, but also in spirit. The spirit of our Constitution could very well be appreciated, if we read carefully the address of Dr. Ambedkar on November 25, 1949, a day earlier to the adoption and enactment of our Constitution by the Constituent Assembly.

One more facet of spirit of a Constitution could be gauged from the observation of Joseph Story, the great American jurist on American Constitution: "The structure of the Constitution has been erected by architects of consummate skill and fidelity. Its foundations are solid. Its compartments are beautiful as well as useful. But it may nevertheless perish in an hour by the folly or corruption or negligence of its only keepers, The People".

4. Some Evidences on the Commitment of Indian Constitution to Economic and Social Justice

To the question: Whether our Constitution has commitment the Country to Social and Economic Justice, in addition to political democracy, (But there is a tyranny of majority even in political democracy). The answer is emphatic yes. It is evident in the Preamble, Directive Principles of State Policy, and even in Fundamental Rights, depending on the use of the concepts of radical jurisprudence and transformative Constitutionalism.

There are enough evidences accumulated on the use of the provisions of our Constitution to ensure social and economic justice. To cite some: Reservation policy for the deprived, land reforms, labour reforms including social security, and many Right-Based Initiatives such as Right to Information Act, Right to Education Act, Right to Employment Act, Right to Food Act, and special provisions for addressing the problem of development imbalances in regions of a State, and so on. Some of the "needs" have been transformed into Rights.

How Constitutional compulsions have been used effectively to pass Right to Food Act need some elaboration. Right to Food campaign started sometime in early 2000s. Starvation deaths in Rajasthan, Orissa and Jharkhand triggered this campaign. The People's Union for Civil Liberties provided leadership for this campaign. In the month of May 2001, there was a Public Interest Litigation (PIL) in the Supreme Court. In January 2002, there was a Public Hearing: **"Voices of Hunger"** organized by NGOs. Further, there was a concern on visibility of India in Global Hunger Index and in multidimensional deprivation, and on higher levels of child malnutrition than Sub-Saharan Africa as reflected in National Family Health Surveys. All these and many more, had led to a new interpretation of Article 21: Right to Life of our Constitution, leading to the judicial interpretation that Article 21: Right to Life encompasses Right to Food, and to treat food as a part of Fundamental Rights. It is recalled that Constitution has to be read in its totality, not as a disjoint pieces. Hence, if Articles 39 (A) and 47 are read along with Article 21, Right to Food becomes a part of Fundamental Rights. Hence Food Security has become one of the Right-Based Acts, reminding

both Central and State Governments that Right to Life and food are both Constitutional and ethical concerns. The judicial new interpretation of Article 21 is in accordance with what the philosopher John Stuart Mill observed: I am now convinced that no great improvements in the lots of mankind are possible until a great change takes place in the fundamental Constitution of their modes of thought. This is exactly what is required in interpretation of the spirit of our Constitution.

Yes, considerable progress in social and economic justice in India has taken place. However, there are evidences of "injustice" also: Income and consumption inequalities, gender development disparities, regional development imbalances, poverty, and malnutrition. Even in 2017, India's rank in Global Hunger Index is 100 out of 115 countries surveyed and so on. In this context, two perspectives of Amartya Sen are relevant. **First,** what is the idea of justice: As already stated, elimination of injustice in the area of food, health, education to Dalits, tribals, minorities and women. **Second,** what is the right concept of freedom in a democracy?

Freedom from:

- Hunger
- Illiteracy
- Gender discrimination
- Social humiliation
- And so on.

5. Does Twenty-First Century belong to the Deprived under LPG Regime?

Earlier centuries did not do much to envelop the deprived into the fold of development orbit, but how about twenty first century during which the country has been on high growth trajectory. The answer to this question is No, because, there are enough evidences to argue that LPG Regime has reinforced the privileges of the privileged, and exclusion of the excluded. Our faith in myth and miracle of market economy has led to the further exclusion of the excluded, due to lack of entitlements, assets, and capabilities. In fact, development space for the deprived has decreased, suggesting the need for enhanced drive for social and economic justice. For example, reservations for the deprived in the management quota seats of professional colleges are denied. Public sector has been downsized, and "barriers" to entry into private sector cannot be surmounted by the deprived due to social and economic disadvantages confronting them. All these, and many more have given rise to many apprehensions: 1. Whether Preamble of the Indian Constitution and Directive Principles of State Policy are put to the back burner? 2. Whether the dictum greatest happiness of the largest number is replaced by the greatest happiness of the smallest number.

Why Social and Economic justice?

This question has been answered by Dr. Ambedkar in his address to Constituent Assembly on 25th of November 1949. To recapitulate the theme: How long shall we continue to deny equality in our social and economic life? Those who suffer from inequality will blow up the structure of our political democracy. In addition to this, there are three other reasons: First, there is a brewing anger against social and economic exclusion. Hence there is a forward-looking rationale (i.e., social and political stability), and backward looking rationale (i.e., to compensate for fast injustice). Second, two propensities of human behaviour as articulated by Adam Smith in his book, Theory of Moral Sentiments. First, may by nature is a commercial animal. Second, however selfish man may be, he has concern for the happiness of others also. Perhaps, the first propensity is becoming more dominant, relegating the second propensity to the background. Third, there are four stages in the behaviour of human beings in response to injustice meted out to them:

- Silent tolerance
- Silent resentment
- Vocal
- Violent

With respect to these four stages of human behaviour, the question that is being raised is India bordering between vocal and violent. Is India in civil war, but undeclared?

Given this kind of situation, our Constitution is the only anchor for the deprived. The story of shepherd boy told by Abraham Lincoln is relevant: A wolf snatches away a lamb from the sheep herd. The shepherd boy runs after this wolf and rescues the lamb.

The lamb says (to the shepherd boy): You have restored my freedom to live. I am grateful to you.

The wolf says (to the shepherd boy): You have snatched away my freedom to grab and eat. I despise you.

Don't we think that we have lambs and wolves in our society at large, and in our institutions? Further, our Constitution is like the shepherd boy. That establishes the relevance of our Constitution to protect the deprived, and our Constitution is almost the only source for social and economic justice.

6. Social and Economic Justice in a Larger Canvas

There were two important movements in India during the 19th and early 20th century. The first one was the independence movement led by Gandhiji. The second one was the social movement led by Dr. Ambedkar, in addition to many other social reformers.

In fact, Dr. Ambedkar had a larger canvas for painting the philosophy of social and economic justice for the deprived. The major building blocks of his larger canvas were:

He was a forerunner to the **land reforms** in the post-independent India. He was deeply concerned about surplus labour in agricultural sector and disguised unemployment in India. Above all, land asset was a source of feudalism and serfdom in rural India. He made a revolutionary suggestion in the Constituent Assembly: To nationalize and redistribute land so that there would be no land lords, no tenants and no land-less labour. This was thought to be a solution to the problems of landlessness of the deprived so that the deprived could escape from the tyranny of the feudal landlords.

But this revolutionary suggestion was not agreeable to the Constituent Assembly. Finally, it was agreed to recommend land ceiling and distribution of surplus land to the deprived.

- **Industrialisation** was suggested as a remedy not only for surplus labour in agriculture, but also an avenue for salvation and emancipation of deprived so that they could migrate to urban areas.
- To Dr. Ambedkar, **labour welfare** was an important domain of social and economic justice. Labour was treated as hiver of wood and drawer of water like slaves in Roman Empire. He suggested Minimum wages for agricultural workers, and social security benefits to industrial workers through State patronized labour welfare system.
- **Social and Economic Justice for Women**

  Dr. Ambedkar treated women as a deprived segment of the Indian society, suffering (perhaps silently) in the clutches of some ancient cultural code. For their emancipation, he introduced Hindu Code Bill in the Parliament on September 15, 1951 with three major components: Abolish different marriage stems and establish monogamy as the only legal system of marriage; conferment of right to property, conferment of marriage rights, and judicial separation of wife and husband. It is to be realised the Bill is in fact a derivative of Preamble of Indian Constitution. There was a stirring debate in the Parliament with strong opposition to the Bill. To quote one strong objection to the Bill by Sham Prasad Mukherjee: The bill would shatter the magnificent structure of Hindu culture, stultify a dynamic way of life they (women) lead, wonderfully adapted to changes for centuries.

  The reaction of Dr. Ambedkar to this strong objection to the Bill was "Yes, survived as vanquished, subjugated and slaved. This survival does not imply the goodness or soundness of the social structure".

  But reaction of Justice Gajendragadkar to this Bill was: The achievement of Dr. Ambedkar would go down in history as a very eloquent piece of poetic justice. The Bill was not approved in Parliament. On September 27, 1951, Dr. Ambedkar resigned from the cabinet. This decision to resign could be treated as courage of conviction. Power must pass and vanish, but glory, which is accumulated through courage, and

conviction alone remains. Some leaders avoid battles to avoid defeat. But some wage epic battles. That alone would pilot the system to the cause of social justice. The great irony was that the components of Hindu code Bill were incorporated in the four bills approved by parliament during 1955-56. Hence, the Hindu code bill presented by Dr. Ambedkar in 1951 was a forerunner for social justice to women.

Social and economic justice to the deprived segments of the society would need a larger canvas to paint and to address the problems confronting these segments through positive discrimination and affirmative action.

Yet, another dimension of the needed social justice emanates from the diversity of India. India is a country of diversity. It is an ethological museum and an epitome of the world. This diversity of India should be reflected in our institutions, public offices, and educational institutions and so on. In fact, India is integrated by law, but it is segregated by practice and perspective. The deprived segments of the society not only live parallel life to privileged, they also have a different understanding of what India has been, is and could be. There are two warring souls and two perceptions. That is why as stated already India is said to be in civil war, but undeclared. We have to realize that the rights of the deprived are protected not by law alone, but by social and moral conscience of the Indian society. Perhaps, an epic battle like the one waged by Dr. Amedkar is needed to awaken the frozen conscience of our society. The Indian constitution as such has all the "ingredients" needed to support social and economic justice. That depends on our understanding of the spirit of the constitution in its totality.

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Application of Statistical Sampling to Audit and Control

T. Srivenkataramana*

Abstract

The traditional literature applying statistical sampling to auditing sometimes overlooks the special structure of audit populations. Much of the literature is based on techniques developed for sample surveys. Of late there is an increasing awareness to take note of the unique environment in which audit sampling takes place and to incorporate all available auxiliary information to improve the precision of estimators. The present paper begins with a brief historical review and then focuses on the special nature of audit populations. This is followed by the description of a class of auxiliary information estimators and the occasional problem caused by situations of low frequency of errors but with large magnitudes. Next, monetary unit sampling is reviewed and key unit sampling is proposed as an alternative when the former may not apply. An outline of a Bayesian formulation to use prior information is provided. Finally, guidelines are provided for a choice of procedure enumerating the major factors to be considered.

Keywords: *Audit and control, Key unit sampling, Monetary unit sampling.*

1. INTRODUCTION

The development of statistical methods in the field of accounting and auditing is instructive of the difficulties in the acceptance of statistical ideas and of problems in adapting standard statistical methodology to special situations. In recent years the accounting profession has turned to statistical techniques to aid in the analysis of financial data. Specifically, statistical sampling has increasing popularity among internal and external auditors. Auditors are expected to ensure effective internal control by creating value to their function. Since complete enumeration is not possible because of vast data, frequently, samples are employed to make this review.

Sampling of accounts is generally concerned with quantitative characteristics. When the auditor examines a set of N accounts, he typically knows the book value Y_1, Y_2, ... Y_N in the population. Denote the total book value by Y. The auditor ascertains, after examining an item, the correct value for this item

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(called the audit value Xi). Clearly if the book amount is correct then Xi =Yi. Thus the purpose is to measure the error: Di = (Yi – Xi).

The objective of sampling here is to infer about the accuracy of the book value. That is whether the total book amount Y is reasonably close to the total audit amount:

$$X = \sum_{1}^{N} Xi$$

2. ATTRIBUTES VS VARIABLES

The first suggestions to use sampling in auditing came in the 1930s (eg.Carman, 1933). Several papers followed in the 1940s. Neter (1949) clearly explained the advantages of these methods. The initial focus was on sampling for attributes. This posed relatively few difficulties. Attributes sampling plans are adequate if the auditor is concerned only with detection of errors and determination of frequency of errors with any prescribed level of confidence variable sampling is necessary. But serious problems arise when we apply standard sampling theory for the case of variables in auditing. For example, if a simple random sample of n items is selected and their audit amounts determined then an unbiased estimator of X is:

$$\hat{X}1 = \frac{N}{n} \sum_{1}^{n} Xi = N\bar{X}$$

Where Xi is the audit amount of the ith sample item and $\bar{X}$ is the sample mean audit amount. This estimator tends to be very imprecise in view of the large variability in many accounting populations. Though stratification by book value reduces the sampling variability there are still several limitations. Comparison of $\hat{X}1$ with the known Y may reveal substantial total error even though no errors were found in the sample.

3. A CLASS OF AUXILIARY INFORMATION ESTIMATORS

Kaplan (1973) has investigated special cases of the following general type of estimator: $\hat{X}_2 = N[\bar{X} + Z(\bar{Y} - \bar{y})]$.

Where Z is either a constant or a function of the sample values (Yi x i), i = 1,2,.....n, drawn by simple random sampling. All estimators of the form (3) are consistent in the trivial sense that if the entire populations is audited, $\hat{X}2 = X$ so that the estimate coincides with the true value. If z is any constant the estimator given by (3) is unbiased. It is easily verified that by setting Z = 0 is (3) we obtain the mean per unit estimator and when $Z = \bar{Y}/\bar{X}$ we have the classical ratio estimator. Finally, the regression estimator occurs when Z represents the sample regression co-efficient. In this set up, for statistical inference one has to appeal to the central limit theorem and hope that the sample size is large enough for the sample mean to be drawn from a normal distribution. Since the sample standard deviation is also to be estimated from the data, the t-distribution is generally used for statistical tests. Thus, if we wish to construct a confidence interval about $\hat{X}_2$ with confidence co-efficient (1 - $\propto$), the interval is given by:

$$\hat{X}^2 \pm \text{tk}(\propto)\, S\widehat{Xn}$$

Where, tk ($\propto$) is the value of Student's t with (k-2) degrees of freedom that is exceeded with probability $\propto$ and $S\hat{X}$ is the standard error of $\hat{X}_2$.

4. FURTHER USE OF AUXILIARY INFORMATION

Since the book amount Yi are known for all items in the population this information can be gainfully incorporated into estimation strategy. For example, consider the difference estimator. Under simple random sampling one may estimate the total error.

D = (Y- X) by

$$\hat{D}1 = \frac{N}{n} \sum_{1}^{n} d1 = N\bar{d}$$

Where di = (yi – xi) is the difference found in the ith sample item and $\bar{d}$ is the sample mean difference. Alternatively, one may use the ratio estimator.

$$\hat{D}2 = Y\,(\overline{d/\bar{y}})$$

Where $\bar{y}$ is the sample mean for y. These estimators can also be used along with stratification of the population units. Another alternative is to use pps sampling with book value as size measure. Then an unbiased estimator D is:

$$\widehat{D3} = \frac{1}{n} \sum_{i-1}^{n} di\,/(y_i\,/y)$$

$$= \frac{y}{n} \sum_{i-1}^{n} di\,/y_i$$

Assuming with replacement sampling for illustration.

Estimators such as the difference, ratio and regression estimators with simple or stratified random sampling or $\widehat{D3}$ have several serious limitations in the very common situation where the frequency of errors is low, often only 1 or 2%, although potentially great in financial impact, and the variability of the data is estimated from the sample. Where no errors are detected in the sample, that is all sample di = 0, the estimated standard error for these estimators is zero. This may be seen from the estimated variance formula for the difference estimator.

$$V(D) = \frac{N(N-n)}{n(n-1)} \sum_{i=1}^{n} (d_i - \bar{d})^2$$

An estimated standard error of zero leads to the unwarranted conclusion that all the book values in the population are correct! With traditional schemes and estimators this problem is frequently encountered in auditing.

MONETARY UNIT SAMPLING (MUS)

The most appropriate form of sampling will depend, among other things, on the relative liability of items of various sizes to be in error and on the relative costs of checking them. Often, the items with larger values will be relatively more important. Anderson and Teitlebaum (1973) have suggested the use of an individual monetary unit such as rupee or dollar as the sampling unit. The auditor would still examine the account to which the sample rupee belongs but then would prorate the total error for the account to each rupee. Thus, if the jth population rupee (j=1,2…..Y) belongs to the ith (i=1….N) account in the population, its audit value is $\sum_j^1 Xi$ / Yi and the error in the jth rupee is Dj = Di / Yi. A simple random sample of n rupee amounts is then selected. If the selections are with replacement the process is equivalent to a PPSWR scheme.

While Neter, John suggest multinomial approach by dividing the population into mixtures of populations which potentially may not serve the purpose where the quality of governance is high. In situations where quality of governance is perceived to be low, binomial approach could serve by dividing the population into two of no error and of potential error. Given the cost of auditing, population over statement error (as has been done by Fienberg, Neter & Leitch) may be attempted in spite of computational complexities.

5. NEEDLE IN HAYSTACK PROBLEM

The situation of most of the accounting units being error free, but with the possibility of a few large errors has been described as above in the literature. MUS tackles this problem effectively only if these errors are associated with large book values. Then the large needle is chopped up into a lot of small needles which occur with sufficient frequency that atleast some of them have a chance of being detected by the sample. On the other hand, if the needles were in audit units with small account balances then MUS might not improve situation. For example, consider the error function p(y) which yields the error rate as a function of the book value of each audit unit. Let

$P_1(y) = C_1$

$P_2(y) = C_2 y$

$P_3(y) = C_3 y (1000 - y)^2$

Here MUS will be effective only for the case of $P_2(y)$. In this setting, we propose below an alternative scheme.

6. KEY UNIT SAMPLING

Suppose the auditor knows, based on previous audits, that the errors are greater among units with certain characteristics, other than higher book balance. Thus, if the rate of errors is known to higher in Location II, one may stratify the population of location and draw a larger sample from Location II. A logical extension of this is key unit sampling. Here the rupee units are replaced by key units and sampling may be done with probability proportional to key units.

As an example, the key units may be the monetary units where the majority of errors are suspected to exist, and audit units themselves in the other cases. If the population of vouchers can be assumed to have a logical arrangement, one operationally convenient method for sample selection is to apply PPS systematic sampling where the key units are the measures of size. Let $Z_1, Z_2 \ldots$ Zn denote these measures. We cumulate the measures of size of the units and assign them the ranges 1 to Z_1, $Z_1 + 1$ to $Z_1 + Z_2$ and so on. In order to select a sample of n units, a random number r is drawn between 1 and k = Z/n where

$$Z = \sum_{1}^{N} Zi$$

Then the units in the sample are those in whose range lie the random number r and all other numbers r + k, r + 2k,…… obtained by adding k successively to r. if there is any unit whose measure of size is k or larger, it is removed beforehand from the selection procedure and is taken into the sample with certainty. Under this scheme the probability that a unit is included in the sample is $\pi_{ij} = \mathrm{nm_{ij}} / \mathrm{Z}$

Key Unit Sampling has distinct advantages in detecting the needle in the haystack where there is previous information suggesting that errors follow a certain pattern, other than occurring in the larger audit units. It is also suggested as being beneficial when the audit units are not quantified in terms of rupees (currency terms).

7. BAYESIAN FORMULATION & OTHER APPROACHES

Whenever apriroi information is not made available of non-zero accounts, Bayesian approach can be used. Felix & Grimlund (1984) assumed normal distribution of error amounts which is incompatible in situations of non-normality. Cox & Snell (1979) have proposed Bayesian bound approach for MUS by making assumptions of gamma distribution for population error rate 'p' & inverse gamma distribution for assessing mean taint error 'M'. The upper bound has been of MUS under Bayes formulation has been attempted by Moors & Jenssens (1989). Observed number of errors and mean value of errors in money terms is expected to follow Poisson variable in its discrete form.

For a given prior model and a given population this upper bound is a random variable, the outcome of which depends only on the sampling results. The authors describe a general theoretical method to derive the probability distribution of the random variable. However, this theoretical approach is essentially applicable only when the population distribution can be represented by a relatively simple function. For complicated population distributions, as are likely to occur in practical situations, simulation remains an indispensable tool.

8. CHOICE OF PROCEDURE

Loebbecke and Neter (1975) point out that the choice of an appropriate statistical audit sampling procedure depends upon audit objectives, the audit environment and audit procedures. Under certain conditions of each of these factors, the different estimators may perform poorly. Based on an extensive empirical study the authors present a decision flowchart to aid the auditor in selecting the procedures.

When the auditor utilizes a statistical sampling approach as a means of gathering evidence to meet one or a set of audit objectives a careful choice must be made of the procedure. A number of factors must be considered if the results are to ultimately satisfy the audit objectives at hand.

These include the constraints of three types as follows:

1. Audit Objectives:

- Attributes versus variables
- Estimation versus testing
- Combined attributes and variables versus variables alone

Environmental Factors:

- Skewness of book values
- Error rate
- Error magnitude
- Error direction and Computer availability

Characteristics of Audit Procedures:

- Ability to enlarge sample
- Nature of sample frame
- Bias of audit procedure
- Availability of corroborative audit procedures and
- Isolates versus simultaneous audit procedures

Audit Objectives:

The audit objectives have a significant bearing on which statistic is of greatest interest and therefore, on whether the sampling procedure concerns an attribute or a variable. For example, in compliance auditing, the concern is, with the degree to which the accounting control procedures are being applied as prescribed.

Primary interest is in whether or not the procedures are correctly applied and in the extent of cases in which they are not correctly applied. Thus the study characteristic is an attribute. While in substantive auditing the objective pertains to a monetary magnitude and the characteristic of interest is a variable. Combined attributes – variables (CAV) procedures have been formulated to obtain an upper bound on the total monetary error. This upper bound is initially estimated based on attributes and the estimated bound is then modified by variables data to obtain a tighter bound.

When the sample results are assessed by means of a confidence interval which indicates a range within which the population characteristic can be expected to lie an estimation approach is said to be used. On the other hand, when the sample results are assessed by means of a decision rule which leads to one or more alternative decisions a testing approach is applied. There is generally a direct link between these two approaches and the distinction is only in the uses. In the testing approach a decision is made based on the sample while in the estimation approach, information about the magnitude of the study variate is obtained without leading directly to a decision.

Environmental Factors:

There are atleast four important environmental characteristics which affect the choice of a sampling procedure for variables or combined attributes – variables: skewness of the population, error rate, and magnitude of errors and direction of errors. These factors affect the behavior of a sample statistic in two main ways: the precision of the estimator and reliability. If the auditor knows in advance the exact nature of these environmental factors, the problem of concern would be solely that of finding a sampling procedure which needs the stated audit objectives and provides adequate precision at an acceptable confidence level. As an example, the auditor dealing with a highly positively skew population and an estimator which is known to be inefficient in such a situation may examine all items on the right tail.

Characteristics of Audit Procedures

There are several situations where the auditor may like to enlarge the sample for instance, in acceptance samplings the testing may be done in two or more stages. Or if the population turns out to be highly skew the auditor may wish to enlarge the sample so that use of normal distribution for constructing a confidence interval is appropriate. Also the nature of sampling frame has an important effect on the choice of the procedure. This determination of optimal strata boundaries based on the book values can be made for stratified random sampling of accounts. An audit procedure is said to be biased when the inherent errors are persistent in their effect. The errors may be introduced by persons other than the auditor too. For example, a customer may not respond at all. Availability of corroborative procedures may be of help when the distributional assumptions are not met fully. Finally, it is to be noted that the auditor may use several audit procedures simultaneously in order to obtain evidence about a set of objectives in an audit area. An illustration is provided by the examination of inventory balances for verification of accurate quantities, correct costs and proper extensions. The situation is quite complex when several audit procedures are used simultaneously. If one could model this situation, taking into account the areas of overlap which exist between the procedures as well as the areas of uniqueness, it might be feasible to develop a test for deciding whether or not the book value is reasonable, such that the test embodies known risks of making incorrect decisions.

CONCLUSION

Audit and control present a special area of application of statistical sampling. Due to the mixture nature of audit populations, direct use of traditional sampling may not yield reliable results. Novel techniques like key unit sampling which suitably incorporate corroborative evidence will be helpful in this context. The choice of the sampling procedure must also consider the objectives, and the audit environment. Auditing forms an area of increasing interest to the statistical samplers.

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Performance of UPA Vs NDA Governments from 2010-11 to 2017-18 - A Critical Evaluation

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Introduction

There are varying reports on the performance of the National Democratic Alliance (NDA) since it took power on May 25th 2014. The analyses of the analysts provide a range from non-performance to the best performing government since independence. While it is incorrect to compare over irregular time period, it is equally important to realize that all performed Governments have set some definite trend keeping social and economic objectives set forth. The Planning Commission then had formulated plans which is now substituted by Niti Aayog. Five year and Roll on plans were formulated under earlier regimes while we have Niti Aayog directing us on the path way to progress. The thrust of development was on Agriculture earlier in the formative years of the Nation (1950-55), it made a shift towards Industry by Mahalanobis model of development planning (1956-61). LPG era made a drift towards services which made Indian Economy gather momentum and faster growth ever experienced.

Now the time has come to elucidate the happenings in growth between two time periods 2010-11 & 2017-18 with a median time slot at 2014-15. The theme here is on analysis of macro performance of Indian Economy during NDA & United Progressive Alliance (UPA) Governments. Only three time periods are considered with truncation in between. The time slots are: 2010-11, 2014-15 & 2017-18.

The method of comparative statics is used to have a photographic analysis of trend set in. There is, however, appropriate linkage provided to events that happened at domestic and beyond National Boundaries. Trends, break ups and continuity are identified to project wherever necessary. As many as, twenty macro-economic indicators are considered for analysis. The indicators are: 1. GDP (Market Prices), 2. GDP (Constant Prices), 3. Gross Savings (% of GDP), 4. Capital Formation (% of GDP), 5. Per Capita Net National Income (PCNNP) at current prices, 6. Production of Food Grains (in MTs), 7. Index of Industrial Production (%), 8. Electricity Generation (%), 9. Prices Inflation (WPI Avg-% change), 10. Prices Inflation (CPI Avg-% change), 11. External Sector Exports US$ (% change), 12. Import US$ (% change), 13. Current A/C Balance (% of GDP), 14. Foreign Exchange reserves US$ Billion, 15. Average Exchange Rate (Rs/US$), 16. Money and Credit-

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Broad Money M3 Annual (% change), 17. Scheduled Commercial Bank (Growth-% change), 18. Gross Fiscal Deficit (% GDP), 19. Revenue Deficit (% change) and 20. Primary Deficit (% GDP).

The economic Survey Reports of Government of India will form the data base of the indicators to be discussed in the present essay.

GROSS DOMESTIC PRODUCT (GDP)

The GDP at market and at constant prices have made a definite decline. The GPD at market prices which was at 7.9% in 2010-11 dropped to 7.5% in 2014-15 and is now at 6.5% in 2017-18. A million jobs have lost due to demonetization on 8th of November 2016. This means wealth creation had hiccough due to a decision for non-economic reasons. The government is making concerted efforts to boost growth. The economy is still adjusting to the vacuum created by an action warranted for administrative corrections. An Economy can gather momentum only when people join voluntarily for system correction.

The GDP at constant prices show the same trend of consistent fall and it is obvious that it stood at 6.1% in 2017-18 after falling from 7.8% to 7.2% in 2014-15 & 2010-11 retrospectively.

The fall of GDP began with UPA regime and continued in NDA rule for reasons beyond economics. The trend in the economy got dented because of lukewarm response of economic agents to changes initiated by them by a change in the Government. Government cannot change the characteristics of people, however, vice versa is true.

GROSS SAVINGS

The gross savings in the economy declined from 32% of GDP in 2010-11 to 29.0% in 2017-18. There was a marginal increase in gross savings to 33.1% in 2014-15. Less savings will not generate investments for the economy to generate wealth. This leads to dependence on foreign investments at a higher cost and at transfer of funds by market rate of interest. The wealth generated will get transferred to investors from outside who will enrich the source economies. Economic projects cannot be initiated under downward savings scenario. How can any government trigger growth without increase in savings? The economy is now poised for a low spiral to be reversed by high return projects such as infrastructure and high employment generation oriented and high return projects. MSMEs are at a critical stage of their upsurge. Savings led investment projects are not at all there as a movement amongst people for acquiring wealth. There is an urgent need to address this issue of augmented savings activities to generate wealth.

CAPITAL FORMATION

Since savings rate was low during the period under reference, capital formation got dented. The effect of this is seen in the decline of capital formation as a % of GDP from 35.1% to 34.4% to 26.4% during 2010-11, 2014-15 & 2017-18 respectively. Non-conversion of savings for productive economic activity as investment is a sign of failure of the investment apparatus to channelize savings. Investment banks should embark upon ideas of routing investments for optimizing growth. Development banks in India are short of ideas. There is, however, more intervention of the governmental apparatus for their convenience in the working of banks at the operations level in spite of tighter regulatory control by the Reserve Bank of India. This will lead to more unsuccessful expeditions in the area of production. How can we think of Indians short of bright ideas; they float around and no one there to pick for production and value generation.

PERCAPITA NET NATIONAL INCOME (PCNNI)

PCNNI at current prices is growing consistently. It has increased from Rs.35,993/- in 2010-11 to Rs.86,454/- in 2014-15. It further increased to Rs.1,11,782/- in 2017-18. There is spiral growth in PCNNI to 140.20% & 22.66% in 2014-15 & 2017-18 with respect to previous base periods. The rate at which PCNNI is increasing has fallen in the NDA regime. The people are accumulating income at the rate at which they had during UPA regime. This is surely a cause of concern. The poverty levels of people will increase if the same trend were to continue. There is little or no spread effect of the earnings of citizens. The purchasing power of people is on the decline. This suggests that job generation has not happened at the expected level. Unless the situation is corrected, in the next forthcoming years, people suffering cannot reduce. This calls for expansion

of job creation activity by developing skills of people. Skills training has been a thrust by the Government. Training people for jobs by induction of skills is to be on top priority of the Government. Is our Governmental machinery ready for an uphill task of production of skilled personnel?

PRODUCTION OF FOOD GRAINS

This is another sector of positive growth since last eight years under consideration. The food grains production has increased from 241.6 MMTs in 2010-11 to 252 MMTs in 2014-15 - an increase of 4.3%. The increase between 2014-15 & 2017-18 is 9.7%. That is, production has increased from 252 MMTs in 2014-16 to 276.5 MMTs in 2017-18. Monsoon has favoured people with food grains; not the market. Agricultural prices crashed during the post demonetization period. Farmers have been suffering have multiplied across States. The number suicides of farmers since several years is a sign of failure of the market to realize better prices. Agriculture being a State subject, movements of farmers for scrapping loans and political promises by leaders for getting waivers are no signs of market improvement. There is need to develop market entrepreneurs to integrate agricultural markets by a robust supply chain systems. The role of Food Corporation of India, Ware Housing Corporation and commodity marketing boards, functional institutions are in existence with sufficient levels of success. More such successes must be replicated to ensure system success.

INDEX OF INDUSTRIAL PRODUCTION (IIP)

There is global doom for the manufacturing sector. Indian manufacturing sector also suffers from the fall in growth rate. The index of industrial production (IIP) has decreased from 7.8% in 2010-11 to 4.0% in 2014-15. It fell further to 3.2% in 2017-18. The only way is to explore the possible areas of manufacturing of goods. Infrastructure development of large scale projects, production of necessities for improvement of quality of life, production of supplements for improvement of health and so on are the possibilities one can think of. Oil exploration is still an exercise yet to gather momentum. Tourism industry needs a big boost through its infrastructure well set for attracting foreign tourists. India has the potential but not social leadership to take on.

ELECTRICITY GENERATION

Power generation is a core critical product to accelerate the economy. Indian economy has a huge gap between demand for and supply of power. Electrification of villages is tall task undertaken by the Government. Power in large scale is required for the industries to operate successfully. What is more needed is quality power which is uninterrupted and at the same voltage. There is shift from hydrogenation to non-conventional sources of energy such as thermal, nuclear, solar and so on. Research and Development activity in the area of power generation is needed to filling the gap between demand and supply. Electricity generation has increased from 5.56% in 2010-11 to 14.8% in 2014-15 and dipped down to 3.9% in 2017-18.

Accelerating the supply of power is the need of the time. GDP cannot growth faster unless momentum of generation is picked up. There is need to review policy documents on power industry to facilitate growth to pick faster than it is now. Power Grid for distribution and power generation- by large and small entrepreneurs- must be tuned up for effective toning up of growth rate.

PRICES INFLATION (WPI Average % change)

Inflation at the whole sale level is on the decline for the worse to happen for agricultural sector. The average inflation with WPI as the base was at 4.8% in 2010-11 and dived to 1.9% in 2014-15. It rose to 2.9% in 2017-18. It is revival of agricultural markets in 2017-18. However, farmers suffered from price crash during 2014-15. The prices of food grains crashed in spite of good monsoon. A bounty in production will feed millions not the grower. What a paradoxical situation? Grow more for better income has never been realized due to failure of agricultural marketing system functioning. Neither there is a transfer of fall at the consumption level. Inflation with CPI as the base stood at 5.9% in 2010-11 & 2014-15, while it was at 3.3% in 2017-18. Barring some transfer of vegetable and fruit prices of other commodities remained as it they were. What a fallacious situation in an emerging economy? Quality governance of institutions will enable change to happen. AMUL like organizations would solve the problems of farmers and consumers by meeting their functional requirements. How many AMULs do

we need to strengthen marketing system? As many we can establish and see them through the success. Unfortunately, the best days are yet to come.

When market fails, Governance is supposed to take over. That is not happening in India. Markets are made to fail to reflect on the inefficiency of the Government. Non-political players who are not professionals create a distort leading to instability. This will not augur well for an emerging economy. Action oriented results are accepted and stability is inherent in it.

EXTERNAL SECTOR

External sector consists of exports and imports. Exports grew at 4% in 2010-11 while it was -1.3% in 2014-15. At the time of taking over, the NDA has negative exports. This was reversed to 12.1% in 2017-18. Export led growth has shown results. At the same time, imports are at -2.6% in 2010-11 & -1.3% in 2014-15 & to +1.8% in 2017-18. There is a parallel trend in both imports and exports. The governmental efforts are in boosting exports and have 'Make in India' strategy at work. This has not made much impact in production of local material for exports. However, sincerity in efforts cannot be denied. Made in India must be our goal. Trade relations and political leadership to accelerate trade will enable generate more employment. We are still on the formulation stage. Indians are everywhere to bring in such an effort of positive growth.

CURRENT ACCOUNT & FOREIGN EXCHANGE

The current account balance as % of GDP dwindling with negative trend. It moved from -2.65 in 2010-11 to -1.3% in 2014-15. The number stood at -1.8% in 2017-18. Similar trend is normally expected with good foreign exchange reserves. The reserves is continuously moving from US$ 304.8 billion in 2010-11 to US$ 341.6 billion a rise of 12.1% where as it was at US$ 409.4 billion in 2017-18 an increase of 19.85%. The country is strong to make transactions for a good period without hindrance. This is unfortunately followed by a fall in Average Exchange rate. The rupee value has decreased from Rs.45.50 to Rs.61.14 in 2014-15. It has further come down to Rs.64.49 per US$ in 2017-18. While reserve situation is favourable, exchange is on the fall. What money value can be more stable? An Indian rupee to a US$! The money market situation is worsening. Is this for good? India is strong when products and value for the products are favourable. A robust monetary system would enable us to move faster and better. Markets are not be established; they are to be built by fundamentals. Monetary fundamentals are to be strengthened to make things better, stronger and robust.

MONEY, CREDIT & BANKS

The broad money M3 is annually changing in double digits. It was at 14.7% in 2010-11 and stood at 10.9% in 2014-15. In 2017-18 it was at 10.5%.The money flow appears stable in terms of annual change. This has to be supplemented by effective growth of scheduled commercial banks. The growth of commercial banks has declined from 17.2% in 2010-11 to 9.0% in 2014-15. It was at 9.3% in 2017-18. The banks are in an unstable condition because of instability by select borrowers whereas Institutions are to be strengthened in the context of changing scenario in business. RBI as a monitor of all Banks need to reverse bank growth rate by performance.

FISCAL INDICATORS

The gross fiscal deficit, revenue deficit and primary deficit as % of GDP are pegged to enable growth achieve a stable rate. All three types of deficits are under effective supervision of Ministry of Finance. Revenue deficit is at 1.9% and Primary Deficit is at 0.1% 2017-18. The financial vigilance of the government will lead to financial affirmative action to make things happen. How should that be done is the question.

CONCLUSION

The economy has not made any significant head way in any sector under consideration. Under UPA some parameters of study had declined; under NDA reversal has just begun.

The GDP declined under NDA mainly because of the demonetization of currency in November 2016. The economy is poised towards growth with a clear trajectory. However, indicators do not in any way reflect significant differences in the sector parameters.

Good days are expected to come. When it will come is a big question!

Performance of UPA V/S NDA Governments 2010-11 to 2017-18 - A Critical Evaluation

Sl. No.	Indicator	2010-11	2014-15	2017-18
1.	GDP (MP)	7.9	7.5	6.5
2.	GDP (CP)	7.8	7.2	6.1
3.	Gross Savings (% GDP)	32.3	33.1	29
4.	Capital Formation (% GDP)	35.1	34.4	26.4
5.	PC / VNI (current prices in Rs.)	35993	86454	111782
6.	Production food grains in	241.6	252	276.5
7.	Index of IP (%)	7.8	4	3.2
8.	Electricity generation (%)	5.56	14.8	3.9
9.	Prices Inflation (WPI avg % change)	4.8	1.2	2.9
10.	Prices Inflation (CPI avg % change)	5.9	5.9	3.3
11.	External (Sector expert US % change)	±4	-1.3	12.1
12.	Import US (% change)	±2.8	-0.5	1.8
13.	Current A/C balance (%GDP)	-2.6	-1.3	-1.8
14.	Foreign Exchange Research US $ billion	304.8	341.6	409.4
15.	Average Exchange rate / USD	45.5	61.14	64.49
16.	Money and Credit - Broad money M3 annual (% changes)	14.7	10.9	10.5
17.	Scheduled Commercial Bank (growth) (% change)	17.2	9	9.3
18.	Fiscal Indicators - Gross Fiscal Deficit (% GDP)	4.8	4.1	3.2
19.	Revenue Deficit (% GDP)	3.2	2.9	1.9
20.	Primary (%GDP)	1.7	0.7	0.1

Source: **www.rbi.org**

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Total Service Quality in Healthcare with Special Reference to Yeshasvini Project in Karnataka

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1.0 Introduction

Awareness for service quality in health sector is a recent phenomenon in developing countries like India. The awareness has become strong enough to deserve serious evaluation of the quality level. Entitlement for a reasonable quality level at affordable cost is now considered almost a *right* of the people.

2.0 Motivation

2.1 Need for the Study

It has been reported that the inequality in access to health service is even more than in economic status in the developing countries. The poor stand highly disadvantaged. Thus, it is a pressing need that service quality in health sector is properly evaluated, taking into consideration all the stakeholders. The Indian case is less investigated. Hence, the need for this study.

2.2 The Research Gap

Service quality in healthcare has been researched and discussed to some extent. There is a body of literature on TQM in service quality, in general, and in healthcare. Some isolated work on service quality along with TQM in sectors like banking is noted.

A unified approach of fusing together service quality considerations with TQM principles in healthcare is not seen in the literature. Clearly, such an effort provides a holistic framework for more effective measurement. This shows a gap in research efforts. Such a consideration is the basic motivation for the work in the thesis. Developing a *(Service Quality + TQM) = Total Service Quality (TSQ)* framework in the context of healthcare is an objective of the work. On the application side, the PPP model of Yeshasvini scheme of the Karnataka Government is evaluated from the TSQ perspective.

3.0 Objectives and Scope

3.1 Objectives

The specific objectives of the study are:

1) To assess the levels of service quality as perceived and expected by service providers and end users together with a ground level evaluation.

The thesis has been awarded Ph.D. degree in Management by Manipal Academy of Higher Education (MAHE) on 30th of May 2018. The guide & co-guide are Dr. N.S. Viswanath, Director and Principal of M P Birla Institute of Management & Dr. T.V Raju, Director (Planning), R V Institutions, Bengaluru, respectively. The author extends grateful thanks to Dr.T.Srivenkataramana for his support and encouragement.

2) To develop an appropriate classification of determinants of service quality in health sector and indicators of quality level, along with the necessary theoretical framework (TSQ).

3) To evaluate the quality aspects of Yeshasvini scheme for healthcare in Karnataka &

4) To draw policy conclusions based on the results of the study.

3.2 Research Questions

Keeping in view the stated objectives, research questions (RQs) are formulated as below:

RQ 1. a) What are the determinants of service quality in healthcare?

b) How to quantitatively model service quality delivery in hospitals?

c) How to fit healthcare service into TSQ framework?

RQ 2. What does the patient-centered empirical evidence on healthcare quality in India suggest?

RQ 3. How is the performance of Yeshasvini healthcare project as a PPP model in Karnataka?

3.3 Scope of the Work

The present study is theoretical in part, by synthesizing the service quality and TQM concepts in healthcare. It provides a Total Service Quality (TSQ) framework. On the application side, the quality aspects of a statewide healthcare scheme are evaluated. This refers to the Yeshasvini scheme, right from its inception in the year 2003 and covers geographically the entire Karnataka State. Input data are gathered from a sample of patients, family members, physicians and administrative staff of the network hospitals including those under the PPP model.

4.0 Description of the work

4.1.1 Statement of the Problem

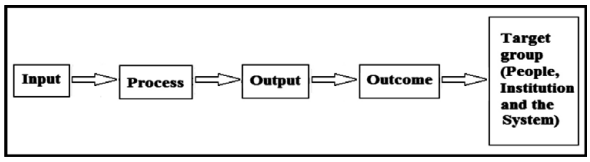
No studies done from a holistic perspective by integrating quality of service & total quality by management practices in an institutional setting. The present study aims to develop a theoretical framework from TSQ perspective and evaluate a *Public-Private-Partnership* (PPP) model from service provider and end user angles in the backdrop of *Total Service Quality.*

4.1.2 Methodology

The theoretical aspects are investigated and quality indices are developed. These methods have been tested before finalization. The data for chosen field studies were collected from secondary and primary sources.

The focus group procedure was used as the method of collecting qualitative data about the Yeshasvini scheme. The participants were either *providers* or recent *beneficiaries* of healthcare.

A field study was conducted in a hospital at Valasad town in Gujarat State. A similar study was conducted covering a few hospitals in Bengaluru and Mangaluru cities. A questionnaire to measure service quality was developed and tested using focus group inputs. The research design is based on the juxtaposing of *Input (service provider) - The Process-Output-Outcome (end-user)* paradigm. The paradigm of design is shown in Figure 1.



Source: Author

Figure 1: Basic Research Design

A matrix of total quality v/s service quality is developed; cost, time & value creation was included.

4.1.3 Instrument Development

All the instruments: a. *Checklist* b. *Schedule* c. *Questionnaire* and d. *Interview schedules* are developed keeping in view the work by Parasuraman and his associates. The *fourteen basic principles* are confounded with quality dimensions.

There are three parts in the instrument: Part I - Demographic items (eleven), Part II - Topics (sixty-three) and Part III - Yeshasvini scheme specific (seven).

4.1.4 The Size of the Sample (n)

The sample size was worked out using a standard rule (Cochran's sample size formula, Chap. 4) as 400. The

precision of estimation depends primarily on the *actual size* of *n* and not that much on the *relative size n/N.* In other words, the role of *N,* after a certain threshold level, N_0, virtually disappears in the determination of precision.

4.2.1 Positive and Negative Attributes

The former ones are desirable, while the latter are not. Examples for positive attributes include compassion for patients, uniform treatment protocol, while absence of fire safety measures and medical negligence are instances of negative attributes.

Classification of Negative Attributes

1) Class *A* Defects: *Very Serious*

Will cause severe health damage to the patient which will be irreversible or will even cause death. Non-testing for allergy or overdose of anesthesia are cases in point.

2) Class *B* Defects: *Serious*

The patient may possibly suffer a Class *A* damage or somewhat less serious health consequences, may end up with reduced balance life span. Absence of fire and radiation safety measures provides examples.

3) Class *C* Defects: *Moderately Serious*

Will cause trouble that is less serious than permanent health damage, but not insignificant in its impact. Certain cases of medical negligence are examples.

4) Class *D* Defects: *Minor*

No impact on health status or longevity. Has minor effect on service quality level. Absence of a pharmacy in hospital premises is an example.

A System of Weights

A suggested method of weighting to arrive at a composite demerit index for the hospital is the following:

Let X_A, X_B, X_C, X_D be respectively the number of Class *A,* Class *B,* Class *C* and Class *D* defects in an inspection unit. Assuming each Class of defect to be independent and occurrence of defects in each Class to be well modeled, one may define the overall number of *demerits* in the inspection unit as

$$X = 100 X_A + 50 X_B + 10 X_C + X_D \quad \ldots (1)$$

The demerit weights (100, 50, 10, 1), though arbitrary, have been widely used in manufacturing industries. Other system of weights may be designed.

The expression (1) has a form $\sum W_i X_i$, which may be converted to a weighted average as

$$I = X/\sum W_i$$

or $I = X/161$ for the choice (100, 50, 10, 1) of weights.

Generalization of *I*

The generalization of *I* to *k* Classes is straightforward. This is given by the weighted average

$$I(k) = \sum_{1}^{k} W_i \; X_i \Big/ \sum_{1}^{k} W_i \quad \ldots (2)$$

where the W_i are weights and X_i is the number of demerits in Class *i.*

The Index *I* and *g* Ratio

The index *I* focus on the negative qualities or deficiencies in a hospital. It is the weighted mean of the number of defects in the four Classes *A, B, C* and *D.* Clearly, larger values of *I* put the hospital in bad light. This negative indicator of quality is helpful in accreditation processes and points to the scope for quality up-gradation.

A similar index I' may be worked out for the positive qualities after a suitable classification into Classes A', B', C' and D'. Finally, the balance of positive and negative qualities may be judged through a comparison of I' and *I* and computing a percentage:

$$g = (I'/I)\,100 \quad \ldots (3)$$

which shows the percentage dominance or otherwise of negative attributes over positive attributes.

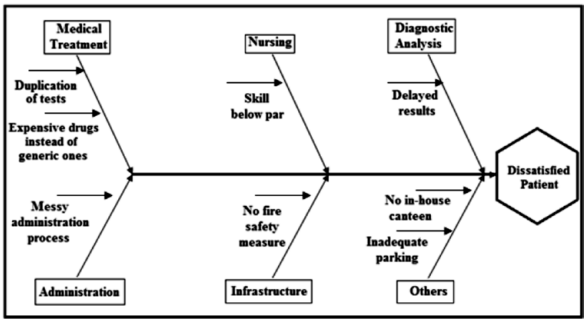
4.2.2 Cause and Effect Analysis of Demerits

One may classify the demerits by ***source,*** leading to a cause and *effect* analysis.

1) Administration 2) Infrastructure 3) Medical treatment 4) Nursing 5) Diagnostic analysis and 6) Others.

The above classification is handy for fixing responsibility for demerits and initiating corrective actions. The

direction of the arrow in the diagram is indicative of the deficiencies all combine to result in a *dissatisfied* patient.



Source: Author

Figure 2: Ishikawa Diagram

4.2.3 De jure and De facto Quality Levels

A human component easily allows for *de jure and de facto* quality levels to be different. The latter reflects the ground realities with all its harsh aspects. De facto situation is what matters to the patients, as it corresponds to the *attained level* of service quality. A hospital may satisfy the norms as per the book (guidelines). But when it comes to practice, there may be a significant gap between what is *'claimed' (de jure),* say *L,* and what is actually *'delivered' (de facto), say L′.*

Assessment of the Two Levels

Assessment of the gap between *L* and *L′* is a necessary step for a realistic quality evaluation of health service that is provided to the public. This is a tricky step, as human respondents are involved, many with vested interests.

An investigative indirect survey will be needed to throw light on the situation.

i) Two methods are proposed:

1) A survey of patients with a few probing questions may be conducted, as a fact-finding exercise,

2) As a better alternative, one may plan a *Delphi method* based evaluation. The focus may be made more pointed by a suitable stratification of the frame.

For instance, the health service providers may be pre-stratified for a specified geographical area.

ii) The *de jure* health service quality level *L* may be accessed through a direct survey of hospital administration and medical personnel, employing the very same stratification.

The gap may be expressed as a ratio:

$H = L'/L$ ... (4)

4.2.4 A General Hybrid Model

The development of a *Service Quality Score (SQS) in a generalized framework is attempted here.* In the setup of a hospital, the service quality variables can be bifurcated:

a) *Binary Variables:*

These are *present/absent* or *yes/no* type characteristics. Availability of a lift system, fire safety measures and an in-house pharmacy are three such examples. When there are *p* such desirable variables, define

X_i = 1 if variable i is present; 0 Otherwise.

for $i = 1, 2, \ldots, p$.

Then, in a vector form, one may write

$$X = (X_1, X_2, \ldots, X_p)$$

which will consist entirely of ones and zeros, depending on availability or otherwise of the factors. These are in fact *indicator variables.*

b) *Rated Variables:*

These are not amenable for direct measurement but can be *rated* in an interval, say 0 to 10. Nursing skill, medical care and simplicity of patient admission are three good examples. In the presence of *q* such variables, the vector *Y* is defined as

$$Y = (Y_1, Y_2, \ldots, Y_q)$$

Where Y_j is the *rating* for characteristic *j, j* = 1, 2… *q.*

With the above notation, a general service quality score model can be formulated:

$SQS = f(X, Y)$ … (5)

Where, *X* and *Y* are vector variables. This is a *hybrid model* in the sense that it has both binary and rated variables as *independent* factors. *SQS* is the *dependent variable* to be evaluated.

If the two components in (5) are segregated, possibly

with different functional forms, one may write the service score as

$$SQS = f_1(X) + f_2(Y) \quad \ldots (6)$$

assuming an additive structure for the components, where f_1 and f_2 stand for the two functional forms.

Linear Structure for f_1 and f_2

When f_1 and f_2 are both linear in the variables, which is the simplest form to consider, the model (6) can be rewritten as

$$SQS = \sum_{1}^{p} a_i X_i + \sum_{1}^{q} b_j Y_j \quad \ldots (7)$$

where the coefficients a_i and b_j are to be estimated using empirical evidence.

The Relative Score

Under the above model, the maximum score occurs when each X_i=1 and Y_j= 10 (assuming rating between zero and ten). This works out to be

$$SQS_{Max} = [\sum a_i + 10 \sum b_j] \quad \ldots (8)$$

Thus, the relative score, relative to the maximum, is

$$SQS_{Rel} = [SQS / SQS_{Max}] \quad \ldots (9)$$

The relative score lies between zero and one, and a value closer to one points to a good service quality level.

Choice of Weights

The coefficients a_i, b_j are non-negative. Parity between the two sets of weights may be ensured by making their averages mutually proportional. Thus take

$$\sum b_j / q = \alpha \sum a_i / p$$

where α is the constant of proportionality. A choice α = 1 keeps the two sets of variables *on par;* $\alpha > 1$ implies greater role for the rated variables and $\alpha < 1$ is for the reverse situation.

The researcher has another lever in the choice of *W,* to account for the relative contributions of $f_1(X)$ and $f_2(Y)$ in the SQS. One may make weights proportional to the *number of* variables in the sets. Thus use

$$W = 2p/(p+q);$$
$$(2-W) = 2q/(p+q);$$

where the sum of weights is two and not one, since the sum $(f_1 + f_2)$ is being estimated and not the average $(f_1 + f_2)/2$. This two-level choice of weights imbibes near proportionality between as well as consideration for the number of factors in each set.

Complementary Roles of *Demerit Index* and *SQS*

While constructing a demerit index *I,* the possible deficiencies in an institution are first classified. The number of deficiencies in each group is counted; then these counts are converted into a weighted average, the weights reflecting the impact of the Classes on quality level. While constructing a *SQS,* there is a bifurcation of quality factors as:

a) Binary variable (with values 0 or 1) and

b) Rated variables, which are rated in a specified range, e.g. 0 to 10.

A score is constructed for each group as $f_1(X)$ and $f_2(Y)$. There is two-level flexibility for choosing weights.

Structure-wise, the demerit index is the weighted average of scores from *negative* quality aspects while *SQS* from *positive* quality aspects. The complementary nature of focuses (negative *versus* positive) accounts for the complementary nature of the two measures as outcomes. A generalization to a multivariate setup (*n* patients and *p* questions) is also discussed.

4.3.1 Empirical Studies on Total Service Quality Evaluation

Table 1: Split of the Surveyed Sample by Hospital Type & City

Respondents: Patient / Attendant			
Hospital	**Type**	**City**	**Sample Size**
Bowring & Lady Curzon Hospitals	Govern-ment	Bengaluru	Thirty-four
Jayadeva Institute of Cardiovascular Sciences & Research		Bengaluru	Thirty-two
K. C. General Hospital		Bengaluru	Thirty-six
The Lady Goschen Govt. Hospital		Mangaluru	Twenty-nine

Wenlock District Hospital	Govern-ment	Mangaluru	Thirty-three
M S Ramaiah Memorial Hospital	Private	Bengaluru	Forty
Narayana Institute of Cardiac Sciences		Bengaluru	Thirty-five
RMD Cancer Hospital		Surat	Thirty-five
Sir Shankara Cancer Hospital & Research Centre		Bengaluru	Forty
Vikram Hospital		Bengaluru	Forty-two
Respindents-Doctor / Support Staff			
Common			Thirty-five
Total Sample Size			**391**

Source: Author

Table 2: Demographic Characteristics of Respondents

Characteristics	Frequency	Percentage (%)
Gender:		
Male	169	47.5
Female	187	52.5
Age:		
Under 20 years	2	0.09
(20-29) years	23	6.5
(30-39) years	32	8.98
(40-49) years	59	16.57
(50-59) years	87	24.4
60 years & above	153	43.37
Location in India:		
South India	289	81.2
North India	67	18.8
Family Size:		
1	1	0.28
2	54	15.16
3	82	23.03
4	116	32.58
5	82	23.03
6 and above	21	5.92
Annual Income (Rs.):		
Below 5 lakhs	21	5.89
(5-10) lakhs	44	12.36
(10-15) lakhs	90	25.28
(15-20) lakhs	106	29.78
20 lakhs & above	95	26.69
Type of Hospital:		
Public	164	46.07
Private	192	53.93
Total	**356**	**100**

Source: Author

4.3.2 Validity and Reliability of the Instrument

In order to judge the validity of the instrument, the standard Cronbach's Alpha was used as a measure, Bartlett's Test of Sphericity to verify the factorability of variables and KMO (Kaiser-Meyer-Olkin) test for sampling adequacy.

Table 3: Cronbach's Alpha for Grouped Responses

Features	Percep-tions	Expec-tations	P - E	P & E
Reliability (Q1 - Q5)	0.75	0.73	0.74	0.75
Responsiveness (Q6 - Q9)	0.71	0.72	0.72	0.71
Assurance (Q10 - Q13)	0.79	0.77	0.79	0.79
Empathy (Q14 - Q18)	0.68	0.69	0.69	0.68
Tangibles (Q19 - Q22)	0.76	0.74	0.72	0.76
Other Factors (Q23 - Q63)	0.94	0.92	0.9	0.9
Total	**0.97**	**0.93**	**0.94**	**0.94**

Source: Author

Table 4: KMO and Bartlett's Test / Results

Kaiser-Meyer-Olkin Measure of Sampling		**0.87**
Bartlett's Test of Sphericity	Approx. Chi-Square	9039.46
	df	1953
	Sig.	0.000

Source: Author

The values of Cronbach's Alpha was greater than 0.68 (acceptable if > 0.6), testifying the reliability of the instrument. The Bartlett's test of sphericity showed that the variables could be grouped into certain factors/dimensions (Chi square 9039.46; df =1953 and $p < 0.000$) (acceptable if Sig. < 0.05). KMO value was 0.87 (acceptable if > 0.6) which indicates that the degree of common variance among the sixty-three variables is high and sampling adequacy is established.

4.3.3 Statistical Analysis of Responses

The summary of the analysis is in the tables below:

Table 5: The Five Largest / Smallest Average Quality Scores

The Five Highest Perceptions	
Statements	**Mean Scores**
SP2 (Problem Solving Capabilities)	3.1461
SP12 (Courteous Staff)	3.0758
SP7 (Timely Service)	3.0590
SP11 (Less Burden on Bills)	3.0140
SP10 (Feeling of Getting Cured)	3.0112

The Five Lowest Perceptions	
Statements	**Mean Scores**
SP29 (First Impression)	2.2640
SP34 (Authenticity)	2.3090
SP46 (Parking)	2.3624
SP49 (Interior Design)	2.3933
SP62 (Wi-Fi Connectivity)	2.4326

The Five Highest Expectations	
Statements	**Mean Scores**
SE9 (Readiness to Respond)	4.4129
SE23 (Timeliness)	4.3680
SE5 (Record Documentation)	4.3287
SE1 (Service Provided)	4.3258
SE18 (Convenient Transaction Hours)	4.3146

The Five Lowest Expectations	
Statements	**Mean Scores**
SE63 (Website Updation)	2.3736
SE49 (Vaastu Signs)	2.4803
SE60 (Uniform)	2.5478
SE58 (Report Availability)	2.5562
SE34 (Authenticity)	2.5590

Source: Author

The Five Largest Differences	
(SP-SE)4 (Timely Cure)	-1.63
(SP-SE)21 (Professionalism)	-1.54
(SP-SE)13 (Domain Knowledge)	-1.54
(SP-SE)5 (Record Documentation)	-1.54
(SP-SE)20 (Hospital Facilities)	-1.52

The Five Smallest Differences	
(SP-SE)51 (Signage)	.00
(SP-SE)53 (Air Quality)	-.02
(SP-SE)25 (Hospital Location)	-.03
(SP-SE)27 (Efficiency)	-.03
(SP-SE)39 (Promptness)	-.03

Source: Author

4.3.4 Data Analysis in Hypotheses Testing Framework

A few hypotheses are formulated and tested using Standard tests. The alternative hypotheses are negations of the null hypotheses and are essentially

two-sided. Therefore, these are not explicitly stated. The null hypotheses are indexed H_{01} etc. Only statistically significant test results are enumerated.

H_0 : *The demographic character (Family Income) of respondent significantly affects the response patterns.*

Against

H_1: The demographic character (Family Income) of respondent does not significantly affect the response patterns.

Method of Test: Regression Analysis (Table 8).

4.3.5 Perceived versus Expected Responses: Paired *t*- Test

In order to check the significance of the differences between the perceptions and expectations of the patient, the standard paired *t*- Test was applied for all items. It is noted that twenty-five of the differences between perceptions and expectations are significant. The negative signs in column two of the table imply expectation exceeding the perception value. This is true of majority of the cases, pointing to perceptions often *not* meeting the expectations. The level of significance is indicated in the last column of the table.

Table 6: Paired Samples *t*- Test

Paired Samples Test									
		Paired Differences							
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the		t	df	Sig. (2-tailed)
					Lower	Upper			
Pair 1	SP1 - SE1	-1.35	1.15	0.06	-1.47	-1.24	-22.31	355.00	0.00
Pair 2	SP2 - SE2	-1.12	1.02	0.05	-1.23	-1.01	-20.72	355.00	0.00
Pair 3	SP3 - SE3	-1.25	1.05	0.06	-1.36	-1.14	-22.42	355.00	0.00
Pair 4	SP4 - SE4	-1.63	1.26	0.07	-1.76	-1.50	-24.45	355.00	0.00
Pair 5	SP5 - SE5	-1.54	1.10	0.06	-1.66	-1.43	-26.37	355.00	0.00
Pair 6	SP6 - SE6	-1.33	1.06	0.06	-1.44	-1.22	-23.68	355.00	0.00
Pair 7	SP7 - SE7	-1.24	1.28	0.07	-1.37	-1.11	-18.21	355.00	0.00
Pair 8	SP8 - SE8	-1.29	1.44	0.08	-1.44	-1.14	-16.94	355.00	0.00
Pair 9	SP9 - SE9	-1.48	1.20	0.06	-1.60	-1.35	-23.24	355.00	0.00
Pair 10	SP10 - SE10	-1.28	1.29	0.07	-1.42	-1.15	-18.72	355.00	0.00
Pair 11	SP11 - SE11	-1.24	1.39	0.07	-1.39	-1.10	-16.89	355.00	0.00
Pair 12	SP12 - SE12	-1.17	1.40	0.07	-1.31	-1.02	-15.74	355.00	0.00
Pair 13	SP13 - SE13	-1.54	1.42	0.08	-1.69	-1.39	-20.45	355.00	0.00
Pair 14	SP14 - SE14	-1.09	1.05	0.06	-1.20	-0.98	-19.56	355.00	0.00
Pair 15	SP15 - SE15	-1.19	1.30	0.07	-1.33	-1.06	-17.36	355.00	0.00
Pair 16	SP16 - SE16	-1.44	1.53	0.08	-1.60	-1.28	-17.79	355.00	0.00
Pair 17	SP17 - SE17	-1.35	1.05	0.06	-1.46	-1.24	-24.29	355.00	0.00
Pair 18	SP18 - SE18	-1.39	1.01	0.05	-1.50	-1.29	-25.88	355.00	0.00
Pair 19	SP19 - SE19	-1.47	1.16	0.06	-1.59	-1.35	-23.87	355.00	0.00
Pair 20	SP20 - SE20	-1.52	1.07	0.06	-1.63	-1.41	-26.87	355.00	0.00
Pair 21	SP21 - SE21	-1.54	1.32	0.07	-1.67	-1.40	-21.96	355.00	0.00
Pair 22	SP22 - SE22	-1.26	1.28	0.07	-1.40	-1.13	-18.61	355.00	0.00
Pair 23	SP23 - SE23	-1.50	1.33	0.07	-1.64	-1.36	-21.19	355.00	0.00
Pair 24	SP24 - SE24	-0.29	1.20	0.06	-0.41	-0.16	-4.52	355.00	0.00
Pair 25	SP25 - SE25	-0.03	1.18	0.06	-0.16	0.09	-0.54	355.00	0.59
Pair 26	SP26 - SE26	-0.24	1.17	0.06	-0.36	-0.12	-3.85	355.00	0.00
Pair 27	SP27 - SE27	-0.03	1.13	0.06	-0.15	0.08	-0.57	355.00	0.57
Pair 28	SP28 - SE28	0.20	1.11	0.06	0.09	0.32	3.43	355.00	0.00
Pair 29	SP29 - SE29	-0.58	1.09	0.06	-0.70	-0.47	-10.08	355.00	0.00
Pair 30	SP30 - SE30	-0.07	1.19	0.06	-0.20	0.05	-1.15	355.00	0.25
Pair 31	SP31 - SE31	-1.34	1.28	0.07	-1.48	-1.21	-19.75	355.00	0.00
Pair 32	SP32 - SE32	-0.09	1.16	0.06	-0.21	0.03	-1.51	355.00	0.13
Pair 33	SP33 - SE33	-0.14	1.26	0.07	-0.28	-0.01	-2.14	355.00	0.03
Pair 34	SP34 - SE34	-0.25	1.35	0.07	-0.39	-0.11	-3.50	355.00	0.00
Pair 35	SP35 - SE35	0.12	1.25	0.07	-0.01	0.25	1.78	355.00	0.08
Pair 36	SP36 - SE36	0.16	1.01	0.05	0.05	0.26	2.93	355.00	0.00
Pair 37	SP37 - SE37	0.08	0.97	0.05	-0.02	0.18	1.58	355.00	0.11
Pair 38	SP38 - SE38	-0.10	1.20	0.06	-0.22	0.03	-1.54	355.00	0.12
Pair 39	SP39 - SE39	-0.03	1.08	0.06	-0.15	0.08	-0.59	355.00	0.56
Pair 40	SP40 - SE40	0.23	1.09	0.06	0.11	0.34	3.88	355.00	0.00
Pair 41	SP41 - SE41	-0.24	1.11	0.06	-0.35	-0.12	-4.03	355.00	0.00
Pair 42	SP42 - SE42	0.13	1.09	0.06	0.02	0.24	2.24	355.00	0.03
Pair 43	SP43 - SE43	0.13	1.29	0.07	0.00	0.27	1.92	355.00	0.06
Pair 44	SP44 - SE44	0.07	1.23	0.07	-0.06	0.20	1.08	355.00	0.28
Pair 45	SP45 - SE45	-0.26	1.08	0.06	-0.37	-0.15	-4.50	355.00	0.00
Pair 46	SP46 - SE46	-0.27	1.43	0.08	-0.42	-0.12	-3.59	355.00	0.00
Pair 47	SP47 - SE47	-0.15	1.04	0.06	-0.26	-0.05	-2.82	355.00	0.01
Pair 48	SP48 - SE48	0.04	1.01	0.05	-0.07	0.15	0.74	355.00	0.46
Pair 49	SP49 - SE49	-0.09	1.10	0.06	-0.20	0.03	-1.49	355.00	0.14
Pair 50	SP50 - SE50	-0.32	1.43	0.08	-0.47	-0.17	-4.23	355.00	0.00
Pair 51	SP51 - SE51	0.00	1.19	0.06	-0.13	0.12	-0.04	355.00	0.97
Pair 52	SP52 - SE52	0.15	1.29	0.07	0.01	0.28	2.13	355.00	0.03
Pair 53	SP53 - SE53	-0.02	1.20	0.06	-0.14	0.11	-0.26	355.00	0.79
Pair 54	SP54 - SE54	-0.08	0.93	0.05	-0.18	0.01	-1.71	355.00	0.09
Pair 55	SP55 - SE55	-0.16	1.33	0.07	-0.30	-0.02	-2.26	355.00	0.02
Pair 56	SP56 - SE56	-0.17	1.26	0.07	-0.30	-0.03	-2.48	355.00	0.01
Pair 57	SP57 - SE57	-0.19	1.00	0.05	-0.29	-0.08	-3.49	355.00	0.00
Pair 58	SP58 - SE58	0.07	1.17	0.06	-0.06	0.19	1.04	355.00	0.03
Pair 59	SP59 - SE59	0.14	1.12	0.06	0.02	0.25	2.32	355.00	0.02
Pair 60	SP60 - SE60	0.17	1.22	0.07	0.04	0.29	2.57	355.00	0.01
Pair 61	SP61 - SE61	-0.36	1.02	0.05	-0.46	-0.25	-6.61	355.00	0.00
Pair 62	SP62 - SE62	-0.17	1.17	0.06	-0.29	-0.05	-2.77	355.00	0.01
Pair 63	SP63 - SE63	0.45	1.07	0.06	0.34	0.56	7.91	355.00	0.00

Source: Author

H $_2$**:** *The perceptions / expectations significantly differ with reference to Hospital location* (Q25);

H $_3$**:** *The perceptions / expectations significantly differ with reference to System efficiency* (Q27);

H $_4$**:** *The perceptions / expectations significantly differ with reference to Timely response by the staff* (Q39);

H $_5$**:** *The perceptions / expectations significantly differ with reference to Sign boards* (Q51) and

H $_6$**:** *The perceptions / expectations significantly differ with reference to Air quality* (Q53).

4.3.6 Correlation Analysis: Probable Error Criterion

Table 7 provides an *extract* for both the cases of the top five positively correlated pairs and top five negatively correlated pairs to reveal the positive and negative associations between the characteristics. Probable Error Criterion was used to decide significance of *r*. The probable error (PE) is given by PE (r) = 0.6745 ($1-r^2$)/$\sqrt{n}$, where *r* is the correlation in a sample of *n* pairs of observations. The role of *n* in addition to that of *r* may be noted in this decision rule.

Table 7: Observed High Correlations

The Five Highest Positive Correlation (Perception)	
Pair	**Correlation**
SP(38-40) (Personalization-Adaptability)	0.9996
SP(19-25) (Latest Equipments-Hospital Location)	0.9904
SP(19-37) (Latest Equipments-Friendliness)	0.9838
SP(24-18) (Effectiveness-Convinient Transaction Hours)	0.9814
SP(30-62) (Staff Diversity-Wifi Connectivity)	0.9759

Source: Author

The Five Lowest Negative Correlation (Perception)	
Pair	**Correlation**
SP(11-63) (Less Burden on Bills-Website Updation)	-0.2091
SP(27-63) (Efficiency-Website Updation)	-0.2347
SP(63-09) (Website Updation-Staff Readiness)	-0.2532
SP(63-10) (Website Updation-Cure)	-0.2771
SP(63-24) (Website Updation-Effectiveness)	-0.3392

Source: Author

The Five Highest Positive Correlation (Expectation)	
Pair	**Correlation**
SE(7-10) (Timely Service-Cure)	0.9967
SE(13-32) (Expertise-Timeliness)	0.9858
SE(6-16) (Treatment Information-Patients Interests)	0.9718
SE(7-8) (Timely Service-Willingness to Help)	0.9572
SE(10-39) (Timely Cure-Promptness)	0.9485

Source: Author

The Five Lowest Negative Correlation (Expectation)	
Pair	**Correlation**
SE(54-3) (Temperature-Problem Identification)	-0.4522
SE(47-62) (Landscape-Wifi Connectivity)	-0.4568
SE(3-40) (Problem Identification-Adaptability)	-0.4637
SE(51-62) (Signage-Wifi Connectivity)	-0.4735
SE(34-62) (Authenticity-Wifi Connectivity)	-0.5590

Source: Author

All high correlations for both perceived and expected scores are statistically significant, while the negative correlations for the *expectations* are significant, but none of them is significant for *perceptions.*

Formally as statistical hypotheses, we can state the following:

Positive Correlations (Perceptions)

$H_{7}^{(7)}{}_{(1)}$: *The perceptions on Personalization and Adaptability are significantly Correlated* (SP (38-40)).

$H_{7}^{(7)}{}_{(2)}$: *The perceptions on Latest equipment and Hospital location are significantly Correlated* (SP (19-25)).

$H_{9}^{(7)}{}_{(3)}$: *The perceptions on Latest equipment and Friendliness are significantly Correlated* (SP (19-37)).

$H_{9}^{(7)}{}_{(4)}$: *The perceptions on Effectiveness and Convenient transaction hours are significantly Correlated* (SP (24-18)) and

$H_{10}^{(7)}{}_{(5)}$: *The perceptions on Staff diversity and Wifi connectivity are significantly Correlated* (SP (30-62)).

Negative Correlations (Perceptions)

$H_{8}^{(8)}{}_{(1)}$: *The perceptions on less burden on bills and Website update are significantly Correlated* (SP (11-63)).

$H_{8}^{(8)}{}_{(2)}$: *The perceptions on Efficiency and Website update are significantly correlated* (SP (27-63)).

$H_{8}^{(8)}{}_{(3)}$: *The perceptions on Website update and Staff readiness are significantly Correlated* (SP (63-9)).

$H_{8}^{(8)}{}_{(4)}$: *The perceptions on Website update and Cure transaction hours are significantly Correlated* (SP (63-10)) and

$H_{8}^{(8)}{}_{(5)}$: *The perceptions on Website update and Effectiveness are significantly Correlated* (SP (63-24)).

Positive Correlations (Expectations)

$H_{9}^{(9)}{}_{(1)}$: *The expectations on Timely service and Cure are significantly correlated* (SE (7-10)).

$H_{9}^{(9)}{}_{(2)}$: *The expectations on Expertise and Timeliness are significantly Correlated* (SE (13-32)).

$H_{9}^{(9)}{}_{(3)}$: *The expectations on Treatment information and Patients interests are significantly Correlated* (SE (6-16)).

$H_{9}^{(9)}{}_{(4)}$: *The expectations on Timely service and Willingness to help are significantly Correlated* (SE (7-8)) and

$H_{9}^{(9)}{}_{(5)}$: *The expectations on Timely cure and Promptness are significantly correlated* (SE (10-39)).

4.3.7 Regression Analysis

Regression was run for responses on the important six demographic variables. The value of R^2 (Coefficient of determination) represents the proportion of variation in the response explained by the individual demographic variable. The results are summarized in the next table, separately for perceptions and expectations.

An examination of table below shows a significant dependence of responses on the family income as reflected by 49.9% for perceptions and 45.8% for expectations. None of the other R^2 values is impressive, implying the weak dependence on the other five demographic variables. This implies that the responses, perceptions or expectations, do not get affected significantly by the age, gender, geographic location, family size or whether the respondent is patient himself/herself.

Table 8: Summary of Regression Analysis

Variable	Perceptions		Expectations	
	R	R^2	R	R^2
Respondent	0.45	0.199	0.49	0.237
SE_Age	0.47	0.221	0.44	0.193
Gender	0.46	0.207	0.44	0.193
Location	0.43	0.184	0.45	0.205
Family Size	0.43	0.184	0.45	0.205
Income	0.71	0.499	0.68	0.458

Source: Author

4.3.8 Results of Factor Analysis

In the initial solution of Factor Analysis, each variable is standardized to have a mean of 0.0 and a Standard Deviation of 1.0. As a result, the total variance equals the total number of variables, being sixty-three in the present case. Also, a factor to be meaningful for interpretation it must have at least unit variance, which suggests a minimum cut-off of one for the eigenvalues, i.e. to have an eigenvalue 1.0; otherwise the factor extracted explains no more variance than a single variable. The analysis shows that there are twelve such components with eigenvalue more than 1 and these collectively account for a total variance of 64.31%. As shown in the table below, variables are loaded into twelve factors and eigenvalue is between 1.02 and 20.99 for these factors/dimensions, which are extracted after Factor Analysis. After varimax rotation, eigenvalue ranged from 1.467 to 10.472, which indicates only a moderate change in the factor pattern. The cumulative variance explained by these components exceeds 60%, which is accepted as the threshold to support the solution in social science investigations (Hair *et al.,* 1995).

Table 9: Factor Analysis

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	20.99	33.32	33.32	10.47	16.62	16.62
2	4.59	7.28	40.60	8.08	12.83	29.45
3	2.41	3.82	44.43	4.56	7.24	36.69
4	2.03	3.22	47.65	3.61	5.73	42.43
5	1.67	2.65	50.30	2.25	3.57	46.00
6	1.48	2.35	52.65	1.95	3.09	49.09
7	1.43	2.27	54.92	1.80	2.86	51.95
8	1.36	2.16	57.08	1.68	2.67	54.62
9	1.22	1.93	59.01	1.60	2.53	57.16
10	1.19	1.90	60.90	1.56	2.47	59.63
11	1.13	1.79	62.69	1.48	2.35	61.98
12	1.02	1.61	64.31	1.47	2.33	64.31

Source: Author

4.4.1 The Working Model of Yeshasvini Scheme

The scheme runs on Public Private Participation (PPP) model. The entities involved are a) the Government (Yeshasvini Trust), b) the Beneficiaries, c) the Network hospitals, and d) the Management Services Provider (MSP).

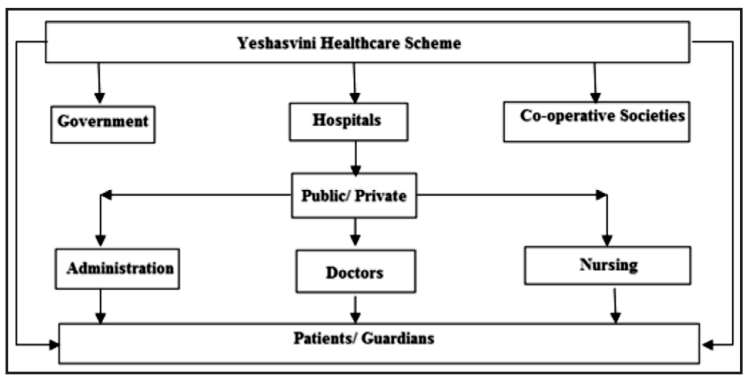


Figure 4: Components of the Scheme

Source: Author

4.4.2 Network Hospitals

There are 730 Network Hospitals across the State at present. Major hospitals like Jayadeva Institute of Cardiovascular Sciences, Kidwai Institute of Oncology, NIMHANS, Government and Private Medical College Hospitals function as network hospitals. The network hospitals treat the outpatient beneficiaries free of cost. Clinical investigations are provided at 25% discount to the beneficiaries. In the case of surgeries, the doctor obtains pre-authorization from Management Services Provider (MSP), performs it, and discharges the patient. The claims are submitted through MSP and the Yeshasvini Trust pays for the same.

4.4.3 Survey Responses from Yeshasvini Beneficiaries

The 118 responses from the beneficiaries of the Yeshasvini scheme were seperately analyzed. The general trend is very much like that observed in the total sample pool.

Table 10: The Five Largest/Smallest Average Quality Scores for Responses from Yeshasvini Beneficiaries

The Five Largest Differences for Yeshasvini Beneficiaries	
(SP-SE)4 - (Timely Cure)	-1.19
(SP-SE)18 - (Convenient Transaction Hours)	-1.19
(SP-SE)9 - (Readiness to Respond)	-1.08
(SP-SE)17 - (Understanding Needs)	-1.06
(SP-SE)5 - (Record Documentation)	1.02

The Five Smallest Differences for Yeshasvini Beneficiaries	
(SP-SE)57 - (Billing Statement)	0
(SP-SE)16 - (Brochures & Handouts)	0
(SP-SE)8 - (Willingness to Help)	0.03
(SP-SE)56 - (Stationery)	0.04
(SP-SE)25 - (Appropriateness of Location)	0.08

Source: Author

The Five Highest Yeshasvini Beneficiaries Perceptions	
Statement	**Mean Scores**
SP12 - (Courteous)	4.15
SP7 - (Timely Service)	3.92
SP16 - (Patient's Interest)	3.9
SP8 - (Willingness to Help)	3.85
SP11 - (Less Burden on Bills)	3.75

The Five Lowest Yeshasvini Beneficiaries Perceptions	
Statement	**Mean Scores**
SP63 - (Website Updation)	2.61
SP49 - (Interior Design)	2.74
SP26 - (Information)	2.81
SP62 - (Wifi Connectivity)	2.81
SP55 - (Business Cards)	2.92

The Five Highest Yeshasvini Beneficiaries Expectations	
Statement	**Mean Scores**
SE9 - (Readiness to Respond)	4.46
SE17 - (Understanding Needs)	4.43
SE23 - (Caring)	4.31
SE10 - (Cured Feeling)	4.25
SE21 - (Professional)	4.25

The Five Lowest Yeshasvini Beneficiaries Expectations	
Statement	**Mean Scores**
SE62 - (Wifi Connectivity)	2.13
SE49 - (Interior Design)	2.21
SE63 - (Website Updation)	2.4
SE36 - (Formality)	2.57
SE46 - (Parking)	2.61

Source: Author

Table 11: Responses to Specific Questions on the Scheme

Statement	Percentage Breakup		
Source of Information	Peers (38%)	Media or Co-operatives (40%)	Others (22%)
Number of Times Scheme Used	One-Two (70%)	Three-Four (16%)	More than Four (8%)
As Insurance Cover	Okay (20%)	Fair (25%)	Good (55%)
Scheme Utility	Low (8%)	Average (20%)	High (55%)
Quality Level of Service	Low (16%)	Average (29%)	High (55%)
Recommendation for Scaling Up	Yes (70%)	No (12%)	Undecided (18%)
Operating Procedure	Simple (51%)	Key (38%)	Messy (11%)

Source: Author

4.5.1. A New Geometric Model: Concept of Coverage

Growth studies often consider coverage of a target population from several standpoints. The progress on each of these fronts is measured in terms of a coverage parameter. The columns of the table identify respectively the problem base, parameters to be addressed, the concerned program implemented and the number of parameters as noted in the contemporary programs. The last column determines the dimensions (number of axes) in the geometric model.

The table below illustrates the typical thrust areas being presently covered in India to improve the overall healthcare scenario. It enumerates the key parameters (dimensions) of the model, which need steps for strengthening and development.

Table 12: Programs and Parameters

Sl. No.	Base	Parameter	Program	No. of Parameters
1.	Child health	Proportion of children covered	Immunization	One
2.	Primary education	Proportions of enrollment & dropout	Universal child education	Two
3.	Human development	Per capita income, Literacy rate & quality of life	Programs related income generation, healthcare & Universal education	Three
4.	Public healthcare	Proportions of population, costs & covered ailments	Public sector & PPP healthcare models	Three
5.	Maternal health	Proportion of women covered in child-bearing group, maternity & infant mortality rates	Maternal healthcare packages & related schemes	Three
6.	Nutrition for school children	Proportion of school children covered, Quality & Nutrition value of food	Mid-day meal schemes	Three

Source: Author

In each of the above situations, it is convenient to visualize that a geometric figure is created, which is desired to be *covered optimally.* Thus, with a single parameter, there will be a *line segment* and optimization implies a push in just one direction. With two parameters, a rectangle will be created in two dimensions, with the parameters as occupants of the axes. The optimum *coverage* occurs when the *covered area* of the rectangle is *maximized,* for a given perimeter. This occurs when the rectangle turns into a *square,* calling for equal paced push in both the directions. In the three-parameter case, a cube is formed, with the parameters along the three directions. This case is analyzed mathematically at some length

now and fit the *Yeshasvini scheme* into this framework, with the following three parameters *viz.* Proportion of 1) Population covered (p_1), 2) health package covered (p_2) and 3) medical expenses covered (p_3).

The first parameter is to be improved through awareness drives / campaigns, while the other two are fallouts of policy decisions.

Working with proportions has a specific in-built advantage that they lie in the interval [0, 1], and hence finally create a geometric figure with each side of length unity. As a result, the figure has length/ area/ volume of magnitude one unit.

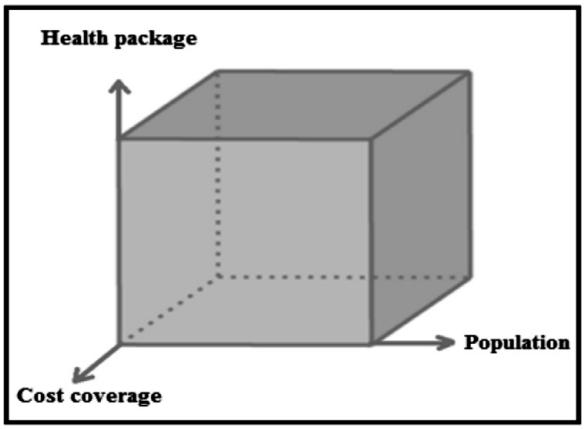
A cube model for three-factor coverage situation of Yeshsvini scheme, starting with the definition of Universal Health Coverage of the WHO, as the base is enumerated here.

4.5.2 The UHC Cube for Yeshasvini Scheme

(Srinivas *et al, 2017*)

Consider this as a hollow standardized unit cube, i.e. the maximum in each of the three dimensions (population, health package and cost coverage) is *unity*. As the rates move along the axes, the hollow of the cube gets filled up. Denote the currently reached proportions by (p_1, p_2, p_3), so that the filled-up volume is

$$V_3 = p_1, p_2, p_3 \quad \ldots (10)$$



Source: Author

Figure 5: Cube Model for Yeshasvini Scheme

This is a good indicator *(impact factor)* of the level (proportion) of health coverage accomplished in the target population, the maximum being clearly unity. This occurs when $p_1 = p_2 = p_3 = 1$ clearly. V_{max} has 1 as its value. In general, the volume gets maximized, for given $\sum p_i = q$, when $p_1 = p_2 = p_3 = q/3$. This represents equal values for the three proportions. This is the point where the geometric mean of the p_i equals the arithmetic and harmonic means. The above result shows the importance of balanced progresses in each of the three aspects. Alternatively, even if one of the progress directions is *unsatisfactory,* the entire coverage picture becomes murky.

Moving on with this scenario, the correct average progress is <u>*NOT*</u> the arithmetic mean

$$A_3 = (p_1 + p_2 + p_3)/3 \quad \ldots (11)$$

but rather the geometric mean

$$G_3 = (p_1\, p_2\, p_3)^{1/3} \quad \ldots (12)$$

which is nearly zero when *any one* of the proportions is near zero. *Optimum* effectiveness occurs with *equitable coverage* in the three directions. The rate G_3 represents the rate at which the cube gets occupied. For *continuously varying proportions,* the rates of change in the occupied portion of the cube are given by the *partial derivatives of* V_3 with respect to the parameters p_1, p_2 and p_3. These are respectively given by $p_2\, p_3$, $p_1\, p_3$ and $p_2\, p_2$. The overall penetration of the program can be measured in terms of the filled-up content of the cube *viz.* V_3, which may be, therefore, termed as *Total Impact Factor* (TIF). Eventually, the hollow cube gets filled up to signal 100% coverage by the scheme. A generalization of the cube model to k- dimensions is also considered and its mathematical properties are investigated.

4.5.3 Budget Allocation for Optimum Coverage

The filled-up volume of the cube is $V_3 = p_1\, p_2\, p_3$ which is maximized, for given $p_1 + p_2 + p_3 = C$, $(0 \leq C \leq 3)$ when $p_1 = p_2 = p_3 = (C/3)$. This is geometrically akin to a rectangle of given perimeter reducing to a square when the area of the figure is to be maximized. This calls for equal paced increases in the pi for optimum coverage, as mentioned earlier.

Let us now consider the situation with a fixed and given budget C_0 that is to be optimally allocated to the three components to maximize the resulting coverage. Let X_i

denote the allocation to dimension i for $i = 1, 2, 3$. Then the constraint is

$$X_1 + X_2 + X_3 = C_0 \quad \ldots (13)$$

and the objective is to work out the allocation in order to achieve optimal coverage.

The coverage, measured by p_i in direction i, clearly depends on the allocation X_i. Thus

$$p_i = f(X_i) \quad \ldots (14)$$

which represents the functional form of dependence. Next examined are two particular choices for $f(X_i)$.

(a) <u>Proportionality with</u> X_i or $p_i = K_i X_i$

Then

$$V_3 = p_1 p_2 p_3 = (K_1 X_1)(K_2 X_2)(K_3 X_3) \quad \ldots (15)$$

where the K_i are the constants of proportionality. To have optimal coverage, the condition is

$$(K_1 X_1) = (K_2 X_2) = (K_3 X_3) \quad \ldots (16)$$

subject to the constraint (13).

Substituting for X_2 and X_3 in (13) in terms of X_1 from (16) leads to

$$X_1 + (K_1/K_2) X_1 + (K_1/K_3) X_1 = C_0$$

or $X_1 [1 + (K_1/K_2) + (K_1/K_3)] = C_0$

or $X_{1\,opt} = [(K_2 K_3) / (K_1 K_2 + K_1 K_3 + K_2 K_3] C_0 \quad \ldots (17)$

It may be noted that the constants of proportionality (K_i) can be different for the three directions. This allows flexible relations between improvement and cost implication.

The expressions for optimum X_2 and X_3 are similarly written down. It is easily verified that the budget constraint (13) is satisfied. Also for $K_1 = K_2 = K_3 = 1$, one gets equal allocation of the budget.

(b) <u>Proportionality with</u> $\sqrt{Xi}$

The improvement is often much *slower* than the increase in the budget provision. Thus, one may take

$$p_i = f(X_i) = K_i X_i^{\,p} \text{ for } i = 1, 2, 3 \quad \ldots (18)$$

Though any $p > 0$ may be considered, a choice of p as a fraction is quite realistic. A good choice is, therefore, $p = ½$, so that the coverage improvement is taken to be proportional to <u>square root</u> of the allocation, and

$$p_i = K_i \sqrt{X_i} \quad \ldots (19)$$

Model (19) incorporates a damping effect on the improvement. For example, in order to double the coverage rate, one has to raise the budget allocation four-fold.

For optimal growth the condition is

$$K_1 \sqrt{X_1} = K_2 \sqrt{X_2} = K_3 \sqrt{X_3} \quad \ldots (20)$$

subject to the constraint (13).

A straight forward recasting leads to

$$X_{1\,opt} = [(K_2^{\,2} K_3^{\,2}) / (K_1^{\,2} K_2^{\,2} + K_1^{\,2} K_3^{\,2} + K_2^{\,2} K_3^{\,2})] C_0 \quad \ldots (21)$$

The expressions for X_2 and X_3 are similarly written, noting the cyclic pattern.

A generalization to cuboid model to accommodate more than three factors is elaborately examined.

5.0 <u>Conclusions / Limitations</u>

5.1 Discussion, Suggestions and Frontiers

Finally, a retrospective view of the dissertation is given along with a summary. Three new directions for future work are outlined, together with some minor gaps in the existing work. The new directions include generalization of the models proposed to other fields, formation of a National Medical Data Base and development of a unified terminology for healthcare system with the terms uniquely reflecting their meaning. Relevant supplementary material is appended.

5.2 Contribution of the Study

The thesis makes a *<u>five-fold</u>* contribution on a modest scale to health sector service quality domain as follows:

1) Theoretical contribution in the form of a few novel ideas and quality measurement methods (classification and measurement indices/growth models) in the TSQ framework.

2) Some empirical evidence on healthcare service quality in Indian context together with discussion of policy issues and anomalies.

3) Examining a PPP model for providing satisfactory healthcare at affordable cost with the potential for countrywide expansion.

4) An effective summary of the work together with

clear outlining of three potential open areas for further work.

5) A brief review of relevant literature precedes the above contributions.

5.3 Limitations of the Work

These primarily concern the following:

1) The empirical evidence is only on a moderate scale due to the limited sample sizes. However, the reliability of the data personally collected by the candidate compensates, at least in part, this limitation.

2) Only two major medicine systems are covered. The alternative systems like *Yunani* and Homeopathy have not been included.

3) The geographical coverage for empirical evidence is not wide spread and limited to three cities, one in Gujarat and two in Karnataka.

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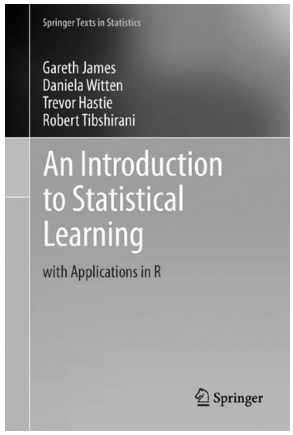
BOOK REVIEW



Gareth James, Daniel Witten, Trevor Hastie & Robert Tibshirani: An Introduction to Statistical Learning with Application in R: Springer, New York, 2013, Corrected at 8th Printing 2017, pp1-426+xiv.

- Reviewer: N.S. VISWANATH

The present book catches any researcher by its title wherein "Application in R" motivates for reading it. The four author written book has ten chapters covering critical aspects of data science for answering research questions raised in marketing, finance, biology and other social sciences. Statistics is a science, an art and is the only discipline whose rigour is rooted in mathematics and methods. The natural numbers in the well-defined number system acquires greater meaning and insights once they are used in the way in which crunching is done lead us to solutions. Data are collected with research design frame work to draw functionalities and testing hypotheses for definitive solutions for larger universal implications. The present book enriches any reader by providing insights in terms of accuracy, precision, interpretability, flexibility and so on functional models fitted by parametric or non-parametric methods. The reviewer got tempted to make a review to enable the target group get access to such a book for gaining competence and confidence in collection, collation and interpretation of data for the work envisaged to answer grey area of research.

The present book is divided into ten chapters. These chapters cover the concepts of statistical learning, Linear Regression, Classification, Resampling Methods, Linear Model Selection, Regularization, Moving beyond Linearity, Tree Based Methods, Support Vector Machines and Unsupervised learning Methods. Models, Estimation and Interpretation of results are critical to any research work. The first chapter discusses in detail regression-linear, linear discriminant analysis, and generalized linear models. Interestingly, reference is made to Generalized Additive Model (GAM). The chapters 1 & 2 discuss model functionality, quality of fit and tradeoff between bias and variance. Introduction to R begins in chapter-2. The limitations of the linear regression, model, coefficients, power of predictability of the model, limitations of linearity, what if the predictor or predictant are classified or quality variable and comparison of linear regression with K-class neighbours are done. The chapter makes an elaborate analysis of linear regression techniques.

Logistic regression for variables is discussed in the back drop of Bayes theorem. Theoretical foundations of Bayes and K-Nearest Neighbours have been discussed in chapter-3.Linear discriminant and Quadratic discriminant analyses have been analyzed using data sets from the real life. While classification is essential for attributes as dependent variable, resampling methods along with cross validation as techniques are

to be used for assessment of test results. Researchers face the problem of interpretability Vs flexibility. Chapter-6 discusses as to how one should mark for a tradeoff. Demonstration has been made of use of ridge regression, the lasso and of dimension reduction. Principal Component Analysis and the partial least squares are well addressed by examples. The shift towards non-linearity is done by polynomial regression. General Additive Model (GAM) for addressing such a problem for both variables and attributes are dwelt in style by the authors in chapter-7. Given a multi-faceted environment wherein interdependence of variables rule the world, decision trees, and random forests are talked by boosting and in chapter-8. Support Vector Machines (SVMs) for multiple classification and logistic regression is in chapter-9. The use of non-parametric methods form the core of fitting the data to a formatted elaboration. The use of ROC curves are discussed for a rational trade off. The use of Clustering and Principal Component Analysis are detailed in chapter-10 under unsupervised learning. In all, the book has several highlights of the tools and their uses in application disciplines. Any user of the book will be familiar with statistical tools after reading in the back drop of R language:

1. K-Nearest Neighbor (KNNN)
2. Logistic regression
3. Linear Discriminant Analysis
4. Srepwise Regression
5. Ridge Regression
6. Principal Component Regression
7. Partial Least squares
8. The Lasso
9. Single Input to Multiple Input Variables
10. Tree Based Methods - a. Bagging, b. Boosting & c. Random forests
11. Principal Component Analysis
12. K-means Clustering
13. Hierarchical Clustering
14. Interpretability Vs Flexibility
15. Model vs. Data Fitting
16. Parametric Vs Non-Parametric Methods.

The book is strongly recommended for researchers in others disciplines and for students of statistical science who would benefit on the application of tools for solving application oriented research problems.

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