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# IMPACT OF RESEARCH ON SOCIETY: EVOLVING PERSPECTIVES

**Editors:**  
**Dr. Santosh Dhar**  
**Dr. Upinder Dhar**  
**Dr. Swati Dubey Mishra**



**Shri Vaishnav Vidyapeeth Vishwavidyalaya  
Indore-Ujjain Road Indore (M.P.) 453111**

# **Impact of Research on Society: Evolving Perspectives**

*Editors:*

**Dr. Santosh Dhar**

**Dr. Upinder Dhar**

**Dr. Swati Dubey Mishra**



**Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore**

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# **Prologue**

## **QUALITY RESEARCH FOR FUTURE**

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Demand for quality research has always been there, but the impetus has intensified in the last two decades. The success of science has made the world to believe in the supremacy of knowledge in developing the societies. New research output shows that knowledge can change quality of life. The nations across the globe expect this to happen more recurrently. The desire for quality research has led the universities and funding agencies to step up their efforts to demonstrate how research can impact the quality of life. The curiosity driven research is encouraged, even if its outcomes become visible only after many years. In Brazil, in the 1970s, it was decided to use ethanol as an automotive fuel because Brazil had a problem with fossil fuel prices. This acted as an inducement to grow more sugarcane and process it to produce ethanol for the domestic market. Only a decade later, it was observed that this was also a good approach to reduce greenhouse gas emission.

Mechanisms have been created by governments, universities and research funding agencies in different parts of the world to assess the impact of research ex-post facto i.e., after the results are published, to meet the demands of the society. The Council of UK Research and Innovation (UKRI) advocates that if a research study improves the quality of lives of millions of people that is a big impact. At the same time, if a study saves the lives of a relatively small number of people, that too is a significant impact. The impact of research in the disciplines like humanities is also assessed, including studies in history that contribute to tourism in certain regions, or research in philosophy that helps to establish ethical initiatives related to climate change (<https://phys.org/news/2019-05>).

There are immense opportunities for researchers in the humanities to demonstrate the impact of their work, based on the criteria advocated by other scholars in the same discipline or subject. The general principles are the same. The scholars working in a particular field of study are expected to formulate the relevant criteria for that field or subject. Until the 1970s, there was never any doubt in the mind of policymakers that public investment in R & D also would have a positive impact on the areas such as communication; the way we work; our housing, clothes, and food; our modes of

transportation; and even the length and quality of life itself<sup>1</sup>. Many countries worked on the principle that science is the genie that will keep the country competitive, but the genie needs to be fed<sup>2</sup>.

In the United States, Bush<sup>3</sup> argued that any investment in science is inherently good for the society. However, from the late 1980s onwards, the empty public coffers increasingly compelled science to account for its accomplishments in the form of internal assessment (otherwise known as *peer reviews*) and indicators to measure scientific output and scientific impact (the buzz words being *audit society* and *new public management*). The only aspect of interest was measuring the impact of research on academics and scientific knowledge. The assumption was that a society could derive most of the benefit from scientific research aimed at the highest level. There has been a visible trend away from instant trust in the validity of this assumption since the 1990s. The expectation is that evidence shall be provided to demonstrate the value of science for society<sup>4</sup>.

What one expects today is assessment of the impact of science on human lives and health, organizational capacities of firms, institutional and group behavior, and environment, to name a few. Society can reap the benefits of successful research studies only if the results are converted into marketable and consumable products or services<sup>5</sup>. The benefits from basic research have been under scrutiny since the 1990s, because the importance of fundamental research for society is not fully understood<sup>6,7</sup>. Research that is highly cited or published in leading journals may be good for the academia, but not

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<sup>1</sup> Burke, J., Bergman, J., & Asimov, I. (1985). *The Impact of Science on Society*. Washington DC: National Aeronautics and Space Administration.

<sup>2</sup> Stephan, P. (2012). *How Economics Shapes Science*. Cambridge, M. A.: Harvard University Press.

<sup>3</sup> Bush, V. (1945). *Science: The Endless Frontier*. (A report to President Truman outlining his proposal for post - war U.S. science and technology policy). Washington, DC: United States Government Printing Office.

<sup>4</sup> Martin, B.R. (2011). The Research Excellence Frame work and the “Impact Agenda”: Are we creating a Frankenstein Monster? *Research Evaluation*, 20 (3), 247-254.

<sup>5</sup> Lamm, G. M. (2006). Innovation Works. A Case Study of an Integrated Pan-European Technology Transfer Model. *B.I.F. Futura*, 21 (2), 86-90.

<sup>6</sup> Salter, A. J. & Martin, B. R. (2001). The economic benefits of publicly funded basic research: A critical review. *Research Policy*, 30 (3), 509-532.

<sup>7</sup> Petit, J.C. (2004). Why do we need Fundamental Research? *European Review*, 12 (2), 191-207.

necessarily for the society<sup>8</sup>. Today, the concern is the assessment of social, cultural, environmental, and economic returns (impact and effect) from the results (research output) or products (research outcome) of publicly funded research<sup>9</sup>.

## Fuzzy Boundary between the Economic and Non-Economic Benefits

In this context, social benefits indicate the contribution of research to the social capital of the nation. For example, stimulating new approaches to social issues, informed public debate, and improved policymaking. Since social benefits are hardly distinguishable from the superior term of societal benefits, in most of the literature the term “social impact” is used instead of “societal impact”. *Cultural* benefits are additions to the cultural capital of a nation. For example, understanding how we relate to other societies and cultures, contributing to cultural preservation and enrichment. *Environmental* benefits add to the natural capital of a nation. For example, reduced waste and pollution, uptake of recycling techniques. *Economic* benefits denote contributions to the economic capital of a nation. For example, enhancing the skills base, and improved productivity. It is not very easy to separate the afore-mentioned areas of societal impact from one another. For example, improvement in the ‘quality of life’ may depend on a mix of social and cultural studies, environmental research, studies on food safety, healthcare research etc.

Interestingly, economic impact overlaps with the other three areas. There is a fuzzy boundary between the economic and non-economic benefits. For example, if a new medical treatment improves health and reduces the days of work lost due to a particular disease, are the benefits economic or social? Societal impact becomes apparent in the distant future. Thus, societal impact is not a short-term phenomenon; it is generally concerned with intermediate or ultimate returns. Four problems that commonly cause trouble in societal impact assessments have been cited<sup>10</sup>. *Causality problem*: It is not clear what impact can be attributed to what cause. *Attribution problem*: Because impact can be diffuse, complex, and contingent – it is not clear what portion of impact should be attributed to a certain research or to other inputs. *Internationality problem*: R & D and innovation are intrinsically international, which makes attribution virtually

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<sup>8</sup> Nightingale, P. & Scott, A. (2007). Peer Review and the Relevance Gap: Ten Suggestions for Policymakers. *Science and Public Policy*, 34 (8), 543-553.

<sup>9</sup> Donovan, C. (2011). State of the Art in Assessing Research Impact: Introduction to a Special Issue. *Research Evaluation*, 20 (3), 175-179.

<sup>10</sup> Donovan C. (2011). State of the art in assessing research impact: introduction to a special issue. *Research Evaluation*, 20 (3), 175-179.

impossible. *Evaluation timescale problem:* Premature impact measurement may result in policies that over-emphasize research bringing short-term benefits<sup>11</sup>.

It is not possible to have a single assessment mechanism since it can be expected that the scientific work of an engineer has a different impact than the work of a sociologist or historian and because research results affect many different aspects of society. Societal impact of research is not always going to be desirable or positive. Furthermore, the same research may well lead to both positive and negative benefits. For example, environmental research that leads to the closure of a fishery might have an immediate negative economic impact, even though in the much longer term it will preserve a resource that might again become available for use. Most of the researchers who have assessed the societal impact of research to date have focused on the economic dimension. As far back as the 1950s, economists began to integrate science and technology in their models and study the impact of R & D on economic growth and productivity. Compared with the other dimensions, the economic dimension is certainly the easiest to measure.

Some of the contributions that publicly funded research makes to economic growth are: (i) expanding the knowledge available for firms to draw upon in their technological activities; (ii) well-educated graduates who join firms; (iii) scientists develop new equipments, laboratory techniques, and analytical methods that are then available for use outside academia; (iv) government - funded research is frequently an entry point into networks of expertise; (v) faced with complex problems, industry willingly draws on publicly funded research ; and (vi) new firms are founded out of scientific projects.

It is widely known that some industries (computers) profit more from research than do others (metal products), and that some scientific disciplines (medicine) contribute more toward assessable benefits than do others (mathematics). *Case studies* enable a comprehensive investigation of individual projects to ascertain the ways in which research has produced societal benefits. Case studies do not permit generalizations to be made but they do provide in-depth insight into processes which have resulted in societal impact, and therefore lead to a better understanding of these processes<sup>12</sup>. Cost-benefit

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<sup>11</sup> Martin, B.R. (2007). Assessing the impact of basic research on society and the economy. *Paper presented at the Rethinking the impact of basic research on society and the economy (WF-EST International conference, 11 May 2007)*, Vienna, Austria.

<sup>12</sup> Bornmann, L. (2013). What is social impact of research and how can it be assessed? A literature survey. *Journal of the American Society for Information Science and Technology*, 64 (2), 217-233.

analyses are very similar to case studies: while they may not be as detailed, they do generally contain more quantitative data.

The book is collection of selected papers accepted for presentation during *SHODH 2020*. The objective is to highlight the research pursued by scholars these days in India. It is likely that these researches may give insight for future research and fraternity of researchers is benefitted.

**Dr. Upinder Dhar  
Dr. Santosh Dhar**

## About the Editors

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**Dr. Santosh Dhar** is Dean, Faculty of Doctoral Studies and Research at Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore. She has been engaged in teaching, research, corporate training and consultancy for the last forty years. She has widely published her work and has 325 publications to her credit. Her earlier assignments have been Professor, Shri Vaishnav Institute of Management, Indore, Professor, Amity Business School, Amity University, Greater Noida campus, Professor, Institute of Management & Dean Research, JK Lakshmi pat University, Jaipur, Senior Professor, OB/HR Jaipuria Institute of Management, Jaipur, Professor and Chairperson OB/HR Area, Institute of Management, Nirma University, Ahmedabad and Guest Faculty at IIM Kolkata and MICA, Ahmedabad. Many research scholars have been awarded Ph.D degree under her supervision. She has designed and conducted management development programs for the executives of several business houses, such as Grasim Industries, J.K. Tyre, Bridgestone, Hindustan Motors, ONGC and GAIL to name a few. She has been on the Panel of Reviewers of the Oxford University Press and Tata McGraw-Hill. She has been Chairperson of Indian Society for Training and Development (Indore and Jaipur Chapter) and had been on the Editorial Board of Indian Journal of Training and Development. She has presented papers in several national and international conferences / seminars and had the opportunity to visit Kathmandu (Nepal), Male (Maldives), Bangkok (Thailand), Beijing, Shanghai, Guangzhou, Shenzhen, Hong Kong (China), Seoul (South Korea) Dubai, US, and Poland in connection with various professional assignments.

Dr. Dhar has coordinated the implementation of a project on the *Empowerment of Women through Enterprise* in North India (2000-2002), which was funded by Canadian International Development Agency (CIDA). She has completed the research project on *Problems of Women Trainers in India and Quality of Work Life as a Determinant of Mental Health in Pharmaceutical Industry*. She has also been principal investigator for Asian Development Bank funded and Rajasthan Government sponsored RUIDP Consultancy project on *Capacity Building of ULBs* of different towns of Rajasthan. She has twice been chairperson of Indian Society for Training and Development, Indore Chapter & Chairperson of the Best Paper Award of the Indian Society for Training and Development, New Delhi. Dr. Dhar was conferred *National Fellowship* for her contributions to HR by the Indian Society for Training and Development in 2006-07.

E-mail: [deanresearch@svvv.edu.in](mailto:deanresearch@svvv.edu.in) Mobile: 9926596697  
Brief Profile



**Dr. Upinder Dhar**  
Vice Chancellor

Dhar is Vice Chancellor of Shri Vaishnav Vidyapeeth Vishwavidyalaya (Indore). Earlier, he was Group Additional Vice Chancellor and Pro-Vice Chancellor Academics, Amity University Uttar Pradesh (Noida); Founder Vice Chancellor of JK Lakshmiपत University (Jaipur); Director - Institute of Management, Dean - Faculty of Management, and Dean - Faculty of Doctoral Studies and Research, Nirma University (Ahmedabad); Director - Prestige Institute of Management and Research (Indore); President - Prestige Group of Educational Institutions (Indore); Professor of Management at NITIE (Mumbai); and Reader at IMS-DAVV (Indore). He has conducted more than 500 management and faculty development programs for the executives of major business houses and faculty members of academic institutions respectively. He has also been Guest Faculty at IIM Calcutta, IIM Indore, IIM Trichy and IIT Roorkee. Besides undertaking consultancy assignments, he has authored/co-authored more than 670 publications. Thirty Four (34) scholars have been awarded Ph.D. degree under his supervision by various universities.

A Fellow of ISTD and a strong proponent of Case Method, Dr. Dhar is a recipient of prestigious Ravi J Matthai National Fellow Award conferred by the *Association of Indian Management Schools (AIMS)*. He has been on the Panel of Reviewers of number of journals, such as International Journal of Training and Development, Human Resources International, Journal of Global Business and Technology, and South Asian Journal of Management. He has also been on the Panel of Experts maintained by the NBA (Bangalore); NAAC (Bangalore); ICSSR (New Delhi); and SAQS (Hyderabad). He was President of Anthropological and Behavioural Sciences Section of the Indian Science Congress Association (2007-08), Indian Society for Training and Development (2008-09) and Association of Indian Management Schools (2014-15).

He has also been Member of the Council of Management of AIMA, Member of ATMA, All India Board of Management Studies of AICTE, Rajasthan State Productivity Council, Governing Board of DELNET, and Member of the Executive Board of AMDISA. He was awarded Commonwealth Fellowship twice to present his papers at the South Asian Management Forums held at Royal Institute of Management, Bhutan and Lahore University of Management Science, Lahore. He has visited the Ivy league institutions like Harvard Business School, MIT Sloan School of Management, and Yale University School of Management. He has also visited more than 15 countries for professional and academic interest. He was a Member of the Model Curriculum Committee for Management Programs constituted by AICTE in 2017. Currently, he is a Member of the Standing Committee on Specification of Degrees u/s 22 of the UGC Act, 1956. He has also been resource person in the Leadership for Academicians Program (LEAP) sponsored by MHRD and organized by IIT Roorkee in 2018 and BHU Varanasi in 2019.

E-mail: vc@svvv.edu.in, upinderdhar@gmail.com

Mobile: 9829089526, 9425900020



**Dr. Swati Dubey Mishra** a **Gold Medalist** is Ph.D in Criminology and Forensic Science from Dr. Harisingh Gour University, Sagar, M.P.

She has qualified University Grant Commission's National Eligibility Test (**UGC-NET**) and was awarded prestigious **Junior Research Fellowship** by Directorate of Forensic Science, Ministry of Home Affairs, Govt. of India, New Delhi and was promoted as **Senior Research Fellow**.

She was awarded **Junior Scientist Award** in National Seminar on 'Role of Chemistry in Basic and Applied Sciences' organized by Dept. of Chemistry, Govt. Holkar Science College, Indore in 2015.

She has actively attended more than 70 National & International level conferences, workshops and seminars. She has Research papers in various National, International & Regional Journals and Conference Proceedings to her credit. She is a meticulous professional with nearly 13 years of extensive experience in the field of teaching, learning, research & development in Forensic Science. She is a member of Board of Studies, Syllabus Setting committee, Paper Setter, Valuer & External Examiner for various reputed colleges/universities. She has delivered guest lecturer in various organization i.e. BT Institute, Sagar, Govt. Institute of Forensic Science, Nagpur, Govt. Holkar Science College, Indore and chaired many sessions.

She is life member of **Indian Science Congress Association (ISCA)**, Kolkata, West Bengal, **Forensic Science Development Society (FSDS)**, Lucknow, U.P., **Global Initiative of Academic Network**, Ministry of Human Resource Development, Government of India, **Madhya Pradesh Library Association**, Bhopal, M.P.

She is presently working as an Assistant Professor & also a recognized Ph.D. supervisor in the subject of Forensic Science at Shri Vaishnav Institute of Forensic Science in Shri Vaishnav Vidhyapeeth Vishwavidyalaya, Indore (M.P.).

**E-mail:** swati.dubeymishra@gmail.com

**Mobile:** 9926596697

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**SECTION – I: SCIENCE & TECHNOLOGY**

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# A Common Fixed Point Theorem for Weakly Compatible Pairs in Fuzzy Metric-Like Spaces

Varsha Pathak

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## ABSTRACT

In this paper, the weakly compatible pair of mappings in fuzzy metric-like spaces have been introduced to prove a common fixed point result for such pairs in complete fuzzy metric-like spaces. The results generalize and extend several known results in fuzzy metric-like spaces.

**Keywords:** Fuzzy Metric-Like Space, Weakly Compatible Pair of Mappings, Fixed Point Theorem.

## 1. INTRODUCTION AND PRELIMINARIES

The evolution of fuzzy mathematics commenced with an introduction of the notion of fuzzy sets by Zadeh [10], as a new way to represent the vagueness in everyday life. There are many practical problems where the nature of uncertainty in the behavior of a given system possesses fuzzy rather than stochastic nature. The concept of a fuzzy metric space was introduced and generalized in many ways [1, 17, 26]. George and Veeramani [2, 17] modified the concept of fuzzy metric space introduced by Kramosil and Michalek [8]. They obtained a Hausdorff and first countable topology on the modified fuzzy metric spaces, which has very important applications in quantum particle physics, particularly in connection with both string and  $\epsilon^\infty$  theory (see, [12] and references therein). In fuzzy metric spaces given by Kramosil and Michalek [8], Grabiecgave the fuzzy version of Banach contraction principle. Subsequently, many authors proved fixed point and common fixed point theorems in fuzzy metric spaces, (see [4, 5, 6, 7, 11, 25]). Recently, Harandi [1] introduced the concept of metric-like spaces as a generalization of partial metric spaces and metric spaces (see [1]) and proved some fixed point results in such spaces. For definitions and examples of metric like spaces, we refer to [1].

The aim of this paper is to introduce “fixed point theorems for weakly compatible pairs of mappings in fuzzy metric-like spaces”.

**Definition 1.1.** [10] A fuzzy set  $A$  in a nonempty set  $X$  is a function with domain  $X$  and values in  $[0, 1]$ .

**Definition 1.2.** [4] A binary operation  $\star: [0, 1] \times [0, 1] \rightarrow [0, 1]$  is a continuous t-norm if  $\{[0, 1]; \star\}$  is an abelian topological monoid with unit 1 such that  $a \star c \leq b \star d$ , whenever  $a \leq c$  and  $b \leq d$ ,  $a, b, c, d \in [0, 1]$ . Three typical examples of t- norms are

$a \star b = \min \{a, b\}$  (minimum t-norm),  $a \star b = ab$  (product t-norm), and  $a \star b = \max \{a + b - 1, 0\}$  (Lukasiewicz t-norm).

**Definition 1.3.** [18] The triplet  $(X, M, \star)$  is a fuzzy metric space if  $X$  is an arbitrary set,  $\star$  is a continuous t-norm,  $M$  is a fuzzy set in  $X^2 \times (0, \infty)$  satisfying the following conditions:

$$(FM1) M(x, y, t) > 0;$$

$$(FM2) M(x, y, t) = 1 \text{ if and only if } x = y;$$

$$(FM3) M(x, y, t) = M(y, x, t);$$

$$(FM4) M(x, y, t) \star M(y, z, s) \leq M(x, z, t + s);$$

$$(FM5) M(x, y, \cdot) : (0, \infty) \rightarrow [0, 1] \text{ is a continuous mapping;}$$

for all  $x, y, z \in X$  and  $s, t > 0$ .

Here  $M$  with  $\star$  is called a fuzzy metric on  $X$ . Note that,  $M(x, y, t)$  can be thought of as the definition of nearness between  $x$  and  $y$  with respect to  $t$ . It is known that  $M(x, y, \cdot)$  is non decreasing for all  $x, y \in X$ . For examples of fuzzy metric spaces, we refer to [8].

### Fuzzy Metric-Like Spaces

We recall the definition of fuzzy metric-like spaces, some examples and properties of fuzzy metric-like spaces.

**Definition 1.4.** [16] The triplet  $(X, F, \star)$  is a fuzzy metric-like space if  $X$  is an arbitrary set,  $\star$  is a continuous t-norm,  $F$  is a fuzzy set in  $X^2 \times (0, \infty)$  satisfying the following conditions:

$$(FML1) F(x, y, t) > 0;$$

$$(FML2) \text{ if } F(x, y, t) = 1 \text{ then } x = y;$$

$$(FML3) F(x, y, t) = F(y, x, t);$$

$$(FML4) F(x, y, t) \star F(y, z, s) \leq F(x, z, t + s);$$

$$(FML5) F(x, y, \cdot) : (0, \infty) \rightarrow [0, 1] \text{ is a continuous mapping;}$$

for all  $x, y, z \in X$  and  $s, t > 0$ :

Here  $F$  with  $\star$  is called a fuzzy metric-like on  $X$ . A fuzzy metric-like space satisfies all of the conditions of a fuzzy metric space except that  $F(x, x, t)$  may be less than 1 for all  $t > 0$  and for some (or may be for all)  $x \in X$ . Also, every fuzzy metric space is fuzzy metric-like space with unit self fuzzy distance, that is, with  $F(x, x, t) = 1$  for all  $t > 0$  and for all  $x \in X$ . Note that, the axiom (FM2) in Definition 1.3 gives the idea that when  $x = y$  the degree of nearness of  $x$  and  $y$  is perfect, or simply 1, and then  $M(x, x, t) = 1$  foreach  $x \in X$  and for each  $t > 0$ . While in a fuzzy metric-like space,  $F(x, x, t)$  may be less than 1, that is, the concept of fuzzy metric-like is applicable when the degree of nearness of  $x$  and  $y$  is not perfect for the case  $x = y$ . By using the following propositions several examples of fuzzy metric-like spaces can be obtained.

**Proposition 1.5.** [16] Let  $(X, \sigma)$  be any metric-like space. Then the triplet  $(X, F, \star)$  is a fuzzy metric like space, where  $\star$  is defined by  $a \star b = ab$  for all  $a, b \in [0, 1]$  and the fuzzy set  $F$  is given by

$$F(x, y, t) = \frac{kt^n}{kt^n + m\sigma(x, y)} \text{ for all } x, y \in X, t > 0$$

where  $k \in \mathbb{R}^+, m > 0$  and  $n \geq 1$ .

**Example 1.6.** Let  $X = \mathbb{R}^+, k \in \mathbb{R}^+$  and  $m > 0$  Define  $\star$  by  $a \star b = ab$  and the fuzzy set  $F$  in  $X^2 \times (0, \infty)$  by

$$F(x, y, t) = \frac{t}{kt + m(\max\{x, y\})} \text{ for all } x, y \in X, t > 0$$

Then, since  $\sigma(x, y) = \max\{x, y\}$  for all  $x, y \in X$  is a metric-like on  $X$  (see [12]) therefore by Proposition 2.2,  $(X, F, \star)$  is a fuzzy metric-like space, but it is not a fuzzy metric space, as

$$F(x, x, t) = \frac{kt}{kt + mx} \neq 1 \text{ for all } x > 0 \text{ and } t > 0.$$

**Proposition 1.7.** [16] Let  $(X, \sigma)$  be any metric-like space. Then the triplet  $(X, F, \star)$  is a fuzzy metric-like space, where  $\star$  is given by  $a \star b = ab$  for all  $a, b \in [0, 1]$  and the fuzzy set  $F$  is defined by

$$F(x, y, t) = e^{\sigma(x, y)/t^n} \text{ for all } x, y \in X, t > 0, \text{ where } n \geq 1.$$

**Example 1.8.** [16] Let  $X = \mathbb{N}$  define  $\star$  by  $a \star b = ab$  and the fuzzy set  $F$  in  $X^2 \times (0, \infty)$  by

$$F(x, y, t) = \frac{1}{e^{\max\{x, y\}/t}} \text{ for all } x, y \in X, t > 0$$

Then, since  $\sigma(x, y) = \max\{x, y\}$  for all  $x, y \in X$  is a metric-like on  $X$  (see [12]) therefore by Proposition 1.5,  $(X, F, \star)$  is a fuzzy metric-like space, but not a fuzzy metric space, as

$$F(x, y, t) = \frac{1}{e^{x/t}} \neq 1 \text{ for all } x > 0 \text{ and } t > 0.$$

**Definition 1.9.** A sequence  $\{x_n\}$  in a fuzzy metric-like space  $(X, F, \star)$  is said to be convergent to  $x \in X$  if  $\lim_{n \rightarrow \infty} F(x_n, x, t) = F(x, x, t)$  for  $t > 0$ .

**Definition 1.10.** A sequence  $\{x_n\}$  in a fuzzy metric-like space  $(X, F, \star)$  is said to be Cauchy if

$$\lim_{n \rightarrow \infty} F(x_{n+p}, x_n, t) \text{ for all } t > 0, p \geq 1 \text{ exists and is finite.}$$

**Definition 1.11.** A fuzzy metric like space  $(X, F, \star)$  is said to be complete if every Cauchy sequence  $\{x_n\}$  in  $X$  converges to some  $x \in X$  such that

$$\lim_{n \rightarrow \infty} F(x_n, x, t) = F(x, x, t) = \lim_{n \rightarrow \infty} F(x_{n+p}, x_n, t) \text{ for all } t > 0, p \geq 1.$$

**Definition 1.12.** Let  $f$  and  $g$  be two self maps of a set  $X$ . If  $w = fx = gx$  for some  $x$  in  $X$ , then  $x$  is called a coincidence point of  $f$  and  $g$ , and  $w$  is called a point of coincidence of  $f$  and  $g$ .

**Proposition 1.13.** [19] Let  $f$  and  $g$  be two weakly compatible self maps of a set  $X$ . If  $f$  and  $g$  have a unique point of coincidence  $w = fx = gx$ , then  $w$  is the unique common fixed point of  $f$  and  $g$ .

**Definition 1.14.:** [16] Let  $(X, F, *)$  be a complete fuzzy metric-like space and  $T: X \rightarrow X$  be two mappings such that the following condition is satisfied:

$$\frac{1}{F(Tx, Ty, t)} - 1 \leq k \left[ \frac{1}{F(x, y, t)} - 1 \right] \text{ for all } x, y \in X.$$

## 2. MAIN RESULTS

**Theorem 2.1.** Let  $(X, F, *)$  be a complete fuzzy metric-like space and  $f, g: X \rightarrow X$  be two mappings such that the following condition is satisfied:

$$\frac{1}{F(fx, fy, t)} - 1 \leq k \left[ \frac{1}{F(gx, gy, t)} - 1 \right] \text{ for all } x, y \in X. \quad (C)$$

Suppose,  $f(X) \subset g(X)$  and  $g(X)$  is a complete subspace of  $X$ , then  $f$  and  $g$  have a unique point of coincidence in  $X$ . Moreover if  $f$  and  $g$  are weakly compatible,  $f$  and  $g$  have a unique common fixed point  $p \in X$ , such that  $F(p, p, t) = 1$  for all  $t > 0$ .

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Proof. Let  $x_0 \in X$  be any arbitrary point, then  $fx_0 \in f(X)$ . Since  $f(X) \subset g(X)$  choose  $x_1 \in X$  such that  $gx_1 = fx_0$ . Again, since  $fx_1 \in f(X), f(X) \subset g(X)$ , choose  $x_2 \in X$  such that  $gx_2 = fx_1$ . In similar way we define a sequence  $\{y_n\}$  in  $X$  as follows:

$$y_n = fx_n = gx_{n+1} \text{ for all } n \geq 0.$$

Now, if  $y_n = y_{n+1}$  for some  $n \in N$  for some then  $\{y_n\}$  is a fixed point of coincidence point  $f$  and  $g$ . Therefore we assume that  $y_n \neq y_{n+1}$  is a fixed point of  $f, g$ .

$$\frac{1}{F(fx_n, fx_{n+1}, t)} - 1 \leq k \left[ \frac{1}{F(gx_{n+1}, gx_{n+2}, t)} - 1 \right] \text{ for all } x, y \in X.$$

$$\frac{1}{F(y_n, y_{n+1}, t)} - 1 \leq k \left[ \frac{1}{F(gy_{n-1}, gy_n, t)} - 1 \right] \text{ for all } x, y \in X.$$

$$\frac{1}{F(y_{n+1}, y_{n+2}, t)} - 1 \leq k \left[ \frac{1}{F(gy_n, gy_{n+1}, t)} - 1 \right] \text{ for all } x, y \in X. \quad (1)$$

Setting  $F(y_n, y_{n+1}, t) = F_n(t)$  and  $1 - k = \lambda$ , it follows inequality from the above inequality that

$$\frac{1}{F_n(t)} \leq \frac{k^n}{F_0(t)} + k^{n-1}\lambda + k^{n-2}\lambda + \dots + \lambda$$

$$\frac{1}{F_n(t)} \leq \frac{k^n}{F_0(t)} + \lambda(k^{n-1} + k^{n-2} + \dots + 1)$$

$$\frac{1}{F_n(t)} \leq \frac{k^n}{F_0(t)} + \lambda(k^{n-1} + k^{n-2} + \dots + 1)$$

$$\frac{1}{F_n(t)} \leq \frac{k^n}{F_0(t)} + (1 - k^n)$$

that is,

$$\frac{1}{\frac{k^n}{F_0(t)} + (1 - k^n)} \leq F_n(t) \quad t > 0, n \in N \quad (2)$$

If  $n \in N, p \geq 1$

$$\begin{aligned}
F(y_{n+p}, y_n, t) &\geq F\left(y_n, y_{n+1}, \frac{t}{2}\right) * F\left(y_{n+1}, y_{n+p}, \frac{t}{2}\right) \\
&\geq F\left(y_n, y_{n+1}, \frac{t}{2}\right) * F\left(y_{n+1}, y_{n+2}, \frac{t}{2^2}\right) * F\left(y_{n+2}, y_{n+p}, \frac{t}{2^2}\right) \\
&\geq F\left(y_n, y_{n+1}, \frac{t}{2}\right) * F\left(y_{n+1}, y_{n+2}, \frac{t}{2^2}\right) * F\left(y_{n+2}, y_{n+p}, \frac{t}{2^2}\right) \\
&* \dots * F\left(y_{n+p-2}, y_{n+p-1}, \frac{t}{2^{p-1}}\right) * F\left(y_{n+p-1}, y_{n+p}, \frac{t}{2^{p-1}}\right) \\
&\geq F_n\left(\frac{t}{2}\right) * F_{n+1}\left(\frac{t}{2^2}\right) * \dots * F_{n+p-1}\left(\frac{t}{2^{p-1}}\right)
\end{aligned}$$

Using inequality (2)

$$\begin{aligned}
F(y_{n+p}, y_n, t) &\geq \frac{1}{\frac{k^n}{F_0\left(\frac{t}{2}\right)} + (1 - k^n)} + \frac{1}{\frac{k^{n+2}}{F_0\left(\frac{t}{2^2}\right)} + (1 - k^{n+1})} + \dots + \frac{1}{\frac{k^{n+p-1}}{F_0\left(\frac{t}{2^{p-1}}\right)} + (1 - k^{n+p-1})} \\
F(y_{n+p}, y_n, t) &\geq \frac{1}{\frac{k^n}{F_0\left(\frac{t}{2}\right)} + 1} + \frac{1}{\frac{k^{n+2}}{F_0\left(\frac{t}{2^2}\right)} + 1} + \dots + \frac{1}{\frac{k^{n+p-1}}{F_0\left(\frac{t}{2^{p-1}}\right)} + 1}
\end{aligned}$$

As  $v \in (0, 1)$ , there for using the properties continuous t-norm we obtain from the above inequality that  $\lim_{n \rightarrow \infty} F(y_{n+p}, y_n, t) = 1$  for all  $t > 0, p \geq 1$ .

Therefore  $\{y_n\}$  is Cauchy's sequence in  $(X, F, *)$ . By completeness of  $g(X)$ , there exist  $u, v \in X$  such that  $v = gu$  and  $\lim_{n \rightarrow \infty} F(y_n, v, t) = \lim_{n \rightarrow \infty} F(y_{n+p}, y_n, t) = F(v, v, t) = 1$ .

Then we show that  $v$  is a unique point of coincidence of  $f$  and  $g$ . Again, from contractive condition (C), we have

$$\frac{1}{F(fx_n, fu, t)} - 1 \leq k \left[ \frac{1}{F(gx_n, gu, t)} - 1 \right] \text{ for all } x, y \in X.$$

$$\frac{1}{F(y_n, fu, t)} - 1 \leq \left[ \frac{k}{F(y_{n+1}, v, t)} - k \right] \rightarrow 0 \text{ as } n \rightarrow \infty.$$

Hence

$$\lim_{n \rightarrow \infty} F(y_n, v, t) = \lim_{n \rightarrow \infty} F(y_n, fu, t) = F(p, p, t) = 1.$$


---

Now we know that

$$F(fu, gu, t) \geq F\left(fu, y_n, \frac{t}{2}\right) * F\left(y_n, gu, \frac{t}{2}\right).$$

Letting  $n \rightarrow \infty$  we obtain

$$\begin{aligned} \lim_{n \rightarrow \infty} F(fu, gu, t) &\geq \lim_{n \rightarrow \infty} F\left(fu, y_n, \frac{t}{2}\right) * \lim_{n \rightarrow \infty} F\left(y_n, gu, \frac{t}{2}\right) \\ &\Rightarrow F(fu, gu, t) = 1 * 1 \\ &\Rightarrow F(fu, gu, t) = 1. \end{aligned}$$

Therefore,  $v = fu = gu$ , i.e.,  $v$  is a point of coincidence of  $f$  and  $g$ .

Let  $w \in X$  be another point of coincidence of  $f$  and  $g$ , then there exists  $z \in X$  such that  $w = fz = gz$ . Then, by (C) we have

$$\begin{aligned} \frac{1}{F(fu, fz, t)} - 1 &\leq k \left[ \frac{1}{F(gu, gz, t)} - 1 \right] \text{ for all } x, y \in X. \\ \frac{1}{F(fu, fz, t)} - 1 &\leq \left[ \frac{1}{F(gu, gz, t)} - 1 \right] = \left[ \frac{1}{F(fu, fz, t)} - 1 \right] < \left[ \frac{1}{F(gu, gv, t)} - 1 \right] \end{aligned}$$

this is contradiction. Therefore, the point of coincidence is unique. Hence by preposition 1.12  $f$  and  $g$  have a unique common fixed point.

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# **A Comparative Study on Effect of Different Acidic pH of Dyeing Medium on Colour Strength of Wool Fabric Dyed with Beetroot Colour extract using Different Mordants**

**Tanveer Malik, Shamayita Patra**

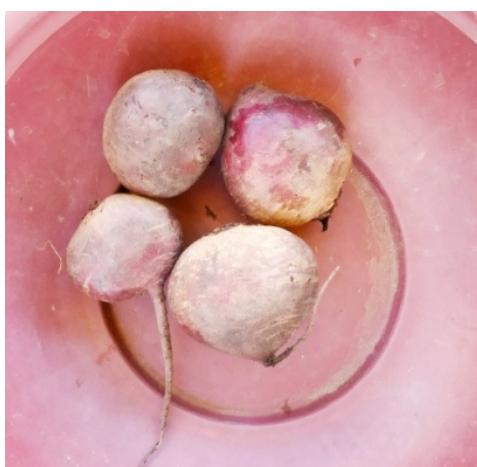
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## **ABSTRACT**

*Natural dye is good alternative for harmful synthetic dye. However, the pH of dyeing bath has considerable effect on colour strength other than mordants. Usually mordant are used to improve the fastness of natural dyes. In this study, natural colorants from beetroot were extracted and applied on wool fabric at different pH with different pre mordants and assessed against the colour strength of the dyed wool fabric. It has been found that at neutral pH copper gives better result.*

**Keywords:** Beetroot, Mordant, Natural dye, pH, Colour strength, Wool fabric.

## **1. INTRODUCTION**



**Figure 1. Beetroot image**

Plant dyes appear as interesting alternatives because of the health hazards of most synthetic dyes. Active dyestuff parts of plants are used for dyeing. Textiles dyed with natural dyes were

found to have inadequate fastness properties which can be improvised by using mordants. Common mordants used are alum, chrome, stannous chloride, copper sulphate, ferrous sulphate etc. So present study is undertaken to evaluate the effect of different mordants on colour strength of dyed wool fabric under different pH of dyeing medium. In this study, natural colour extracted from beetroot is used.

Beet root is known by its red colour. The characteristic feature of this vegetable is its dark purple skin and a distinctive purple flesh. The colour responsible for the red hue of red beet juice is a group of molecules called Betalain. Betanin is the main colouring compound present in red beetroot juice colour [1-9].

## **2. MATERIAL AND METHODS**

### ***2.1. Materials***

**2.1.1 Natural Dye Source:** Beetroot powder

**2.1.2 Textile material:** 100% wool fabric.

**2.1.3 Auxiliary chemicals for dyeing:**

- For pH adjustment: Acetic acid and sulphuric acid
- Mordants: Ferrous sulphate and copper sulphate.
- Sodium chloride (NaCl)
- Non ionic detergent

### ***2.2. Process of dyeing***

#### **Step 1: Non- ionic detergent wash**

A wool fabric sample was washed with 2g/l of non-ionic detergent at 70°C for 10 min. Then the fabric was washed 2 to 3 time with cold water to remove detergent completely.

#### **Step 2: Mordanting the sample:**

Washed wool samples were pre-mordanted with 5% mordant (ferrous sulphate and copper sulphate) aqueous solution at a boiling temperature for 60 min with M: L of 1: 20. The bath is then drained and fabric is washed in normal water.

### Step 3: Dyeing of sample:

The mordanted wool fabric samples were dyed with 1% stock solution of beetroot dye powder. The dyeing conditions are M: L is 1: 20, Shade % is 15% keeping pH 2, 5 and 7 for 60 min at 90°C

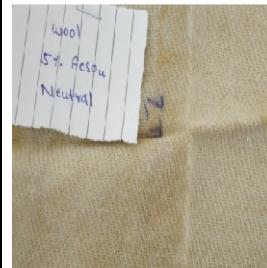
### 3. RESULT AND DISCUSSION

The colour strength of the pre-mordanted wool fabric dyed with beetroot powder at different pH is tabulated in the table no.1. The formula used for measuring colour strength is  $K/S = [ \{ (1-R)^2 / 2R \} ]$  Where R is the reflectance, K is absorbance and S is the scattering. The values are the average of five readings.

**TABLE 1: Beetroot powder at different pH**

Dye	Mordant	pH Condition	Colour Strength
Beetroot dye	5% Ferrous sulphate	pH 7	13.551
Beetroot dye	5% Ferrous sulphate	pH 5	11.984
Beetroot dye	5% Ferrous sulphate	pH 2	9.124
Beetroot dye	5% Copper sulphate	pH 7	14.487
Beetroot dye	5% Copper sulphate	pH 5	10.807
Beetroot dye	5% Copper sulphate	pH 2	6.995

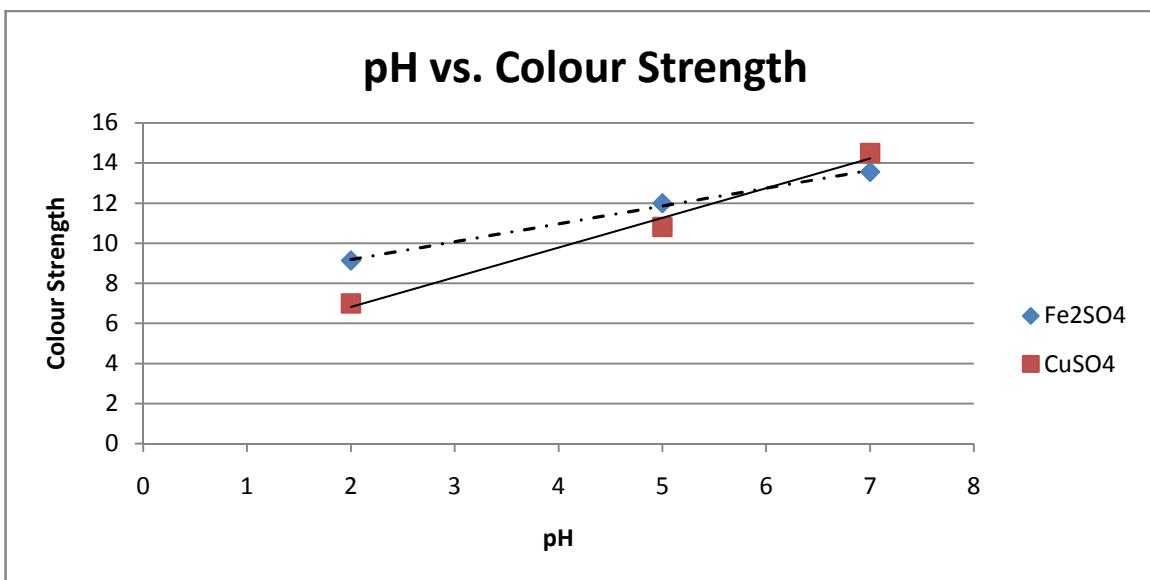
**TABLE 2: Fabric samples dyed with 5% ferrous sulphate ( $Fe_2SO_4$ ) at different pH**

			
Undyed wool fabric	pH 7	pH 5	pH 2

**TABLE 3: Fabric samples dyed with 5% copper sulphate ( $\text{CuSO}_4$ ) at different pH**

Undyed wool fabric	pH 7	pH 5	pH 2

From physical observation (Table 2 & 3), it is evident that pH in the acidic range has shown very low colour strength. However, for both the mordants (ferrous sulphate and copper sulphate) neutral pH has shown better colour strength than the acidic pH (Figure 2).



**Figure 2. pH vs. Colour Strength**

#### 4. CONCLUSION

From this initial study it is evident that acidic pH has adverse effect on beetroot colouring agent. However, copper sulphate has performed better than the ferrous sulphate at neutral pH as pre-mordant mildly.

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# A Review and Study of Coupled Fixed Point Theorems in Partially Ordered Metric Spaces

**Yogita Sharma, Shishir Jain**

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## ABSTRACT

*The aim of this paper is to review and study the coupled fixed points in mappings in partially ordered metric spaces having mixed monotone property.*

**Keywords:** *Fixed point; coupled fixed point; partially ordered metric space; mixed monotone mapping;*

## 1. INTRODUCTION

The many mathematicians have done remarkable work on fixed point in partially ordered metric spaces. The very first initiative in this direction was taken by Ran and Reuring [10], which was a combination of Banach contraction principle and Knaster Tarski fixed point theorem. They have taken a class of continuous and monotone mappings  $f: X \rightarrow X$  on a complete metric space  $(X, d)$  with partial order relation. The results of Ran and Reuring were extended by Nieto and Rodriguez [9] to the functions which are not necessarily continuous.

Many other authors [1, 6, 5, 9, 12, 13] extended some coupled fixed point theorems in partially ordered complete metric spaces and found that these results are useful to investigate a large class of problems and have discussed the existence and uniqueness of a solution for initial value problems, periodic boundary value problems and a nonlinear integral equations.

## 2. PRELIMINARIES

We begin this section by some notion, definition and theorems required in our subsequent discussions.

### 2.1 Definition ([9])

Let  $(X)$  be a partially ordered set and  $F: X \rightarrow X$ . We say that  $F$  is monotone non decreasing if  $x, y \in X, x \leq y \rightarrow Fx \leq Fy$ .

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*Research Scholar, SVVV, Indore and Assistant Professor, Department of Computer Science, Shri Vaishnav Institute of Management, Gumashta Nagar, Indore (M.P.)  
Professor, Department of Mathematics, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Ujjain Road, Indore (M.P.)*

## 2.2 Definition ([9])

Let  $(X, \leq)$  be a partially ordered set and  $F : X \rightarrow X$ . We say that  $F$  is monotone nonincreasing if  $x, y \in X, x \leq y \Rightarrow Fx \geq Fy$ .

In 1997 Alber and Guerre-Delabriere [14] introduced the notion of weak  $\phi$ -contraction in the context of Hilbert space.

## 2.3 Definition ([14])

A self mapping  $F : X \rightarrow X$ , on a metric space  $X$  is called weak  $\phi$ -contraction if there exists a continuous nondecreasing function  $\phi : [0, +\infty) \rightarrow [0, +\infty)$  with  $\phi(t) = 0$  if and only if  $t = 0$  such that

$$d(Fx, Fy) \leq d(x, y) - \phi(d(x, y))$$

for all  $x, y \in X$ .

Chatterjea [3] defined a new type of contraction condition:

$$d(Fx, Fy) \leq k(d(x, Fy) + d(y, Fx))$$

for all  $x, y \in X$ , where  $k \in [0, \frac{1}{2})$ , called  $C$ -contraction and proved the existence and uniqueness of the fixed point of the mapping  $F$ .

Choudhury [4] generalized the concept of  $C$ -contraction as follows:

## 2.4 Definition ([4])

A mapping  $F : X \rightarrow X$  where  $(X, d)$  is a metric space is said to be weakly  $C$ -contractive if for all  $x, y \in X$ , the following inequality holds:

$$d(Fx, Fy) \leq \frac{1}{2}(d(x, Fy) + d(y, Fx)) - \varphi(d(x, Fy), d(y, Fx)),$$

where  $\varphi : [0, \infty) \times [0, \infty) \rightarrow [0, \infty)$  is a continuous function such that  $\varphi(x, y) = 0$  if and only if  $x = y = 0$ .

Khan et al. [8] introduced the concept of altering distance function as follows:

## 2.5 Definition ([8])

The function  $\psi : [0, \infty) \rightarrow [0, \infty)$  is called an altering distance function. If the following properties are satisfied.

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$\psi$  is continuous and nondecreasing.

$\psi(t) = 0$  if and only if  $t = 0$ .

Bhaskar and Lakshmikantham [13] introduced the notion of the mixed monotone property and the coupled fixed point of a mapping  $F$  from  $X \times X$  into  $X$

## 2.6 Definition ([13])

Let  $X$  be a metric space,  $(x, y) \in X \times X$  and  $F: X \times X \rightarrow X$  be a mapping.  $(x, y)$  is called a coupled fixed point of the mapping if

$$F(x, y) = x \text{ and } F(y, x) = y.$$

## 2.7 Definition ([13])

Let  $(X, \preceq)$  be a partially ordered set and Let  $F: X \times X \rightarrow X$  be the mapping  $F$  is said to have the mixed monotone property if  $F(x, y)$  is nondecreasing in  $x$  and is nonincreasing in  $y$  and

$$y_1, y_2 \in X, x_1 \preceq y_2 \Rightarrow (x, y_1) \succeq (x, y_2).$$

$$\begin{matrix} y_1, y_2 \in X, & x_1 \preceq x_2 \Rightarrow F(x_1, y_1) \preceq F(x_2, y_1) \\ & F \end{matrix}$$

## 3. RESULTS

We begin this section by reviewing the paper of Bhaskar and Lakshmikantham [13] in their paper they gave the following results and remarks:

### 3.1 Theorem ([13])

Let  $F: X \times X \rightarrow X$  be a continuous mapping having the mixed monotone property on  $X$ . Assume that there exists a  $k \in [0, 1]$  with

$$d(F(x, y), F(u, v)) \leq \frac{k}{2}(d(x, u) + d(y, v)), \forall x \succeq u, y \preceq v.$$

If there exists  $x_0, y_0 \in X$  such that

$$x_0 \preceq F(x_0, y_0) \text{ and } y_0 \succeq F(y_0, x_0).$$

Then, there exist  $x, y \in X$  such that  $x = F(x, y)$  and  $y = F(y, x)$ .

In the next theorem, the authors established the result for the function, that need not be continuous. Instead we required that the underlying metric space  $X$  has an additional property defined in the following theorem.

### 3.2 Theorem ([13])

Let  $(X)$  be a partially ordered set and suppose that there exists a metric  $d$  in  $X$  such that  $(X, d)$  is a complete metric space. Assume that  $X$  has the following property:

- i) if a nondecreasing sequence  $x_n \rightarrow x$ , then  $x_n \preceq x$ , for all  $n$ ;
- ii) if a nonincreasing sequence  $y_n \rightarrow y$ , then  $y \preceq y_n$ , for all  $n$ .

Let  $F : X \times X \rightarrow X$  be a continuous mapping having the mixed monotone property on  $X$ . Assume that there exists a  $k \in [0, 1]$  with

$$d(F(x, y), F(u, v)) \leq \frac{k}{2}(d(x, u) + d(y, v)), \forall x \geq u, y \leq v.$$

If there exists  $x_0, y_0 \in X$  such that

$$x_0 \preceq F(x_0, y_0) \text{ and } y_0 \succeq F(y_0, x_0).$$

Then, there exist  $x, y \in X$  such that  $x = F(x, y)$  and  $y = F(y, x)$ .

**Remark 1.** Above theorems cannot give guarantee of uniqueness of the coupled fixed point.

Authors also ([13]) used following technique to establish unique coupled fixed point in previous theorems such as:

For every  $(x, y), (x^*, y^*) \in X \times X$ , there exists a  $(z_1, z_2) \in X \times X$  that is comparable to  $(x, y), (x^*, y^*)$ , then uniqueness of coupled fixed point can be established provided

$(X, \preceq)$  be a partially ordered set such that: For  $(x, y), (u, v) \in X \times X$ ,  $(x, y) \preceq (u, v) \Leftrightarrow x \succeq u, y \preceq v$  and proved the following result.

### 3.3 Theorem ([2])

Let  $(X)$  be a partially ordered set and  $d$  be a metric on  $X$  such that  $(X, d)$  is a complete metric space. Let  $F : X \times X \rightarrow X$  be a mapping having the mixed monotone property on  $X$  such that there is a  $k \in [0, 1]$  with

$$d(F(x, y), F(u, v)) \leq \frac{k}{2}[d(x, u) + d(y, v)], \text{ for each } x \succeq u \text{ and } y \preceq v.$$

Assume that either

$F$  is continuous or

If a non-decreasing sequence  $(x_n, y_n) \rightarrow (x, y)$ . Then  $(x_n, y_n) \preceq (x, y)$ , for all  $n \in N$ . If there exist  $x_0, y_0 \in X$  such that  $x_0 \preceq F(x_0, y_0)$  and  $y_0 \succeq F(y_0, x_0)$ , then there exist  $x, y \in X$  such that  $x = F(x, y)$  and  $y = F(y, x)$ .

Further more, if for each  $(x, y), (z, t) \in X \times X$ , there exists  $(u, v) \in X \times X$  that is comparable to  $(x, y)$  and  $(z, t)$ , then the coupled fixed point  $(x, y)$  of mapping  $F$  is unique. The authors applied the results to periodic boundary value problems.

Harandi [6] has strengthen the results of Bhaskar and Lakshmikantham [13] by using the concept of the following theorem of Neito and Lopez [9] as follows:

### 3.4 Theorem ([6])

Let  $(X, \leq)$  be a partially ordered set and  $d$  be a metric on  $X$  such that  $(X, d)$  is a complete metric space. Let  $F : X \times X \rightarrow X$  be a mapping having the mixed monotone property on  $X$  such that there is a  $\lambda \in [0, 1)$  with

$$\begin{aligned} d(F(x, y), F(u, v)) + d(F(y, x), F(v, u)) &\leq \lambda(\max(d(x, u) + d(y, v)), d(x, F(x, y))) \\ &\quad + d(y, F(y, x)), d(u, F(u, v)) \\ &\quad + d(v, F(v, u)), d(x, F(u, v)) \\ &\quad + d(y, F(v, u)), d(u, F(x, y)) + d(v, F(y, x))), \end{aligned}$$

for each  $x \succeq u$  and  $y \preceq v$ . Assume that either

- a)  $F$  is continuous or.
- b) If a non decreasing sequence  $(x_n, y_n) \rightarrow (x, y)$ , then  $(x_n, y_n) \preceq (x, y)$ , for all  $n \in N$ . If there exist  $x_0, y_0 \in X$  such that  $x_0 \preceq F(x_0, y_0)$  and  $y_0 \succeq F(y_0, x_0)$ , then, there exist  $x, y \in X$  such that  $x = F(x, y)$  and  $y = F(y, x)$ .

Many mathematicians have done remarkable work on fixed point theorems on metric spaces equipped with partially ordered sets. First initiative was taken by Ran and Ruring [10]. In 2011, Harjani et al. [7] has proved the result of Choudhury [4] in a complete partially ordered metric spaces.

### 3.5 Theorem ([7])

Let  $(X, \leq)$  be a partially ordered set and suppose that there exists a metric  $d$  in  $X$  such that  $(X, d)$  is a complete metric space. Let  $F : X \rightarrow X$  be a continuous and nondecreasing mapping such that

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$$d(Fx, Fy) \leq \frac{1}{2}(d(x, Fy) + d(y, Fx)) - \phi(d(x, Fy), d(y, Fx))$$

for every comparable  $x$  and  $y$ , where  $\varphi : [0, \infty)^2 \rightarrow [0, \infty)$  is a continuous function such that  $\varphi(x, y) = 0$  if and only if  $x = y = 0$ . If there exists  $x_0 \in X$  with  $x_0 \preceq Fx_0$ , then  $F$  has a fixed point.

### 3.6 Theorem [7]

Let  $(X, \preceq)$  be a partially ordered set and suppose that there exists a metric  $d$  in  $X$  such that  $(X, d)$  is a complete metric space. Let  $F : X \rightarrow X$  be a non-decreasing mapping such that

$$d(Fx, Fy) \leq \frac{1}{2}(d(x, Fy) + d(y, Fx)) - \phi(d(x, Fy), d(y, Fx))$$

for every comparable  $x$  and  $y$ , where  $\varphi : [0, \infty)^2 \rightarrow [0, \infty)$  is a continuous function such that  $\varphi(x, y) = 0$  if and only if  $x = y = 0$ . Suppose that for a non-decreasing sequence

$\{x_n\}$  in  $X$  with  $x_n \rightarrow x$ , we have  $x_n \preceq x$  for all  $n \in \mathbb{N}$ . If there exists  $x_0 \in X$  with

$x_0 \preceq Fx_0$ , then  $F$  has a fixed point.

Harjani et al. [7] also proved fixed point theorems for non continuous mappings, non-increasing mappings. W. Shatanawi [11] has generalized the results of Harjani et al. [7] using altering distance function introduced by Khan et al. [8] and also generalized the results of Bhaskar and Lakshmikantham [13] in this new contraction condition.

### 3.7 Theorem [11]

Let  $(X, \preceq, d)$  be a complete partially ordered metric space. Let  $F : X \rightarrow X$  be a continuous non-decreasing mapping. Suppose that for comparable  $x, y$ , we have

$$\psi(d(Fx, Fy)) \leq \psi(\frac{1}{2}((d(x, Fy) + d(y, Fx))) - \phi(d(x, Fy), d(y, Fx)))$$

where

- $\psi : [0, \infty) \rightarrow [0, \infty)$  is an altering distance function.
- $\varphi : [0, \infty) \times [0, \infty) \rightarrow [0, \infty)$  is a continuous function with  $\varphi(x, y) = 0$  if and only if  $x = y = 0$ .

If there exists  $x_0 \in X$  such that  $x_0 \preceq Fx_0$ , then  $F$  has a fixed point. And examined the validity of result without the continuity of function  $F$ .

### 3.8 Theorem [11]

Suppose that  $X, F, \psi$  and  $\varphi$  are as in Theorem 3.7 except the continuity of  $F$ . Let for a non-decreasing sequence  $\{x_n\}$  in  $X$  with  $x_n \rightarrow x \in X$ , we have  $x_n \preceq x$  for all  $n \in \mathbb{N}$ . If there exists  $x_0 \in X$  such that  $x_0 \preceq Fx_0$ , then  $F$  has a fixed point.

Authors also presented a coupled xed point on an ordered metric space for a non-linear weakly  $C$ -contraction type mapping.

### 3.9 Corollary ([11])

Let  $(X)$  be a partially ordered set and  $d$  be a metric on  $X$  such that  $(X, d)$  is a complete metric space. Let  $F : X \times X \rightarrow X$  be a continuous mapping having the mixed monotone property on  $X$ . Assume that for  $x, y, u, v \in X$  with  $x \succeq u$  and  $y \preceq v$ , we have

$$(d(F(x, y), F(u, v))) \leq (\frac{1}{2}(d(x, u) + d(y, v))) - \phi(d(x, u), d(y, v))$$

where  $\varphi$  is as in Theorem 3.8. If there exists  $(x_0, y_0) \in X \times X$  such that  $x_0 \preceq F(x_0, y_0)$  and  $y_0 \succeq F(y_0, x_0)$ , then  $F$  has a coupled xed point.

And checked the validity of Theorem 3.8 if  $F$  is not necessarily continuous.

### 3.10 Corollary ([11])

Suppose that  $X, F$  and  $\varphi$  are as in Corollary 3.9 except the continuity of  $F$ . Suppose that for a nondecreasing sequence  $\{x_n\}$  in  $X$  with  $x_n \rightarrow x$ , we have  $x_n \preceq x$  for all  $n \in \mathbb{N}$  and for a nonincreasing  $\{y_n\}$  in  $X$  with  $y_n \rightarrow y$ , we have  $y_n \succeq y$  for all  $n \in \mathbb{N}$ . If there exists  $(x_0, y_0) \in X \times X$  such that  $x_0 \preceq F(x_0, y_0)$  and  $y_0 \succeq F(y_0, x_0)$ , then  $F$  has a coupled xed point.

**Remark 2.** If  $\psi = I_{[0, \infty]}$  [Identity function] is taken in Theorem 3.7, corollary 3.9 can be obtained. Similar proof can be done in Theorem 3.8 and corollary 3.10 can be obtained.

**Remark 3.** Take  $\phi(s, t) = [\frac{1}{2} - \frac{k}{2}] = (s + t)$  in Corollary 3.9 to get Theorem 3.1.

**Remark 4.** Take  $\phi(s, t) = [\frac{1}{2} - \frac{k}{2}] = (s + t)$  in Corollary 3.10 to get 3.2.

## 4. FUTURE SCOPE

Some generalizations of the results of Harjani et al. [7] and Bhaskar and Lakshmikantham [13] in partially ordered metric spaces are discussed. Since the results of Bhaskar and Lakshmikantham have vast applications in existence of unique solution of initial value and boundary value problems and weaker notion of contaction condition which is weak  $C$ -contaction generalized these results, this combination can play a key role in finding the solutions of many more such problems which could not be discussed so far. Also the results can have the applications to the existence of fixed points in partial metric spaces.

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# **A Review of Literature on Smart Manufacturing / Industry 4.0 Concept**

**Sunil Pimpleya, Rakesh Malviya**

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## **ABSTRACT**

*The objective of this paper is to review the various research papers on Industry 4.0 concept implementation and find the barriers in the context of manufacturing and automobile industries. For chronological literature review various online databases were identified like Elsevier's Scopus, Thomson Reuter's Web of Science, IEEE Explore, ProQuest (ABI/INFORM), Emerald Publication, ASME, Taylor and Francis, John Wiley and Sons, SCIRP, Springer Open, and Science Direct etc. On the basis of chronological literature review crucial barriers were identified which directly affect the implementation of industry 4.0 concept. It has been found that few industries understand the concept in detail. This review paper attempts to facilitate industries to identify the barriers before implementing Industry 4.0 concept.*

**Keywords:** Smart Manufacturing, Industry 4.0, Manufacturing Industries, MCDM.

## **1. INTRODUCTION**

Manufacturing has emerged as one of the high growth sectors in India. Prime Minister of India had launched the 'Make in India' program to place India on the world map as a manufacturing hub and give global recognition to the Indian economy. India is expected to become the fifth largest manufacturing country in the world by the end of year 2020. The fortune of manufacturing ventures is being changed worldwide by the development of a more digitalized environment, where worth chains are connected and production framework have become insightful, self-governing and mechanized. These headways are acknowledge tremendous upgrades in the adaptability, effectiveness, and computerization of assembling. German, manufacturing methodology assumed a key job on this change, first activities to keeping up and advancing its criticalness as a "forerunner" in the modern area (Kagermann et al. 2013). Industry 4.0, a German strategic initiative, is aimed at creating smart factories where various emerging technologies like big data analytics, internet of things, additive manufacturing, virtual reality, cloud computing, robotic systems are deployed to achieve cyber-physical systems (CPS) and human-equipment interface leading to economic, environmental and socially sustainable manufacturing systems (Lee et al., 2015; Lasi et al., 2014; Bahrin et al., 2016; Schmidt et al., 2015). The popular expression "Industry 4.0" has emerged to confront the most recent difficulties in assembling frameworks. The impeller Industry 4.0 (I4.0) is empowering and strengthening this pattern utilizing its advancements, changing the method for living, making

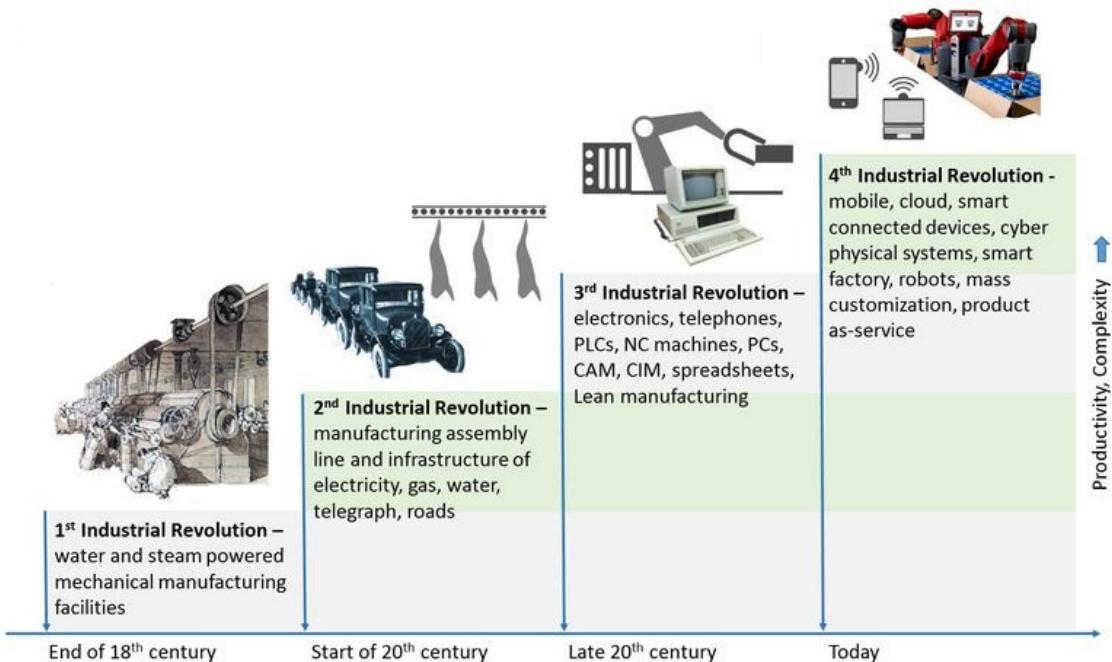
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*Research Scholar, SVVV, Indore*

*Assistant Professor. Department of Mechanical Engineering SVITS, SVVV, Indore*

new plans of action and better approaches for assembling, reestablishing the business for the supposed computerized change. Industry 4.0 first appeared in an article published in November 2011 by the German government that resulted from an initiative regarding high-tech strategy for 2020 (Zhou et al., 2015). The creation of the steam motor launch the primary modern upheaval, second mechanical transformation concentrated on large scale manufacturing, third modern insurgency stressed figuring (Acemoglu, 2002; Von Tunzelmann, 2003), and the fourth modern upset is the advanced unrest in modern generation which is rising up out of upgraded systems administration and computerization of all territories of generation (Schröder, 2016).

Figure 1 shows every one of the four transformation devices alongside the timeframe of genuine occurring. The essence of industry 4.0 is the rise of advanced assembling otherwise known as "savvy manufacturing plant," which means brilliant systems administration between industry units, portability informs, the adaptability of mechanical activities and their interoperability, incorporation with clients and providers and in the reception of imaginative plans of action (Jazdi, 2014). The essential viewpoint related to industry 4.0 is the astute systems dependent on CPS (Barreto et al., 2017). Industry 4.0 incorporates the advanced and physical world utilizing the CPS giving expanded profitability and productivity among the associations (Pereira et al., 2017). The CPS contains savvy machines, stockpiling frameworks and creation offices that can trade data, activating activities and controlling each other.



**Figure 1. Industrial Revolutions (Khan et al., 2016)**

It may be viewed as the assembly of a few rising ideas and new advances, for example, Industry 4.0, the fourth Industrial upset, is a straightforward a promising assessment point (Chiarello et al., 2014). It might be seen as the association of a couple of creating thoughts and new advances, for instance, radio-recurrence recognizable proof (RFID), huge information, distributed computing, keen sensors, AI (ML), mechanical autonomy, added substance producing (AM), man-made brainpower (AI), increased reality and the Internet of Things (IoT) (Mehta et al., 2017). The trend-setting innovations associated with Industry 4.0 are rebuilding whole creation frameworks by changing simple work processes into computerized and decentralized generation forms. These cutting edge innovations can broadly raise creation, by first vertical mix, second-level mix, and third start to finish designing. It coordinates individuals, machines, and information, making increasingly responsive stock chains. The generation approach has characterized I4.0 as the clever progression of the work pieces' machine-by-machine, an industrial facility, with an ongoing correspondence between machines. In this condition, I4.0 will make fabricating shrewd and versatile utilizing adaptable and collective frameworks to take care of issues and settle on the best choices (Motyl et al., 2017). It brings in a decent advancement for the mechanical situation concentrating on making savvy items, shrewd procedures and keen strategies (Weyer et al., 2015). Organizations expect to expand the degree of digitalization, cooperating in computerized biological systems with clients and providers.

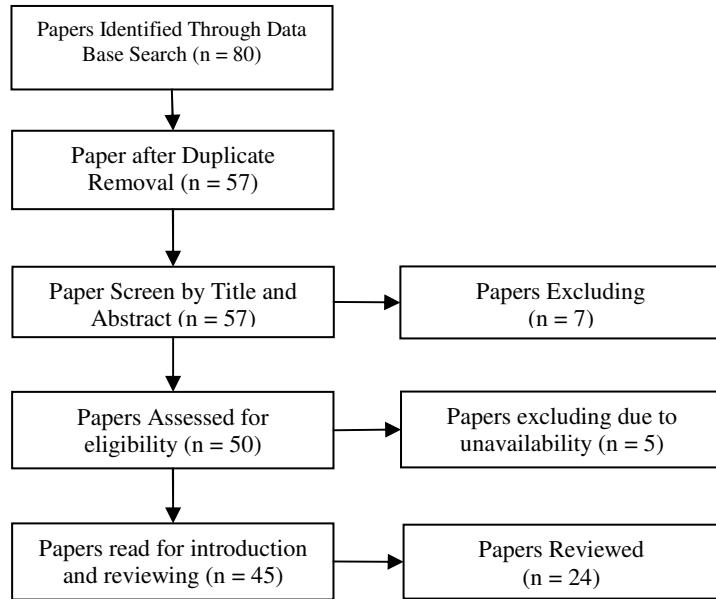
## 2. REVIEW OF LITERATURE

### 2.1 *Literature search strategy*

To ensure the literature search was as broad and comprehensive as could reasonably be expected, yet inside degree, the inquiry technique included mixes of a few watchwords that are important to Industry 4.0. Keeping the objective of the paper in mind the Industry 4.0 related watchwords were incorporated Figure 2 shows the flow chart for literature review of this paper.

**TABLE 1: Key words in the literature search**

Industry 4.0 related keywords	Other related words
Industry 4.0	Barriers for implementation of new Technology
Cyber Physical System (CPS)	Multi Criteria Decision Making (MCDM)
Smart Manufacturing	AHP
Smart Factory	TOPSIS
Smart Product	



**Figure 2. Flow chart specific to the systematic literature review of this paper**

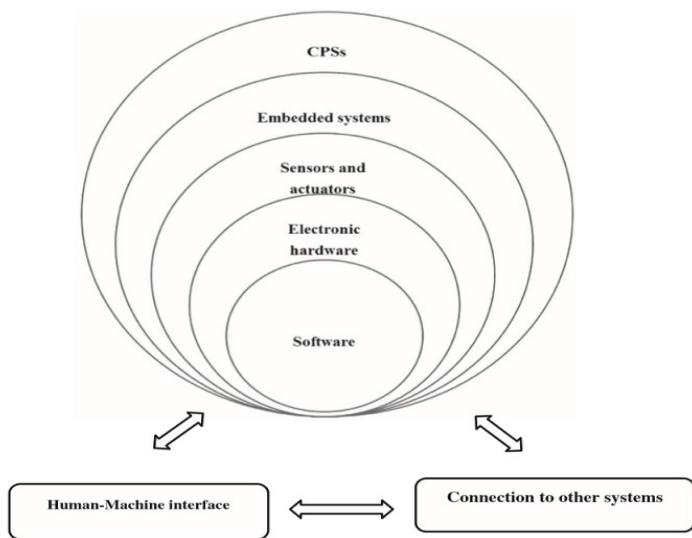
While searching the database, different variations of spelling the words (e.g., organization and organisation, or cyber-physical system and cyber physical system) were also considered. The literature searches only included academic literature i.e. peer-reviewed journal articles and conference proceedings published in English after the year 2013. The reason for not including papers prior to the year 2013 is that the origin of the term “Industry4.0” is associated with Kagermann et al. (2013) and almost no other peer-reviewed journal articles or conference papers existed prior to that.

## **2.2 Industry 4.0 and its components**

Kagermann et al. (2013) from the outset distributed the key ideas of Industry 4.0 and have from that point forward, laid the foundation for the Industry 4.0 procedure. Recognizing the capability of Germany as a worldwide innovator in assembling, the creator confides in Germany to profit by its specialized ability and tap into the probability of industry 4.0 (Leyh et al., 2017). The focal point of industry 4.0 is in setting up savvy items and creation forms (Brettel et al., 2014). The basic segments of industry 4.0 are CPS, IoT, Internet of Services (IoS) and Smart Factories (Hermann et al., 2016). Shafiq et al., (2015), characterize CPS as the combination of the physical and advanced universes by making worldwide systems for organizations that coordinate their innovation, warehousing frameworks, and generation offices. The different tasks of the physical frameworks are coordinated utilizing physical functionalities through systems administration utilizing figuring and correspondence foundations (Bagheri et al., 2015; Harrison et al., 2016; Monostori et al., 2016).

## 2.3 Human-Equipment interaction in CPS

Segments of human-equipments connection in a CPS domain have appeared in Figure 3. The CPS contains diverse innovation segments that incorporate the implanted frameworks, sensors, equipment and programming. Implanted frameworks go about as one of the huge specialized techniques that encourage incorporated connection between the physical articles and their computational components or administrations related with them. In a generation framework, sensors assume a significant job in the activity of the IoT and CPSSs. A sensor is characterized as "a mechanical gadget touchy to light, temperature, radiation level, or something like that, which transmits a sign to an estimating or control instrument." It is a valuable gadget that gathers and transmits the assembling procedure data progressively to the PCs (Mueller et al., 2017). The assortment and trade of information are conceivable through the CPS, which interconnects and arranges different articles that are inserted electronic sensors, actuators, or other computerized gadgets (Xia et al., 2012; Leitão et al., 2016). Distinctive programming's are required for processing the ongoing information, keeping up information security and protection, and controlling the equipment gear's sent in the CPS. The equipment parts incorporate 3D printers, mechanical frameworks and other equipment's. The CPS works in an IoT biological system that consolidates smart and self-governing machines, progressed prescient examination, and machine-human coordinated effort to improve profitability, proficiency, and unwavering quality (Thramboulidis et al., 2016).



**Figure 3. Human and machine interaction in a CPS (Thramboulidis et al., 2016)**

So as to make Industry 4.0 a triumph, these exclusive methodologies must be supplanted by open and institutionalized arrangements. The Smart Factory has understood an absolute first multi-merchant and exceptionally particular generation framework as an example reference for

Industry 4.0 (Weyer et al., 2015). The Industrial Internet of Things (IIoT) presents huge effects on plans of action (BM) of set up assembling organizations inside a few enterprises. Arnold et al., (2016) breaks down the impact of the IIoT on these BMs with specific regard to contrasts and likenesses subject to differing industry divisions.

Oesterreich et al., (2016) explore the state of the art as well as the state of practice of Industry 4.0 relating technologies in the construction industry by pointing out the political, economic, social, technological, environmental and legal implications of its adoption. The current globalization is faced by the challenge to meet the continuously growing worldwide demand for capital and consumer goods by simultaneously ensuring a sustainable evolution of human existence in its social, environmental and economic dimensions. In order to cope with this challenge, industrial value creation must be geared towards sustainability. Currently, the industrial value creation in the early industrialized countries is shaped by the development towards the fourth stage of industrialization, the so-called Industry 4.0. This development provides immense opportunities for the realization of sustainable manufacturing. Stock et al., (2016) present a state of the art review of Industry 4.0 based on recent developments in research and practice.

## ***2.4 Smart factory***

Like IoT, IoS is emerging, based on the idea that services are made readily available through web technologies, allowing companies and private users to merge, create and offer new kind of value-added services. A Smart Factory is built on the perception of a decentralized production system, in which humans, machines, and resources converse with each other, like a social network enabled by IoT, IoS and CPS (Pereira et al., 2017). Kiel et al., (2017) draws a broad and prearranged picture of IIoT related economic, ecological, and social benefits and challenges. The IIoT requires an extension of the established Tipple Bottom Line (TBL), by three further dimensions, i.e., technical integration, data information, and public context.

Industry 4.0 and smart factory are the terms often used for next generation production systems. To remain competitive in the market, enterprises want to employ these technological advancements in order to explain current challenges and serve customers in new ways which were not anticipated before. In order to supply new services quickly, new methods and technologies have to be introduced at manufacturing level. Khan et al., (2016) proposes an approach from strategic to operational level for the implementation of industry 4.0 and also provide new opportunities, scenarios, and applications enabled by introducing new tools and technologies for industry 4.0.

## ***2.5 Barriers to adoption of industry 4.0***

Industry 4.0 is an essential territory for research and application, as it offers esteem expansion to the assembling yields and frame works by coordinating rising advances in assembling and

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administrations (Li, 2018). The primary explanations behind the vulnerabilities lie in the high speculation levels and the vague money saving advantages for the business 4.0 application zones. Further, the workforce does not have the satisfactory abilities required to adapt up to the up and coming mechanization and there is an absence of lucidity in the principles for the usage of industry 4.0 which has made vagueness in numerous associations. This computerized change should cross numerous obstacles before being effectively grasped wholeheartedly by all associations (Zhong et al., 2017; Koch et al., 2014; Mueller et al., 2017).

Most of scientists concur that the examination of boundaries identified with usage of Industry 4.0 remains to a great extent unexplored in the surviving writing and merits further examination. There has been some divided examination of these boundaries; for example, certain creators propose that the absence of a gifted workforce, clashes between laborers because of changing workplaces (Müller and Voigt, 2017), lack of budgetary assets, information security (Kiel et al., 2017; Breunig et al., 2016), low degrees of institutionalization, poor comprehension of coordination (Müller and Voigt, 2016) and frameworks engineering are the significant snags to the execution of Industry 4.0. Notwithstanding, to date these boundaries have just been broken down separately and for the most part from an innovative point of view. The appropriation of Industry 4.0 is a mind-boggling process, inside which components impact one another along these lines, an exhaustive exploration of each one of these variables is required.

Rennung (2016) proposed to analyze the relevance of the industrial service industry in the framework of the project Industry 4.0. In an expanding number of cases, the advancement of the venture is unacceptable and assumes an emergency like personality. The after effect of the investigation is the recognizable proof of pertinent business administrations, and an appraisal of the pertinence of logical ways to deal with administration systems for the task "Industry 4.0". Schumacher (2016) proposed an exactly grounded novel model and its execution to evaluate the Industry 4.0 development of modern undertakings in the area of discrete assembling. The principal objective was to broaden the discrete assembling. Müller (2018) examined the relevance of Industry 4.0 related opportunities and challenges as drivers for Industry 4.0 implementation in the context of sustainability, taking a differentiated perspective on varying company sizes, industry sectors, and the company's role as an Industry 4.0 provider or user. The results show that strategic, operational, as well as environmental and social opportunities are positive drivers of Industry 4.0 implementation, whereas challenges with regard to competitiveness and future viability as well as organizational and production fit impede its progress.

Some researchers have distinguished its building structure and offered a vital guide that can serve producers as a straightforward guide for the procedure of Industry 4.0 change. Müller (2018) breaks down how Industry 4.0 triggers changes in the plans of action of assembling SMEs (little and medium-sized ventures), by directing a subjective from three enterprises. To begin with, the outcomes show that Industry 4.0 includes three measurements, in particular, high-grade digitization of procedures, brilliant assembling, and intercompany availability.

Second, Industry 4.0 influences the three plan of action components of assembling SMEs esteem creation, esteem catch, and worth idea by giving explicit models for plan of action development in every one of the three components. Third, it shows that both the job as a client as well as the supplier of Industry 4.0 and whether an organization is inside persuaded or potentially remotely constrained towards usage effect which plan of action components are improved. Fourth, the investigation outlines four SME classifications, intended to assist chiefs with evaluating their own organization's situating towards Industry 4.0.

### 3. CONCLUSION

The implementation of Industry 4.0 is the prime agenda for developing as well as developed economies in the context of the manufacturing industry. The main objective of this review was to analyze the academic progress in fourth industry 4.0 in a systematic manner to provide insights on the topic. The future research needs to be focused on identifying major barriers for implementation of industry 4.0 concepts in Indian Manufacturing Industry.

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# A Review on Defect Characterization, Fault Tolerant Strategies and Clocking Mechanisms Quantum-dot Cellular Automata

Shiraz Husain, Namit Gupta

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## ABSTRACT

Although Quantum-dot Cellular Automata (QCA) seems to be a new, novel as well as promising nano-technology to replace Complementary Metal-Oxide-Semiconductor (CMOS), it faces many reliability issues as it suffers from high defect and fault rate in manufacturing. Hence, the design of robust and fault tolerant QCA circuits is indeed required for the consolidation and actual realization of this new technology. QCA designs of different level of complexity suffer from the inadvertent impact of delay, slow timing and thermal fluctuation sensitivity due to the use of multiple cells among different clocking zones. Besides this the phase shifts in clocking network can be present due to manufacturing variations due to uneven path lengths in the clocking circuits. The clocking architecture used must ensure fast timing and efficient pipelining approaches to guarantee a kink-free behavior in switching. This paper provides a comprehensive report on various defects, clocking mechanisms and fault tolerant strategies used in literature and suggests possible research areas in this domain.

**Keywords:** Beyond CMOS, Defects, Fault Tolerant, Quantum-dot Cellular Automata (QCA).

## 1. INTRODUCTION

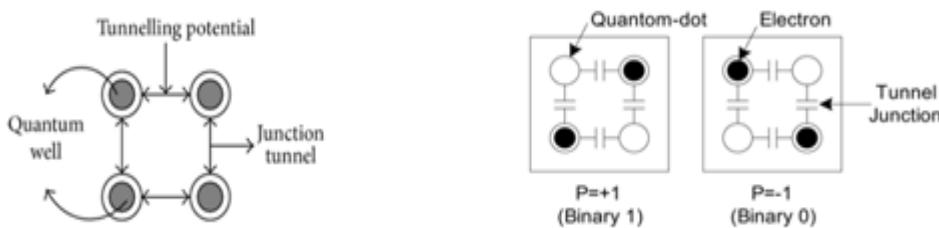
Moore's prediction of doubling transistor count has brought the CMOS technology to its saturation. The feature of scaling that initially helped integration in CMOS devices has now become its bottleneck. The problem such as photolithography of smaller devices, the power density of the chip and the interconnects are bringing challenges for scientists and researchers to seek some new technology that bypasses all these problems aside. Hence research has to be accelerated in areas of nano-scale computing. The quantum-dot Cellular automaton (QCA) is one such technology. The other alternatives besides QCA in research are Carbon Nano-Tubes (CNT's), Single Electron Tunneling Transistor (SET), NW FET, Graphene FET and Fin Field Effect Transistors (FinFET) [1-5]. (Shamik, 2015), (M. T., 2004), (P. Douglas Tougaw, 1996), (Tougaw C. L., 1993), (Cramming More Components onto Intergrated Circuits, 2006).

This novel technology uses quantum dots for digital computation and offers features like lower power consumption (typically 100 times less than CMOS), High operational speed (in the range

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Research Scholar, SVVV, Indore  
Professor, SVVV, Indore

of THz) and High device integration (approximately 10 times than CMOS). In QCA, the electron's position delimits the logical values, not the potential. The QCA cell is the smallest and fundamental unit of Quantum-dot Cellular Automata. It has a square structure created with four quantum dots positioned at the vertices of the square. The electrons that appear in quantum dots are quantum mechanical particles, which can tunnel (move from one place to another in response to change in electrical field) between dots due to columbic interaction. The information is transferred from one cell to another through this columbic interaction between cells. The two electrons take a specific orientation into the cell as soon as electrons are injected. After Tunneling, the two electrons always have a property to stay at diagonal position of square such that two polarizations are possible as shown in Figure 1. In this way, QCA offers new device architectures for transferring binary information via cell-to-cell interaction.



**Figure 1. (a) QCA cell, (b) QCA cell with its Polarization  $P = +1$  and  $P = -1$**

Such cells can now be used to design combinational and sequential circuits such as logic gates, memories, processors etc. The QCA cell with four quantum dots is shown in Figure 1(a). The polarization  $P$  of the QCA cell is calculated by given quoted equation (1) (Tougaw C. a., 1997):

$$P = \frac{(\rho_1 + \rho_3) - (\rho_2 + \rho_4)}{(\rho_1 + \rho_2 + \rho_3 + \rho_4)} \quad \dots (1)$$

Where,  $\rho_i$  is expectation value of an electron to exist on particular site for the ground state.

## 2. DEFECT CHARACTERIZATION AND FAULT TOLERANT STRATEGIES

Defects are the imperfections of the cells of a circuit, generally caused by manufacturing process deviations. The occurrence of defect is independent of technology and is subject to several types of research for different technologies, such as CMOS (M. Blyzniuk, 2001) and Carbon nano-tubes (Charlier, 2002). Errors may be considered as unexpected deviations in the input-output response of a system. In a circuit, an error can be considered when for a known set of inputs; the state of the output is undetermined or unpredictable. Despite defects, errors can also arise due to external factors. A defective circuit may or may not be an erroneous circuit, depending on the integrity of the response of its outputs. Even when defects exist, if the circuit is able to perform its function correctly, it cannot be considered as erroneous. Designers have to

face many challenges to design sound systems, which can cope even in the presence of defects and other external factors.

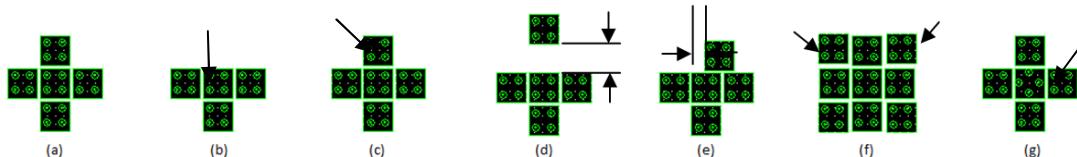
Modeling defects in QCA at the molecular level must take into account the manufacturing process and assembling techniques of the technology (Huang, M. B., & F, 2004). As the realizability of QCA is still in its immature phase, the possibility of defects lies in manufacturing and the deposition phase both. These defects are lethal to the correct operation of the cell and are hard to detect. However, chances of defect relies more in the synthesis process (M. Momenzadeh, 2005). A missing dot or an additional dot is very unlikely due to the ease of purification of small inorganic molecules (Momenzadeh, 2005). For example, Nuclear Magnetic Resonance (NMR) is considered as 99% pure for model compounds such as the Creutz-Taube (CT) Ion. Moreover, electrochemical measurements for the CT Ion recorded to have less than one molecule in 10<sup>5</sup> in the incorrect charge state. The various effects of geometry misalignments on metal cells of QCA devices are reported in (Dayane & Torres, 2006).

The manufacturing or fabrication defects include:

- **Vacancy:** Cell omission defect occurs when a particular cell is missing compared to its fault free design.
- **Dopant:** Dopant defect takes place when one or more dot is found missing from a QCA cell. Cells with such defects cannot change their polarization state accurately.

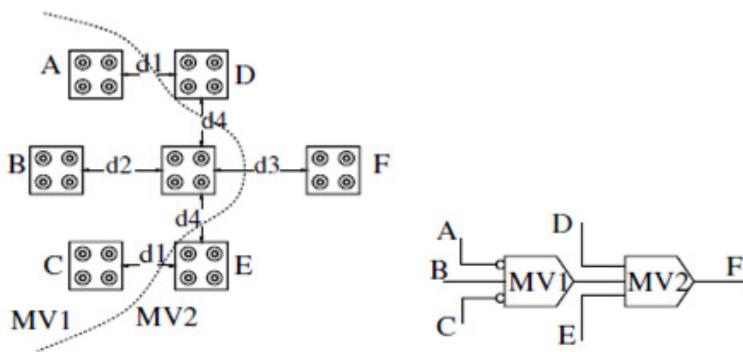
The cell positioning defects include:

- **Interstitial:** Such defect occurs when a cell is wrongly placed from its justified position.
- **Misalignment:** Such defect takes place when particular cell/cells are not properly aligned with respect to its defect-less design.
- **Extra Cell:** Extra cell defect occurs when an extra or additional cell is erroneously placed on the surface.
- **Dislocation:** Rotation cell defect is a defect where a cell is rotated by a certain angle of  $\theta$  (M. Momenzadeh, 2005).



**Figure 2.** (a) 3 input majority voter using 5 QCA cells without any defect, (b) majority voter with Vacancy defect, (c) majority voter with dopant defect, (d) majority voter with interstitial defect, (e) majority voter with misalignment defect, (f) majority voter with extra cell deposition defect and (g) majority voter with rotational defect.

As noticed, the cell positioning defects are investigated more due to its frequent occurrence in any QCA based system. Defect classes discussed in this paper is mostly similar to those reported in (Dayane & Torres, 2006), which is based on an analogy of a two-dimensional crystal lattice. In (Momenzadeh, 2005), the extra cell deposition effects have been analyzed by induced functional faults for some benchmark QCA devices, such as Majority voter (MV), Inverter and different wires (straight, L-shape, coplanar crossing, and fan-out). It has been observed that for an MV, a single cell vacancy defect has a greater effect than a single extra cell defect. For the QCA inverter, most of the single extra cell defects may result in a non-inverted type of functional fault. This also verifies that vacancy defects have pronounced effects on such devices. Similarly, for QCA wire, the straight configuration shows exceptional resilience to extra cell defects. A similar tendency applies to the L-shaped wire and Fan-out. An unusual effect where lack of polarity or the presence of glitches in a signal leads to an undetermined fault has been observed.



**Figure 3. Proposed MV gate in (M., M.B., J., & F., 2004)**

AOI gate is designed which is realized by concatenation of two MV gates. The problem of bridging was observed in the gate. As the input has to be wired with the gate and inputs are very closer to each other resulting in cross polarization. The majority voter is shown in Figure 3.

Timothy & Dysart (2008) tested various wire configurations with missing cells in the diagonal region of the wire. Such missing cells leads to failure in output causing inversions in logical level. The missing cell along with one or two additional missing cells nearby creates inversion when a diagonal pattern occurs in the wire. A unique feature for defect simulation for robustness analysis of QCA circuits is added in QCA Designer by (Reis & Torres, 2016). It utilizes different probability models named as sequential, assignable and random for insertion of different defects into the circuit. It also has a feature of including phase shifts into the clocking circuitry to predict the robustness of the circuit to clocking variations. Experiments conducted on inverter, majority gate and full adder reveals that simulation for the different probability models produces different results. Also, tests conducted under the similar probability model gives distinct results because defect classes used in both the cases were different. Therefore, we

can say that reliability of circuit is dependent on defect class and type of the errors. Finally, the heat maps indicate the critical regions of the circuit that are more prone to defects.

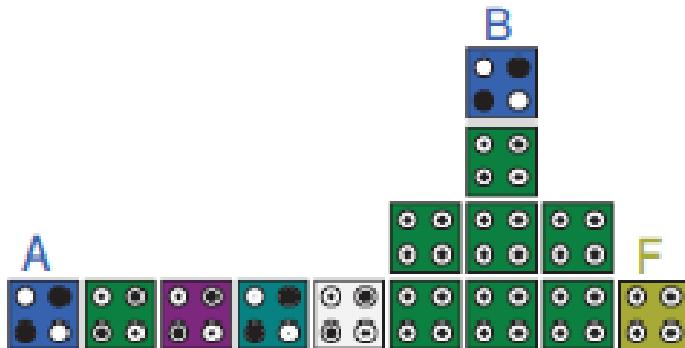
As observed in (Reis & Torres, 2016), critical regions perform logic operations, as seen in Full adder (FA1): Its critical region comprises mostly the cells of 5-input Majority Gate designed within its structure. Information provided by heat maps will directly affect production requirements for different structures. Also, it suggests specific changes in existing structures so that the design becomes more reliable. Zhang, Lv, Liu & Yunlong (2015) found that the inversion in output is measured in case of cell displacement and misalignment taking place when defective cell are moved with a certain radius. The results reveal that different devices such as majority voter, inverter and wire have different fault-tolerance regions. The fault-tolerance of rotated cell MV is stronger than a normal majority voter based on the polarization and regions of these two devices.

A novel design of inverter, majority gate and full adder is proposed in (Reis & Torres, A novel methodology for robustness analysis of QCA circuits, 2015). As compared to other inverters two cells help in providing polarization at output node due to which the robustness of the inverter to defects is increased. On the other hand massive use of cells is done in majority voter for defect tolerance. The massive use of cells also increases area of the design but makes the design more robust to faults. The design of inverter is shown in Figure 4.



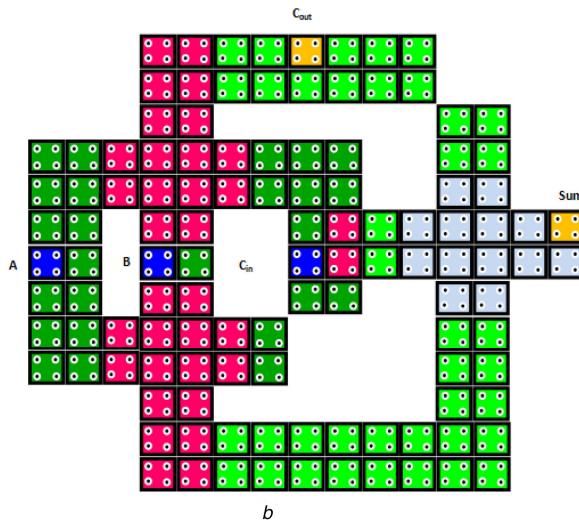
**Figure 4. Modified inverter design in (Reis & Torres, A novel methodology for robustness analysis of QCA circuits, 2015)**

Design of efficient XOR and XNOR gate is proposed using QCA cell interaction principle as shown in Figure 5. The suggested designs are more stable and fault tolerant as compared to previous cell interaction based designs. The results shows that XOR and XNOR gate shows improved performance in case of single cell omission defect single extra cell defect.



**Figure 5. XNOR gate presented in (M. H. Mahalat, 2017).**

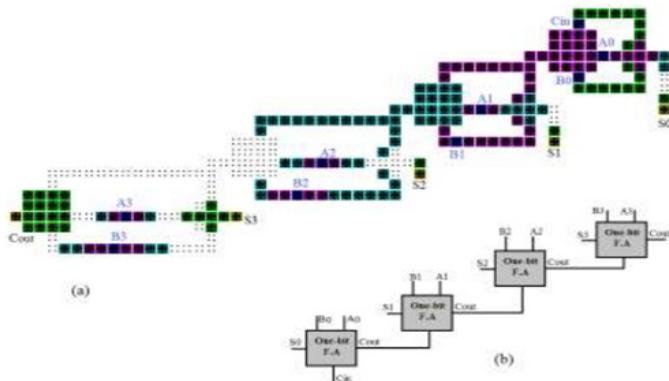
Singh, Raj, & Sarin, (2018) studied fault-tolerant designs of 2-input XOR gate and Single bit full adder circuits. The design of full adder is shown in Figure 6. The designs were exposed to cell omission, cell misalignment, cell displacement, and extra cell deposition defects. Significant improvements in fault tolerant capability against defects have been noticed. Also, the design used lesser area and delay as compared to previous designs. The results of energy dissipation emphasize that increasing fault tolerance in QCA circuits, may lead to more energy dissipation and hence tradeoff is necessary. The effect of temperature variations was also studied.



**Figure 6. Full adder proposed in Singh, Raj, & Sarin (2018).**

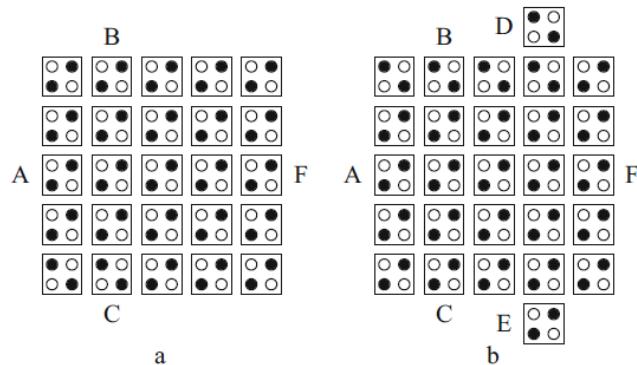
In Zahra Tageri (2019), an RCA full adder is proposed using a 4X4 based XOR gate. It takes a delay of four clock delay. The RCA full adder is shown in Figure 7.

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**Figure 7. RCA full adder shown in (Zahra Taheri, 2019)**

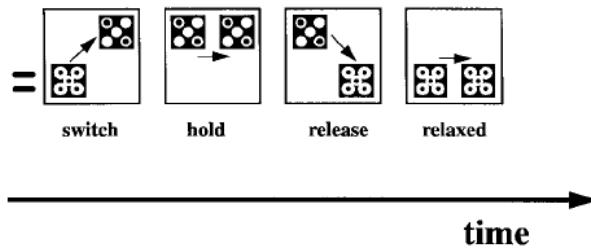
Sun, Lv, Zhang, & Guangjun (2018) proposed two different designs of XOR gate that uses 5x5 QCA tile as shown in Figure 8. Further using this XOR gate, full adders were designed. The design has massive use of cells and was found better than previous XOR gate in terms of defects.



**Figure 8. 5x5 tile based XOR gate designs proposed in (Sun, Lv, Zhang, & Guangjun, 2018)**

### 3. CLOCKING MECHANISMS

The clock signals are used to pump the logical information throughout the circuit with the help of successive latching/unlatching of cells connected to the different clock phases. The clock is also used to provide energy for the cells to make up for the loss happened due to dissipative processes (S Lent, Mo, & Lu, 2006). Cells latch to a particular polarization determined by the electrostatic (columbic) interaction with the adjacent cells.



**Figure 9. The four stages of adiabatic pipelining**

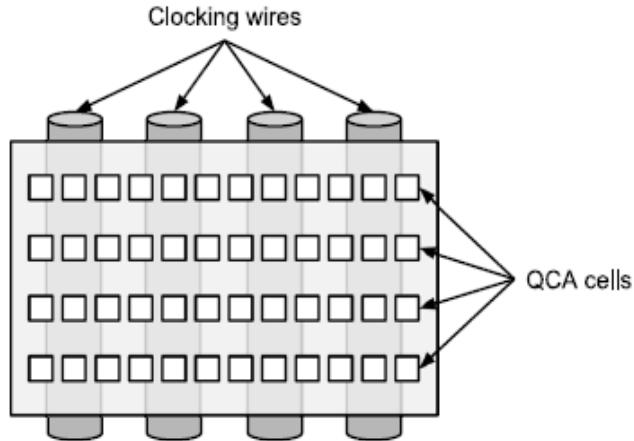
In the adiabatic switching (Tougaw, 1997), it is always assumed that the inter dot potential barrier is being modulated simultaneously for all cells in the array. This seems to be an important feature to be taken care during fabrication. It utilizes one electrode to control the barriers of all cells in a design. But such a clocking mechanism suffers from inherent wiring issues if each cell had to be separately timed and controlled. However, by relaxing this stringent requirement slightly, if we subdivide an array of cells into zones, we can divide the computational problem and make use of a multi-phase clocking and pipelining system. For each zone, a single electrode modulates the inter-dot barriers in all the cells. This enables us to use one zone to operate, then freeze its state by raising the inter-dot barriers and use the output of that zone as the input to a successor zone. During the calculation phase, the successor array is kept unpolarized so that it does not influence the calculation. Within the zone clocking scheme, each array of cells connected to a particular phase of the clock acts like a D-latch (Ottavi, 2007; Liu & Lent, 2004).

As soon as a particular zone is latched, it retains its information until the clock is relaxed and remains independent of changes in the polarization of neighboring cells as shown in Figure 9. Within each square, the cell on the left depicts the state of the cells at the commencement of the cycle, while the right cell represents cell state at the end of the cycle. The relative height of the cells represents the height of their inter dot barriers. As the cell passes through these four clocking stages, the barriers are raised initially, then held high, then lowered, then finally held low. The four phases of adiabatic switching discussed in Tougaw (1997) are as follows: a) switch; b) hold; c) release, and d) relax. Also, such QCA clocking can be used to synchronize the information between different inputs reaching the gates. Moreover, such clocking styles avoid the back propagation of the signal through wires. Dividing into different clock zones limits the length of the wire decreasing the effect of thermodynamic limitations. Such features in the clocking circuit ensure its correct operation and provide the flexibility required to make any QCA circuit.

The method to bury wires below the QCA surface in molecular QCA is proposed in Hennessy & Lenta (2001) and as shown in figure 10. The potential barrier for different polarization has to be induced electrically or magnetically. The division of circuits into different clock zones must consider manufacturing limitations of the clocking networks, the restriction due to

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thermodynamics, bypassing of long wires, and also the synergies between neighboring cells and at the same time producing correct logical outputs and avoiding inter-cell interference.

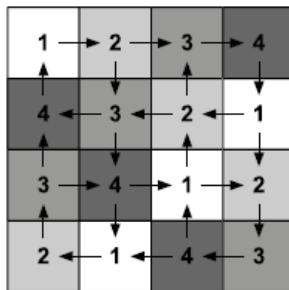


**Figure 10. Clocking wires below the QCA layer**

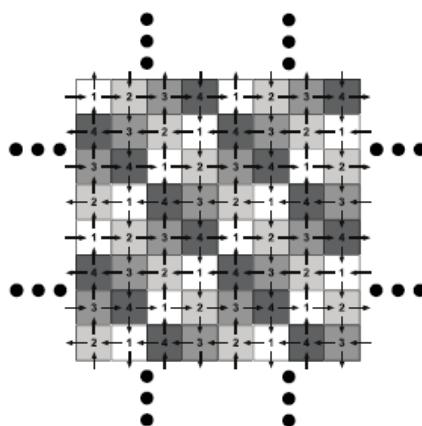
As discussed by Hennessy & Lenta (2001), clock zones must have a uniform, continuous and defined shapes. Despite this, they did not propose any clocking scheme. According to them, metal wires could be placed side by side, such that a one-dimensional arrangement of clock zones is formed. However, having only 1-D does not help in creating feedback paths, which are necessary for the implementation of sequential circuits, like memory elements, microprocessors, and microcontrollers. A QCA ALU is used in (M. T., 2004) to illustrate five basic problems that a QCA clocking scheme shall address: 1) an immense difference in wire lengths; 2) clock zones with irregular widths; 3) big discrepancy in the number of cells between zones; 4) feedback paths, and 5) remaining unused area. A 2-D QCA clocking scheme is suggested in Vankamamidi (2008). This clocking scheme takes into account the size of the zone to avoid the thermodynamic effects. The most assuring one, 2DDWave, consists of a grid of small square zones along with a clocking circuitry. Despite these favorable configurations, the feedback path still remains a problem due to its high overhead. Also, it was unclear whether the grid can be rotated while dealing with large circuits containing loops or not. Thus a clocking must have uniform clock zones, regular bounded shapes, feature to establish feedback paths of different lengths, and a well defined clocking circuitry. In Campos (2016) a clocking scheme which complies with all these requirements was proposed. It seems to be scalable and flexible to allow efficient and easy placement as well as routing of any kind of QCA circuit.

At any time, the QCA clock can be in one of four phases. Consequently, the complete QCA circuit can be realized with four different clock zones, in the following numbered from 1 to 4. The current phase of each clock zone is different from the others. The principal idea of the USE

clocking scheme is to keep clocking zones with adjacent numbers close to each other, while zones with non-adjacent numbers must be kept distant.



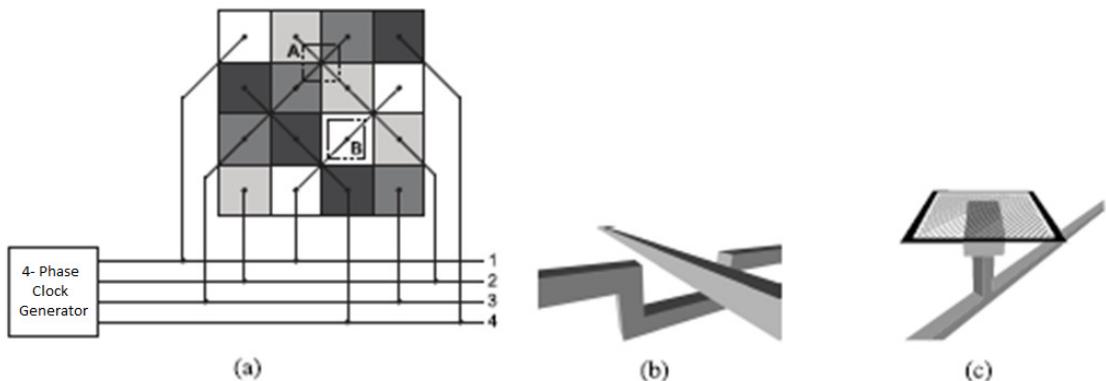
**Figure 11. Structure of USE. Each square is a clock zone that contains QCA cells, while the arrows indicate the information flow**



**Figure 12. Expandability of USE clock zone scheme. This allows an enormous amount of routing paths and the easy creation of feedback paths, necessary for memory designing and development of complex structures. Further, USE also helps in the easy realization of coplanar and multilayer wire crossings.**

At any time, the QCA clock can have four phases. Thus, the complete QCA clock can be partitioned into four different clock zones from 1 to 4. The present phase of each zone shall be distinct from the others. The basic idea of this clocking scheme is to arrange clocking zones with adjacent numbers close to each other, while clocking zones with non-adjacent numbers must remain distant. Like clock zone 2 should always be adjacent to clock zone 1, from where its inputs should come, and adjacent to clock zone 3, to where its outputs proceed. The USE clocking scheme can be understood from the given Figure 11. Here, each square resembles a clock zone that contains QCA cells, while the arrows indicate the flow of logical information

between QCA cells that are located in adjacent clock zones. USE clocking scheme allows the creation of straight wires and small feedback loops. Keeping the feature of expandability in mind as shown in figure 12, all clock zones follow a particular sequence from right to left or top to bottom. This feature also helps in the design of bent wires and loops.



**Figure 13. Circuitry to generate the required electric fields for the different clock zones of USE, with wire crossing on “A” and the metal pad on “B” (b) Zoom on metal wire crossing (c) Uniform clock zone creation by the metallic pad.**

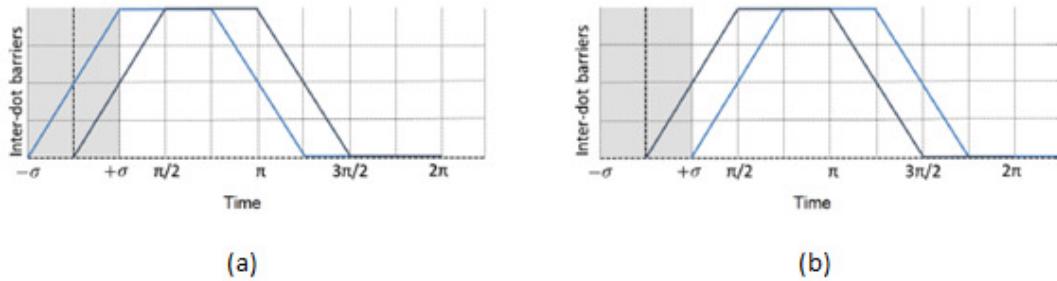
Besides the above discussed advantages of USE, the proposed circuit to generate the electric fields for the different clock zones is complex as shown in Figure 13. According to Vankamamidi (2008), diagonal metal wires buried under the entire QCA design are required as shown in Figure 7(a) to provide the clock zone signals generated by a four-phase clock generator. In order to create wire crossings, another metal layer is required as depicted in Figure 7(b). Additionally, a small metal pad is created below each clock zone in a third layer that generates a uniform electric field for each clock zone as shown in figure 7(c). Hennessy & Lenta (2001) proposed that the fabrication of these structures is possible by similar techniques used for integrated circuits based on CMOS technology.

Besides other defects, the behavior of a QCA system is substantially affected by the shifts in the phases of the clock signals (Ottavi, 2007; Karim, et al., 2009; Reis & Torres, 2016). The clock signals are provided by an external circuit, which is again prone to defects and unusual operation conditions, such as temperature effects. Phase shifts may result from manufacturing variations from uneven path lengths.

A defective clocking network can add a standard deviation  $\sigma$  to the natural phase shift  $P$  of the clock signals. As the logical information must flow synchronously in QCA, any unusual condition may drive the outputs to a faulty state. The phase shift  $P$  for deviated clock signals may be modeled as:  $P = (\pi/2) \times i \pm \sigma$ , where  $i$  is the sequential clocking zone identifier, such as  $0 \leq i \leq 3$ , and  $\sigma$  is the standard deviation introduced by the external clocking circuit defective

condition (Dayane & Frank, 2016). According to (Ottavi, 2007),  $\sigma$  values greater than  $\pi/4$  rad., would raise the probability of having two clocking zones whose phases are inverted, a condition that is unlikely in fact. Thus, a reasonable interval for the clocking phase shift standard deviation is  $0 \leq \sigma \leq \pi/4$  rad.

The regions shaded in gray color on the graphs as shown in Figure 14 represent the  $\pi/4$  rad. boundaries for the standard deviation  $\sigma$  in the clock signal phase. According to the model adopted in this work, the clock signal is allowed to assume any phase shift between such boundaries.



**Figure 14. The boundaries for the standard deviation in the clock signal phase. The deviations in the clock signal phases can produce errors in the output signals of the QCA circuits since they potentially affect the correct information sequencing. (a) A clock signal, depicted in blue, whose phase is advanced by  $\pi/4$  rad relative to the reference signal, shown in black. (b) A clock signal, depicted in blue, whose phase is delayed by  $\pi/4$  rad relative to the reference signal, shown in black.**

Such errors can be categorized into unwanted delays or logic state inversions (F., et al., 2009). If the clocking zone loses its order, an undesired delay may occur. This will lead to logical inversions further producing errors in output.

#### 4. CONCLUSION

Since the self-assembly fabrication process for QCA is subjected to defects, shortly if the QCA circuit and system exists, defects must be approached to avoid the failure of it. Looking into the reliability of QCA, an extreme need for fault-tolerant circuits is required. Also, analysis of QCA oriented defects, it's modeling, and the development of the corresponding fault model is required. For a QCA system with a high failure rate, a possible approach for establishing the most suitable fault-tolerant technique must consider tolerating both high manufacturing (i.e. permanent) and operational (i.e. transient) fault rates. In this paper, the review of various types of defects, the different clocking mechanisms and the various fault tolerant structures have been

addressed. There seems a lot of scope in this field in future. As far as QCA Designer tool is concerned the options for testing faults and defect tolerance in the design must be studied and explored. The Heat maps generated must be used as tool for identifying the defected areas in the design and later design could be improved by applying defect tolerant strategies. Also there is no method that could predict the areas where fault tolerant mechanism can be applied. Again there is no front end tool, where digital design using logic gates, flip-flops etc. could be done and can later be transformed into layout.

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# A Study of Palmprint Ridge Density for Sex Identification

**Ashish Badiye, Neeti Kapoor, Swati Dubey Mishra**

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## ABSTRACT

*Palmprints like fingerprints are encountered on the scene of a crime and are useful in establishing identity. They are also valuable in identification during medico-legal investigations in cases of mass disasters/mass homicides, etc. wherein body parts are severed/chopped off. This work aimed to evaluate the palm print ridge density in the samples taken from a Muslim population of Maharashtra for the existence of any topological variations. In females, the mean ridge density in all the areas of right and left was found to be 13.06 and 13.11, respectively. While in males, the mean ridge density in all the areas of right and left hand was found to be 11.32 and 11.57, respectively. The sample studied revealed that females present a significantly higher ridge density than men and, as such, have narrower ridges over the entire palmar surface.*

**Keywords:** *Palmprint; Ridge Density; Male; Female; Epidermal ridges.*

## 1. INTRODUCTION

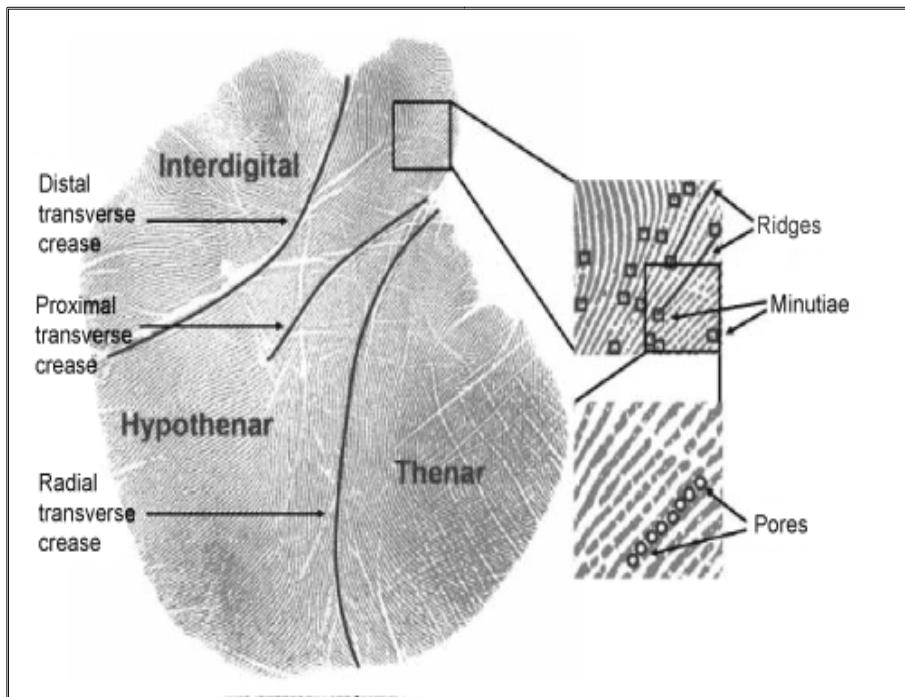
Analysis of fingerprints and palm prints at the crime scene is vital to identify the suspect and establish the presence of the perpetrator. It is valuable in identification during medico-legal investigations in cases of mass disasters/mass homicides, etc. wherein body parts are severed/chopped off. Palm prints are sometimes useful in establishing an identity as finger prints<sup>1</sup>. Palm prints of suspects are obtained only when latent or visible palm prints have been discovered at crime scenes. The use of palmprints, however, is limited. Palm prints classification systems are largely based on the study of the various palmar areas<sup>2</sup>.

The crucial period for establishing an epidermal ridge pattern occurs between the 6th and 16th week of prenatal development, and the 6th month of prenatal development is considered the gestational age at which papillary ridge development is completed. Dermatoglyphic features and their components are both environmentally and genetically determined, although the arrangement of ridges remains constant throughout life. Ridge breadth is of biological, medical, and genetic interest. As compared to the various dermatoglyphic features such as general pattern type, pattern distribution, and others, the variation in ridge breadth has not received as much attention<sup>3, 4</sup>. Many studies have been carried out using fingerprints<sup>5-8</sup>, although very few studies

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*Research Scholar, SVVV, Indore & Assistant Professor, Govt. Institute of Forensic Science, Nagpur  
Research Scholar, SVVV, Indore & Assistant Professor, Govt. Institute of Forensic Science, Nagpur  
Asst. Professor, SVIFS, SVVV, Indore, Madhya Pradesh*

had been conducted to assess sexual and topological differences in palmprints for forensic applications<sup>4, 9-11</sup>.

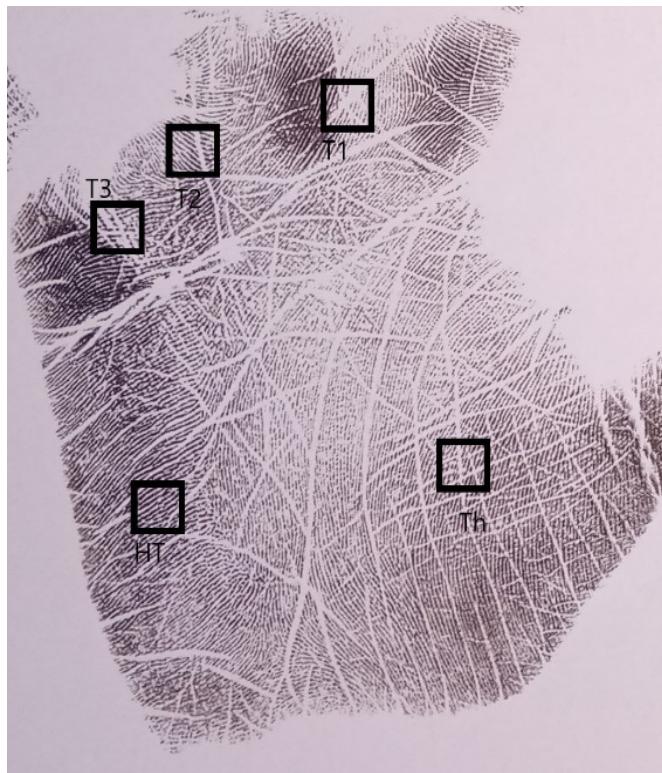


**Figure 1. Some Features and Areas of the Palm**

The aim of this work is to analyse sexual, bimanual, and topological variations in epidermal ridge breadth on palm prints taken from a Muslim population of Central Indian samples for subsequent application in inferring sex from the palm prints.

## 2. METHODOLOGY

The study was conducted on 100 subjects (50 males and 50 females). In this study, the subjects were chosen randomly in the age group of 18-50 years from the Muslim community. The materials used for this study were printers' black ink, glass plate, roller, magnifying lenses, transparency sheet, marker, scale, and palm print card. The subjects were properly explained about the objectives of the intended study, and informed verbal consent was taken from them. They were asked to wash and dry their hands to remove dirt and grease. For the collection of palmprints, a plain glass plate of dimensions 12x12 inches had been cleaned and uniformly smeared with a thin layer of black printer ink by using the roller. The donors were asked to apply their palm first on the smeared plate and then on the duly prepared palm print card. The process was repeated for all individuals.



**Figure 2. The areas of the palm print studied. (Image not to scale)**

The five prominent areas were analysed on the palm prints (Figure 1) that included central prominent part of the thenar eminence (TH), hypothenar region (HT), middle portion of area beneath index finger and middle finger (T1), middle portion of area beneath middle finger and ring finger (T2) and middle portion of area beneath ring finger and little finger (T3). The ridges in each of these areas were counted using the standard method and tabulated.

### **3. RESULTS AND DISCUSSION**

The mean ridge density of females in the Right hand in the thenar region is 11.98, in the hypothenar region is 13.2, in the T1 region is 13.28, in the T2 region is 13.6 and in T3 region is 13.26. Left hand in the thenar region is 12.42, the hypothenar region is 13.16, in the T1 region is 13.1, in the T2 region is 13.74 and in the T3 region is 13.14. (Table 1)

The mean ridge density of males in the Right hand in the thenar region is 11.10, in the hypothenar region is 10.85, in the T1 region is 11.44, the T2 region is 11.96 and T3 is 11.27. The left hand in the thenar region is 11; the hypothenar region is 11.33, the T1 region is 11.54, the T2 region is 12.33, and the T3 region is 11.67. (Table 2)

**TABLE 1: Mean Ridge Density in various regions of palm prints in females**

	AGE	LEFT HAND					RIGHT HAND				
		TH	T1	T2	T3	HT	TH	T1	T2	T3	HT
<b>FEMALE</b>											
<b>MAX</b>	45	16	16	20	17	17	18	18	18	17	17
<b>MIN</b>	18	10	9	9	10	10	8	10	10	10	9
<b>MEAN</b>	27.66	12.42	13.1	13.74	13.14	13.16	11.98	13.28	13.6	13.26	13.2
<b>SD</b>		1.52	1.47	2.03	1.83	1.70	1.96	1.87	1.81	1.81	1.67

**TABLE 2: Mean Ridge Density in various regions of palm prints in males**

	Age	LEFT HAND					RIGHT HAND				
		TH	T1	T2	T3	HT	TH	T1	T2	T3	HT
<b>MALE</b>											
<b>MAX</b>	46	16	15	16	15	14	15	15	16	14	16
<b>MIN</b>	18	8	9	9	8	8	8	9	9	9	7
<b>MEAN</b>	24.72	11	11.54	12.33	11.67	11.33	11.10	11.44	11.96	11.27	10.85
<b>SD</b>		1.85	1.75	1.75	1.74	1.42	1.56	1.51	1.62	1.19	1.75

The combined (male + female) mean ridge density and standard deviation by area for right and left hands combined is shown in Table 3.

**TABLE 3: Mean ridge density and standard deviation (SD) by area and sex for right and left hands combined**

MALES					FEMALES												
RIGHT HAND				LEFT HAND				RIGHT HAND				LEFT HAND					
A	Mean	R	SD	A	Mean	R	SD	A	Mean	R	SD	A	Mean	R	SD		
HT	10.85	7-16	1.75	HT	11.33	8-14	1.42	HT	13.20	9-17	1.6	HT	13.16	10-17	1.5		
TH	11.10	8-15	1.56	TH	11.00	8-16	1.85	TH	11.98	8-18	1.9	TH	12.42	10-16	1.5		
T1	11.44	9-15	1.51	T1	11.54	9-15	1.75	T1	13.28	10-18	1.8	T1	13.10	9-16	1.4		
T2	11.96	9-16	1.62	T2	12.33	9-16	1.75	T2	13.60	10-18	1.8	T2	13.74	9-20	2.03		
T3	11.27	9-14	1.19	T3	11.67	8-15	1.74	T3	13.26	10-17	1.8	T3	13.14	10-17	1.8		

In the studied Maharashtra Muslim population sample, there exist topological differences in ridge thickness on the epidermal palm surface. The most distal and central areas of the palm (interdigital area III) presented the narrowest ridges, while the thickest ridges were observed in the most proximal and radial area (thenar-I area).

## 4. CONCLUSION

These topological differences were more marked in males than in females, especially in the right hand. The sample studied revealed that females present a significantly higher ridge density than men and, as such, have narrower ridges over the entire palmer surface. Further detailed research is necessary in order to determine whether some of these differences are caused by different manual activities and to assess the impact that differential growth and development rates during pre- and postnatal stages may have on epidermal ridge breadth. These findings could be applied in the field of forensic science in order to improve sex identification using palm prints.

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# **Agro Shade Net: Construction and Applications- A Review**

**Pavan Gupta, Shamayita Patra**

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## **ABSTRACT**

*Agriculture is the backbone of Indian economy. Still food security continues to be a pressing issue in India due to shrinkage of farm land. This major challenge can be diluted with the help of agro textile. Agro textile products not only boost up the yield but also improve quality of agro products. Shade net is one of the majorly used agro textile product especially for horticulture and floriculture. Shade net is mainly used for controlling the micro climate inside the shade net house. However, it also used as insect protection net, bird protecting net, hail net, etc. The objective of this review paper is to elaborate different domains of shade net such as polymer used for manufacturing the shade net, constructional parameters. Also, application of shade net in agriculture with the challenges and opportunities in India are addressed.*

**Keywords:** *Agro Textiles, Agro shade net, Microclimate, Agro-products.*

## **1. INTRODUCTION**

“India is the second largest food producer in the world”, it signifies the contribution of agriculture in Indian economy [1]. Agro textiles are the engineered textile products that help in boosting up the yield and quality of agro-products. Also, it yield high profit with less land [1, 2]. These benefits result in further socio-economic development of the stake holders within the agriculture community [1, 2]. Agro textiles include woven, nonwovens and knitted fabrics. Main areas of application of textiles in agriculture include crop production, horticulture, floriculture, forestry, animal husbandry, aqua-culture, agro engineering, and packing related applications [3, 4]. Some popular agro textile products are fishing net, mulch mat and agro shade net [5, 6].

Weather resistance and lightweight are the basic requirements of textiles for agro-textiles . Lower price and durability makes man-made fibres preferable over natural fibres [7]. Shade net is one of the majorly used agro textile product especially for horticulture, floriculture, nurseries and to raise forest. It is useful especially in summer to reduce weathering rate of sapling and newly grown plant’s mortality [8]. Shade net is mainly used for controlling the micro climate inside the closed ecosystem such as green house and shade net house. Similarly it acts as protection barrier against insect, bird, hail etc. [4]. This paper reviews about the shade net. The

discussion includes polymers used for manufacturing the shade net, constructional parameters and applications of shade net in agriculture along with the challenges and opportunities in India.

## 2. SHADE NETS

Shade net is the engineered textile net structure. When it is used with an enclosed structure, is referred as shade net house. It helps to create a suitable microclimate for plant growth by moderating sunlight, moisture and air flow rate. It protects the crop from natural weather troubles such as rain, hail, sand, frost, etc. Thus it helps to maintain the quality of agro product with higher yield. Shade net enables farmers to lengthen the cultivation season as well as off season cultivation [4, 7, 9-15]. Shade nets are mostly made of Polyethylene or Polypropylene flat filament yarn with different shading percentages viz. 25%, 50%, 95% etc [1, 4, 7, 8, 16-21]. Shade nets last longer for 3 to 5 years depending on the climatic condition, cultivation practises and self-aging [1, 6-8]. Degradation of plastic films occurs when radicals are formed under the effect of the ultra-violet (UV) rays. Therefore, specialized UV treatment is applied to protect them from UV rays [6, 18-20].

Agro shade nets are available in market according to material, dimensions of threads, texture, mesh size, porosity, weight, colour, reflectivity, shading factor, air permeability, tensile strength, durability, etc. (Table 1) [4, 7, 9-11, 19]. The selection of shade net specification depends on the requirement of crop and the land geography [1, 2]. However, there is no standard criteria for choosing the best net with respect to actual requirement. It is mostly governed by empirical or economic criteria [4, 11].

**TABLE 1: Parameters of shade nets [7]**

S.N.	Shade net parameter	Range
1	Type of Material	HDPE, PP
2	Thread Dimension	Round Monofilament or flat tape
3	Fabric Texture	Woven, Leno and Knitted
4	Mesh Size (mm)	1.7-7.0
5	Weight(g/m <sup>2</sup> )	15.0- 325.0
6	Length(m)/Width(m)	25-300 /1-20
7	Color	Mostly Black, Green and Transparent
8	Shading (%)	25 - 90
9	Durability (years)	3 - 6

### 2.1 Shade Net Polymer

High density polyethylene (HDPE,  $\rho = 940\text{-}960 \text{ kg/m}^3$ ) fibre is the primary material of shade nets [4, 7, 17, 18]. It is a non-toxic, recyclable, non-biodegradable, chemically inert, waterproof

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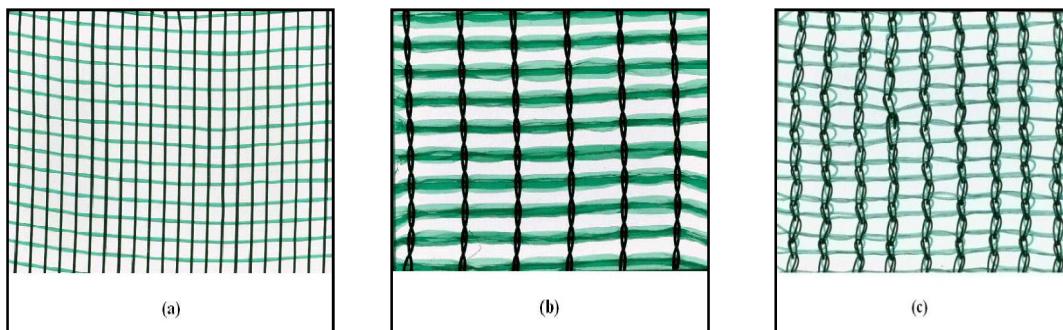
and durable material [7, 22]. It is usually treated with UV protecting agent to improve its UV resistance. It has good mechanical characteristics (Table 2) [1, 7, 9, 17, 22]. Polypropylene (PP,  $\rho = 900\text{-}910 \text{ kg/m}^3$ ) is also used as 2<sup>nd</sup> most popular raw material in the shade net production. Starch-based biodegradable materials are also used in some innovative agro-net materials. However, biodegradable materials are not very common in the market due to their high costs [7, 18].

**TABLE 2: Mechanical properties of HDPE fiber [7]**

Tensile Strength (GPa)	6.0 - 8.0
Elongation at Break (%)	15-50

## 2.2 Shade Net Construction

HDPE threads are used either in form of round monofilaments or flat tapes for shade net construction viz. woven, leno or knitted or Raschel construction (Figure 1).



**Figure 1. Shade net construction (a) Woven texture; (b) Leno texture; (c) Knitted or Raschel texture [7]**

Woven structure is made with simple interlacement between warp and weft threads in the loom [4]. Leno structure is produced with the same type of looms with leno weave. While knitted structure is produced with Raschel warp knitting machines [7]. The mesh size for shade nets range from 1.7 to 7.0 mm, thickness varies from 0.25 mm to 0.32 mm. The weight of shade nets depends on the thickness of threads, the texture, and on the mesh size: generally, it varies from 15 g/m<sup>2</sup> up to 325 g/m<sup>2</sup> [7].

## 3. CHALLENGES AND OPPORTUNITIES IN INDIA

Many studies have been done to evaluate the application of shade nets for sustainable crop production in the regions of adverse climatic conditions. A few studies are summarized in table 3.

**TABLE 3: Application of shade net for different plants**

S.N.	Plant used for experiment	Results	References
1	Tomato	60-80% higher yield/plant with good quality than open field.	[23][24][27]
2	Eggplant	Yield/plant is 60-70% higher than open field	[24]
3	Radish	Yield/plot is 80-100% higher than open field	[24]
4	Cucumber	15-20 % higher yield/plant than open field	[24][25]

Protected cultivation using shade net is beneficial and there is a great opportunity even in Indian agro industry. Therefore, encouragement in the application of agro shade nets is needed in India. The major challenges in the field of agro textile (especially shade net) are tubulised in the following segment and needed to be addressed.

- Lack of awareness among the farmers,
- Absence of required standard to ensure product quality and implementation guidelines,
- Absence of product specification, etc. [1].

#### 4. CONCLUSION

Shade nets are beneficial for higher yield with quality agro products and Indian farmers are slowly adopting shade net technology in various agricultural applications. However, scientifically justified technical parameters for nets used in specific agricultural applications have not been established yet. Still now they are totally controlled by empirical or economic criteria. Cheaper biodegradable shade net is a thriving research area.

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# **Detection of Cannabis in Drug Abusers Nails**

**Nandini Bansod, M.P. Goutam**

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## **ABSTRACT**

*Drug of abuse or illicit drugs have become a serious issue and global evils during the last few years. In present scenario, drug abuse detection in keratinized matrices, such as hair and nail clippings, has gain considerable attention because of several benefits over drug testing methodologies employing body fluids, such as urine or serum. Keratinized matrices such as fingernail and toenails can accumulate drugs with long term exposure. Cannabis is one of the most commonly abused drugs worldwide as well as Nail is one of the physical evidence that can be encountered in criminal cases related to homicide and sexual offences etc. The present study is focused on the extraction and identification of cannabinoids and their metabolites in the nails using High Performance Liquid Chromatographic analysis.*

**Keywords:** *Drug of Abuse, Keratinized Matrices, Cannabis, HPLC.*

## **1. INTRODUCTION**

Nail is one of the physical evidences that can be encountered in criminal cases related to homicide and sexual offences etc. Incorporation of substances into the nails mainly occurs through diffusion of compound from the rich blood supply, which accumulate substances to both germinal matrix and the nail bed on the underside of the nail plate, thus allowing incorporation in both a vertical and horizontal way during nail formation. Unlike other type of biological evidence, nail is remarkably stable to most of the environmental conditions and does not break down easily. (1) The objective of the present study is to extract and detect hallucinogen (*cannabis sativa*) and evaluate its analytical limits of long-term follow up of consumption. Cannabis is one of the most widely abused drugs, its active constituent, delta 9-tetrahydrocannabinol ( $\Delta 9$ -THC), produces a myriad of pharmacological effects in animals and humans. It can also potentially lead to dependence and behavioral disturbances and its heavy use may increase the risk for psychotic disorders (2). It is found that the detection window of the drug abuse in blood and urine can only be detected within the time limit of 4-6 days. To overcome this situation alternative specimen are needed to be examined because hairs sample could solve the problem of this nature and time limit can be increased from days to months/week only while toenails and fingernails analysis has become an alternative and reliable technique as that can examine metabolites even after year (3). Therefore, the present study has been undertaken and the presence of cannabis drug was determined using High performance liquid chromatographic analysis.

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*Research Scholar, SVIFS, SVVV, Indore  
Professor, SVIFS, SVVV, Indore*

## 2. MATERIAL & METHODS

In this study all chemicals of analytical grade. Solvents and chemicals were obtained from Shreeji analytical and research Pvt. Ltd. (Indore, India). Test sample was marked as QN-1 and All Experiments were performed at Shreeji Analytical & Research Laboratories Pvt. Ltd. The nail clippings (test samples) examined were collected from Gwalior Manasik Arogyashala (M.P. India).

### 2.1 Extraction of cannabinoids from nail clipping

Nail clippings were first sonicated using methanol, isopropanol and distilled water successively with the Bio-technic Ultrasonicator. The decontaminated nail clippings were air dried, weighed and cut into small pieces. Then alkaline hydrolysis was carried out for the extraction following incubation of the nail clippings in 1 mL of 1M sodium hydroxide solution at 950C for 30 min. After the resulting hydrolysates, cooled to room temperature then 5 ml of ethyl acetate was added and the mixture agitated for 60 min on sonicator. Samples so obtained were then centrifuged for 15min/3000 rpm. The ethyl acetate layer from each mixture was transferred into a clean screw-cap vial and evaporated to dryness at 60C on Hot Plate. The extracted samples were first screened by the fast Blue B test to detect the cannabinoids and its metabolites. High Performance Liquid Chromatography: HPLC was performed for the confirmatory analysis of cannabinoids and its metabolite as suggested by Toshi et al and Arno et al (4-5).

### 2.2 Methodology

Fast blue B salt test - Briefly, 2-3 drop of extract was taken on filter paper, a pinch of fast blue B salt (fast blue B mixed with anhydrous sodium sulphate in the ratio 2.5: 100) was added to it. The presence of wine red colour on the filter paper indicated presence of cannabis.

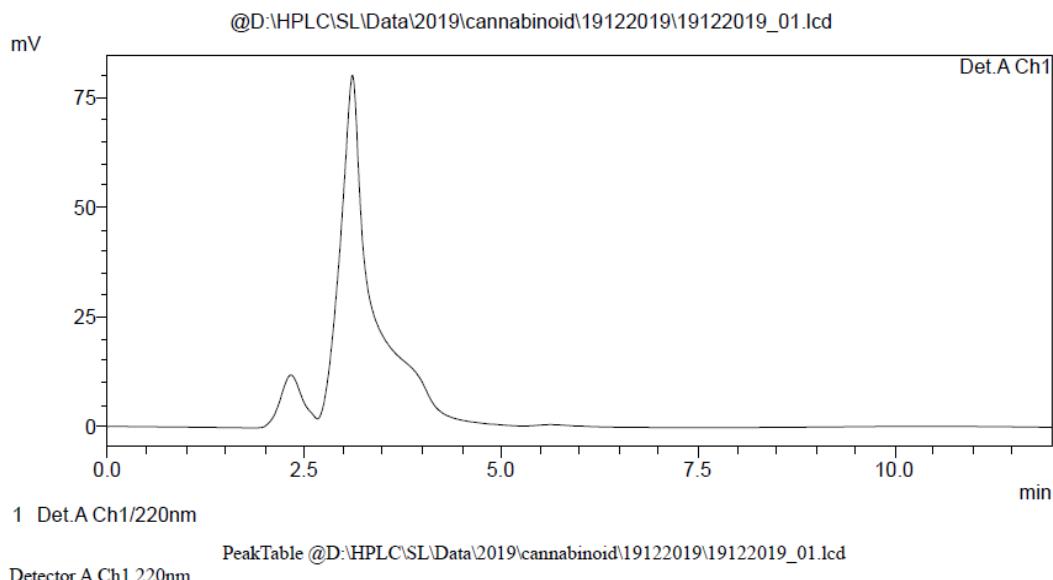
### 2.3 Experimental condition for HPLC

Column	KROMOSIL C18
Column Size	4.6 $\mu$ m150mm
Flow rate	0.6 ml/min
Temperature	22.9 degree C
Mobile Phase	Linear Gradient A : 0.1% acetic acid B: acetonitrile
Run time	0 min 45A: 55B , 8min: 100B
Data process	Blank Subtraction Performed (acetonitrile)
Detection	UV220 nm

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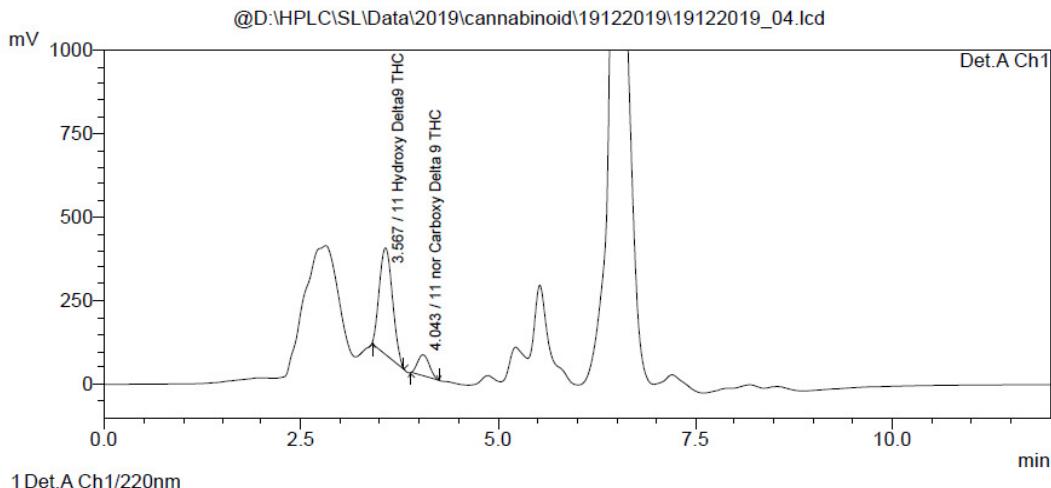
## BLANK SPECIFICATION

Acquired by : Admin  
Sample Name : cannabinoid  
Sample ID : Blank  
Tray# : 1  
Vail # : 1  
Injection Volume : 25  $\mu$ L  
Data File Name : 19122019\_01.lcd  
Method File Name : cannabinoid HPLC.lcm  
Report File Name : Default.lcr  
Data Acquired : 19-Dec-19 15:29:50  
Data Processed : 19-Dec-19 16:36:43



**Figure 1. Chromatogram of blank sample (Solvent)**

Acquired by : Ajawariya  
Sample Name : cannabinoid  
Sample ID : QN  
Tray# : 1  
Vail# : 4  
Injection Volume : 25  $\mu$ L  
Data FilenamE : 19122019\_04.lcd  
Method FilenamE : cannabinoid HPLC.lcm  
Date Acquired : 19-Dec-19 16:11:22

**Figure 2. Chromatogram of test sample QN-1****TABLE 1. Showing Retention time of cannabis metabolites**

Detector A Ch1 220nm

Peak#	Name	Ret. Time	Area	Area %	Height	Height %
1	11 Hydroxy Delta9 THC	3.57	3674040	85.17	317693	83.681
2	11 nor Carboxy Delta 9 THC	4.04	639533	14.83	61957	16.319
Total			4313572	100.00	379650	100.000

### 3. RESULTS AND DISCUSSION

HPLC chromatograms so obtained were compared with standard data Base (COSMOCORE Nacalai USA.) (4) and cannabis metabolites 11 Hydroxy Delta 9 Tetra hydro Cannabinol and 11 nor Carboxy Delta 9 Tetra Hydro Cannabinol were identified in nail clippings (test sample QN-1) thus HPLC technique found to be suitable and useful technique to confirm the presence or absence of cannabis drug in nails of drug abusers.

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# Modified Droop Controller for Low Voltage Microgrid

Shraddha Gajbhiye, Navita Khatri

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## ABSTRACT

*This paper proposes a modified droop control with the objective of equivalent power sharing between parallel inverters in islanded microgrid as well as stability. The past robust droop controller uses conventional frequency droop. The proposed controller is modified robust controller which is dependent on the frequency droop strategy considering low voltage microgrid. The simulated results show improved stability of frequency reference by limiting the frequency error and also exhibit equal power sharing between two parallel inverter considering R-L line impedance.*

**Keywords:** Frequency Droop Strategy, Modified Droop Controller, Low Voltage Microgrid

## 1. INTRODUCTION

These days, increasingly distributed generation (DG) and renewable energy assets, e.g., wind, sun and tidal strength, are connected to the public grid through electricity inverters. They often form microgrids before being related to the general public grid [1]–[4]. Because of the availability of high current power electronic devices, it is inevitable that many inverters area unit required to be operated in parallel for dynamic and/or affordable applications. One more reason is that parallel-operated inverters offer system redundancy and high dependableness required by essential customers. A natural drawback for parallel-operated inverters is a way to share the load among them. A key technique is to use the droop management [5]–[13], that is wide employed in standard power generation systems [14]. The advantage is that no external communication mechanism is required among the inverters [10, 15]. This allows sensible sharing for linear and/or nonlinear masses [10, 16–20]. In some cases, external communication means that area unit still adopted for load sharing [21] and restoring the microgrid voltage and frequency [3, 9]. Alternatively, microgrid management in associate islanded mode is complex than grid connected mode. The voltage and frequency of the microgrid are supported by the first grid if it is among the grid connected mode. On the other way, the voltage and frequency management and even electricity management is done by microgrid in islanded mode. The incidence of power mismatch among the DG units, unbalanced load voltages and frequency deviations results into existence of circulating current. Therefore, this is utmost requirement of an efficient controller to manage voltage and frequency balance. The controller also provides acceptable strength sharing amongst DG units in islanded mode operation [22].

The essential objective of an islanded mode is to stay up precise power sharing among numerous DG. Whenever the operation of microgrid shifted to island mode, potential difference, E and frequency,  $\omega$  are thought-about to be maintained with many inverters operating in parallel and sharing the load. These inverters act to control the voltage, amplitude and frequency and having completely different mode of operation like alternative converter [23]. The controller also provides the specified current required. However, the problem of power quality [24] that contributed by the existence of transient circulating current in line electric resistance [25] can result in the system instability, so will harmful for the inverters [26] because of twin of the output voltage. In an islanded microgrid, loads should be properly shared by multiple DG units. Generally, the management techniques for operation of inverters in islanded microgrid operation will be split into 2 categories; droop management techniques[27, 28] and active load sharing techniques [29, 30].

This paper aims to expand the strategy of robust droop controlled which [31] deals with frequency droop rather than voltage droop, for LV network based microgrid. It will retain the frequency reference of 50Hz in parallel-connected inverters considering RL line electric resistance. The management approach conferred by the previous author applied Q-  $\omega$  and P –E droop to the resistive line electric resistance to boost the strategy that works for grid connected applications via adding a unit to control the load voltage. Practically, the operation of the management is powerful against load perturbation and even an emergency circumstance like disconnection of DG unit and therefore the proposed controller is truly being designed for frequency control. The parallel-connected inverters incorporate with a proportional -integral controller (PI) and pulse-width modulation (PWM) within the islanded microgrid. The simulation studies are performed to verify and analyze the potential of the proposed controller against the standard droop controller.

## 2. DROOP CONTROL THEORY

In Microgrid, the system reliability and stability is achieved only by the voltage regulation when more micro sources are interconnected. This voltage regulation damps the reactive power oscillations and voltage. In a complex power system, when multiple DGs are connected to the microgrid, the power sharing among them is made properly with the help of a control strategy called droop control. Droop control also enables the system to disconnect smoothly and reconnect routinely to the complex power system. The role of droop control in power sharing is that it control the real power on the basis of frequency droop control and it controls the reactive power on the basis of voltage control. The voltage and frequency can be manipulated by regulating the real and reactive power of the system.

The basic conventional droop control equation can be given by

$$P = \frac{V_1 V_2}{X} \sin \delta \quad \dots \dots \dots \quad (1)$$

$$Q = \frac{V_1^2}{X} - \frac{V_1 V_2}{X} \cos \delta \quad \dots \dots \dots \quad (2)$$

For above equations, resistance (R) is neglected for an overhead transmission lines as it is much lower than inductance (L). Also the power angle  $\delta$  is lesser, therefore  $\sin \delta = \delta$  and  $\cos \delta = 1$ .

$$\delta = \frac{XP}{V_1 V_2} \quad \dots \dots \dots \quad (3)$$

$$V_1 - V_2 \equiv \frac{XQ}{V_1} \quad \dots \dots \dots \quad (4)$$

Hence from above equations (3 & 4), it is clear that the power angle  $\delta$  can be controlled by regulating real power P. Also the voltage  $V_1$  can be controlled through reactive power Q. Dynamically, the frequency control leads to regulate the power angle and this in turn controls the real power flow. Finally, the frequency and voltage amplitude of the microgrid are manipulated by adjusting the real and reactive power autonomously. As a result, the frequency and voltage droop regulation can be determined as:

The relationship between real power frequency and reactive power voltage can be given as: -

$$f = f_o + k_p (P + P_o) \quad \dots \dots \dots \quad (5)$$

$$V = V_o + k_q (Q - Q_o) \quad \dots \dots \dots \quad (6)$$

For equal load sharing, the conventional droop controller equations are

$$V_i = V^* - n_i P_i \quad \dots \dots \dots \quad (7)$$

$$\omega_i = \omega^* + m_i Q_i \quad \dots \dots \dots \quad (8)$$

Where

f, V= The frequency and voltage at a new operating point

P, Q= Active and reactive power at a new operating point

$f_o$ ,  $V_o$  = Base frequency and voltage;

$P_o$ ,  $Q_o$  = Temporary set points for the real and reactive power;

$k_p$ ,  $k_q$  = Droop Constant.

$\omega$ = rated frequency.

### 3. ACTIVE AND REACTIVE POWER THEORY IN LOW VOLTAGE MICROGRID

In LV microgrid, where  $R \gg X$ , Power dispatch equations is given by: -

$$P = \frac{V_1}{R^2 + X^2} [R * (V_1 - V_2 * \cos\delta) + X * V_2 \sin\delta] \dots \quad (9)$$

$$Q = \frac{V_1}{R^2 + X^2} [-R * V_2 \sin\delta + X * (V_1 - V_2 * \cos\delta)] \quad (10)$$

In case of low voltage (LV) distribution line,  $R \gg X$ , so in LV network where  $R \gg X$ , equations 7 & 8 are reduced to 9 & 10 and is given by: -

$$P \cong \frac{V_1^2}{R} - \frac{V_1 * V_2}{R} \dots \quad (11)$$

$$Q \cong -\frac{V_1 * V_2}{R} \delta \dots \quad (12)$$

In LV microgrid, where  $R \gg X$  with small power angle  $\delta$  and small voltage difference  $V_1 - V_2$ , the active power  $P$  depends mainly on voltage difference  $V_1 - V_2$ , while the power angle  $\delta$  and frequency depends mainly on reactive power  $Q$ . Thus, the traditional frequency droop control through active power and voltage droop control through reactive power, used in HV levels is not functioning very well on LV network based microgrid. As a result, the voltage control would be implemented through active power and frequency control through reactive power production/consumption in a converter and LV network based microgrid ( $V_1 - V_2 = IR$ ).

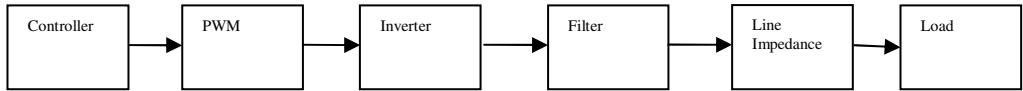
So,  $f \sim Q$

$V \sim P$

### 4. MODELLING OF SINGLE PHASE FULL BRIDGE INVERTER AND PARALLEL CONNECTED INVERTERS

#### 4.1 Single phase Inverter

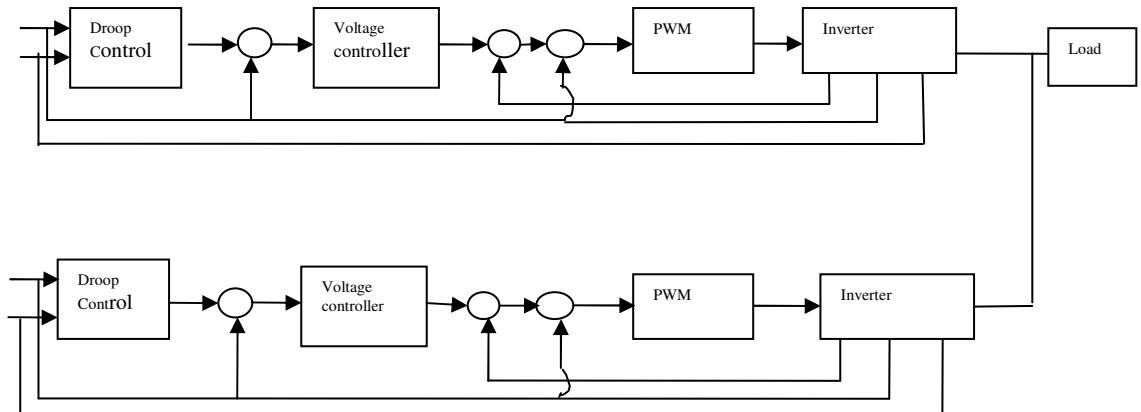
The single-phase inverter is an electronic circuit that enables a voltage to be applied across a load in either direction. It can be simplified justified with a switching scheme of full-bridge converter. Typically, it consists of a DC power source and a bridge-type inverter with *LCL* filter as shown in Figure 1. The inverter is a device which converts a DC input supply voltage into symmetrical AC voltage based on the modulation signal from the PWM modulation.



**Figure 1. Block diagram of a single phase Inverter**

#### 4.2 Parallel connected Inverters

Two parallel-connected inverters are used to fill in the microgrid configuration as depicted in Figure 2. The model of parallel-connected inverters is a necessary in order to apply droop method in the system. A PI controller is used with the voltage feedback loop [29] to regulate the output voltage. In order to ensure in-phase similarity of the output voltage of each inverter, the same voltage reference is used,  $V_L 0^0$ . The PI controller gain the feedback values of output voltage and current from the inverter, thus, generate a proper controlled signal before transmitted to PWM. Then, PWM used to put through the switching process and pass a practical condition of the microgrid. The active and reactive power of each inverter is obtained based on the voltage and current measurement after filtering, later will be fed to the proposed controller block to produce new value of reference voltage,  $V_{ref}$  and angular frequency,  $\omega_i$  which will be led to proportional power sharing.



**Figure 2. Parallel- connected inverters in microgrid configuration**

#### 5. ROBUST DROOP CONTROLLER MODELLING

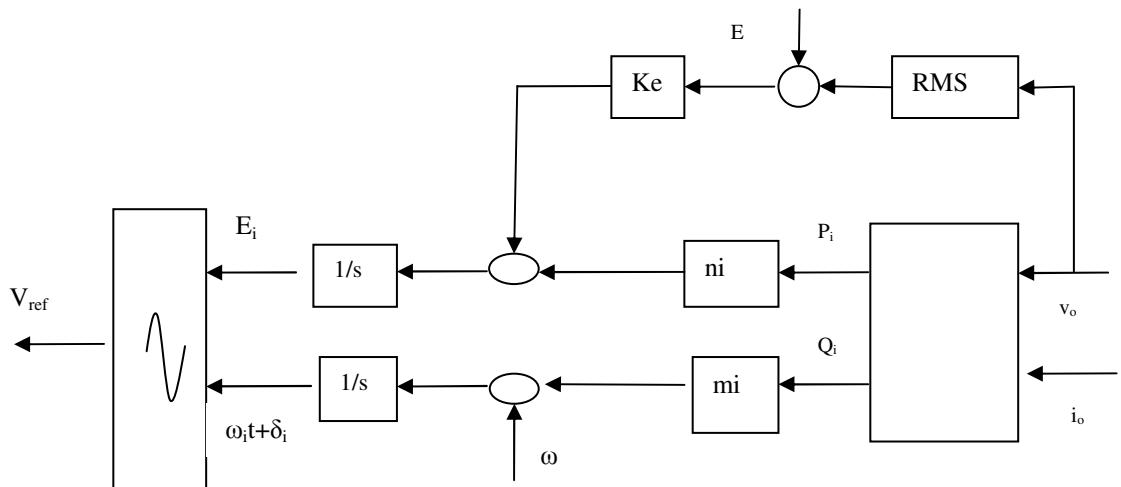
From equation (7), it can be re-written as,

$$\Delta V_i = V_i - V^* = -n_i P_i \dots \dots \dots \quad (13)$$

And the voltage  $V_i$  can be implemented via integrating  $\Delta V_i$ , i.e

$$V_i = \int_0^t \Delta V_i dt \dots \dots \dots \quad (14)$$

This works for the grid connected mode where  $\Delta V_i$  is eventually zero (so that the desired power is sent to the grid without error), as proposed in [32]-[34]. However, it does not work for the stand alone mode because the actual power  $P_i$  is determined by the load and  $E_i$  cannot be zero. This is why different controllers had to be used for the standalone mode and the grid-connected mode, respectively. When the operation mode changes, controller also needs to be changed. It would be advantageous if the change of controller could be avoided when the operation mode changes. Also, the load voltage  $V_0$  drops when the load increases. The voltage also drops due to the droop control, according to equation 4. The smaller the coefficient  $n_i$  the smaller the voltage drop. However, the coefficient  $n_i$  requires drop  $V^* - V_0$  and needs to be fed back in a certain way to obtain a fast response. In order to make sure that the voltage remains within a certain required range, the load voltage to the basic principles of control theory. It can be added to via an amplifier  $K_e$ . This actually results in an improved droop controller shown in Figure 3. This strategy is able to eliminate (at least considerably reduce) the impact of computational errors, noises and disturbances. As to be explained below, it is also able to maintain accurate proportional load sharing and hence robust with respect to parameter drifts, component mismatches and disturbances.



**Figure 3. Proposed Droop (Robust) controller**

## 6. RESULTS AND DISCUSSION

The above strategy has been verified in MATLAB simulink version 2013, which consists of two single-phase inverters powered by separate 325 V dc voltage source. The inverters are

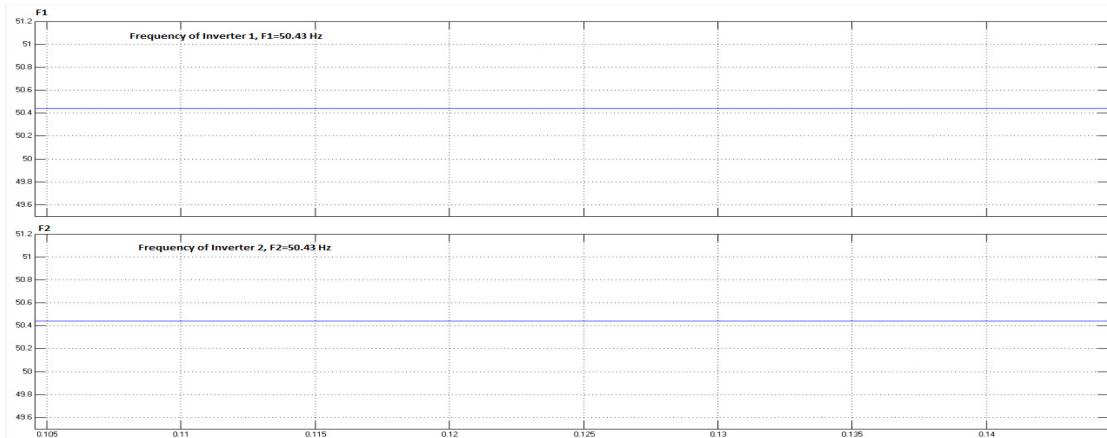
connected to the ac bus, and the load is assumed to be connected to the ac bus. Different parameters values are shown in Table 1.

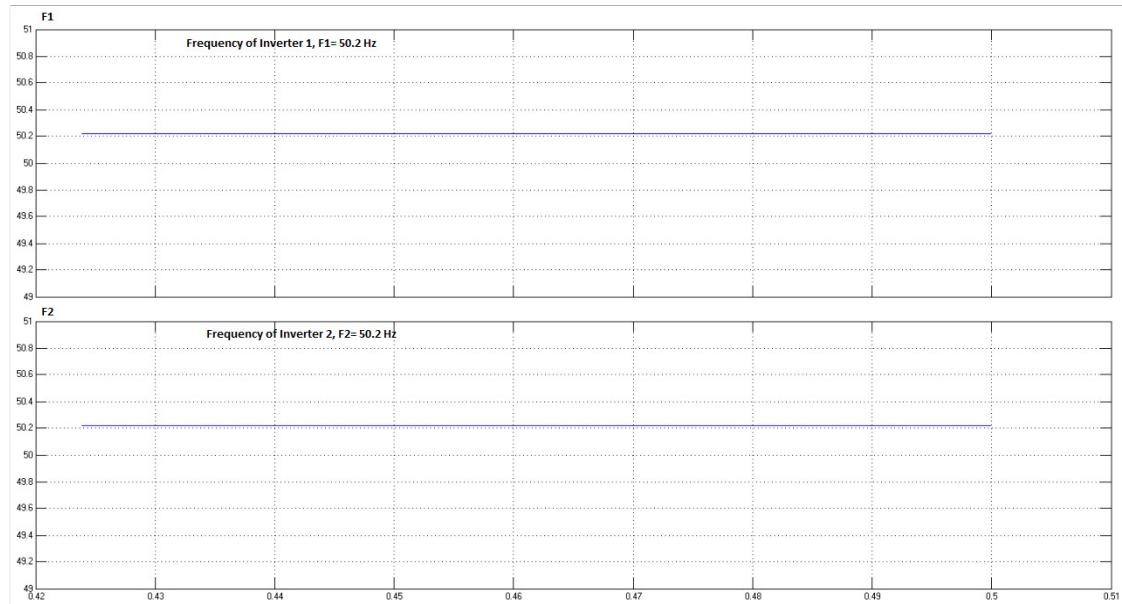
**TABLE 1: Parameter list**

Description	Value
Filter Inductance	2.97e-3 H
Filter Capacitance	5.33e-5 F
Rated frequency	50 Hz
Number of parallel connected Inverter(n)	2
Amplifier( $K_e$ )	3
DC link voltage( $V_{DC}$ )	325 V
No of load Impedance( $Z_L$ )	2
Line Resistance	10 $\Omega$
Line Inductance	10e-3 H

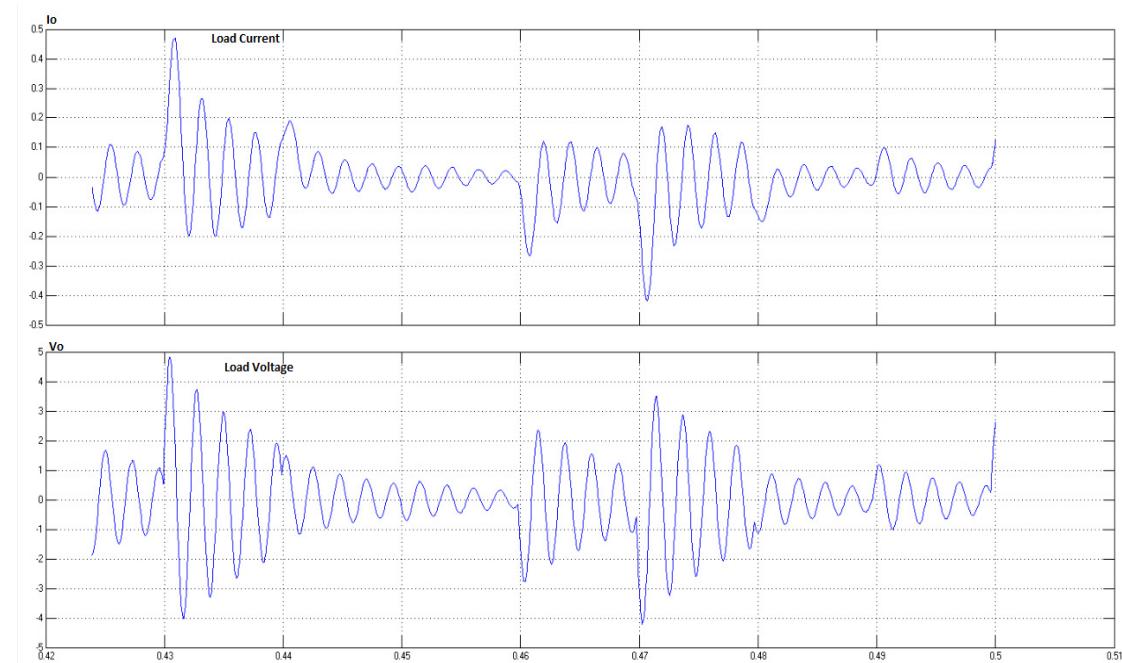
**TABLE 2: Results**

Result with conventional droop control	Result with Robust droop control
Load Frequency= 51.5 Hz	Load Frequency= 51.5 Hz
Frequency of Inverter 1= 50.43Hz	Frequency of Inverter 1= 50.43Hz
Frequency of Inverter 2= 50.43 Hz	Frequency of Inverter 2= 50.43 Hz

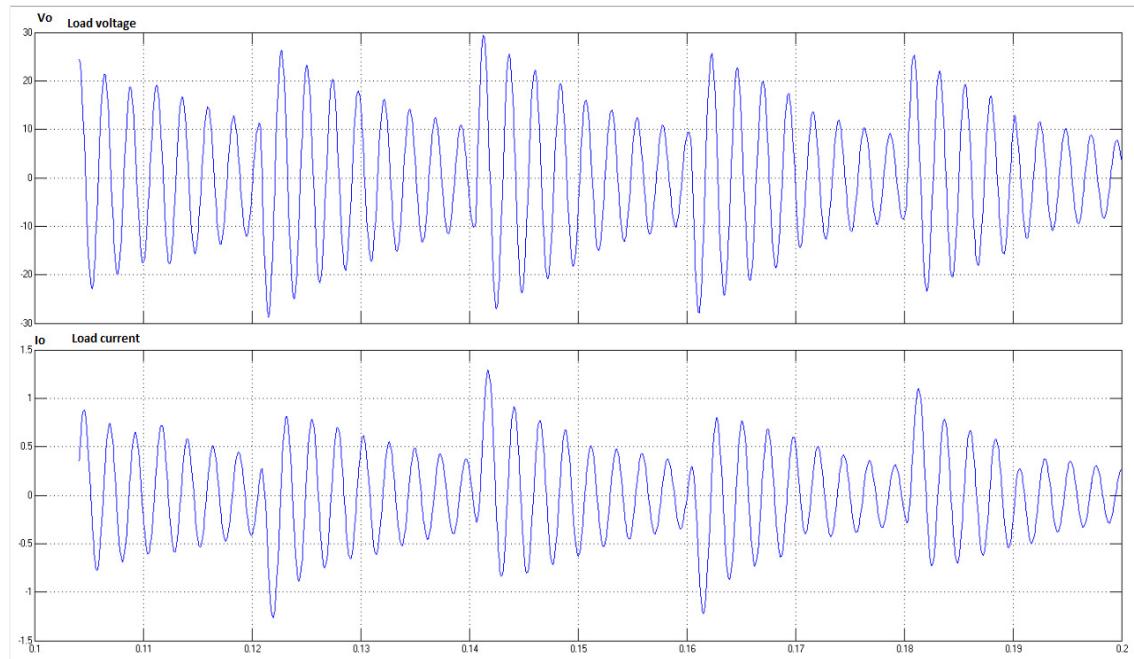
**Figure 4(a). Output frequency of two inverters by Conventional method.**



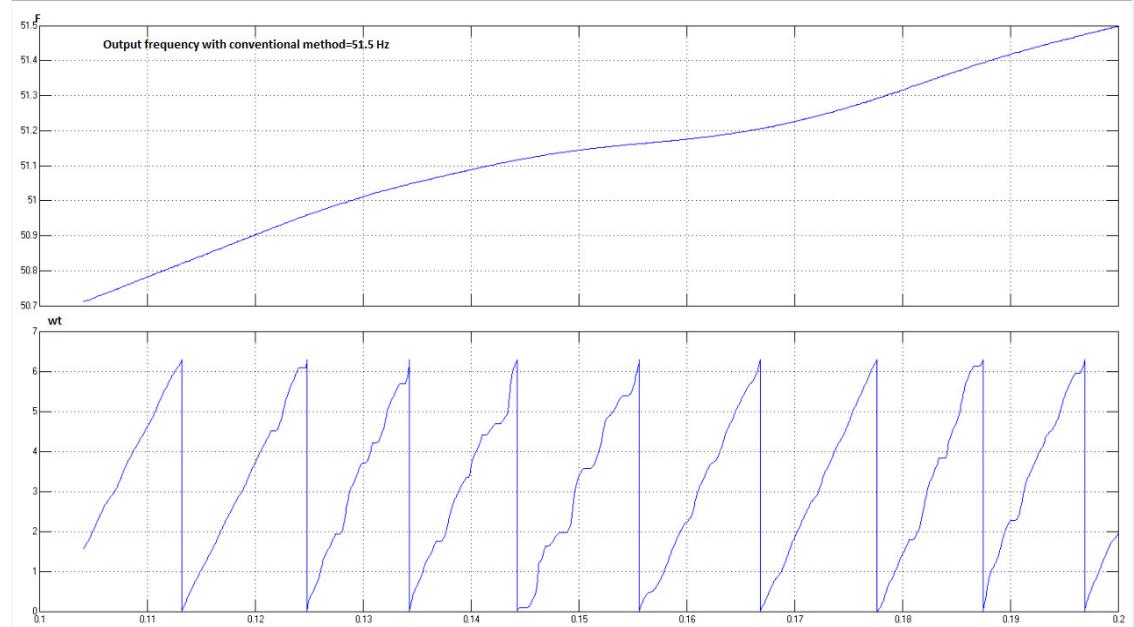
**Figure 4(b). Output frequency of two inverters by Proposed method**



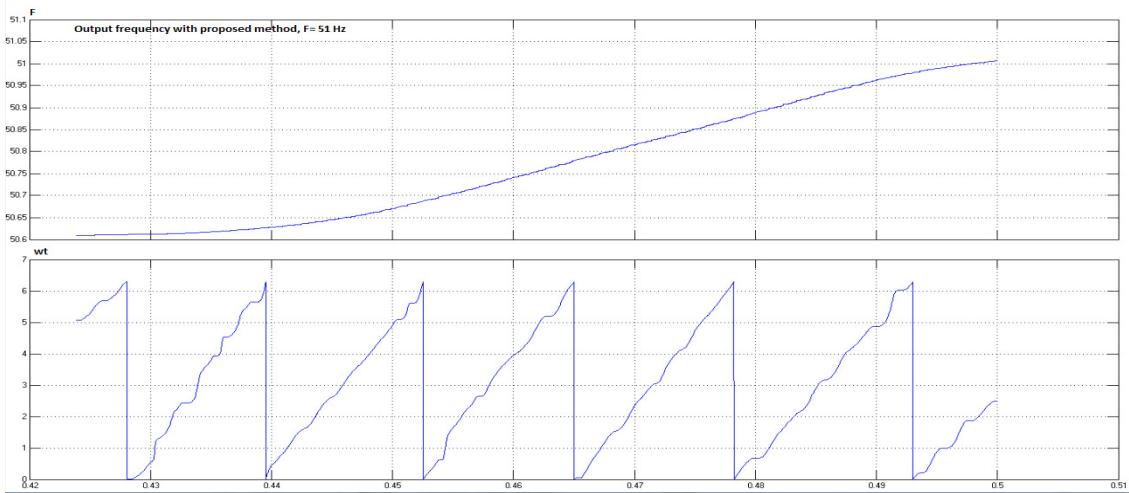
**Figure 5(a). Load voltage and current by conventional droop control**



**Figure 5(b). Load voltage and current by Proposed droop control**



**Figure 6(a). Load frequency and  $\omega t$  by conventional method.**



**Figure 6(b). Load frequency and  $\omega t$  by Proposed method**

The results from the proposed robust droop controller with  $K_e = 3$  are shown within the second individual graph of Figures.4-6 and therefore, the results from the traditional droop controller are shown within the first individual graph of Figures. 4-6. the proposed droop controller outperformed the traditional droop controller in terms of sharing accuracy and voltage drop. Scrutiny of wt graph of Figures.6, there have been no noticeable changes within the performance for the proposed droop controller however the load frequency is improved with proposed controller. Also load voltage is obtained with fewer harmonics in proposed droop control. Comparative output is shown in Table 2.

## 7. CONCLUSION

This paper has given a modified droop controller in parallel connected inverters and also the inherent limitations of the standard droop control theme. Centered management action can be taken in remaining frequency reference by applying the frequency droop methodology. A simplified model of single-phase inverter is employed to research system stability in terms of output current and voltage. The proposed controller supplies a stable angular frequency for microgrids operating within the islanded mode. The restricted scope of the previous standard droop controller that analyzed with voltage droop has been noticed. Meanwhile, the proposed controller has tested that it's capable of outperforming the lacks of the standard droop controller in providing a stable response.

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# **Thin Layer Chromatography for Swift Analysis of Malathion in Toxic Baits Using Novel Solvent System**

**Nirwan Ingole, Swati Dubey Mishra**

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## **ABSTRACT**

*Poisons have long been used to kill domestic and wild animals for various purposes. The deliberate use of pesticides for animal poisoning is a widespread practice around the world because of their easy and economic accessibility, silent features and smooth use. Toxic bait is a common inexpensive method to kill the animals. There are so many baiting methods i.e. baiting carcasses with poisons, soaking grains in pesticide solutions, poisoned waterholes tainting and injecting pesticide in the baits using syringe. In this study, novel solvent system was developed for swift analysis of one of the pesticide i.e malathion using Thin Layer Chromatography. This method was also applied to identify the malathion in toxic baits.*

**Keywords:** *Poison, Toxic Baits, Pesticide, Thin Layer Chromatography.*

## **1. INTRODUCTION**

Use of poison to kill wild animals for the various purposes has an old history. Human are killing wild animals for the purpose of meat (as food), medicine preparation, controlling population of animals, protecting crops, protect human-wildlife conflicts and to trading their body parts like ivory teeth (Elephant), horns (Deer), skin (Tiger, Leopard) and furs (Bird) etc. as these have a high demand and cost in national international black market of various countries. Earlier humans were using plant and animal poisons to kill wildlife animal but recently humans are using synthetic poisons such as carbamates, organochlorines, organophosphates, pyrethroids, anticoagulant and other types of rodenticides, compounds like phosphine, strychnine, paraquat, and cyanide are also used [1-4]. These poisons are easily available in market, more effective than traditional poisons, cheap and easy to administer than traditional poisons hence these types of poisons are becoming the preferred choice of the many wildlife animal killers. Intentional poisoning commonly involves household poisons like rodenticides, insecticides and Nicotine etc. Agricultural pesticides and feed additives are involved in malicious livestock poisonings as these products are easily accessible in the farms. Natural toxins may be introduced to the expensive animals to be appearing accidental poisoning to attempt insurance claims. The selection of poison to kill animal varies region to region depending on accessibility of poisons.

Methods adopted to kill the animal includes baiting carcasses with poisons, soaking grains in pesticide solution, mixing pesticides to form salt licks and poisoned waterholes tainting.

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*Assistant Professor & Research Scholar, SVIFS, SVVV, Indore  
Assistant Professor, SVIFS, SVVV, Indore*

Pesticides in liquid form may be injected into bait by use of a syringe [4]. Detection of these poisons in the poisoned baits and animal tissues is the recent challenge to many investigators working in the field. Malathion is one of the commonly available pesticide which is used in the agricultural field for the purpose of controlling the damage of crops by the insects. It is also used for the domestic pest control purposes [5]. Malathion is available in the Indian market by the brand names like Milthion, Kill Bugs, Bug Solin etc. Pure form is colorless having strong smell but as the times passes the smell of malathion reduces. Malathion is partially soluble in water and highly soluble in organic solvents.

**TABLE 1: Structure and physical properties of Malathion**

Structure	Molecular Formula & Molecular Weight	Physical Properties
<p>The chemical structure of Malathion is shown. It features a central carbon atom bonded to two carbonyl groups (C=O) and two methyl groups (CH<sub>3</sub>). One carbonyl group is further bonded to a methylene group (CH<sub>2</sub>) which is attached to a phosphate group. The phosphate group is linked via an oxygen atom to a sulfur atom, which is double-bonded to a second sulfur atom. The first sulfur atom is also single-bonded to a methyl group (CH<sub>3</sub>).</p>	$C_{10}H_{19}O_6PS_2$ & 330.3	Melting point: -2.85 °C, Boiling point: 156-157 °C, Density: 1.23 (25 °C).

## 2. EXPERIMENT

### 2.1 Materials and reagents:

Standard of Malathion was purchased from Sigma aldrich, analytical grade chemicals i.e. dichloromethane petroleum ether, ethyl acetate were purchased from **Loba Chemie** Iodine crystals was purchased from Rankem, Insecticide milthion (Malathion 50% EC) was purchased from market. Apple was used to prepare poisoned bait.

### 2.2 Apparatus:

Pre coated Silica Gel Plate (Silica gel 60 F254, Merck KGaA, Germany), Digital Balance, UV Cabinet were used for analysis. Glass tanks were used to develop TLC plate.

### 2.3 Sample preparation:

#### 2.3.1 Standard Sample:

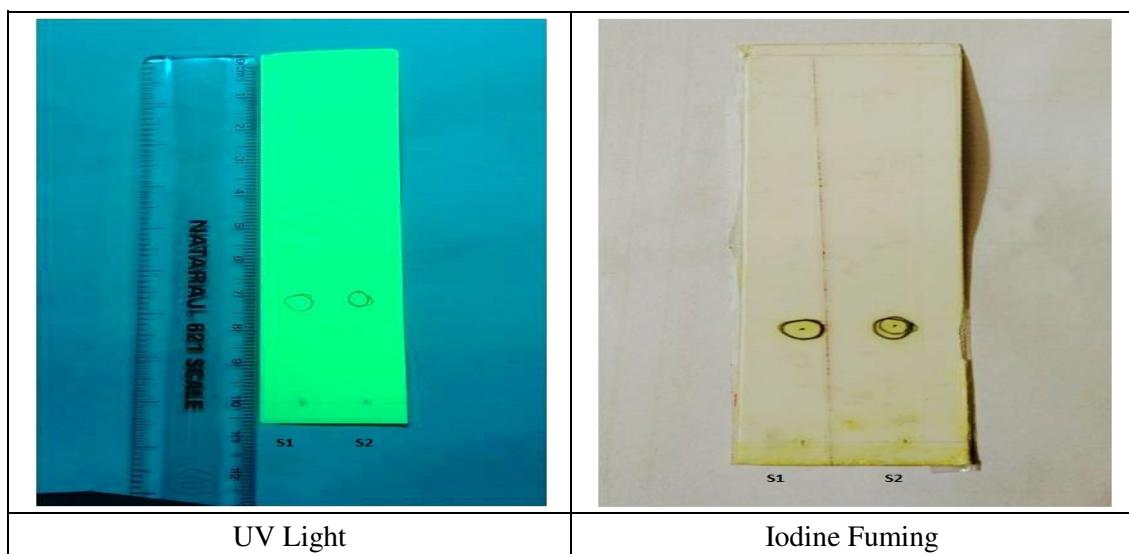
Standard sample was prepared by diluting 0.05 ml of malathion in 5 ml of dichloromethane.

### 2.3.2 *Poisoned Bait Sample:*

10 ml milthion was injected in an apple and kept for 24 hour at the room temperature and then malathion extracted from apple using dichloromethane. These samples were stored in amber color glass containers under refrigeration.

### 2.4 *The Technique*

Samples S<sub>1</sub> (Standard), S<sub>2</sub> (Poisoned Bait) were applied at starting line, about 1 cm away from one edge of the pre-coated TLC plate. Solvent was allowed to run 10 cm from starting line. After the application of sample spot, plate was placed almost vertical in a saturated glass chamber containing the optimum developing solvent. After the development plate was removed from the chamber. The plate was allowed to dry and subjected to detection/identification. First the TLC plate was viewed under UV light in UV cabinet then detection was made by iodine fuming method. After visualization of the spot R<sub>f</sub> value were calculated.



**Figure 1. TLC of Malathion using 90: 10 (Petroleum Ether: Ethyl Acetate)**

S1= Standard Sample, S2= Poisoned Bait

## 3. RESULTS AND DISCUSSION

### 3.1 *Optimization of mobile phase*

In order to establish the mobile phase that gives best result for the screening of malathion, according to elutropic series of solvents, the tried mobile phases were varied from non-polar to

polar solvents and their various combinations. Finally, the optimum solvent system found out to be 90: 10 (v/v) proportions of petroleum ether and ethyl acetate respectively and used for the present study. Using the above combination, the R<sub>f</sub> value of malathion was found 0.26.

### **3.2 Selection of visualization mode**

Apart from UV light, iodine fuming method was chosen for detection of malathion which was not reported earlier. Brown color spot of malathion was clearly visible after the treatment of iodine.

### **3.3 Inter day analysis:**

The developed method was validated for repeatability and standard deviation was found 0.022

**TABLE 2: Method validation through Inter day analysis**

<b>Day</b>	<b>Number of Trial</b>	<b>R<sub>f</sub> Value of Standard Sample</b>	<b>R<sub>f</sub> Value of Poisoned Bait</b>
Day-1	1	0.28	0.29
	2	0.27	0.29
Day-2	3	0.23	0.24
	4	0.24	0.24
Day-3	5	0.24	0.25
	6	0.29	0.29
Day-4	7	0.28	0.28
	8	0.29	0.29
Day-5	9	0.24	0.25
	10	0.25	0.24
		Mean R <sub>f</sub> Value= 0.26	Mean R <sub>f</sub> Value= 0.26
		Standard Deviation= 0.0221	Standard Deviation= 0.0224

## **4. CONCLUSION**

Melathion was identified by Thin Layer Chromatography using a mobile phase petroleum ether: ethyl acetate (90: 10) and visualizing it first under UV light and finally with Iodine Fuming. Method was found to be rapid and suitable for routine laboratory analysis of malathion. The solvent used is non carcinogenic, comparatively less toxic. Moreover, no significant interference was observed in the bait sample.

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**SECTION – II:**  
**MANAGEMENT, SOCIAL SCIENCES & HUMANITIES**

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# **Antecedents of Brand Switching Intentions: An Empirical Study of Jio Telecom**

**Mridul Mishra, Santosh Dhar**

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## **ABSTRACT**

*Brand switching in Telecom Industry became more prominent after Foreign Direct Investment increased to 74% in year 2000. FDI led to increase in number of operators per circle and competition. This was followed by introduction of Circle Specific Mobile Number Portability (MNP) in 2011 and National portability in 2015. The changed scenario in telecom sector facilitated and accelerated the brand switching in Indian Telecom Market. When the Indian Telecom Industry was going through consolidation & closures in 2015-2017 and existing operators were struggling for profitability, Reliance Jio was commercially launched in September, 2016 and accumulated huge customer base. It is now ranked No 2 among operators with more than 300 million customers. Brand Switching is very convenient today as the process of Mobile Number Portability is far smoother and customers are better informed. Studies and data show that today number of brand switch is higher than new acquisitions. Secondly, reasonable number of customers are switching their brand silently and do not communicate with their service provider. This is leading to more concerning situation for service providers. The present paper attempts to explore factors that lead to Brand Switching Intentions of the existing customers.*

**Keywords:** *Brand Loyalty, Switching Intentions, Satisfaction, Service Quality*

## **1. INTRODUCTION**

Customer loyalty has always been a passion for organizations but now turned into necessity, mainly due to increased competition, specifically in service industry. Customer loyalty attracts a lot of focus as it indicates relationship between customers and organization. Kotler & Keller (2006) defines brand loyalty as the extent of consumer faithfulness towards a specific brand and this faithfulness is expressed through repeat purchases and other positive behaviors such as word of mouth advocacy, irrespective of the marketing pressures generated by the other competing brands. Companies are trying to keep the existing customers by building a strong brand loyalty. Reichheld (2006) established that cost of retaining customer is lower than the cost of acquiring a new customer. In highly competitive markets like India with high unpredictability and little product differentiation, brand loyalty is a major element in marketing strategies and tactics.

Brand loyalty literature tends to concentrate on performance of brands with normal market conditions for current complexities (Keller and Lehmann, 2006) when market disruptions become more prevalent and sustainability of brand loyalty becomes tough. With increasing awareness, it is difficult to please a customer as they are well informed, demanding and more exposed to multiple market players. Thus, Brand loyalty can help a company by creating entry barriers and contribute by giving the ability to respond to competitive threats. It helps in increasing sales, and revenues and the customer's lower sensitivity to marketing efforts of competitors (Delgado-Ballester and Munuera-Alema'n, 1999). Kotler & Keller (2006) confirmed that as brand's percentage of loyal customers goes up, market share increases and the brand becomes more profitable.

The above findings stand valid for telecom market also, but long term loyalty still remains an elusive dream for telecommunication service providers (Moreira et al., 2016). In recent years switching service providers have increased manifold in telecom in west (Tesfom et al., 2016). Keller (2008) has defined brand switching as brand jumping, referring to the processing which a customer change from buying one brand of a product to buying another brand. According to Van Trijp et al (1996), majority brand switches occur not because they are inherently rewarding but because they are essential for attaining or avoiding another purchase or consumption. Young adults are observed to be easily attracted by such motivation because of inadequate financial resources (Ness et al., 2002). Furthermore, Shukla (2009) established a relationship between brand switching and brand loyalty and found that brand switching occurs due to decline in brand loyalty and growing acceptance of other brands, which leads to customer's willingness to try alternative brands.

Brand switching in services is a growing research area in marketing. Several studies have highlighted the factors contributing to customer brand switching behavior. Crosby and Stephen (1987) found that dissatisfaction is the key element in the insurance industry. Kelley, Hoffman, and Davis (1995) found that service encounter failures in the retail industry trigger brand switch. Further many studies suggested that service quality and satisfaction are related to service switching (Zeithaml, Berry, and Parasuraman, 1996).

### ***Indian Telecom Industry***

Indian Telecommunication Network stands at number two position, the China being number one, with respect to size and number of users. India also have the distinction of having second largest customer base of internet users with 636.73 million subscribers as of March, 2019. With such a huge number of mobile users the overall tele-density is 89.92%. Indian Telecommunication Industry contributed nearly 6.5% (Rs 9 Lacs Crores) of GDP against world average of 4.6% for the year 2018 (Economic Times India and GSMA \_Landon based Telecom Trade Body). GDP contribution is estimated to reach nearly 8% (Rs 14.5 Lacs Crores), once 5G auctions are through and 5G services are rolled out.

Telecom Industry took a major leap in 1995 once the sector opened for private investments. First major disruption was in year 2000 when FDI was increased to 74% from 51% and this resulted a band of foreign operators investing heavily along with their Indian Partners, few nationally but most of them were limited to specific circles only and resulted in to increase in number of Telecom Operators and the number went up to 7 and 8 operators per circle by year 2007-08. This led to fierce competition, varied product offering and price cuts to attract customers, “price cut’ being the prime tool. Today India has the lowest voice and data rates across globe with second largest mobile users as 1171 million as of 31<sup>st</sup> August, 2019. Second major disruption was the introduction of Mobile Number Portability in 2011 within circle followed by National MNP in 2015, which allowed a mobile customer to change the operator but to retain his mobile number nationally. Mobile Number Portability has fueled the pace of Brand Switch and forced the service providers to think and rethink the acquisition and service strategy in a way to keep the customer intact with their respective brands.

Hyper competition and lower revenue paved way for consolidation of Indian telecom industry and most of the regional and national players faced mergers, bankruptcy and closure of operations. Under the above turmoil & circumstances Reliance Jio was commercially launched on September, 2016 and had accumulated customer base of 50 million in first 3 months itself. The customer acquisition did not slow down here and continued with the same pace. Reliance Jio is currently at number two position with 29.74% market share with over 300 million subscribers.

## **2. REVIEW OF LITERATURE**

The Review has shown that many factors have been identified which contribute to brand switching behavior.

### ***Brand Loyalty***

According to Shrivastava and Dixit (2017) customers with higher age on network with any service provider have greater loyalty. Longer association can only be possible if customers are satisfied with overall service offerings. There are researches confirming positive correlation between brand loyalty and brand switching. Sahi, Sambyal & Sekhon (2016) also confirms through their study that higher the loyalty lowers the switching intentions. On the contrary, Hussain, & Zubairshah (2018) found brand image insignificant and does not impact brand switching as influence of culture may be plausible explanation of dimensions that differ from those in the original model.

### ***Customer Satisfaction***

Customer satisfaction is mainly a mental comparison between expectations and the perceived performance after a specific purchase. Serving customers and providing them with satisfaction

have become the prime focus of modern marketing theory (Mishra, 2010). Martins (2013) undertook a study on switching intentions of mobile users of Brazil and Germany and found that customer satisfaction seems to have inverse relationship with switching intentions in both countries. Customer satisfaction has an antecedent like perceived service value and perceived performance of service. Hussain, & Zubairshah (2018); Shrivastava and Dixit (2017) also found in their respective study that customer satisfaction arrests brand switching and are negatively correlated.

### ***Service Quality***

Service quality plays significant role in brand switching intentions and induces transition from being a loyal customer to switching intentions. Aslam and Farooghi (2018) researched on factors leading to brand switching and found that inconvenience and service encounter failure have significant and inverse impact on brand switching. Uppu, Pujari & Gundala (2016) and Quoquab et al. (2018) found service quality is the most critical factor to brand switch confirming to above studies.

### ***Switching Cost***

Shah, Hussain, & Zubairshah (2018) confirmed that switching cost has inverse effect on brand switching, higher switching cost will lead to lower brand switch intentions. Quoquab et al. (2018) found that switching cost plays a moderate role in switching intentions. On the contrary Wimalasiri (2018) in his study for under graduates to evaluate the impact of switching cost concluded that switching cost has insignificant impact on brand switch means even if the cost is higher; subscriber may switch.

### ***Price***

Uppu, Pujari & Gundala (2016) and Hussain, & Zubairshah (2018) concluded that price plays a critical role and one of the most important factor which makes the customers to switch loyalties to another provider. On the other hand, Aslam and Farooghi (2018) researched on factors leading to brand switching and found that impact of price was insignificant as price is no longer a differentiator as it was similar all across service providers.

Most of the researches which have been undertaken in the past to study switching behavior were more focused on in finding out reason from customers those who have already “switched” from one brand to another. Studies also indicate that significant number of brand switching happens quietly. Uppu et al. (2016) found that 55.65% respondents have intentions to switch brand and 43.33 % (out of 55.65%) have already switched in last one year. Moreover, it was also found that 78% of total subscribers switched their brand quietly and did not contact their parent service provider. The operator Reliance Jio is chosen for study as it is at No 2 position with over

300 million customers in just 3.5 years of operations and has the distinction of clocking the fastest growth.

Keaveney (1995) developed a model to examine consumer switching behavior across service providers. The model includes eight factors influencing service switching; they are pricing, inconvenience, core service and service encounter failures, responses to service failures, competition, ethics and automated switching. Considering the above research the study has been undertaken with following objective

- To explore the factors that lead to brand switching intentions with special reference to Reliance Jio.

### **3. RESEARCH METHOD**

#### ***The Study***

It is an exploratory research and the sample universe is existing customers of Reliance Jio who has minimum 3 months association with the operator. The care was taken that the questionnaire is given only to existing customers of Reliance Jio.

#### ***Tools for Data Collection***

A questionnaire with final 26 items was used for data collection. The questionnaire was on 5-point Likert Scale and was primarily adapted from study by Quoquab et al. (2018). It was further refined and altered according to objective of the study with specific reference to Reliance Jio. Initially, 33 items were framed and narrowed down to 26 after discussing with the executives of Telecom Industry. The questionnaire that was prepared for collection of responses was distributed through emails and other social media services in the form of “Google Form”.

#### ***Tools and Data Analysis***

Item total correlation was done to determine internal consistency among the items. The item (I like to experience freshness and change in services and offerings) was found insignificant with the correlation value 0.12898. As the value is less than desired 0.1946 hence the item is eliminated and not considered for further studies. Remaining 25 items were further subjected to second iteration and all the items were found significant. The Cronbach's Alpha test for 25 items produced the Reliability of 0.903 which confirms the consistency and stability. The Factor Analysis was done for 25 items, which yielded seven factors. They are convenience (8.794), satisfaction (1.876), product differentiation (1.759), value for money (1.547), service quality (1.414), latest technology (1.126) and value added services (1.012). Further, the Principle Component Analysis is used to get the % of variance, which comes at 70.113% against desirable variance of 60%.

## 4. DISCUSSION

Seven factors have been identified. They have been discussed with available research studies.

### ***Factor-1: Convenience***

The factor Convenience is constituted of eleven items with a total factor load of 8.794 and 35.175% of variance. The items are as under:

Convenience	14- Hassle-free complaint registration process	0.871
	16- Speed of complaint resolution	0.844
	15- Adequate Customer support	0.787
	19-Pre purchase expectations and commitment were met	0.621
	17- Right choice by subscribing Jio	0.609
	18- Fully satisfied with Jio	0.603
	11- Network coverage and connectivity	0.579
	12- Value added services and content	0.561
	10- Voice Call quality	0.548
	9- Data speed	0.537
	13-Subscription process is customer friendly	0.516

Convenience means “to proceed without difficulty and add to one’s ease or comfort”. Convenience to a customer is any element of customer experience that saves the customer’s time and effort. It can also be understood as the ease of operating any product or services without frustration. Convenience in service can be thought of as a means of adding value to consumers by decreasing the amount of time and effort a consumer must expend on the service (Colwell et al., 2008). Kaura (2013) found that service convenience in banking sector increases customer satisfaction. Decision convenience was most profoundly found to influence customer satisfaction compared. Aslam and Farooghi (2018) also endorsed in their study that inconvenience and service encounter failure have significantly impact and increase brand switching. Chang et al. (2010) found in their study that that customer satisfaction is positively influenced by service convenience and customer loyalty is positively influenced by customer satisfaction, Furthermore, service convenience indirectly affect satisfaction through perceived service value.

### ***Factor-2: Satisfaction***

This factor is composition four items with factor load of 1.876 and 7.506 % of variance. The items are as under:

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Satisfaction	33- Will consider Jio for my next purchase	0.801
	32- Would recommend Jio to a friend or colleague	0.742
	34- Overall opinion of Jio as a brand	0.708
	28- Would prefer to stay with Jio	0.547

Satisfaction is one of the most critical factors and is found to be integral part of any service industry and defined as the customer's after-purchase judgment or evaluation of a specific product or service. Serving customers and providing them with satisfaction have become the prime focus of modern marketing theory (Mishra, 2010). Clemes (2007) empirically concluded from a study in the banking industry customer satisfaction and switching behavior is negatively correlated. Kim et al. (2008) concluded that customer satisfaction and switching barriers are each found to have a direct effect on subscribers' intentions to switch. Higher satisfaction lowers the intentions to switch and vice versa. Study also revealed that highly satisfied customers tend to show a high likelihood of staying and higher tolerance to price increases or decreases by competitors.

### ***Factor-3: Product differentiation***

The factor Product Differentiation consists of four items with factor load of 1.759 and 7.035 % of variance. The items are as follows:

Product Differentiation	29- Would like to try a different Service Provider	0.721
	30- I intended to try new features/ options provided by other Service Providers	0.717
	23- I often think of switching from Jio	0.477
	21- I can stop using Jio	0.469

Differentiation can be understood as the action or process of differentiating or distinguishing between two or more things or people. Product differentiation is a marketing strategy that strives to distinguish a company's products or services from the competition. Greenstein and Mazzeo (2006) presented a strong evidence of a consistent role for product differentiation in building and expanding markets for local telecommunications in US including some of them disrupted many market participants. This included market entry strategies that resulted in markets with significantly heterogeneous product types in contrast to markets dominated by firms of one type or other. The patterns of new entrants in market suggest that they were careful about the product characteristics of their competitors. The study also confirms that new Service Providers entered markets where their types of services were more attractive to consumers and product offerings were important to their success. Kothari et al. (2011) sees service quality as "differentiation in services" which can be considered as a valid observation because if all

service providers have similar service quality standards, customers will not have an intention to switch to other service providers

#### ***Factor: Value for money***

The factor Value for Money consists of two items with total factor load of 1.547 and 6.188% of variance. The items are as follows:

Value for Money	24- If I switch from Jio, my monthly cost may go up	0.804
	25- If I switch from Jio, data speed may get compromised	0.775

Best value for money can be understood as the most advantageous combination of cost, quality and sustainability to meet customer requirements. Quality means meeting a specification which is fit for purpose and sufficient to meet the customer's requirements. Afzal et al. (2013) in their study considered various parameters and found that price is the second most influencing factor in brand switching and has shown strong positive relationship with switching behaviour. According to Peng and Wang (2006) high pricing negatively influenced the purchase probabilities of customers. Customers mainly switch due to pricing issues; they can be either high or unfair pricing. Kim et al. (2008) established relationship of price with satisfaction and trust and described the price as being the most influential factor on customer satisfaction and trust.

#### ***Factor-5: Service quality***

The next factor is Service Quality having one item with total factor load of 1.414 and with % of variance of 5.657%. The item is as bellow:

Service Quality	22- I will switch if I face service issue with Jio	0.846
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Service Quality is an assessment of how well a delivered service conforms to the client's expectations. Bateson (1995) stated that the service quality is generally conceptualized as an attitude, the evaluation of the service offered. Quality is basically made up from a series of evaluated experiences and usually fluctuates less comparatively than attitudes built from the satisfaction and emotions (Nair, 2014). Althonayan et al. (2015) reconfirmed in their study that better service quality increases customer satisfaction and helps in decreasing brand switching intention.

#### ***Factor-6: Latest technology***

The factor Latest Technology comprising two items with total factor load of 1.126 and % of variance is 4.502 %. The items are as follows:

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Latest Technology	26- I may lose opportunity to experience 5G, if I switch from Jio.	0.766
	20- Jio has increased my Internet usage	0.715

With technology ruling every industry, companies are in need to modify their products and services to offer quality products and services to the customers. Moreover, when deployed and implemented the right way, technology can be the key enabler in improving the customer service and experience. Liotou et al. (2015) revealed that technical quality is directly linked to customer satisfaction and experience and telecom operators needed a radical shift from technical quality requirements to customer experience guarantee. This is critical due to ever increasing mobile applications and explosion of traffic.

#### **Factor7: Value added services**

The seventh and last factor is Value Added Services with total factor load of 1.012 and % of variance of 4.050%. The item is as follows:

Value Added Services	27- I am missing out on some offers and features provided by other Service Provider	0.761
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Nair (2014) found value added services as the latent variable with high significant strength of relationship with customer satisfaction and suggested that to be successful in the present competitive telecom market, service providers must improve customer satisfaction by focusing on the underlying factors like value added services; Service products; tariff; corporate image and service quality. Akbar, Soomro and Khan (2016) concluded in their study that the cellular service users are most responsive to pricing structure, value-added services and call quality out of identified eight different features. Respondents clearly showed their intention of switching if their network service providers are unable to deliver competitive value-added services and adequate call quality. Further the study reveals that Value added services and Pricing strategies are the two important factors that influence the consumer behavior while switching the brands in telecom sector.

## **5. CONCLUSION**

The study is undertaken with an objective to explore the factors that lead to brand switching intentions with special reference to Reliance Jio. Seven factors, namely convenience, satisfaction, product differentiation, value for money, service quality, latest technology and value added services were identified.

## **IMPLICATION**

Customer's Voice is the most valuable input for any organization. As this study examines switching intentions based on opinion of Reliance Jio customers on identified factors. This will

be a critical input to the Indian Telecom Industry and in specific to management of Reliance Jio with regard to appropriate action, suitable change in policy or strategy to arrest switching intentions now and be future ready for any such requirement at the earliest.

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# **Development and Standardization of a Psychometric Tool to Assess the Degree of Fear**

**Sarika Patel, Upinder Dhar**

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## **ABSTRACT**

*Fear is a powerful emotion experienced by people across cultures. According to American Psychological Association Dictionary of Psychology (2018), ‘fear is a basic, intense emotion aroused by the detection of imminent threat, involving an immediate alarm reaction that mobilizes the organism by triggering a set of physiological changes.’ The present study is an attempt to develop a standardized tool for assessing fear amongst the people drawn from general population. The study was conducted on a sample of 160 people (81 females, 79 males). Analysis of the data resulted in a scale comprising of 29 items focused at assessing the extent of fear on Likert scaling method. The factors of fear were also identified to understand the constitution of fear.*

**Keywords:** *Physiological Reaction, Classical Conditioning, Vertebrates, Anxiety, Innate Fear.*

## **1. INTRODUCTION**

Fear is an important emotion and a survival mechanism. When one comes across threatening stimuli such as a speeding car, the body reacts to it, mostly in the form of physical reactions. These reactions include increased heart rate, sweating, shouting, freezing or fleeing (Kozlowska, Walker, McLean & Carrive, 2015). In other words, when one comes across something that can harm him/her physically, psychologically or emotionally, he/she is afraid and the body reacts to the feeling of fear. Sometimes this response is called “fight or flight response”. Fear is a basic and common emotion experienced by most of the people in their lives. Almost every person fears something at some or the other point of life. There are various types of fear like fear of animals, fear of death, fear of failure and fear of losing something amongst others. Motivation and personality theories indicate that there are five types of fear that are usually experienced by people and are named as: evolutionary danger, novelty, intensity, learning and social. Whenever a person confronts a stimulus that falls under any of the above mentioned categories, the person will experience fear. For example, a person who has to board the flight for the first time (Gray, 1987).

Fear has been defined by several researchers according to their understanding about it. Some of the most common and comprehensive definitions are covered in this paper. The first definition is given by LeDoux in 2013 and it states that fear is what happens when the brain is aware that

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*Research Scholar, SVVV, Indore  
Vice Chancellor, SVVV, Indore*

its personal well-being (Physical, Mental, Social, Cultural, Existential) is challenged. Feeling of fear like any other feeling results from the cognitive processing of situations(LeDoux, 2013). The second and the most comprehensive definition is given by American Psychological Association Dictionary of Psychology and it defines fear as the basic, intense emotion aroused by the detection of imminent threat, involving an immediate alarm reaction that mobilizes the organism by triggering a set of physiological changes. These include rapid heartbeat, redirection of blood flow away from the periphery toward the gut, tensing of the muscles, and a general mobilization of the organism to take action (American Psychological Association, 2018).

Fear is an emotion that is both innate and acquired. Behaviourists like John B Watson in his theory of fear said that ‘innate stimuli of fear’ (those stimuli that can produce fear without learning) are limited to loud noise, sudden loss of support and pain. Fear due to all the other stimuli is learned i.e. acquired by experiences. Also, it treats all species as equal, animals and humans both learn fear(Gray, 1987). Ethologists like Konrad Lorenz and Niko Tinbergen performed a series of experiments to show that fear is an instinct and comes naturally from birth and also differs from species to species (Gray, 1987). It believes that every vertebrate species is biologically prepared to withdraw, to attack, to become immobile, or to issue a distress call in response to a small class of events that might signal potential harm (Blanchard & Blanchard, 1972, 1988).

There is a clear distinction between three concepts that are used interchangeably in clinical settings: Fear, Anxiety and Phobia. Anxiety is defined as an emotion characterized by apprehension and somatic symptoms of tension in which an individual anticipates impending danger, catastrophe, or misfortune. The body often mobilizes itself to meet the perceived threat: Muscles become tense, breathing is faster, and the heart beats more rapidly. Anxiety may be distinguished from Fear both conceptually and physiologically, although the two terms are often used interchangeably. Anxiety is considered a future-oriented, long-acting response broadly focused on a diffuse threat, whereas fear is an appropriate, present-oriented, and short-lived response to a clearly identifiable and specific threat. A persistent and irrational fear of a specific situation, object, or activity (e.g., heights, dogs, water, blood, driving, flying), which is consequently either strenuously avoided or endured with marked distress. (APA Dictionary of Psychology, 2018).

For the purpose of this research, an *operational definition* was framed on the basis of available definitions and theories: Fear is a feeling induced by perceived / actual threat that occurs to cause change in metabolic functions and change in behaviour such as fleeing, hiding or freezing from perceived/actual traumatic event.

## **2. RATIONALE**

Researchers are still trying to get an inclusive definition of fear that can explain this complex but important emotion in a comprehensive way. There are a number of researches on concepts like anxiety and phobias that are closely related and are used interchangeably in clinical settings

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but are not same as fear. Also, there are very few tools available to measure fear in a normal population in Indian context. This research is an attempt to develop and standardize a measure of fear for Indian population which can be later used as a diagnostic tool in clinical settings.

### **3. OBJECTIVES**

1. To develop and standardize a psychometric measure to assess the degree of fear.
2. To identify the constituent factors of fear.

### **4. METHOD**

**Study:** To develop a psychological tool for assessing the degree of fear in terms of various constituent factors.

**Design:** A multi-stage randomised design was used for this study.

*Stage 1:* An operational definition was framed on the basis of review of literature.

*Stage 2:* Seventy-five (75) statements were made keeping in view the operational definition.

*Stage 3:* The statements were reviewed and repetitive as well as ambiguous statements were dropped.

*Stage 4:* Thirty (30) Judges were approached for the assessment of the items. The eligibility for being a judge was post-graduation as minimum qualification and at least 10 years of experience after Post graduation.

*Stage 5:* The statements that received more than 75 percent of acceptance by the judges were retained for developing the scale.

*Stage 6:* Thirty-one (31) statements were, thus, retained out of seventy-five (75) statements made for the purpose initially.

*Stage 7:* A tool of 31 statements, measured on a five-point Likert scale was finalized.

**Sample:** The tool developed in this study was administered on 182 people. After collecting the data, 22 filled up forms were dropped in view of either being incomplete or biased responses. The details of the final sample of 160 people are as under:

Males = 79

Females = 81

Age = 21 to 60 years

Average age = 28 years

The data was collected using simple random sampling from Indore city of Madhya Pradesh.

**Tools for Data Collection:** The tool developed for the study was administered for data collection. The tool comprises of 31 statements measured on a five-point rating scale. Instructions were clearly mentioned in the beginning of the scale.

**Tools for Data Analysis:** SPSS 23.0 version was used for data analysis. Item-total correlation and Factor analysis were employed for analysing the data. Split-half reliability was computed for the scale and it was found to be 0.76. In order to find out validity from coefficient of reliability (Garret, 1981), the reliability index was calculated, which indicated high validity on account of being 0.87.

## 5. RESULTS

Standardization is a mandatory process in developing a psychometric tool, hence reliability, validity and norms were computed for standardization of this scale.

**Item-total correlation:** Item total correlation was computed on the sample of 160 and in the first iteration two (2) items were found insignificant. These two items (15, 27) were thus dropped. On the second iteration of 29 items, all the items were found significantly correlated with the total score. Thus, the scale was finalised on 29 items.

**Factor Analysis:** KMO-Bartlett test for sampling adequacy was computed on the data and the score came out to be 0. 782. The scores obtained on the final scale were subjected to factor analysis. Eight (8) factors obtained through factor analysis are as follows:

### ***Factor 1: Loss of Belongings***

This factor is constituent of seven (7) items like: losing important documents (0.743), getting arrested in false accusation (0.713), loss of property (0.701), cheat on partner (0.620), ill parents (0.611), breaks into home (0.597), end of a relationship (0.589) with total factor load of 4.574 and variance of 13.746 percent.

### ***Factor 2: Being Alone***

This factor is constituent of five (5) items like travelling alone (0.832), out at night (0.740), alone at home (0.721), boarding a flight for the first time (0.596), dark (0.533) with total factor load of 3.422 and variance of 10.250 percent.

### ***Factor 3: Haunting Experiences***

This factor is constituent of two items like seeing a ghost (0.826) and attacked by evil spirits (0.794) with total factor load of 1.620 and variance of 7.939 percent.

### **Factor 4: Mishappening**

This factor is constituent of three items like witnessing a road accident (0.783), someone dying in front of me (0.666), reminded of past surgery (0.650) with total factor load of 2.099 and variance of 6.989 percent.

### **Factor 5: Performance before others**

This factor is constituent of two items like perform on stage (0.837) and speaking in front of others (0.741) with total factor load of 1.578 and variance of 6.899 percent.

### **Factor 6: Wrong Decisions**

This factor is constituent of four items like wrong decision (0.782), great loss of money (0.597), unable to fulfil expectations (0.451), cross the deadline (0.418) with total factor load of 2.248 and variance of 6.424 percent.

### **Factor 7: Making Excuses**

This factor is constituent of only one item which is telling a lie (0.821) with total factor load of 0.821 and variance of 6.328 percent.

### **Factor 8: Facing the Test**

This factor is constituent of five items like appearing for an interview (0.613), appearing for an exam (0.548), result is announced (0.523), taking a giant wheel ride (0.471), seeing a snake (0.441) with total factor load of 2.596 and variance of 5.375 percent.

### **Factor-wise norms**

**TABLE 1: Norms for interpretation of raw scores**

Factors	1 Loss of belongings	2 Being Alone	3 Haunting Experiences	4 Mishappe ning	5 Performance before others	6 Wrong Decisions	7 Making excuses	8 Facing the test	Total
Mean	25.30	12.01	6.78	9.90	5.81	13.29	3.24	16.94	93.01
SD	6.15	4.33	1.27	2.74	2.28	3.31	1.20	3.43	15.70
High	32 & above	17 & above	9 & above	14 & above	9 & above	18 & above	5	21 & above	110 & above
Normal	19-31	8-16	5-8	7-13	3-8	10-17	2-4	13-20	77 to 109
Low	18 & below	7 & below	4 & below	6 & below	2 & below	9 & below	1	12 & below	76 & below
Statements	7, 12, 24, 19, 25, 4, 29	6, 8, 9, 10, 11	22, 23	13, 14, 18	26, 27	15, 16, 17, 21	28	1, 2, 3, 5, 20	1, 2, 3...29
Total	7	5	2	3	2	4	1	5	29

The calculation of norms for general population gives a range with the help of which the intensity of fear experienced by a person can be known. Similarly, a factor wise range is derived, to know the intensity of fear on a particular factor.

## 6. DISCUSSION

The authors have studied the constituent factors of Fear in this study. It comprises the development and standardization of a 29-item scale to assess the degree of fear. There are eight constituents of fear according to this study, namely Loss of Belongings, Being Alone, Haunting experiences, Mishappening, Performance before others, Wrong Decisions, Making Excuses and Facing the Test.

*Loss of belongings* is the first constituent factor of fear as it has the highest percent of variance. This means that most of the people who experience fear have loss of belongings at the back of their mind. This factor is comprised of statements like losing important documents and loss of property as seeds embedded within the experience of fear. Since people connect things with their identity, so losing their belongings is like losing their identity. Terror Management Theory (Biernat & Danaher, 2013) suggests that humans are fundamentally afraid of the thought of losing everything (dying).

*Being Alone* is the second constituent factor of fear, as it has the second highest percent of variance indicating that people experience fear when alone. A study by Lee et. al., (2019) found that people generally experience increased loneliness in three phases of their lives, the late 20s, mid 50s and late 80s. The probable reasons for fear of being alone at these stages of age could be relocating to a different city for studies or work, being away from home, poor interpersonal relations, lack of support system and several others. Add more experiences like not living with children. This view is supported by the study done by Settersten, Ottusch & Schneider (2015), which discussed the probable factors that could trigger loneliness in adults in their late twenties.

The third constituent of fear found in this study is *Haunting Experiences*, which is comprised of statements like fear of ghosts and evil spirits. Most of the literature available in this context suggests that fear due to ghosts and evil spirits is usually experienced by children. For example, a survey of fears in a large non-clinical sample by Hall discussed fears of the supernatural, such as of ghosts, spirits, and witches (Hall, 1987). It was noted that the majority of children probably pass through at least one stage of fearing ghosts, but these fears tend to decline after adolescence. In contradiction to the available literature, it was found in this study that some people in their late twenties might also experience such fears.

*Mishappening* could be a potential fear in people. It includes instances like fear of witnessing an accident or seeing someone's death. Researches indicate that people generally have fear of mishappenings like crime against them (Patel and Mishra, 2016). Usually, when people have some threatening experiences, they tend to be more fearful; they fear the recurrence of the same unpleasant experience that occurred in the past. While moving towards, late twenties people

have a number of responsibilities, it could be marriage, it could be parenthood or taking care of ageing parents and thus this kind of fear is common at this age. There are researches on fear of death experienced by people at this age (Russac, Gatliff, Reece and Spottswood, 2007).

*Performance before others* is a common fear experienced by most of the people. These fears are usually based on an irrational thinking pattern like ‘people will judge me’, ‘people will make fun out of me’, ‘I may not be able to perform well’, ‘I am a failure’. Fear of evaluation being the major reason for this kind of fear (Valentine, 2002). Since emotional stability matters the most at this age, most people fear performing before others as they attach fear of judgement and fear of failure with their self-worth.

*Fear of making wrong decisions* is one of the most prominent fears in people as most of the important decisions of life related to marriage and finance have a significant impact on the quality of life of a person. Arnett (2014) believed that ‘emerging adulthood’ is a preparation for adulthood and thus people are usually afraid to make wrong decisions in the beginning of this phase.

*Making excuses* ‘Fear of telling a lie’ emerged to be a significant constituent of fear among people. People are concerned more about their image in front of others (social image) and also do not wish to hurt anyone. This is in accordance with ‘fear of losing out’ studied by Bedford and Chua(2018)which suggests that people have fear of losing out. They are well aware about the consequences and thus do not wish to do anything that can lead to trouble. There are a few researches supporting this evidence and further exploration is required.

The least significant constituent of fear found in this work is *facing the tests*. People nearing their thirties have less fear of tests probably because most of the people in this age range have already completed their formal education and are familiar with such situations. Secondly, by this time most of the people are mature, their personalities have been shaped. A lot of people have fear of public speaking or fear of performing before others. Sometimes this fear increases to the extent that people start experiencing performance anxiety. But it is possible to overcome this fear naturally with age and also with the help of cognitive behavioural interventions (Westwood, 2001). Increased understanding of the world around them makes them less fearful on some aspects of life.

Limited number of studies are available referring to the constituents of fear identified in the present study. The findings of this study suggest that loss of belongings, being alone, haunting experiences, mishappening, performance before others, making a wrong decision, telling a lie and facing a test, emerged as major fears among people in their late twenties and early thirties. The probable reasons have been mentioned independently for each factor, still there are some common reasons that justifies the existence of above-mentioned fears. According to Tudor (2003) fear is experienced as a consequence of complex interactions among sets of grouped variables. They are bodies, personalities, social subjects, environment, cultures, social

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structures. The interplay of these factors makes one feel afraid while they come across a particular stimulus, for example, going out in the dark.

## 7. CONCLUSION

A psychometric tool for measuring the degree of fear in normal population is developed. The scale is comprised of 29 items on a five-point rating scale, varying from ‘strongly disagree’ to ‘strongly agree’. The split half reliability of the test is 0.77 and the validity is 0.87. Norms developed for general population indicate that scores between 77.32 to 108.72 should be considered as *normal* fear, scores lying below that as *low* fear and score lying above that as *high* fear.

### ***Implications***

1. The psychometric tool to measure fear developed in this study can be used to differentiate between people who have healthy and unhealthy levels of fear.
2. This tool can be used in clinical settings to measure the degree of fear in patients. This will help in identifying people who are high on fear and are more prone to psychological disorders like anxiety disorders and phobias and thus provide the necessary interventions.
3. Factor-wise norms developed for this study will be helpful in identifying the exact type of fear a person is experiencing. Knowing this can help in designing appropriate interventions for the person.
4. It will be helpful for psychotherapists and counsellors as they can design therapeutic and counselling sessions that are focused specifically on a particular constituent of fear. For example, a person whose score is high on ‘mishappening’, will be provided with specific interventions like CBT and REBT to reduce that fear.

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# **Development and Standardization of a Psychological Tool to Measure the Extent of Pain in Normal Population**

**Saumya Gada, Upinder Dhar**

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## **ABSTRACT**

*Pain is a psycho-physiological response of the body which permeates through all the bodily systems. The International Association for the Study of Pain (2018) defines pain as an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage. Consistent with conceptualizations of general pain as consisting of physical and emotional components, this paper presents the process of developing a psychometric tool to assess general pain. The study was conducted on a sample of 153 respondents and the tool developed comprised of 27 items on five-point Likert scale. The scale can be administered for the assessment of the degree of general pain in normal population for better planning of therapeutic interventions.*

**Keywords:** General Pain, Psycho-Physiological, Unpleasant Experience, Psychometric Tool, Physical Components, Emotional Components

## **1. INTRODUCTION**

Pain is a subjective experience which may disrupt the momentum of daily life by its limiting and negative influence. The word ‘Pain’ itself conveys its impact on one’s life. It comes from the Latin word ‘Peona’ meaning a fine, a penalty. The dominant health challenges like cancer, heart disease or pneumonia are the focal points of scientific and medical research. But, pain is a universal accompanying factor and symptom at times. The perception of pain plays a crucial role in the management of pain. How do people manage pain is also highly influenced by their pain tolerance level. Many people report pain in the absence of tissue damage, usually for psychological reasons. There is usually no way to distinguish their experience from that due to tissue damage if we take the subjective report.

No matter where you are in the world or what language you speak, touching a steaming hot object would hurt and cause pain. But, where does pain come from? The current understanding of pain comes from a combination of research findings from many areas. Instead of looking at pain as purely biological, psychological, or philosophical, an integrated approach to pain gives a more comprehensive idea. The article by Loeser and Melzack (1999) very precisely indicate the

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*Research Scholar, SVVV, Indore  
Vice Chancellor, SVVV, Indore*

changes in the realm of pain. Until the 1960s, pain was considered as an unavoidable sensory response to tissue damage. Infact, pain is probably the most common indicative reason to solicit medical consultation. Discomfort due to headaches, burns, cuts, joint pain, back pain are some commonly occurring complaints of pain during a person's life span. Many components apart from the sensory dimension play an instrumental role in the experience of pain which are still not fully explored and studied. The affective dimension of this omnipresent experience of pain is usually neglected.

The history of pain brings forth multiple theories to describe the various approaches to the understanding of pain. The Hindu philosophy on pain outlined by Pandya (1987) has its basis in the four holy scriptures "Vedas", particularly the Atharva Veda. According to Hindu philosophy, pain and suffering are consequences of 'karma'. Ancient texts, namely from the Syriac Empire (200 BCE), describe pain as a multidimensional experience. The Book of Medicines(Budge 2002), conceptualized pain as the outcome of bile and phlegm mixed with cold and heat.

Medical Approach to pain brings forth four theories of pain. The Specificity theory refers to the presence of dedicated pathways for each somato-sensory process. The Intensity theory of pain conceptualized in the fourth century BCE by Plato defined pain as an emotion which occurs when a stimulus is strong. The Pattern theory of pain was put forth by Nafe (1929). This theory stated that any soma esthetic sensation occurred by a specific pattern of nerve cells. In 1965, Melzack and Patrick Wall proposed the Gate Control Theory of Pain. This theory accepted that there are nociceptors (pain fibers) and touch fibers and proposed that that these fibers synapse in two different regions within the dorsal horn of the spinal cord.

In order to systematically understand the concept of pain, many definitions have been proposed in the past few years. Kumar and Elavarasi (2016) in their study enlisted various definitions of pain and few diagnostic classification systems for various pain disorders. The definition of Pain by the International Association for the Study of Pain (2018) seems most relevant. It states that pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage.

Olson (2015) believes that over the past 30 years a better comprehension of pain as the 5th vital sign has been achieved. The identification of pain as 'the fifth vital sign' since 1990s did increase the needed visibility and attention to pain assessment. Ruscheweyh et al., developed the Pain Sensitivity Questionnaire for the assessment of pain sensitivity based on pain intensity ratings of daily life situations. The West Haven-Yale Multidimensional Pain Inventory (WHYMPI) developed by Kerns is widely used with behavioural and psycho physiological assessment strategies in the evaluation of chronic pain patients in clinical settings.

The McGill Pain Questionnaire (MPQ) and its brief analog, the short-form MPQ, are among the most widely used measures of pain. Bodily and Emotional Perception of Pain (BEEP), is a

questionnaire to measure Reaction to Pain in Chronic Pain Disorders developed by Antonio et al., (2019). The Wong-Baker Faces Pain Rating Scale is a pain scale developed by Donna Wong and Connie Baker. This pain scale was originally developed for children but can be used with all patients age 3 and above.

The Visual Analogue Scale (VAS) consists of a straight line with the endpoints defining extreme limits such as ‘no pain at all’ and ‘pain as bad as it could be’. In a Verbal Rating Scale (VRS) adjectives are used to describe different levels of pain. The respondent is asked to mark the adjective which fits best to the pain intensity.

In pain drawing, the patient is asked to mark the areas of pain on an outline of a human figure. According to some protocols, the subjects are just asked to shade those body areas where they feel pain. Others ask the patients to indicate different types of pain (e.g. burning, electrifying, etc.) with different symbols and several grading-schemes have been developed. Pain-O-Meter, this tool consists of a mechanical VAS and two lists of terms describing the pain affect.

Operational Definition of General Pain formulated for the present study:

*General Pain refers to an unpleasant sensation that can range from mild and localized discomfort to agony, which has both physical and emotional components.*

## **2. RATIONALE**

Pain is an experience which can affect all systems of our body. No disease is independent of discomfort. The mere presence of pain may affect an individual’s routine life. The pain responses are mostly influenced by psychological, social, genetic, cultural and cognitive factors. Therefore, pain tolerance threshold varies from person to person, and the experience and effect of pain is also subjective.

Quantification of pain becomes difficult because of its multi-dimensional nature. Over the last few decades, the emotional component of pain apart from the physical component has received attention in the scientific community. Valid and reliable assessment of pain has been mainly limited to the clinical population. A psychometric tool which can be used for assessment of general pain in the normal population is required, especially in the Indian context. The intent of the study is to fill this gap and develop a Psychometric assessment tool which measures the emotional as well as physical components of pain. The tool would provide better understanding of general pain and thereby facilitate the management of pain.

## **3. OBJECTIVES OF THE STUDY**

- 3.1 To develop and standardize a measure to assess general pain.
  - 3.2 To identify the constituent factors of pain.
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## 4. METHOD

**4.1 Study:** To develop and standardize a psychological tool to assess general pain.

**4.2 Design:** A multi-stage randomised design was used in making the psychological tool to assess general pain.

Stage 1: Review of Literature on pain was done. Operational definition was framed on the basis of the review of literature.

Stage 2 : In view of the operational Definition, 74 statements were made.

Stage 3: The statements were reviewed and repetitive as well as ambiguous statements were dropped.

Stage 4: Assessment of the statements was done by 32 judges for their expert inputs. The eligibility for the judges were minimum 10 years of work experience after a post graduate degree in any discipline.

Stage 5: The statements that received more than 75% of acceptance by the judges were retained for developing the scale.

Stage 6: 27 statements were, thus retained out of 74 statements made for the purpose initially.

Stage 7 : A tool of 27 statements on a five-point Likert Scale was finalized. The options being : Never, Rarely, Sometimes, Often and Always with the score of 1, 2, 3, 4 and 5 respectively ( Appendix I).

### 4.3 Sample

Simple random sampling from Indore city, Madhya Pradesh was used to collect data for the study. The tool developed in this study was administered on 160 people. After collecting the data, seven filled up forms were dropped in view of either being incomplete or biased responses.

The details of the final sample of 153 respondents are as under:

Males = 85

Females = 68

Age = 21 to 60 years

Average Age = 39 years

#### **4.4 Tools for Data Collection**

Primary data was collected by using the scale developed in the research consisting of 27 statements with 5-point rating scale. A brief guideline about the procedure to fill the questionnaire was given to the participants. The demographic data including name (optional), age, gender, education, occupation, place of living was recorded.

#### **4.5 Tools for Data Analysis**

The data analysis techniques applied in the research were Item total Correlation and Factor Analysis. Split half reliability was computed using the Spearman Brown Coeffcient and was found to be 0.870. In order to find out the validity from coefficient of reliability (Garret, 1981), the Index of reliability was calculated and was found to be 0.932. Computation was done with the help of SPSS Version 23 (Statistical package for the Social Sciences, IBM Inc., Chicago, USA).

### **5. RESULTS**

The reliability, validity and norms for the psychological scale were computed in order to standardize the scale.

#### **5.1 Item - Total Correlation**

Item - Total Correlation was computed on the sample of 153 respondents (68 Females and 85 Males). In first iteration, all items were found to be significantly correlated at 0.05 Level of Significance. Thus, the scale was finally developed with 27 items.

#### **5.2 KMO Measure of Sampling Adequacy and Bartlett's Test of Sphericity**

The Kaiser - Meyer - Olkin Measure of Sampling Adequacy value was 0.866 indicating that the sample size was adequate and the data can be further subjected to Factor analysis.

#### **5.3 Factor Analysis**

Seven factors were drawn on the basis of factor analysis using Principal component method and Varimax Rotation.

##### **Factor 1 –Helplessness**

This factor is constituted of eleven items like Seeing a badly injured person (.876), Seeing a person struggling to breathe (.867), Seeing a profusely bleeding person (.865, Seeing a person with deep burns (.840), Seeing a person dying (.828), Seeing a person being physically tortured

(.819), Seeing an animal being hit by a vehicle (.796), Seeing a disabled person struggling to ascend/ descend the stairs (.713), Seeing an elderly person doing laborious work (.708), Seeing a wound being dressed (.624), and Seeing a person pulling a heavy cart (.596). The total factor load was 8.532 with variance of 26.336 percent.

### ***Factor 2- Long Working Hours***

This factor is constituted of 3 items like when I stoop to work (.733), while sitting on the ground (.723) and bowel movement after irregular meals (.533). The total factor load was 1.989 with variance of 8.753 percent.

### ***Factor 3 – Exertion***

This factor is constituted of 3 items like Pain in feet, if walk briskly (.774), Pain in neck/ shoulder, if driving a four wheeler (.619) and Pain in calf, when running continuously (.540). The total factor load was 1.933 with variance of 7.872 percent.

### ***Factor 4 – Strenuous Activity***

This factor is constituted of 2 items like, Pain in eyes, if reading in dim light (.763) and Pain in thighs, if exercising after a long gap (.455). The total factor load was 1.218 with variance of 6.652 percent.

### ***Factor 5 – Uncomfortable Posture***

This factor is constituted of 3 items like, Pain in feet, if wear heeled footwear (.774), Pain in shoulders, if carrying heavy luggage (.612) and Pain in back, if riding a two wheeler (.605). The total factor load was 1.99 with variance of 6.275 percent.

### ***Factor 6 - Longer Sittings***

This factor is constituted of 3 items like, Pain in neck, if working on the laptop (.839), Pain in back, after sleeping in a particular posture (.470) and Pain in knees, if sitting in a particular posture (.397). The total factor load was 1.706 with variance of 6.226 percent.

### ***Factor 7 – Inequity***

This factor is constituted of 2 items like, Pain in knees, if standing continuously (.621) and Pain on seeing a child carrying a heavy bag (.612). The total factor load was 1.233 with variance of 4.498 percent.

The factor analysis showed a random spread of attributes across factors. To obtain further clarity, the statements were grouped under different areas of the body. The mean scores were computed as under:

#### ***Area-wise mean scores***

<b>Area of the body</b>	<b>Back</b>	<b>Feet</b>	<b>Shoulders</b>	<b>Neck</b>	<b>Knees</b>	<b>Thighs</b>	<b>Eyes</b>	<b>Calf</b>
Mean Score	8.688	6.07	5.610	5.409	5.253	3.350	3.240	3.175
Item Nos.	6, 10, 11	13, 18	2, 17	1, 17	3, 20	7	21	23

#### ***5.4 Norms***

The calculation of norms for general population gives a range which helps in assessing the extent of pain experienced by an individual. Likewise, factor-wise norms range were computed to determine the extent of pain experienced on a particular constituent factor.

**TABLE 1: Factor-wise Norms for Interpretation of Raw Scores**

<b>Factors</b>	<b>1 Helplessness</b>	<b>2 Long Working Hours</b>	<b>3 Exertion</b>	<b>4 Strenuous Activity</b>	<b>5 Uncomfortable Posture</b>	<b>6 Longer Sitting</b>	<b>7 Inequity</b>	<b>Total</b>
Mean	43.61	8.41	8.76	6.63	9.16	8.84	6.11	92
SD	10.03	2.76	2.81	1.84	2.63	2.42	1.42	16
High	55	12 & Above	13 & Above	9 & Above	13 & Above	12 & Above	9 & Above	109 & Above
Normal	34-54	6-11	6-12	5-8	7-12	6-11	5-8	76-108
Low	33 & Below	5 & Below	5 & Below	4 & Below	6 & Below	5 & Below	4 & Below	75 & Below
Item Nos.	12, 16, 14, 5, 4, 19, 9, 27, 25, 22, 8	11, 15, 24	18, 17, 23	21, 7	13, 2, 10	1, 6, 20	3, 26	1, 2, 3, 4, 5, 27
Total	11	3	3	2	3	3	2	27

## 6. DISCUSSION

The present study has made an attempt to develop and standardize a 27 item psychological tool to measure the extent of pain in general population. The seven constituent factors of pain identified in the study are: Helplessness, Long working hours, Exertion, Strenuous activity, Uncomfortable posture, Longer sittings and Inequity.

### ***Factor 1: Helplessness***

It means that merely seeing a person in physical pain and being unable to help may induce pain in an individual. Helplessness is experienced as an outcome of empathy. People who empathise may feel helpless when unable to help a person in distress, whereas a person with sadistic tendencies may not experience helplessness. A study conducted by Franklin et.al (2013) studied the neural responses to perceiving suffering in humans and animals when they were presented with pictures of human versus dog suffering. They found that viewing human and animal suffering led to large overlapping regions of activation previously implicated in empathic responding to suffering.

### ***Factor 2: Long Working hours***

It describes the pain experienced due to long working hours. Any activity which is performed for more than the usual duration, may cause discomfort. The average age of the sample in the scale was 39, which happens to be the age in which individuals usually focus on their career related ambition, plan for future years, strive for stability in personal life, explore self and attend to physical health demands. Strife for balance amongst various facets of life is a signature challenge of this age group. Understandably, long working hours take a toll on their physical health. Guo (2002) studied the relation of working hours spent on repeated activities and prevalence of back pain. The results indicated that the prevalence of back pain increased as the number of working hours spent increased.

### ***Factor 3: Exertion***

A low score indicates that the respondent experiences low level of pain. It may indicate high level of pain tolerance, sedentary lifestyle and a passive life. Female respondents of the average age group are likely to experience pain due to post child birth exertion. Heneweer et.al (2009) explored the relation between physical activity and low back pain. Being physically active is often suggested to be important in the prevention and management of lowback pain. The relation between the level of activity and back pain may be a U-shaped curve, i.e., both inactivity and excessive activities (back-unhealthy activity) present an increased risk for back pain.

### ***Factor 4: Strenuous Activity***

It describes the pain experienced due to activities which are strenuous, like reading in dim light for a long time or exercising after a long gap. Strenuous activity has emerged as a constituent

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factor of pain as the average age group in the study is likely to be engaged in physically and mentally demanding activity associated with professional and personal life.

#### ***Factor 5: Uncomfortable Posture***

Although technology has facilitated and enhanced life activities, it has also given rise to unnatural postures which may induce pain. Multi-tasking while using laptop and mobile phone has emerged as a cause of pain in people. Bohns et.al (2010), studied the relation between power posture and pain tolerance and concluded that dominant postures led to higher pain thresholds than submissive postures.

#### ***Factor 6 - Longer Sittings***

If a respondent scores low on this factor, degree of pain due to longer sittings is low. It may indicate high level of pain tolerance. More than half of us spend over six hours sitting down each and every day. Sitting can have short- and long-term effects on your health and body, making this seemingly benign activity quite serious.

#### ***Factor 7 – Inequity***

Pain is also experienced by observing or facing unfairness in life situations. For example, seeing a child carrying a heavy bag may cause empathetic pain. Inequity or discrimination on basis of various aspects like gender, caste or region may be a significant constituent factor of pain. Discrimination is evident in many situations like job opportunities, top leadership role and decision making at homes, to name a few.

## **7. CONCLUSION**

This study was undertaken with the objective to develop and standardize a psychometric tool to assess pain in general population. The Scale developed comprises of 27 items on a five-point Likert Scale, varying from ‘Never’ to ‘Always’. The Split –half reliability of the scale is 0.870 and validity is 0.932. Norms developed for general population indicate that scores between 76 to 108 should be considered as normal, lying below that as low pain and score above as high degree of pain.

#### ***Implications***

The tool developed in this study has substantial scope in the assessment of pain in general as well as clinical population. Factors here represent the areas of pain as perceived by normal population. The identification of factors is beneficial in the diagnosis of the reason of pain perceived as by an individual. The contributing factor of pain can be assessed and accordingly medical interventions can be outlined. This scale can be applied in psychological research work, planning of therapeutic support for improved functionality and total pain management.

The scale gives inputs about the bodily areas in which pain is experienced by an individual, which can be an important input in the designing of therapeutic support. It can provide an important guideline to plan Counselling interventions for the sufferer, enabling him/her to lead a healthy and active life. This study can be treated as a preliminary study to further conduct an exhaustive research on a larger and more diverse set of population for specific pathological problems. Pain has an integral psychological aspect, which needs to be essentially assessed. The effect of associated constructs like empathy, pain tolerance threshold, personality profile, social quotient and spirituality quotient can be explored. Further research can be done by comparing the degree of pain in different areas of the body and in terms of constituent factors of pain.

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## APPENDIX I SCALE Choice of Response:

1	2	3	4	5
Never	Rarely	Sometimes	Often	Always

### I experience discomfort or an unpleasant sensation:

1. In my neck, when I work on the laptop for more than one hour. ( )
2. In my shoulder/s, if I carry heavy luggage. ( )

3. In my knees, when I stand continuously for more than 30 minutes. ( )
4. If I see a person dying. ( )
5. If I see a person with deep burns. ( )
6. In my back, after I sleep in a particular posture. ( )
7. In my thighs, when I exercise after a long gap. ( )
8. If I see a person trying to pull a heavy cart on the road. ( )
9. If I see an animal being hit by a speedy vehicle. ( )
10. In my lower back, when I ride a two-wheeler for more than an hour. ( )
11. In my back, when I stoop and work for more than 15 minutes. ( )
12. If I see a person injured badly. ( )
13. In my feet, if I wear heeled footwear for a long time. ( )
14. If I see a person bleeding profusely. ( )
15. When I sit on the ground for more than 30 minutes. ( )
16. If I see a person struggling to breathe. ( )
17. In my neck/ shoulder, when I drive a 4-wheeler for more than 100 kms. ( )
18. In my feet, if I walk briskly for more than 5 kms. ( )
19. If I see an innocent person being physically tortured. ( )
20. In my knee/s, if I sit in a particular posture for a long time. ( )
21. In my eyes, when I read in dim light for more than 45 minutes. ( )
22. If I see a deep wound being dressed. ( )
23. In calf muscles, when I run continuously for more than 2 kilometers. ( )
24. In bowel movement, if I have irregular meals. ( )
25. If I see an elderly person doing laborious work. ( )
26. If I see a child carrying a heavy bag. ( )
27. When I see a disabled person struggling to ascend / descend the stairs. ( )

# **Development and Standardization of Customer Ecstasy Scale**

**Surbhi Jajoo, Santosh Dhar**

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## **ABSTRACT**

*With the advancement of Online Shopping in different arenas, there is more of psychological bonding of customers with the company and the prime focus is to lure customers and retain them which is only possible if a sense of trust is developed between the services and the customers. Customer Satisfaction and Customer Delight have been worked upon and are being used to attain competitive advantage. Since everyone in the market is trying to satisfy or delight its customers, it becomes imperative for the organizations to ecstasies' its customers while providing services. Customer Ecstasy relates to the positive emotions of the customers after service is delivered. It is an experience which leads to the positive impact of the services offered to the customers, which is likely to make them say wow. Customer Ecstasy with reference to Online Shopping is just not reaching beyond the expectations but making the customer experience the bliss of shopping. In this context, the main objective of this paper is to develop a standardized measure for Customer Ecstasy with special reference to Online Shopping.*

**Keywords:** Customer Ecstasy, Online Shopping, Scale, Measure.

## **1. INTRODUCTION**

The worldwide marketing environment is influenced by the rapid development of the internet. Online shopping is a fast-growing phenomenon. Online shopping is used as a medium for communication and electronic commerce. It adds to improve value, quality and attractiveness while delivering customer benefits and give better satisfaction. Therefore, online shopping has become more convenient and is gaining popularity day by day. It is observed that a huge number of customers shop online so for both the customers and business, the wide use of internet and the rapid growth of technology have created a new market. E-commerce is an important channel to find potential customers as well as to retain their existing customers. Amazon, Flipkart, Myntra have already crossed billion-dollar valuation and are the best-known examples for the same. With this emerging field of shopping the interest of marketers is also increasing in studying what motivates consumers to shop online. Fierce competitions among online sellers have forced them to gain the competitive edge in the field of virtual shopping.

Customer's level of happiness is the best indicator of customer making purchase in the future which helps the firm gain competitive advantage and increase market share. In order to gain

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*Research Scholar, SVVV, Indore  
Dean-FDSR, SVVV, Indore*

competitive advantage marketers are not only concentrating on satisfying their customers but taking a step ahead to delight or ecstasies customers by providing something in addition of what is expected. In addition, long term relationships with customers often means a greater resulting profitability as their economic positions improve over time. Happiness has also been linked with purchase intentions. Buyers purchase a brand which they feel will maximize their satisfaction, therefore, if their expectations of a particular brand are high, they are more likely to purchase it. Satisfying or delighting the customers is not enough. In current era where the competition is stiff one needs to do something unique to retain the customers, an effort which is less intensive than catching new customers.

Customer Ecstasy is of prime importance for pondering as how to make customers feel extremely happy and escalated. Many online sites try to build personal rapport with the customers by surprising them or by providing unexpected gift on the special occasions. It is important for future of the company to have an informal relationship with the customers which can only be achieved if they do more than just to satisfy the customers which other companies are also doing. In fact, there has to be something unique and different from the other websites.

**Customer Ecstasy** strategy is market driven or it drives the market. For Example - Products that are not customer (user) friendly have no place in the market although they are engineered using the best technology. The interface of the product is as crucial as the internal technology of the product. Normally Customer expectations are typically not very high for all the products or services but a merchandiser's role is to surprise them. Customer Delight offers them something what they haven't even imagined, and Customer Ecstasy is something that adds value factor which will cause them to say WOW! Ecstasy can vary from friendly customer helpline to cash backs which ultimately built a trust between the two parties.

The purpose of this study is to develop and validate an instrument to measure Customer Ecstasy in Online shopping. Potentially this scale will benefit Online shopping vendors to develop marketing strategy.

## 2. REVIEW OF LITERATURE

Hasina et al (2011) attempted to identify the factors affecting customers' intention and satisfaction to shop online. The study concluded that advertisement, brand, shopping experience, time, trust etc. are the yardsticks to customer satisfaction and online shopping based on various issues. Delarosa, Dharmesti and Nugroho (2012) examined the mediation role of customer satisfaction in the causal relationship between antecedents of customer satisfaction and customer loyalty in the Indonesian online store context. The results showed that the influences of information quality, security (privacy), payment system, delivery, and customer service toward customer loyalty are significantly mediated by customer satisfaction. Two other antecedents that are transaction ability and response have no significant effect. Whereas, other antecedents that are web design and product variations only have a direct significant effect to customer loyalty.

Santhi (2012) has attempted to understand the factors influencing customer satisfaction towards online shopping. The study found that customer preferred these factors while online shopping such as; product price, accessibility, ease of use, quality and availability of the products, payment options, return policies, authenticity in information etc. The results revealed that customers are becoming more aware about technology and they find easy to search for products at varied range. These customers are confident enough to buy high value products online.

Karim (2013) found in his study on motivations of consumers for decision making processes towards inhibitions of online shopping. The findings disclosed that consumers believe in convenience such as; time saving, easy to use, navigation of website, no stress, cheap price and shopping fun while purchasing products online. In contrast, the barriers of online shopping are security in payment, trust, return policies, lack of customer service etc. Jayasubramanian (2015) found that majority of the customers agreed with the ease to choose and comparisons with other products. They also satisfied with the quality of information about the products in online shopping. Regarding ranked by the customers, the study found that convenience is given first ranked followed by time saving, attractive offers, product delivery, return policies, security, mode of payment and personal information privacy. All these dimensions have significant impact on customer satisfaction in online shopping.

Sudhakar and Kumari (2016) discussed that majority of customers preferred online shopping for on time delivery, payment security, time saving while as others, were satisfied due to warranty, choice, availability, door delivery, discount offers, price and convenience. But after sale service found no association with customer satisfaction as customers were dissatisfied with the after-sale services. Rastogi (2017) studied the key factors that influence online buying behaviour of consumers and their level of satisfaction with purchasing of apparels. Based on his study involving survey on 200 respondents, the author found out that customers perceive online shopping to be convenient, more economic and offering more variety than offline shopping. The author also reported that male customers have more positive perception of online shopping of apparels.

Dholakia and Uusitalo (2017) had conducted a comprehensive study to understand the influence of consumer characteristics (such as age, household income and family composition) on perception of shopping benefits associated with electronic and physical shopping towards customer satisfaction. The study revealed three dimensions such as hedonic benefits (such as fun, enjoyable, rewarding and satisfying), utilitarian benefits (convenient, easy, and efficient) and perceived stress (stressful, intimidating, and difficult) as underlying consumer perceptions on shopping methods. It was found that the socio-demographic variables such as age, household income and family composition had a significant effect on the perception of benefits for both computer and store shopping. It was identified that hedonic and utilitarian benefits were negatively related to age of the respondent for computer shopping; only the utilitarian benefit was significant for store shopping and it was positively related to age.

Hamza and Saidalavi (2018) have explored the influences of benefits perceived in online shopping such as; price, convenience and wide choice among options towards customer satisfaction. The result showed that Indian customer is satisfied by the factors of convenience, wide range of products and low price. In this study, online customers are significantly influenced by aforesaid parameters. This study has presented the model that would be referable for online retailers. Rawat (2006) has examined customer delight in his study for the context of fashion retailing. He found that the antecedents associated with delightful customer experiences specific to shopping for fashion apparel were in three categories product-related: price, size. Variety and availability service-related: friendly, helpful, personal assistance, easy return and experience-related: Store Layout, displays, music, atmosphere.

Shaw and Lin (2006) in their study focused on the relationship between customer satisfaction and customer loyalty. The result of their study found various antecedents for building customer loyalty which were then brought down to four factors, website design and technology, trust and security, customer service and value proposition. Adnan (2015) investigated the factors impacting the online purchasing patterns of consumers in Pakistan. The variables included in the proposed framework were perceived advantages, perceived risks, hedonic motivations, website design and lastly, psychological factors that included trust and security factors. The findings indicated that perceived advantages, perceived risks and psychological factors were the significant variables. Perceived advantages and psychological factors had a positive impact on the consumer attitudes towards buying behaviour.

### **3. RATIONALE OF THE STUDY**

In today's fast-moving world, customers can't be satisfied in just one single way. Expectations of customers are very high, and they have varied choice to fulfil those expectations, hence there is need to deliver unique services which leads to retention of customers. New business tactics and ways can retain the customers for a short period as other competitors also start giving the similar offers. Retention of the customers is possible if online services provide him satisfaction and delight and go beyond to give him ecstasy-an overwhelming feeling of happiness.

To thrive in the digital era, one must go an extra mile to sustain itself in the market. Global competitiveness and expanding economies have made the term Customer Satisfaction and Customer Delight all more important and have gone even beyond to Customer Ecstasy -the extreme level of bliss which the customer experiences while purchasing the product. To achieve which one must know the factors which leads to customer ecstasy.

The rationale behind the study is to explore the shopping experience of people who have purchased via Internet, the respondents' expectations from online shopping in general. What were their concerns when buying from an online retailer, how they evaluate merchant websites from which they have bought, what are the benefits that they can have when purchasing online and what are the elements that must exist in the online shopping experience in order to develop a scale to measure customer ecstasy.

## 4. DEVELOPMENT OF SCALE

After reviewing the relevant literature definition of customer ecstasy was outlined as the *extreme level of bliss which the customer experiences while purchasing the product.*

### 1. Item Generation

A total of 80 items were identified from review of literature and shopping experience of people who have purchased via Internet. Of which 28 items were rejected due to similar context. 52 items were retained for validation.

- a) **Validation of items/statements:** These items/statements were validated from expert judges through personal interviews. The judges were constituted of 10 professors of management discipline and 20 managers of marketing field. The judges were post graduates and had the minimum experience of 5 years.

They were asked to assess items for ambiguity, clarity, triviality, sensible construction and redundancy, as well as to make sure that the items reflected the definition of Customer Ecstasy.

- b) **Pre-test for item refinement:** After collecting the data it was tabulated and the statements that had 75% and above acceptance by the judges were retained. 25 items / statements had the frequency of 75% and above.

### 2. Data Collection and Analysis:

On these 25 items/statements a measure based on Likert type of scale was developed.

- a) **Filtration:** The questionnaire was circulated to 250 online customers of which 244 filled in questionnaire were received 12 of which were rejected due to incomplete data resulting to 232 respondents. After filtering the data, the data analysis was done on the sample.
- b) **Item Total correlation:** After tabulating the data, analysis was done to eliminate the weak and insignificant items by measuring internal consistency through item total correlation.

In the first iteration 6 items were dropped. Remaining 19 items were further subjected to second iteration in which 3 items were dropped leaving 16 items.

These 16 items were further subjected to third iteration and no item was found insignificant therefore, all 16 items were retained for the final scale. (Appendix)

### c) Reliability test and Validity Test

Cronbach's alpha and Spearman's half split was used to check the reliability and validity of data.

- **Cronbach's alpha:** The result is presented below

Reliability Statistics	
Cronbach's Alpha	N of Items
.873	16

- **Spearman's half split:** From the half-test reliability, the self-correlation of the whole test is calculated by Spearman-Brown formula.

Result of reliability of data by Spearman's half split is **0.87** which is more than .7 hence the data is reliable.

Validity of the test is checked which resulted as **0.93** which is high score.

## 5. CONCLUSION

A scale was developed to measure customer ecstasy with reference to online shopping. The statistical analysis yielded an appropriate level of reliability and validity. The scale can be used by online sellers to collect information about customers perspective and using this information marketing managers can develop marketing strategies.

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## APPENDIX 1

1. Post-purchase touch with customers makes them feel important
2. The random free shipping day allure customers
3. Availability of the products according to the feel of the moment excite customers
4. Customers are overwhelmed if product exceed their expectations
5. Cancellation of order with no extra charge encourages customers.
6. No restrictions on number of replacements exhilarate customers.
7. A birthday special discount makes customers feel loved.
8. Exclusive events like amazon prime day thrill customers.
9. Personal benefits in terms of payback points captivate customers.
10. Customers draw pleasure in a free lifetime membership.
11. Ease of accessing the website and easy navigating engines boost customers
12. Exotic website designs fascinate customers.
13. Quick response to questions or concerns about products excites customers.
14. Be upfront and honest with customers when errors occur lead to customers trust
15. Delivery of the products before the specified time exhilarates customers.
16. Delivering products with trial option at home excites customers.

# Evaluating Buying Behavior of Consumers While Choosing a Credit Card

**Manisha Pipariya, Anupam Singh**

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## ABSTRACT

*Credit card, usually known as plastic money, has become the blazing issue and has its substantial impact on the banking industry. Different individuals hold different notions related to the credit cards so it becomes very interesting to study the different dimension of the credit card industry and its related areas. The whole study revolves around the credit card business in India, its customer base, potential customers and the consumer behavior pertaining to the credit card. The project tries to drive into the minds of customers of credit cards and also endeavor to know what they actually expect from a credit card service. The target population for this study is the population of Indore. The study involves survey through self-administered questionnaire to the consumers. Data was examined, analyzed and presented in the tabular form and is carried out to study the significant difference between the overall satisfaction levels of services provided by the various credit card issuers. Findings also suggest that how an attribute plays an important role in changing the attitude and buying behavior of consumers.*

**Keywords:** Consumers, Buying Behavior, Credit Card.

## 1. INTRODUCTION

Customer increasingly expects higher quality, service and some customization. They perceive fewer real products' differences and show fewer brands loyalty. They can obtain extensive credit card information from the internet and other sources which permits them to shop more intelligently. When the buyer of credit card gets satisfied after purchase, it depends on the performance of credit card in relation to buyer's expectations in general. Satisfaction is a person feeling of pleasure or disappointment resulting from comparing a credit card performance in relation to his expectations. If the performance falls short of expectations, the customer is dissatisfied. If performance matches expectations, the customer is satisfied. If the performance exceeds expectations the customer is highly satisfied or delighted.

### 1.1 Credit Card-An Overview

The dictionary defines a credit card as 'A card which can be used to obtain cash, goods or services up to a stipulated credit limit. The supplier is later paid by the credit card company which in due course is reimbursed by the credit card holder who will be charged interest at the

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Research Scholar, SVSM, SVVV, Indore  
Assistant Professor, SVSM, SVVV, Indore

end of the credit period if money is still owing.' The word '*credit*' comes from Latin, meaning 'trust'. This means that using a credit card is effectively like taking-out a loan. That loan must be re-paid to the credit card company (the lender) within the credit cycle (billing is usually every 30 days and thus the credit period can vary from 7 days to 45 days depending on when the purchase was made). If the money is not repaid within this time an interest charge is levied (applied) to the remaining balance. A credit card generally works by giving its holder an immediate authority to purchase services and goods such as travel and hotel reservations as well as shopping for merchandise in and outside country. A consumer can also use credit card online facilities to get benefit from his credit card. This online credit card facility is easy to use and it is faster than the actual procedures of cash transactions. A customer can apply credit card on different outlets and he can also make purchase online by using his credit card in a case he does not have liquid cash. Most credit cards are issued by local banks or credit unions, and are the shape and size specified by the ISO/IEC 7810 standard as ID-1.

When a purchase is made, the credit card user agrees to pay the card issuer. The cardholder indicates consent to pay by signing a receipt with a record of the card details and indicating the amount to be paid or by entering a Personal Identification Number (PIN). Also, many merchants now accept verbal authorizations via telephone and electronic authorization using the Internet, known as a 'Card/Cardholder Not Present' (CNP) transaction. Electronic verification systems allow merchants to verify that the card is valid and the credit card customer has sufficient credit to cover the purchase in a few seconds, allowing the verification to happen at time of purchase. The verification is performed using a credit card payment terminal or Point of Sale (POS) system with a communications link to the merchant's acquiring bank. Data from the card is obtained from a magnetic stripe or chip on the card.

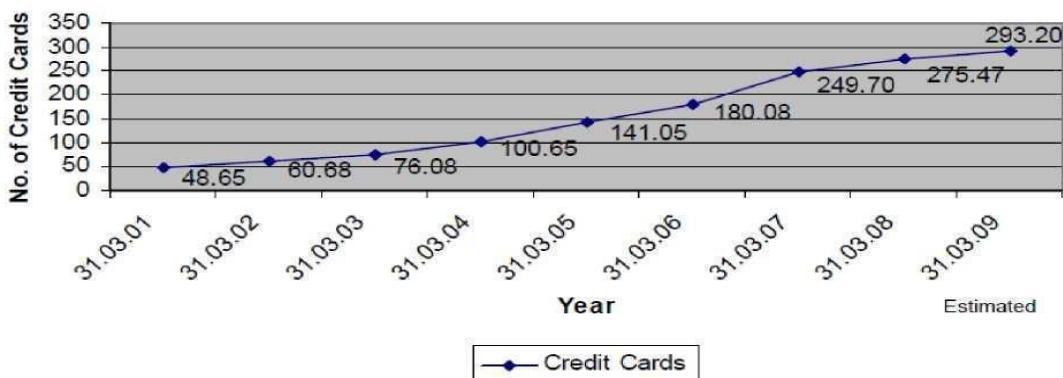
## 1.2 Credit Cards in India

- **Segment Performance:** The number of credit card base in India is increasing at a slower pace. The total number of credit cards outstanding during the year ending March 2018 was 275.47 lakh with a growth of 10.32 % as compared to 39 % growth during the year ended March 2017. It is estimated that credit card growth rate may further reduce in the year 2018-19 with an increase of 6 % to 293.20 lakh cards by March 2019 (Ceicdata.com, 2020).
- **Market Share:** ICICI Bank tops the chart when it comes to the highest credit card issuing bank, with 90 lakh credit cards in the market during the year 2018. It covers 33% of the market share.

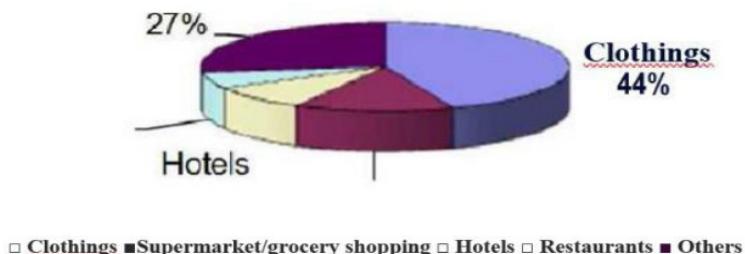
Both SBI and HDFC are having a market share of about 13% with a card base of 36 lakh and 35 lakhs respectively. **Sector Wise Market Share of the Banks:** --The market share of private sector banks has increased to 48% in 2018 from 44% in 2017. The private sector banks have shown an increase in their credit card base by 19 % from 109.90 lakh credit cards in the previous year to 130.77 lakh cards by March, 2019. The market share of foreign sector banks has fallen from 37% in 2017 to 34% in 2018 with 95 lakh credit cards in the

market as on March, 2018. Public sector banks constitute 16% market share, with 45.34 lakh credit cards. Other banks totaling to 4.36 lakh credit cards cover the balance 2% of market share (Research, Services and Card, 2020).

### Growth in Credit Cards Issued



- Industry Spend:** More and more Indians are using credit card for purchasing essentials as well as luxurious goods. The credit card spend has increased significantly during the year by 16% to Rs. 67, 383 crores during the year 2019 as compared to Rs. 57, 985 crore in the previous year.
- Credit Card Spending Pattern:** The Indian Credit Card Industry is still at a nascent stage, when compared to economies in West Asia. Only 14% of Indians currently own a credit card. 73% of Indians spend less than \$ 35/- on an average each month, while 25% spend between \$ 35/- and \$ 300/-. Only 2% of Indians spend over \$ 300/- on the credit card during a month. 72% of Indians use their credit cards 1-2 times a month, while 23% of Indians use their cards between 3-5 times and remaining 5% use their cards 6 times or more every month.



### Credit Card Spending Segments

Source: *The Hindu Business Line- December 27, 2017*

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The pie chart shows that 44% of Indians use their credit card most often for purchases of clothing, 14% for supermarket/grocery shopping, 9% at hotels and 6% at restaurants.

The usage of credit cards at retail outlets has nearly doubled from 30-35% two years ago to 50%- 60% currently. (Source-The TOI, New Delhi - March 22, 2018)

#### ***1.4 Objectives of the Study***

- **Primary objectives:**
  - To find out the current trends in the credit card business.
  - To identify factors influencing the adoption and usage of credit cards.
  - To identify the differences in the expectation and deliverance.
  - Customer attitude and behavioral pattern toward credits card.
  - To investigate the stages involved in the behavior of the consumers during credit card purchasing.
- **Secondary objectives:**
  - To get familiarity with aspects pertaining to the credit card.
  - To analyze the customers' expectations from credit cards facilitator.

## **2. REVIEW OF LITERATURE**

Several researchers conducted consumer behaviors and the role of credit cards. Lunt (1992) stated that it is important for banks offering credit card services to study what makes consumers who have 5 or 6 credit cards use one rather than another when making a purchase to determine marketing techniques. Among many factors affecting card adoption include high credit limit, quality customer service, fair fees, and a fair interest rate are the factors that count at the point of sale. In addition, lower interest rates, cash advance checks with low rates, and sweepstakes are some of the marketing promotions used by banks. Some other promotions were cash back bonuses and no annual fee. Moreover, Sulaiti, Ahmed, and Beldona (2016) studied the role of credit card on consumer behavior and found that credit card usage by consumers across the oil-rich Arab countries (such as Qatar, Bahrain, and Kuwait) is changing in their consumption behavior, because having credit card motivates Arab consumers to buy more often, and encourage promoting impulse buying. Carow and Staten (2012) found that convenience and rebates are the main reasons for using a bank credit card.

Furthermore, Hayhoe, Leach, Turner, Bruin, and Lawrence (2010) found that affective credit attitude (feeling about using credit cards) and gender influenced college students' credit purchasing. Affective credit attitude predicted the purchase of clothing, electronics, entertainment, travel, gasoline, and food away from home. Their results also indicated that

gender differences in the relationship between financial practices, financial stress, affective credit attitude and the number of credit cards with a balance. Lee and Kwon (2012) found that consumers' usage of store credit cards is related to a number of variables, including the use of bank cards, credit history, and attitude toward credit, income, education, and ethnicity. It is important for banks to develop marketing strategies to attract and win competition in the industry. Devlin, Worthington, and Gerrard (2017) examined credit cardholders carrying many credit cards at the same time. In this case, there were main credit cards (most often used cards) and subsidiary cards (rarely used cards) and the respondents stated that their subsidiary cards were held for "stand-by purposes". Bielski (2011) suggested that development of loyalty programs and e-commerce programs that all add to high quality customer experience for credit card business. Moreover, those programs can attract and retain credit card users.

### **3. RESEARCH METHOD**

The research work being done here is exploratory in nature hence more of a field work is demanded. For the purpose of the study both primary and secondary data is examined.

#### ***3.1 Data Collection Design***

The data required for the study is obtained from various secondary sources. Descriptive design has been used because a large number of respondents were studied based upon the various factors. The research is adopted to know what is happening in the market with respect to products, the customers and their attitude.

The key features of the methodology are:

- 1) Primary data:** - For the purpose of above stated project a survey through questionnaire is being conducted. It includes both open ended and close ended questions.
- 2) Secondary data sources:** - To keep abreast with the dynamic Indian market, I seek to consult various existing data also in the related areas so that a comparative study is formulated. The source used includes books, Journals, Magazines, Newspapers, Internet and even academicians in the related areas.

#### ***3.2 Analysis of Data***

The data collected by conducting a survey was analyzed with the help of statistical tool ANOVA.

#### ***3.3 Data Analysis and Interpretation***

This study is focused on credit card adoption criteria of the respondents and marketing implications. Data were collected from 206 respondents in Indore. The results indicated that

customer characteristics affecting credit card choice criteria included age, marital status, education, and income level. In addition, customer profile was developed to help bank marketers create marketing campaigns. Marketing implications from this study suggested banks to offer flexible installment plans and attractive point redemption. Furthermore, credit card issuers should enable the credit cards to be used in more domestic stores. Limitations and future research directions are discussed. The data of 206 credit cardholders were collected in Indore and nearby areas for the study.

**TABLE 1: Customer Characteristics in Percentage**

<b>Customer Characteristics</b>		<b>Percentage (%)</b>
Gender	Male	54.4
	Female	45.6
Age (Years)	21-25	13.1
	26-30	32.5
	31-35	28.6
	36-40	17.0
	41-45	2.4
	46 or more	6.3
Marital Status	Single	57.3
	Married	36.4
	Divorced	6.3
Education	Below Bachelor's Degree	6.3
	Bachelor's Degree	77.2
	Higher than Bachelor's degree	16.5
Income (Rs.)	20, 000 or less	29.6
	20, 001 -40, 000	40.3
	40, 001 -60, 000	20.9
	60, 000 or more	9.2

The respondents of this study were 54.4% male and 45.6% female. 61.1% of the respondents were the age between 26 - 35 years old. Most of them (57.3%) were single. The majority held Bachelor's Degree (77.2%) with the monthly income ranging from 20, 001 to 40, 000 rupees.

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For the degree of importance, being accepted by all domestic stores was the most important criterion for adopting the credit card ( $x = 4.77$ ), followed by being able to be used worldwide ( $x = 4.63$ ), and having a low annual fee ( $x = 4.56$ ), respectively.

The criteria having low importance for the cardholders for choosing the cards were being able to finance payments with installment plan ( $x = 3.48$ ) and having good interest rates ( $x = 3.54$ ). Overall, bank marketers should provide low annual fees and enable credit cards to be used nationwide and worldwide.

**TABLE 2: ANOVA of Credit Card Choice Criteria**

Credit Card Choice Criteria	Customer Characteristics				
	Education	Age	Marital Status	Income	Gender
	F-statistics	F-statistics	F-statistics	F-statistics	F-statistics
Have good interest rates	3.326	2.903	2.539	0.625	1.712
Be able to finance payments (having installment plan)	4.849	4.771	2.868	4.793	0.673
Be from a well known bank	4.878	2.612	0.509	1.430	0.392
Be accepted by all stores (domestically)	0.354	7.715	22.959	7.925	1.984
Have a high credit limit	0.527	7.530	1.605	3.459	2.615
Have a low annual fee	2.849	11.007	14.090	0.811	0.748
Be able to be used worldwide	0.819	10.487	10.444	2.197	0.250
Be able to collect points for amount used	10.654	14.333	9.047	0.595	0.548

The ANOVA test was conducted in order to identify differences among five customer characteristics-including education, age, marital status, income and gender- with eight credit card choice criteria. For the first customer characteristic, the results indicated that different age groups perceived degree of importance of all eight choice criteria differently. Having

installment plan, being able to use worldwide, having point collection and providing high credit limit are more important for the respondents in the age of 21-40 than those in 41 years old or more. In addition, credit cards accepted by most stores (domestically) and with low annual fees are more important for consumers at the age of 21 - 35 than for older consumers.

According to the data collected, credit card marketing promotion may develop two different campaigns to attract different age groups. The first group, 21-40 years old, representing over 90% of the respondents clearly concerns with those benefits discussed above, while low annual fees and being accepted by all stores domestically were only more important for those in 21- 35 years old. The second customer characteristic was education. Respondents below Bachelors degree were highly attracted to good interest rates offered and to point collection offers. For the groups of Bachelors degree and below Bachelor's degree, good bank reputation and installment plan are significantly for their credit card adoption.

Marital status was the third characteristic. Single and married respondents were considered being accepted by all domestic stores, having a low annual fee, and being able to collect points to be important choice criteria. Moreover, single respondents were regarded being able to use credit card worldwide as a crucial aspect for choosing a credit card. Income differences also had effects on credit card choice criteria. Respondents with monthly income below 40, 000 Rupees selected credit cards by concerning being accepted by all domestic stores and having a high credit limit, while those with income below 60, 000 Rupees made decision on having installment plan. However, in this study gender had no statistically significant effect on credit card choice criteria. Either male or female respondents made decision on adopting credit cards indifferently.

In summary, customer characteristics lead to identifying three distinguished criteria in this study, including having installment plan, being accepted by all domestic stores, and being able to collect points for amount used. Customer characteristics which highly affected the choice criteria can lead to create customer profile of respondents.

#### **4. IMPLICATIONS AND CONCLUSIONS**

This study indicated that to satisfy credit cardholders' needs, low annual fees, and domestic and worldwide credit card acceptance is highly necessary. However, in order to offer different services from competitors and to build long-term customer loyalty, bank marketers can initiate a marketing campaign with attractive installment plan choices and point redemption. Additionally, making credit cards to be more widely used in more domestic stores can increase credit card adoption. This requires collaboration among banks and other businesses to share higher benefits from greater numbers of card users. For installment plan, longer installment period should be provided for allowing customers to pay back in longer term with lower amount of payment, while banks can have higher profit from interest charges. Moreover, various interest rates on installment plan can be offered.

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# **Impact of Experience, Commissioning Type and Branch on Learned Optimism: A Study of Armed Force Officers in India**

**Rumiya Agashe, Santosh Dhar**

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## **ABSTRACT**

*Today, organisations have realised that human capital needs to be valued and conserved for sustainability of organisation. Towards this thought, organisations are focusing on the health and wellbeing of its employees. The strongest deterrent towards achieving this goal is work-stress. Businesses need to gain maximum efficiency from its employees, at the same time they need to ensure that they are not jeopardising their mental health. This is possible when businesses develop a positive and energetic taskforce that sustain pressure and stress. Many psychologists believe that Optimism is an attitude that positively affects employees' mental and physical health and contributes to reducing stress and increasing longevity. Hence, HR Managers are looking at prospects of identifying and developing HR tools that can foster Optimism among employees. Seligman argued that Optimism can be learnt and that it can be taught through providing positive exposure. However, no mention has been found in literature if job type, job-contract and experience have any role to play in developing Learned Optimism within employees. Towards this objective, an imperial research is carried out in Indian Armed Forces where 406 active serving Officers from the three main Branches-Army, Air force and Navy participated. The results indicated that experience, type of Commissioning (job contract) and branch of Officers have significant impact on Learned Optimism of Officers in Armed Forces. Discussion on the same highlights that experience and job correlates as contributing factors in development of Optimism within employees.*

**Keywords:** *Learned Optimism, Type of Commissioning in Armed Forces, Branches and Experience.*

## **1. INTRODUCTION**

There is no denial that incorporating positive psychology in workplaces has several positive outcomes towards organisational effectiveness and well-being. One of the most influential elements of positive psychology is Optimism. Many researchers have argued that such credit is given to Optimism because of the fact that it can be nurtured within individuals through training. Another feature that brings attention to the popularity of Optimism is that it is claimed to be a style of thinking and is not associated with the permanent character of a person.

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*Assistant Professor, Vikrant Group of Institutions, Gwalior  
Dean, FDSR, SVVV, Indore*

Individuals can change their style of thinking through guidance, experiences, practise and appropriate exposure. Such a way of acquiring a positive outlook towards past experience, present and future situations is called Learned Optimism. Towards understanding of antecedents to effective development of Learned Optimism within individuals, few researchers have suggested that it is a product of social interaction and experience.

The blend of these two perspectives – the social and the psychological experiences at work is a way through which Optimism is groomed within individuals. To substantiate these speculations, no empirical research has been so far carried out. In order to gather evidence towards the same, this empirical study focuses on studying Armed Forces Officers of three major branches Army, Airforce and Navy at different levels of experience and type of commissioning (job contract). It is speculated that within the same organisational framework i.e. Armed Forces, Officers would exhibit different levels of Learned Optimism due to differences in Branch, type of Commissioning and years of experience in Armed Forces. But before proceeding, the conceptual framework and related literature that were reviewed is presented for a deeper understanding.

## **2. LEARNED OPTIMISM**

Learned Optimism is a part of positive psychology that deals with the attitude with which a person explains the outcomes, gives justification for actions, as well as anticipates of future events in a realistically positive outlook and sustained productive striving (Mukund & Singh, 2015; Seligman et al., 2005; Tenney et al., 2015). Such an outlook is a portrait of personal strength and fortitude (Peterson & Seligman, 2004). “Optimistic expectations appear to be an important part of what it takes to succeed in high stress situations... [and are associated with] the ability to bounce back from frequent failures” (Schulman, 1999).

While some individuals are innately hopeful, it is not always that Optimism is part of disposition or personality. Akin to helplessness and pessimism, Optimism can be driven by situation and can be specific to the cause, and can be Learned or acquired through experience (Abela, Bronzina, & Seligman, 2004; Seligman et al., 2005). As a matter of fact, Optimism and helplessness are often considered opposite ends of the same string. They both can be influenced through favourable and unfavourable situations. For example, social workers who enter and embrace the field with the laudable and hopeful wish to help others and who are generally optimistic in outlook develop a sense of powerlessness or become anxious, resentful, and discouraged over a period of time through repeated exposure to helpless situations. Hence in order to prevent disengagement and the resentment of hope, it is important for organisations to identify ways and means to bring in Optimism among employees.

Optimism strengthens individuals to have honest appraisal and develop acceptance of true limitations and demands while attributing problems to temporary or situational causes rather than projected permanence or personal flaws, thus reducing stress (Goodmon, Kelly, Maudlin, & Young, 2015; Van Hook & Rothenberg, 2009; Ryu, 2016). One of the vital components of

effective management of stress, negative emotions, and pessimism is cultivation of Learned Optimism in employees through mindfulness, introspection, spiritual practices, enlightened awareness, and continued education on the personal and general effects of occupational stress (Goleman, 1995; McCollum, 2015). Spirituality and spiritual practices act as a buffer against pessimism. While pessimism causes stagnation, resentment, rumination and self-blame about past failures and difficult times, Optimism on the other hand creates a sense of hope (Collins, 2005; McCollum, 2015; Seligman, et al., 2005; Tillich, 1952; Wood, Joseph, & Linley, 2007).

Optimism assists in accepting personal and professional limitations and helps in realistically dealing with the fact that disparities, inequities and injustice exist and persist in every organisation. Acceptance is an essential element of Learned Optimism because it allows a closer focus on the 'good opportunities' that should be encashed, rather than on the 'lacunas' that cannot be worked upon. Optimism grows from: (a) positive and healthy appraisals of one's personal strengths, efforts and limitations; (b) a view of problems as external to self and subject to change; and (c) an orientation toward future favourable possibilities (Carver, Scheier & Segerstrom, 2010).

Learned Optimism advocates that there is a future to ruminate and that tomorrow embraces hope for transformation. To counter corrosive cynicism, fatigue, fatalism and burnout (Van Hook & Rothenberg, 2009) and to maintain an optimistic and balanced view, it is important for organisation to provide positive experience and exposure. Also regular fun activities and restorative sleep are essential to efficacy and health of employees which in turn affects their mental health (Collins, 2005; White, Blackburn, & Plisco, 2015). Through review of literature it is clear that Learned Optimism is a relatively new concept and hence not much has been done to investigate its antecedents especially the ways through which organisations can contribute to bring Optimism in employees.

### **3. INDIAN ARMED FORCES**

The military organisation of the Republic of India is called Indian Armed Forces. It comprises three professional uniformed services: the Indian Army, Indian Navy, and Indian Air Force. Indian Armed Forces are also reinforced by the Indian Coast Guard and paramilitary organisations (Assam Rifles, and Special Frontier Force) and various inter-service commands and institutions such as the Strategic Forces Command, the Andaman and Nicobar Command and the Integrated Defence Staff. The Indian Armed Forces works under the control of the Ministry of Defence (MoD) of the Government of India.

With strength of over 1.4 million active personnel, Indian Armed Forces is the world's second largest armed force and has the world's largest volunteer army. Joining the Armed Forces not only gives its personnel a chance to serve their country, but also an opportunity to be a part of the most respected and well recognised organisation of the country. Employees are screened and trained precisely for their jobs. Selection of candidates is based on a number of parameters including physical and mental toughness, IQ and EQ. Qualified candidates undergo tough

training after recruitment and are brought to at par with the expectations of the job. Span of their employment contract differs based on the type of commissioning with a minimum of 10 years. There are two types of commissioning – Permanent and Short Service Commissioning. Permanent Commissioned (PC) Officers serve in the Armed Forces till they retire. These Officers are mostly recruited at a very early stage of their life. Mostly, the PCs are recruited after they finish their schooling or during/right after their graduation. Short Service Commission (SSC) means that they are recruited for a period of 10 years. These Officers are generally recruited after they finish their graduation or sometimes post-graduation. The tenure for SSC can be extended up to 14 years. Only a select few SSC can opt to take up permanent commission.

Learned Optimism of these personnel is important and is considered very crucial for the performance of the troop/unit they are serving with. It is speculated that Learned Optimism among these Officers may vary due to influence of the type of job contract, experience and branch because it is speculated that the dynamics of work environment and motivation factors of Officers influence their Learned Optimism.

Based on the speculations, the following objectives are formulated for the study.

1. To study the impact of branch on the Learned Optimism of Officers of armed forces.
2. To study the impact of experience on the Learned Optimism of Officers of armed forces.
3. To study the impact of type of commissioning – permanent / short-service on Learned Optimism of armed forces.

## **4. RESEARCH METHOD**

### ***4.1. The Study***

The study undertaken was exploratory in nature that has provided insights into factors that affect Learned Optimism of Officers of Military Organizations with special reference to Indian Armed Forces.

### ***4.2. Hypotheses***

To meet the objective of this paper i.e. to explore if branch, experience and type of commissioning have an impact on Learned Optimism of Employees in military organisations with special reference to Indian Armed Forces the following hypotheses is formulated.

H01: There is no significant difference in Learned Optimism of Officers of Army, Air force and Navy.

H0<sub>2</sub>: There is no significant difference in Learned Optimism of Officers with varied years of experience.

H0<sub>3</sub>: There is no significant difference in Learned Optimism of Permanent Commissioned and Short Service Commissioned Officers

### **4.3. The Sample**

The sample was collected from active serving Officers of Indian Armed Forces. More than 700 Officers were contacted, out of which 406 Officers volunteered to participate in the research work. The sample size was tested for adequacy using KMO and Bartlett's Test and was found adequate (more than .60).

**TABLE 1: Showing the results of KMO and Bartlett's Test**

Kaiser-Meyer-Olkin	Measure of Sampling Adequacy	.868
Bartlett's Test of Sphericity	Approx. Chi-Square	1406.721
	Df	36
	Sig.	.000

### **4.4 The Tools**

#### **4.4.1 For Data Collection**

##### **Primary Data**

An Internet-based self-report survey was used as the data collection tool. The survey was placed online for administration. Participation was strictly voluntary. Each survey was assigned a unique URL linked to the survey instrument.

##### **Instrument**

##### **Learned Optimism Scale (L.O.S.)**

Standardized scale developed by Pethe et al (2000) has been used to measure Learned Optimism. The scale is comprised of 22 items and measures on 5-point Likert scale from “never” to “always”.

The Cronbach's alpha of the original scale is reported 0.89. Reliability of the scale and its constituting factors was checked on the data under research. Cronbach's value for the scale as well as its constituting factor is observed satisfactory. The internal reliability of the scale observed for this sample was .926 which is considered satisfactory.

### ***Secondary Data***

Secondary data used in the research is collected from: research papers, e-journals, books, newspaper, government report (available in website of Ministry of Defence), and other publications from the official websites of Indian Army, Airforce and Navy.

Also, for the initial understanding of organisational terms in Armed Forces and its culture, an unstructured survey method was used. Information about ranks, training, branch, organisational practises, norms, values was collected through informal interaction and interviews with Senior Serving Officers of Armed Forces at various training establishments of Indian Armed Forces.

#### ***4.4.2 Tools for data analysis***

Data was organised and analysed using Microsoft Excel. To initially test whether there exist any relation between the variables of the study, correlation analysis was used. Further to substantiate the relationships that were found significant, hypotheses tests were done using - z- test and one way-Anova.

### ***4.5 Data Screening***

Before putting the data to hypotheses testing, the data was screened for univariate outliers and missing values. No outliers and missing value were found. Further to test the normality of the data, skewness was computed using SPSS and thereafter z-score of skewness was calculated manually by dividing its standard error to skewness value. Since all skewness z-score were above 3.3, the data was considered normally distributed.

## **5. DATA ANALYSIS**

### ***5.1 Problem Statement I***

#### ***Learned Optimism = $f$ (Branch)***

In Armed Forces, there are three major branches- **Army, Airforce and Navy**. These branches have different working culture, size of unit and operational difficulties. In this section, the intention is to identify whether there is any influence of branch on Learned Optimism among Officers of Armed Forces.

For the said purpose a test of correlation between the branch and the score of Learned Optimism was carried out using Kendall's Tau correlation (used for correlating discrete and continuous data-set). Through test, it was found that a correlation between the Branch and Learned Optimism was significant (Table 2).

**TABLE 2: Showing Kendall's correlation analysis between Branch and Learned Optimism**

		LO_SCORE	Branch
LO_SCORE	Kendall's Tau Correlation	1	.141
	Sig. (2-tailed)		.004
Branch	Kendall's Tau Correlation	.141	1
	N	406	406

*. Correlation is significant at the 0.01 level (2-tailed).*

To further validate the found correlation between Branch and Learned Optimism of Officers, one-way Analysis of Variance between the branches were studied. With ANOVA testing, it was found that variance in Learned Optimism score of Officers due to difference in Branch was significant. Learned Optimism in Army officers was highest and was closely followed by Navy. It was observed that Learned Optimism of Airforce Officers was lowest among the three branches.

**TABLE 3: Showing Branch-wise Sample Size, Mean and Variances in Learned Optimism**

BRANCH	N	Mean Learned Optimism	Variance
AIRFORCE	160	93.80625	107.0377
ARMY	199	97.41709	93.18375
NAVY	47	96.85106	115.086

**TABLE 4: Results of one way ANOVA to showing the variance in Learned Optimism of Officers of different Branches**

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1201.595	2	600.798	5.940	.003
Within Groups	40763.333	403	101.150		
Total	41964.929	405			

*Significant at .05 level of significance.*

## 5.2 Problem Statement 2

### Learned Optimism = $f$ (Experience)

Learned Optimism is said to be positively impacted by exposure and confidence acquired through experience. In order to empirically study the relation between the experience and Learned Optimism of Officers in Armed Forces, Karl Pearson's Correlation was tested on the given sample and the results indicated a significant and positive relation existed between experience and Learned Optimism of Officers (Table 5).

**TABLE 5: Results of Karl Pearson's correlation analysis between Experience and Learned Optimism**

		LO_SCORE	Experience
LO SCORE	Pearson Correlation	1	.106
Experience	Pearson Correlation	.106	1
	N	406	406

*Correlation is significant at the 0.05 level (2-tailed).*

To further substantiate the findings and to have a deeper understanding of the problem statement, z-test was conducted to identify whether a significant difference between the means of Learned Optimism of Officers with high experience and low experience existed.

For conducting z test, a new set of data was also extracted from the available sample and comprised of two discrete levels of experience.

**Level 1 LOW EXPERIENCE** comprised of Officers with experience between 0-7 years. The sample size was kept 40 and the data was extracted using stratified random sampling method.

**Level 2 HIGH EXPERIENCE** comprised of Officers with experience above 20 years. The sample size was kept 40 and the data was extracted using stratified random sampling method.

**TABLE 6: Showing results of Z- Test comparing the means of Learned Optimism of Officer with High Experience and Low Experience**

	LOW EXPERIENCE	HIGH EXPERIENCE
Mean	94.89744	99.35897436
Known Variance	124.25	66.44
z	-2.01768	
P(Z<=z) two-tail	0.043624	
z Critical two-tail	1.959964	

*z is significant at the 0.05 level (2-tailed).*

The results of the z test is detailed in Table 6 wherein it was found that the mean score of Learned Optimism of Officers having experience between 0-7 years (**Low**) was **94.9** and the mean score of Learned Optimism of Officers having experience above 20 years (**High**) was **99.35**. The difference in mean was found **significant** at  **$z=-2.017$** . With the results of the two analyses it is evident that there is an impact of experience on Learned Optimism of Officers in Armed Forces.

### 5.3 Problem Statement 3

#### Learned Optimism =*f*(Type of Commissioning)

It is assumed that Permanent Commissioned Officers (PC) have greater confidence and control over their work as compared to Short Service Commissioned (SSC) Officers. Also, PC Officers see themselves as long term associates of the organisation as compared to SSC Officers whose job contract is limited to 14 years of service (extendable to 5 year more).

Hence, in this section, correlation between the Learned Optimism of Officers and type of Commissioning was tested using Kendall's Tau Correlation as the data was to be compared in two discrete categories. Through the correlation analysis it was found that there exists a significant relation between the two variables. The results indicated a significant relation existed between experience and Learned Optimism of Officers (Table 7).

**TABLE 7: Showing results of Kendall's correlation analysis between Commissioning Type and Learned Optimism**

		LO_SCORE	Commissioning Type
LO SCORE	Kendall's Tau Correlation	1	-.126
Commissioning Type	Kendall's Tau Correlation	-.126	1
	N	406	406

*Correlation is significant at the 0.05 level (2-tailed).*

To further substantiate the findings of correlation analysis, a z-test was conducted to see if there exists a significant difference between the Learned Optimism of Officers due to their type of commissioning.

For the said purpose, a new set of data was extracted from the available sample. This data comprised of equal representation of the two types of commissioning – PC and SSC.

**Type 1 PC** comprised of Officers who are Permanent Commissioned. The sample size was kept 45 and the data was extracted using stratified random sampling method.

**Type 2 SSC** comprised of Officers who are Short Service Commissioned. The sample size was kept 45 and the data was extracted using stratified random sampling method.

**TABLE 8: Showing the results of Z- Test comparing the means of Learned Optimism of PC Officers and SSC Officers.**

	Permanent Commissioned	Short Service Commissioned
Mean	97.09	92.31
Known Variance	71.53	109.45
z	2.38	
P(Z<=z) two-tail	0.02	
z Critical two-tail	1.96	

*z is significant at the 0.05 level (2-tailed).*

The results of the z test is detailed in Table 8 wherein it was found that the mean score of Learned Optimism of Officers having **SSC** was **92.31** and the mean score of Learned Optimism of Officers having **PC** was **97.09**. The difference in mean was found **significant** at **z=-2.38**, indicating that Learned Optimism of PC Officers are significantly higher than SSC Officers. The results signified the impact of type of Commissioning on Learned Optimism of Officers in Armed Forces.

## 6. DISCUSSION

The results have revealed that Officers working in Army and Navy have higher Learned Optimism as compared to Officers of Airforce. This can be attributed to the fact that both Army and Naval operations are more team centric. Hence, in order to ensure the success of their teams, a lot of Optimism is driven in the young Officers by their seniors. These Officers know that they are the one who need to lead the team through rough challenges. Studies have revealed that optimism of military cadets have a significant relationship with their senior's rating of their leadership potential (Chemers, Watson and May, 2000). Officers often force themselves to be positive as they know that their morale at work would affect the morale of the team. According

to Chee W. Chow, Kamal Haddad & Gangaram Singh (2007), morale is positively related to optimism. Hence when these men keep their morale high, optimism is floated in team and positivity becomes contagious. The positive interaction among group members fuels harmonious passion.

March et al. (2013) defined harmonious passion as “a strong desire to freely engage” and is the result of autonomous internalization where individuals willingly accept the activity (or object) as important. This sense of willing participation is associated with optimism, volition and personal approval, where individuals freely engage in the activity rather than feeling compelled to do so thus fostering more optimism within (Vallerand et al., 2003; Vallerand et al., 2010). The Learned Optimism among Airforce Officers is found to be relatively lesser. This can be attributed to the fact that, Officers of Airforce, to a large extend, work in small independent units where in the major risks and discussions are borne by the Officers only. Major decisions of flying a mission is borne by the pilot and navigator only. Such frame of working requires these Officers to be more self-reliant and realistic than just optimistic. The Learned Optimism of Army Officers is observed to be highest. Due to the professional necessity, Army Officers are exposed to several difficult and different work environments. An Officer involved in counter insurgency operations is more intimately exposed to life threatening risks. Having such exposure, boosts the Learned Optimism in these Officers many-folds as compared to other armed force Officers who are not exposed to front line operations frequently.

Another finding of this study is that Learned Optimism increases with experience of Officers. The relation between Optimism and experience has remained a debatable topic among researchers. While few claim that there exists a negative relation between Optimism and experience (Burke & Mikkelsen, 2006), the present findings are in line with the findings of Padhy, Chelli, & Padiri (2015), where it was found that optimism is positively related to experience of police officers. According to Burke & Mikkelsen (2006), beliefs and feelings of employees differ over the course of their career. Through experience, it takes either of the two forms- optimistic or pessimistic (Padhy et al., 2015). In the present context, a positive relation between these two variables is found, because, with years of experience, the exposure and knowledge of equipment, operations and preparedness for contingencies also increase in Officers. This provides a sense of confidence and control towards work and hence the Learned Optimism is positively impacted.

The findings also show that Learned Optimism of Permanently Commissioned Officers is higher than Short Service Commissioned Officers. This can be attributed to the fact that Permanent Commissioned Officers know that their association with the organisation is long-term, and hence, they develop a sense of belongingness towards their organisation. The senses of belongingness and trust for the organisation boost the morale of Officers, allowing them to feel confident at workplace. Here, the Optimism is triggered by the sense of ownership with the organisation. Studies have revealed that organisation citizenship behaviour is positively associated with optimism of the employees (Niranjana & Pattanayak, 2005). On the other hand,

Short Service Commissioned Officers find their job temporary and hence they are detached with their workplace. This contributes to the lowered Optimism among Officers with Short Service Commission.

## 7. CONCLUSION

Organisation needs to have optimistic employees. Such goals can be attained by providing appropriate exposure and experience to its employees. Organisations must value experienced employees as they are the source of Optimism for youngsters in the organisation. Additionally, through this research it is found that Learned Optimism is influenced by the type of job contract. A contract which is long term enables an employee to feel associated with the organisation and boosts Optimism in employees. Also, the profile or type of work is an influencing factor towards development of Optimism. Employees who are put to work in teams and groups would tend to have better Optimism than employees who work in solitude. Optimism is contagious and can be used to influence group behaviour.

### ***Scope for Future Research***

The finding of this work is restricted to the Armed Forces only. The study can be replicated to various other sectors for generalisation. Also there exists a scope to extend the study in several verticals of Armed Forces for example Learned Optimism of Officers during peace and war can be studied. The study can also be replicated to similar military organisations of other country to further substantiate the findings.

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# Krishna from Conventional Text to Contemporary Canvas: In Reference to the Krishna Paintings of Jamini Roy

## Ruchi Agrawal

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### ABSTRACT

*The multifaceted character and legendary tales of Krishna have been a strong influence in fine arts since time immemorial. The references of this miraculous divine human incarnation of God can be traced back to before the common era. There is no direct mention of Krishna in Rigveda, which is considered as the oldest Indic text, dated to around 1500 BCE, although the name does appear in spiritual praises a few times in the referred text. Tenth to twelfth century marked Krishna with a new perception. From there onwards, Krishna was not confined to temples and traditional texts but the devotion for Krishna was expressed in unique ways, like in fine arts, dance and music as well as textual compositions. His romantic life of Gokul and Vrindavan developed a ‘bhakti’ movement with emotional and cultural sentiments. Considering this dramatic revolution in the historical perception of Krishna, we begin to approach the Krishna of Indian Paintings. Jamini Roy explored new and modern style in paintings and is among those artists who painted independently. He took inspiration from folk arts and rural life. Jamini Roy’s ‘Krishna Leela’ series is incorporated with the elements of traditional art forms in modern arts. For centuries, one of the most cherished and universally acknowledged theme of arts, Krishna has been an entity beyond time, which has no end or beginning. This paper aims to shed light on the mystery of Krishna which has inspired the imagination of the ancient and still continues to engage the modern and contemporary.*

**Keywords:** Krishna, Bhakti movement, Jamini Roy, Gokul, Vrindavan.

### 1. INTRODUCTION

The earliest references to Krishna seem to occur in the *Chandogya Upanishad* of perhaps the sixth century BC. For the next few centuries nothing further is recorded and not until the great ‘Mahabharat’ around fourth century BC to fourth century AD does a more detailed Krishna makes his appearance (Archer, 2004). Another reference to Krishna is in the *Atharvavedas* the destroyer of *Kesi*. Krishna is also mentioned in the *Puranas* for killing the demon *Kesi* (Banerjee, 1994). As such one may feel inclined to identify this Krishna with the Epic Krishna. Vasudev is mentioned in the *Ashtadhyayi* (sixth century) by Panini (another name of Krishna is Vasudev, being the son of Vasudev)

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The greatest contribution considered by Krishna to Indian culture is the *Bhagavat Gita*. Krishna is treated as both God and man in the Gita and other parts of *Mahabharat*. Gita also contains the authentic teachings of the *Bhagavat* cult and the modern Vaishnavism. *Bhagavat Puran* is perhaps the most pervasive of illustrated manuscripts, which has the collection of tales about Vishnu. It comprises twelve books that in large part recount the ten main forms of Vishnu's incarnations on earth to defeat the powerful evildoers. Krishna is one of them.

The worship of multifaceted divine character can be traced back to well before the Common Era. There is no direct reference to Krishna in the *Rigved*, the oldest Indic text, dated to circa 1500 BCE, although the name does appear for a few times in the spiritual praises (Edwin2007) The determination of a time period for Krishna has been the subject of intense discussion and debate. Chronological approaches differ in placing the life of Krishna variously between 3000 BCE to 1500 BCE. The early date of 3000BCE is based on the astronomical calculations depending on the precise data mentioned for the times of birth and death of Krishna in the *Puranas*, and the date of 1500 is based on archaeological dating of the *Mahabharat* based on material identification from the prehistorical excavations (Vemsani, 2016)

Krishna has been narrated as a naughty but irresistible cowherd of Gokul. He is the child absorbed in *leelas* like stealing butter and curd, hiding from his mother, taking cows for grazing in the jungles, sporting with the *gopis* (cowherd maidens) and *gopas* (herdsman), playing his seductive flute, lifting of *Govardhan* mountain to protect the villagers from devastating rains and floods, stealing clothes of the maidens of Vrindavan. Krishna gained the reputation for dallying with the local cowherd maidens and wives, especially Radha. He enchanted them, captivated their hearts with his hypnotic music and it leads to a *raasleela* at midnight, eliminating the gap between the divine and human (Guy, 2005).

All these mischievous childhood deeds, induced love and attachment for Krishna in the hearts of the villagers. These *leelas* have been one of the most celebrated subject of art and literature.

## 2. KRISHNA IN LITERATURE

There is a huge volume of literature on the life and preaching's of Krishna. Tenth to twelfth century marked Krishna with a new perception. From here onwards, Krishna is not confined to temple and conventional texts but the devotion for Krishna is expressed in new ways, such as in arts, dance and music as well as textual compositions. The view point is altered and Krishna's mischievous cowherd lover image was brought to the foreground. Krishna as God is adored and since he had shown divine love with the cowherd maidens (*gopis*), he was loved and worshipped recalling these encounters. The relations of Krishna with the *Gopi*'s, especially Radha were enormously magnified. With this dramatic revolution in the story, we begin to approach the Krishna of Indian painting. The *Bhagavat* gave the lead to writers of the devotional field. Poets like Kalidas, Amaru, Keshavdas, Bhartihari, Jayadeva, Surdas in their poetry interprets the celebrations of love of Radha Krishna.

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*Gita Govinda* is the song of the cowherd, a Sanskrit poem written by the Bengali poet, Jayadeva (twelfth century). It has the isolation of Radha and Krishna caused due to the jealousy and Krishna's neglect and then the reunion as its theme, Jayadeva describes the longing of Radha and Krishna's love making with growing sensuality yet the poem continuously reverts back to praises of Krishna as God (Archer, 2004). Bilvamangala, a poet of Malabar, composed *Krishnakarnamrita, Balgopalstuti* (The childhood of Krishna), comprising of Krishna songs. In Bengal the other poets like Vidhyapati and Chandidas flourished around 1420, produced Radha and Krishna lyrics in Maithili and Bengali respectively. Mira bai of Western India, was spreader of the bhakti movement, singing the glory of the lord, became a great devotee of Krishna. She was followed by Vallabhacharya(1478), and his disciples Krishna Das, Surdas, Parmanand Das and Kumban Das. They wrote poems in which Radha's adventures with Krishna and their romances were described devotedly.

*Mukundamala* of Kulshekhar Alvar, *Anandamandakini* by Madhusudan Sarasvati are compositions full of devotions for Krishna and Radha. One of the works of Surdas in which he composed his love poetry with the six ragas and thirty-six raginis (traditional modes of Indian music), the ragas and raginis is of special importance which has been painted extensively. The other poets who followed him were Keshav Das (Orchha 1580), Govind Das (1590), Bihari lai(1650) and Kalidas (1700). The poems of these poets had religious ecstasy, blended with the feeling of passionate romance (Guy, 2005). In Keshav Das's *Rasik Priya*, Krishna the *Nayak* and Radha as *Nayika*, was composed in Hindi around 1591. Krishna with a blend of prince and cowherd shows elegance and poise. Love for God is blended with charm of courtly loving and nobility of a spiritual religious act. All these variety of literatures provided the platform for the emergence of Indian paintings.

## Krishna in paintings

Miniature paintings around fourteen -fifteen centuries A.D. emerged as powerful movement in Rajasthan and Gujrat, spread to central, Eastern and Northern India because of the patronage of rich Jain merchants. Jain scriptures were commissioned by the members of merchant community which were done on palm leaves of long rectangular strips. The text was inserted with paintings of Mahavir or his earthly career. Then arose the notion of illustrating the secular poetries. With the growing devotion for Krishna, came the demand for illustrated manuscripts.

Krishna is considered the '*purnaavatar*' of Vishnu, has dark coloured skin (blue), the king of Dwarika, the teacher, philosopher for Arjun, adored by *gopis* and *gopas* of Vrindavan, generally clad in yellow silk *dhoti*, mostly with a flute and peacock feather on his head, is one of the most celebrated in paintings. It is the romantic image of lover accompanied by his beloved Radha, that has gripped the wider imagination of the artists. Around 1450, one version of the *Gita Govinda* and two of the *Balgopalstuti* were produced in Western region of India. Pilgrims had brought copies with them while journeying from Bengal on visits to the sites. The three text mentioned were illustrated in the Jain style (Archer, 2004).

With the Mughal invasions the elements of Islamic arts were incorporated with the Indian traditions. Miniaturists painted random subjects, such as *Bhagavat purana*, *Raagmala* series, stories from epics like *Ramayan*, *Mahabharat*, and so on. Illustrated versions of passionate love poetry were executed. Krishna was portrayed as the most elegant of lovers and not as God, Radha and the cowgirls as the very embodiment of fashionable women. Along with the amalgamation of Islamic and Persian influence, there was the phase of indigenous art which struggled to sustain, and in the attempt, there emerged patrons who promoted the India's own tradition, theme, thought and mindset. Artists were also patronised by the Rajput rulers. The Rajput rulers and other Hindu rulers, traders, and feudatories being the followers of Vaishnavism, and the growth of *bhakti* movement lead to the execution of arts on the themes of religion and traditions. The theme of Krishna and Radha were most profusely illustrated. The prepondering theme is love, treated in a variety of ways, as in the illustrations for the *Raagamala* (musical modes), the *Bara masa* (twelve months i.e. Seasons) and the *Nayaka-Nayikabhedha* (classification of heroes and heroines) (Tomory, 1982)

Illustrated versions of *Bhagavat puran* were produced in various parts of India. Indian artist sometimes chose isolated episodes and composed their pictures around them. Different rulers at different times and places, commissioned the artists who executed the sets of illustrations of *Gita Govinda*, *Rasikpriya*, scenes from *Bhagavat puran*- Nanda celebrating Krishna's birth, the child Krishna stealing butter, Krishna exacting toll from the cowgirls, Krishna extinguishing the forest fire, versions of *Rasmanjari*, but their chief subject had been the tender enchantments of courtly love. Ladies were portrayed longing for their lovers. Krishna's arm would be shown placed lovingly around Radha's shoulder. Radha and the cowgirls were shown celebrating the festival of Holi with Krishna, visualization of Krishna combing Radha's hair, adorning her with makeup can be seen in various artworks.

One of the finest series of raga and raginis pictures executed at Hyderabad and now in the India Office Library, London contains exquisite versions with Krishna themes (Archer 2004). Various museums and world institutions around the globe have huge number of paintings in their collections. Numerous artworks are also in private collections globally.

### **3. ART MOVEMENT**

The modern art movement began in the early 1900' in India. Artists like Rabindranath Tagore, Nandalal Bose, Abanindranath Tagore rejected the western concept but wanted to create art that was distinctly Indian. They took inspiration from Indian mythology and religion. Rabindranath Tagore can be rightly acclaimed as a leader of modern art in India. The simple Indian folk art of Jamini Roy and the canvases of Amrita Shergil with bold post- impressions are significant forms of modern art of India. Indian art was affected by the political turmoil in the closing decades of the nineteenth century especially painting. The Western cultural impact and degeneration of the local tradition in art influenced the modern movement in Indian art. All these factors lead to the revivalist movement in Indian art (Bhattacharya, 1994).

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India is a country of varied regions and is known for its cultural diversity. These various regions have their own styles and patterns of arts. These arts are dependent on the regional life and holds a vast entity of past, present and future. These arts are simple, ethnic and vibrant, practiced by the rural populations or tribes. One such tribal community is the Santhal tribes, which are a native group of India and Bangladesh. The artist of this community are called '*Patuas*'. Jamini Roy liked to be called a *Patua* and his art was very much inspired by this tribal art. Jamini Roy was one of the most significant modernists of early twentieth century India. He received his diploma in fine arts in 1908 from the Government School of Art in Calcutta. The quest for an Indian identity lead Jamini Roy to experimentation. He was fascinated by Kalighat paintings, the terracotta temple friezes, folk arts, craft traditions and East Asian calligraphy. His work began showing signs of simple and bold use of lines. Some of his well-known works includes Santhal drummers, Mother and child, Krishna -Balram and women figures like Radha, *Gopini*, *Pujarinis*. He painted ordinary rural people, scenes from Krishna *Leela*, Ramayan, icons from folk traditions of the region and witty representations of animals.

The series of Krishna *Leela* is one of his magnum opuses. In this painting Jamini Roy has represented the Krishna scene from Hindu epic. Child Krishna has been depicted as an infant in blue toned skin sitting on his mother's lap. Mother Yashoda is draped in a *saree* and is surrounded by devotees on either side. The painting appears symmetrically balanced though it is not. Set within a rectangular frame with bold borders, four human figures are painted. All the figures have side profiles with big eyes. The eyeballs have not been drawn which is a peculiar occurrence in many of his works. The decorative forms of *Alpana* also appears on the surface of his paintings.



**Image credit:** collections.vam.ac.uk

**Object:** Painting, **Place of origin:** Bengal (made)

**Date:** ca.1930 (made), **Artist:** Jamini Roy

**Medium:** Painted in Gouache on canvas

**Credit line:** Given by Mr. J.C. Irwin

**Museum number:** IS.202-1959, **Gallery location:** In Storage.

This another painting by Jamini Roy is depiction of Krishna with *Gopas*. The complete painting has symmetrical balancing with an exception to Krishna' figure which is in *Tribhang* posture. Krishna has been painted in bluish colour. There are three human figures all of which are profile faced. Stylised form of trees and peacock is not to be missed. The human figures are clad in '*Dhoti*'. Krishna is in yellow and the devotees/*Gopa*'s in different colours. The painting has bold strong lines which is again a style followed by Jamini Roy. Body decoration with stylised ornamentations and *Alta* on feet and palms is notable. Hair are tied into an ornamental design which is a common feature in many of his works. The eyeballs are missing in the big eyes as usually seen. Jamini Roy has discarded the illusion of depth and regarded composition as a subtle arrangement of coloured areas on flat surface.



**Image credit: astaguru.com**

**Medium: Tempera on cloth, Year: c1950**

**Size: 48 x35.5, Signed: Bottom Right**

Provenance: From a private Mumbai based collection, artwork was acquired by a famous freedom fighter and businessman directly from the artist in the 1950'. Thence by descent

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#### **4. CONCLUSION**

India is a country of rich traditional and cultural history. Since the days of remote past, the epics like *Ramayan*, *Mahabharat*, *Bhagavat Purana* have continued to evince the different arts in India. These epics have held the imagination of artists since long. Krishna has been a fascinating and mysterious character which has been a source of perennial inspiration to the poets and artists. Jamini Roy has taken up the theme of Krishna and Ram and has created a series of paintings with modern arts incorporated with primitive influence. Perhaps it is the enigma of the themes of Krishna which has held the imagination of the ancient and continues to engage the contemporary and modern. Innumerable works of Krishna are with the Galleries around the globe which are considered royal treasures.

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# **Library Collection Development in Digital Era**

**Nimita Kapoor, Pankaja Tiwari**

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## **ABSTRACT**

*Collection development is a dynamic and continuous activity in library. It involves selection committee, library staff, subject experts and users. This article discussed the impact of information technology on collection development and collection management. The paper highlights the concept of Collection development, its needs and advantages and disadvantages in digital environments. The paper also focused types of e-resources and criteria of selection for digital resources.*

**Keywords:** Collection Development, E-resources, Digital collection.

## **1. INTRODUCTION**

Collection Development (CD) is the most important function in libraries to make available needed information resources to their users. Its goals vary according to the type of library and its user community. Effective budgeting and cost-effective selection are important to build the strong collection possible with available resources. Collection Development Management (CDM) is a group of important activities and the process of scientifically building the entire library collection to effectively serve the users' varied needs such as studying, teaching, research development and recreational etc. This process of Collection Development covers the various library housekeeping activities related to selection, purchase, maintenance and assessment of information resources available in current and retrospective manner in the Library materials. This process also covers the planning and various strategies to manage the continuous acquisition, and review of collections to determine its relevance based on the needs of users.

The concept of collection development came into existence in 1980's with the realization that the collection of any library should be directed towards service instead of collection alone. The main guiding factors of collection development are users information needs and available resources within the library (Johnson, 2004). For planning effective collection development of a library, it is essential to frame an exhaustive collection development policy.

### **1.1 Concept of Library Collection**

Library Collection includes books, periodicals, newspapers, manuscripts, films, maps, micro-form, CDs, cassettes, videotapes, DVDs, e-books, audio books, databases, and other formats of information resources. In the digital era, libraries are changed into the information centre. It

provides their users not only print resources but also provides online e-resources including databases, of e-journals, e-books, e-magazines e-thesis etc. Encyclopedia of Library & Information Science (1971) states about the Library collection as the grand total of library resources available in the form of print like books, manuscripts, serials, government and society documents published in the forms of pamphlets, catalogues, reports and non-print materials like recordings, microfilm roles, micro cards and microfiche documents, punch cards.

## ***1.2 Library Collection Development***

Development of a library collection includes the selection policy, budget, collection evaluation, selection of materials, planning for resource sharing and collection maintenance. ALA (2013) defines the Collection Development as a term which covers a number of activities and operations related to the development and management of the library collection including the determination and co-ordination of information material selection policy, assessment of needs various type of users and collection use studies, collection evolution, identification of collection needs of the user society, selection of information resources, planning of the effective cooperation for resource sharing, maintenance and weeding out process of the available collection.

The International Federation of Library Associations and Institutions (IFLA)defined the Collection development as, acquisition and collection development focuses on methodological and topical themes pertaining to acquisition of print and other analogue library materials (by purchase, exchange, gift, legal deposit), and the licensing and purchase of electronic information resources.

## **2. REVIEW OF LITERATURE**

Natarajan (2018) presented his view in his paper and revealed the university libraries subscribed e-journals, e-resources, e-databases their users and faculties. The university also needs to conduct awareness programmes for the users about the e-resources available in the libraries. Okogwu and Ekere (2018) discussed in his paper about types of policies, identifies the tools and techniques, selection criteria and evaluation of e-resources of university libraries in south east Nigeria. It recommended that libraries should formulate CD policy and adopt a written e-resources collection development policy. Also e-resources selected and evaluated on the high and maximum utilization of users. Varadaraju and Ramesh (2018) explained their paper that engineering college libraries Hyderabad subscribed all AICTE proposed e-journals and books on engineering on behalf of all private engineering colleges and access be given to them. The centre provides 24 hours online databases and e-journals their users and all private engineering college libraries.

Naick and Mohan (2017) explained in his paper that only print collection materials are present in library but users demands/ needs print, non-print and electronic resources. It recommended

that collection development policy is very essential for effective selection and procurement of media resources and e-resources. Nicholas and Uduebor (2017) conducted a study collection development processes in the National library of Nigeria, Abuja and Usen polytechnic library in Edo state. It revealed that both library adopt different processes in their bid to development and enrich their collection development. Srivastava, Parabhoi and Sonkar (2016) revealed that digital age has created big challenges of librarian and collection development. In this present time, selection and subscription of e-resources is very critical work and librarian have to pay attention on cost and usefulness of e-resources and demand of users. Mondal and Maity (2016) have published their study selection and acquisition procedure of electronic resources. The finding of the study indicates about new technology, licensing and pricing concerns as part of the selection process. It shows also proper budget should be allotted for subscribing e-resources.

Bhattacharya and Das (2015) in this study, author focused on present status of e-resources available in engineering college library of west Bengal. We find that demand of electronic format is concerned for engineering student. In this way, electronic resources established academic librarians/ professional experts, library collection are essential for this work.

### **3. COLLECTION DEVELOPMENT IN DIGITAL ENVIRONMENT**

The revolution of Information Communication Technology has changed the traditional library into digital library. The implementation of ICT has transformed the operation, function and services of the libraries. In the digital era, the roles of librarians have changed and now they have to act as information mediators. Today, libraries are functioning under constantly changing environment and face a variety of complex challenges like information explosion, IT revolution, network revolution, limited library budgets, and various types of user demands and availability of information resources in diverse media and so on.

In digital era, the procurement of online database is the part of collection development. Libraries are redefining their collection development policies due to low cost of e-resources, 24/7 access to e-resources, fast and easy access and multidimensional needs of modern users.

### **4. NEED OF COLLECTION DEVELOPMENT IN DIGITAL ERA**

- Information explosion.
- Save the time of users.
- Availability of information in various formats (Print, non-print, electronic, audio-visual etc.)
- Different approaches and needs of user.
- Limitation of library (time, space & human power).

- To well management and retrieval of information
- To search national and international database.
- Impact of Information communication technology.
- Increasing numbers of users.

## **5. TYPES OF DIGITAL COLLECTION/E-COLLECTION:**

### **5.1 *E-Books***

E-book is a book-length publication in digital form, consisting of text, images, or both, readable on computers or other electronic devices, although sometimes defined as "an electronic version of a printed book"(WIKIPEDIA). E-books are usually read on dedicated hardware devices known as e-Readers or e-book devices. E-books are preferred by the users for their features like changeable font size, make citation, links to other relevant sites, searching, sending to other users etc.

### **5.2 *E-Journals***

An electronic journal provides research papers review articles, scholarly communication, issued periodically in electronic form by use automation. E-journals are mostly useful tool for researchers. E-journals have an impact not only on libraries but on authors and publishers too. Hence, now-a-days majority of the users expect up to-date and timely information from library and information centers. Information from journals can easily, quickly, pin-pointedly and remotely be retrieved, provided the journals are available in electronic format. Academic and other special libraries cannot reject e-journals in their collections. Another type of online journals, whose full-text is available in the web for viewing and downloading free of charge, called open access articles. Open Access Articles means online access without access charge to individuals and libraries.

### **5.3 *E-Thesis and Dissertation***

E-Theses and dissertations are now very useful tool to collect large data for specific subject. This is a very useful service for users or mostly researchers. It reduces the duplication of research works and gives assistance for the selection of the research area to the users of the libraries. As these can be searched subject wise, it reduces the labor of the reference staff a lot.

## **6. COLLECTION DEVELOPMENT THROUGH CONSORTIA APPROACH IN DIGITAL ERA**

With the Information explosion, it is becoming difficult for the librarian to satisfy the increasing information need of the users. Due to economic reason no library is in a position to acquire all

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such information in print or other form. Due to cost effectiveness, librarians are coming together in the form of consortia for resources sharing. In India, CSIR Consortia, FORSA, IIM Library Consortia, INDEST Consortium and UGC- INFONET e journal consortium are some of the consortia serving the varies kinds of institution in the country.

## 7. CRITERIA FOR SELECTION OF DIGITAL RESOURCES

Now-a-day mostly institutional libraries are provided e-resources or digital collection to fulfill its user's need. But collection development is very difficult task than printed resources in digital environment. It is not an easy step to select e-resource available, but some selectors have given following parameters to evaluate the e-resources:

- **Institutional Requirements:** E-resources should be acquired according to institutional needs and requirement.
- **Authenticity:** It related with accurate facts, facts impartially presented and up to date information etc.
- **Appropriateness:** It includes concept, usefulness of data, titles, captions etc related to subject and suitability according to user's requirements.
- **Scope:** In related with coverage of e-resources development according to users satisfactions.
- **Access:** Access to e-resources should be easy and fast according to user's level.
- **Quality:** Quality of e-publishers and e-resources should keep in mind while selecting the resources for library.
- **Format:** It is available in formats like Adobe PDF and Microsoft reader.
- **Cost:** Cost should be budget i.e. less expensive for satisfactory substitutes average supplemental costs for replacement; repair; physical processing and storage

## 8. ADVANTAGES OF DIGITAL COLLECTION

The advantages of digital library collection include:

- Nearly unlimited storage space at a much lower cost.
- Beyond Geographical Barriers.
- 24 X 7 Availability
- Multiple accesses.
- Remote access.

- Enhanced information retrieval.
- Preservation for print material.
- Universal accessibility.
- Provides various search options.
- Eliminates printing and postage cost.

## **9. DISADVANTAGES OF DIGITAL COLLECTION**

- High infrastructure and installation cost.
- Need special equipment's to access.
- Lack of compatibility among different publishers.
- Hardware and software compatibility issues between publishers and users.
- Difficulty inherent in relating to a large amount of data on a screen.
- Causes more concern about copy right.

## **10. CONCLUSION**

Collection development management is changing day-by-day. New structures for collection development are dominating the acquisition of reference tools, electronic journals and digital archives of historical materials in bundled packages. Collection development work does not stop at these acquisition functions. It includes the follow up of the selection decision, organizing it, and assisting patrons in their use and expanding access.

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# **Literature and Cinema: A Study of Narrative Techniques in Adaptation**

**Akanksha Shekhawat**

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## **ABSTRACT**

*Two distinct yet also remarkable works of art include cinema and literature. While literature was a famous form of artistic expression in the 18th and 19th centuries, cinema took its place in the 20th century. Although these two arts have certain similarities and variations, yet both the forms are closely linked in enlightening their readers and audience to a different world respectively. In both the forms storylines, characters, events, action, drama are used to entertain their followers. The difficult task of films is to cut the narrative in 90 or 120 minutes. Literature can take longer and extend the story to include explanations, digressions, analysis or opinions. Films have no text but books have hundreds of pages. In other terms, cinema is the culture that puts together the greatest number of people. As a reader, the ideas, internal monologs and detailed descriptions of persons and events are privileged. Yet films are external, based on movement, narration and visuals. This paper throws light on the relationship between the literature and cinema, differences in their very nature, narrative techniques and effects on their readers and viewers from different perspectives. This paper will also address the process of adaptation. The primary interest is to assess the language in each narrative, using the translation theory and intertextuality theory.*

**Keywords:** Literature, Cinema, Adaptation, Language, Narratives

## **1. INTRODUCTION**

Literature was a famous form of artistic expression in the 18th and 19th centuries, while cinema took its place in the 20th century. Unlike literature, which had an immense impact over centuries, Cinema today stands out as the most unifying art, unifying the largest number of individuals. “One estimate claim that 30 percent of the movies today derive from novels and that 80 percent of the books classified as best sellers have been adapted to the cinema” (Corrigan 2). This is because the audience shows great interest to watch the adaptations not because they are more likely to win awards, but because the famous novels are of the highest quality. Statistical data shows a considerable growth of the search for source text after the adaptation of the novels. The comparative study of these works of art then makes an evaluation of the excellent contribution of one art to another. This paper throws light on the relationship between the literature and cinema, differences in their very nature, narrative techniques and effects on their readers and viewers from different perspectives. This paper will also address the

process of adaptation. My primary interest is to assess the language in each narrative, using the translation theory and intertextuality theory.

## **2. NOVEL AND FILM: AUTONOMOUS WORKS**

Considering film as a literary translation, although these two arts have certain similarities and variations, yet both the forms are closely linked in enlightening their readers and audience to a different world respectively. Furthermore, translation will be interpreted as transition from that time when translation is no longer treated as mimesis, a practice involved in development and reception conditions. Thus, there is a whole new structure as a result of this transformation process, and the text must be treated as an individual work. therefore, the concept of fidelity of the film over the novel is rejected here, as this concept here is historic, simplified and subjective, specifically when both works are from different historical backgrounds. In other words, literature can be said to be an art which is acquired through writing and film gives life to these texts through voice, music, visual effects and actors. Literature seems to have all the meanings concealed intrinsically that are used to make a film.

In order to make a film, story line, dialogues and screenplay needs to be produced. In the film-making process, production and technology are secondary. The way in which both media express their significance is where the similitude and the difference lie. When the text is rewritten in a new system of language such as the cinema, new representation mechanisms are perceived as the procedures should take poetic and polemical features of the new medium into account. Words have been the only way to express, but a movie has audible voice, which is stronger and life-like while a book has only written words on it. The audio-visual products do provide readers with access to representative writings of the textual tradition of literature. The variety of ways of editing, which introduces, critique, modifying and re signifying texts or perhaps, these practices lead to the production dynamics of literary systems. A single scene in a movie is like a full phrase or a collection of phrases in a novel. The audio and visual influence is a long-lasting triumph over the written words on the audience.

## **3. ADAPTATION: THE CENTRALITY OF NARRATIVE**

Many aspects need to be taken into account in terms of understanding the adaptation process. The most significant, probably, is narrative and the discourse, without which there would have been no adaptation. The more we interpret the process of film adaptation as an origin of the fictional film, the more we find the importance of the narrative to the novel and film. Regardless of the source of films--like an invention, as a leisure or expression--and regardless of the uncertainties regarding its development, its enormous and lasting popularity is due to its shares with the novel. According to Barthes, the narratives of the world are numberless. Narrative is first and foremost a prodigious variety of genres, themselves distributed amongst different substances--as though any material were fit to receive man's stories. Able to be carried by articulated language, spoken or written, fixed or moving images, gestures, and the ordered mixture of all these substances; narrative is present in myth, legend, fable, tale, novella, epic,

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history, tragedy, drama, comedy, mime, painting, stained glass windows, cinema, comics, new items, conversation. Moreover, under this infinite diversity of forms, narratives are present in every age, in every place, in every society; it begins with the very history of mankind and there nowhere is nor have been a people without narrative. All classes, all human groups, have their narrative, enjoyment of which is very often shared by men with different, even opposing, cultural backgrounds. Caring nothing for the division between good and bad Literature, narrative is international, trans-historical and trans-cultural: it is simply there, like life itself (Barthes 79).

Narration is a kind of subject which is close to the discourse of point of view. Where the narrator can express an opinion extensively on the story in the novel, but cannot comment in the film. In the novel narrator can be seen as a personality entity, while in the film they remain anonymous. The apparent way to combat this obstacle is verbal narration whether it is on or off the screen, although there has been much discussion about whether or not the practice is cinematic.

#### **4. ADAPTATION AS TRANSLATION AND THEORY OF INTERTEXTUALITY**

Study on the translation process of the literary texts into cinema has now become a significant subject of study. Translations influence the interaction among literary systems, not only as a rewriting of source text, or projecting footage of an author or a literary piece in various systems, but also for implementing new elements into poetics that define elements of change. Cattrysse, while addressing the method of adaptation as translation states that it is incorrect to treat translation as more connected to source text allegiance than to any other adaptation. As far as literary texts are concerned, few of the poetics elements of the source text, like the style, themes, language, genres should be observed by translators and literary norms of the target system that influence their decision-making. The translation process on screen tends to follow this concept, as film adaptations are incorporated into specific poetics, into a different production context and therefore they are characterized by particular creative processes and are sometimes submitted to certain market constraints in which the main aims in many cases are to offer entertainment to audience or to represent cultural products with other commercial purposes.

Intertextuality theory gives readers numerous ways to decode texts. It is a way of interpreting text, which also includes works of literature. It treats all text as a literary work, and not just as a closed text but as an accessible substance that contains references of others. The writing of an author will therefore, always have references of the other sources. It relates knowingly or unknowingly, directly or indirectly. Theory of Intertextuality is based on the idea that focuses on the words and concepts of the text which is borrowed from one another. A writer is also a reader of the texts, even before he writes and also during his process of writing. Either the writer takes away allusions, observations, references, quotations and citations to past or related

texts or is influenced in certain respects by other texts. In this sense, reading is converted into a process of switching between texts and meaning which is derived from the text. The text therefore, transforms into an intertext.

Unlike fidelity, which tends to restrict the analytical spectrum, intertextuality greatly extends it. This is a concept which has been used in various philosophical frameworks. This is an approach that informs and teaches other fields of language and art study. This enabled it to develop several branches that it can't be used unless one of its definitions is carefully chosen. On a more particular level, intertextuality breaks down barriers between texts that allow multiple works to be invaded in any discourse. Theoretically, intertextuality is a large concept, made up of diverse and often conflicting concepts.

## **5. LITERATURE VERBALITY AND CINEMA ICONICITY**

Language is the principal difference between film and book: one is visual while the other is literary. Language of novel is theoretical and philosophical, and of the film is perceptive and presentational. There, it must be remembered that the novel is an art which is based on language as both a branch of literature and also as a narrative form. Yet, grammar, vocabulary and syntax are all language components. Vocabulary includes words that represent objects or abstractions, while the word is organized by the grammar and syntax. Film is also a language-based art such as the literary art of narration. Literature and cinema are distinct in their relations, and there is little sense of establishing similar comparisons in colloquial interaction between them.

The image of the movie is not just a word but a sentence or a series of phrases. In the movie, the extension of the action is important, and the novel also extends the action by means of character insight and a summary and interpretation of the events described. A major difference among literary discourse and filmic speech is quantitative: it is nearly small in the movie (for instance, a car) is almost very large in the literary text, like a long sentence describing that car, and vice versa, what really is big in the movie, can be like a small element in the literature as a word.

## **6. CONCLUSION**

The film should never be a mere replica of the literature but it must have its very own characteristics and techniques which motivate the viewer to cherish. While both are interdependent in some way, the two must be studied so that a film based on a piece of literature is fully understandable. Although many people can say in their literary form that it's a screenplay of the film, it may be wrong to look at a literary work like that. Even in the text form, it does have an impression of reality and once it appears on a silver screen, it increases its quality much more than it does in the written form. Therefore, film adaptation studies must not rely on the assumption of fidelity on assessing high-or low-quality criteria of the items being studied. Instead, the way in which these texts are read in the new language context, the circumstances by way of cultural transfers and their function in the filmed context should be observed.

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# **Readiness of Indian Organizations for implementing the HR Analytics**

**Atul Chanodkar, T.K. Mandal**

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## **ABSTRACT**

*In recent times, demands from the business leaders and organizations for HR Analytics have been increased as a specific domain to have proper decision making. CHROs and top management people from HR are seeking support of HR analysts for evidence based decision making. Organizations vary in terms of their preparedness for the implementation of HR Analytics on various parameters like right mix of skills, availability of information resources, cultural and organizational readiness. It is also evident by this research.*

**Keywords:** *HR Analytics, Data Analytics, HR Analytics Readiness, Indian industries, Digitization.*

## **1. INTRODUCTION**

Digital technologies in the era of industry 4.0 have been disrupting the ways HRs take decisions in industries. Introduction of HR Analytics is the integration of the technology in traditional and modern approaches in human resource management. Digitization is recognized as one of the significant driver of innovation in today's industries. HR Analytics is one of the evidence-based decision-making system through which the assessment can be performed with the help of models of machine learning and analytical algorithms. In this paper, we study the readiness of the Indian organizations for the implementation of HR Analytics. Experts believe that analytics in workforce may improve the productivity, employee well-being and performance standards. Organizations need to ensure right foundation for implementing the analytics to ensure better employee productivity.

## **2. REVIEW OF LITERATURE**

### **2.1 HR Analytics**

For the past few years, HR analytics has been a rising trend. Many professionals in HR believe that HR analytics may answer the questions that is a challenge to the workforce. The goal is to transform large complex data into insights and help the decision-making process of HRM (Rasmussen & Ulrich, 2015). According to Fitz-enz (2010), “analytics is a mental framework, a logical progression first and a set of statistical tools second”. It starts with the challenge to be

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*Research Scholar, SVVV  
Professor, SVVV, Indore*

tackled in human resources and then moves towards the statistical analysis to understand and reveal the insights solution through data (Fitz-enz & Mattox, 2014). After that the next significant thing according to Levenson (2013) is not only collecting data, but also knowing what decisions can be taken (Fitz-end, 2010).

## ***2.2 Capability and Resource Readiness***

In Industrie 4.0 Maturity Index, Schuh et. al (2017) defines resources as tangible, physical resources. It includes all the resources of an organization like financial, human resources, tools for achieving the targets, machineries, equipment and various other tangible and non-tangible resources. Resource readiness needs the competencies to collect, store, clean and prepare the data and information. It includes the tools and systems for data evaluation. The resources readiness starts with human resources working on data analytics and it should be ensured whether companies possess necessary tools and technologies to support HR professionals and department.

## ***2.3 Information System Readiness***

Information to be analyzed for workforce is mostly in socio-technical manner. It is an interaction between the people processes and technical integration. The information system should be capable of doing evaluations based on the data available comprising statistical, analytical analyses, machine learning and big data techniques.

## ***2.4 Cultural Readiness***

Schuh et al. (2017) states that “organizations won’t be able to achieve the required agility if they simply introduce digital technologies without addressing corporate culture”. It is about assessing the understanding of organizations regarding data and whether organizations are valuing data-driven decisions, as opposed being driven by intuition, perception or bias. It also includes cultural readiness capability to understand whether companies have appropriate culture and internal processes to embrace insights generated by the analytics.

## **3. OBJECTIVES**

The objectives of this study is to examine the readiness of the organizations for implementation of HR analytics on three measures:

- Strategic readiness (getting started with HR analytics)
- Capability Readiness (Building capability for implementation)
- Cultural readiness

## 4. HYPOTHESIS

- $H_0$ : There is no readiness of Indian organizations for implementing HR analytics.
- $H_1$ : There is readiness of Indian organizations for implementing HR analytics.

## 5. RESEARCH METHODOLOGY

### 5.1 Sample

Convenient Sampling has been used for the study as few companies are currently working on HR analytics in India. The responses are collected from the HRs of the manufacturing and service organizations and academicians and trainers who are practicing HR analytics. The sample size is 114 respondents.

### 5.2 Data Collection

A questionnaire developed by IBM is used for the purpose of data collection. The responses are collected from the professionals in HR domains of various industries through google forms and emailing questionnaire. IBM SPSS 20.0 is used to assess the data.

### 5.3 Data Analysis

The questionnaire collects different types of data like categorical and ordinal. And answers were analyzed using SPSS 20.0 software. To analyze readiness level, the questionnaire is classified on three dimensions that are primary initiation from the organization for HR analytics, second, questions based on building capability for implementing HR analytics and third is related with the culture.

Questions	Readiness Criteria
Q1, Q2, Q3, Q4, Q5, Q6	Getting Started with HR Analytics (Strategic Readiness)
Q7, Q8, Q9, Q10, Q11	Capability Readiness
Q12, Q13, Q14, Q15	Cultural Readiness

We have used the scoring rules by

Average Score	Alignment Assessment	Readiness Level
0% – 20%	Very Low	1
21% – 40%	Low	2
41% – 60%	Medium	3

61% – 80%	High	4
81% - 100%	Very High	5

Average of the data gained through questionnaire has been used for knowing the broad picture of the readiness of the organizations to implement HR analytics.

### ***Descriptive Statistics***

	N	Minimum	Maximum	Mean	Std. Deviation
Getting Started	114	1.00	5.00	3.6272	.71688
Capability Building	114	1.00	4.80	3.3474	.82914
Analytical Culture	114	1.00	5.00	3.2368	.96386
Overall	114	2.07	4.33	3.4191	.57141
Valid N (listwise)	114				

The mean for the overall score indicates that the organizations are ready for implementation of the HR analytics with the mean score of 3.41 which is equivalent to 60% to 80% readiness. For the three criteria individually, the mean scores are 3.62, 3.34 and 3.23 for getting started, capability building and cultural readiness respectively.

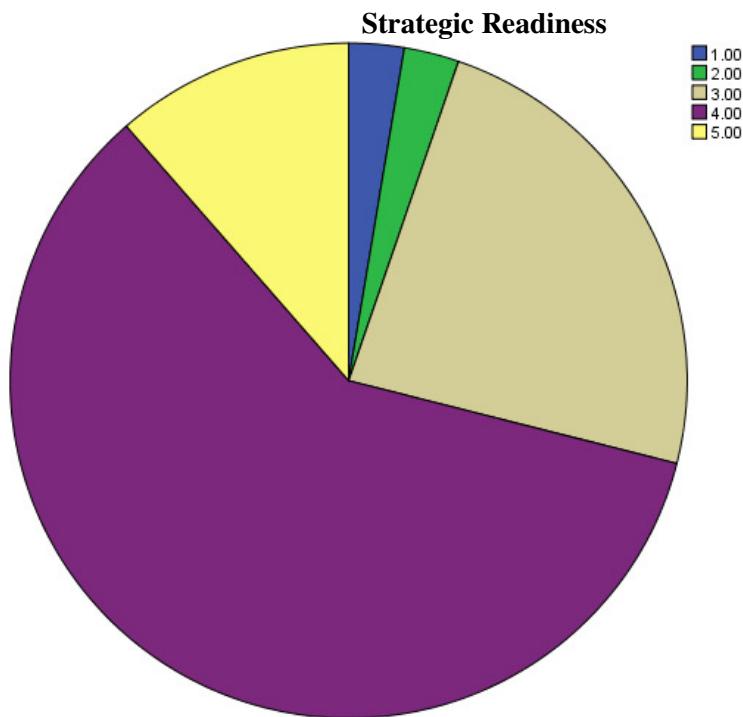
#### ***5.3.1. Calculating the Strategic Readiness***

### ***Frequencies***

Statistics		
Strategic Readiness		
N	Valid	114
	Missing	0

Strategic Readiness					
	Frequency	Percent	Valid Percent	Cumulative Percent	
Valid	1.00	3	2.6	2.6	2.6
	2.00	3	2.6	2.6	5.3

	3.00	27	23.7	23.7	28.9
	4.00	68	59.6	59.6	88.6
	5.00	13	11.4	11.4	100.0
	Total	114	100.0	100.0	

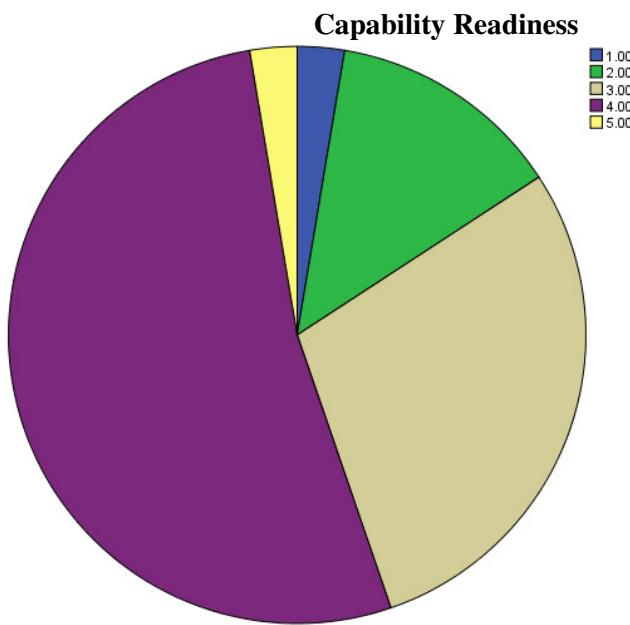


**With the percentage of 59.6% to the average score, there is a strategic readiness of medium level in maximum organizations.**

### 5.3.2. Calculating the Capability Readiness

Statistics		
Capability Readiness		
N	Valid	114
	Missing	0

Capability Readiness					
	Frequency	Percent	Valid Percent	Cumulative Percent	
Valid	1.00	3	2.6	2.6	2.6
	2.00	15	13.2	13.2	15.8
	3.00	33	28.9	28.9	44.7
	4.00	60	52.6	52.6	97.4
	5.00	3	2.6	2.6	100.0
	Total	114	100.0	100.0	



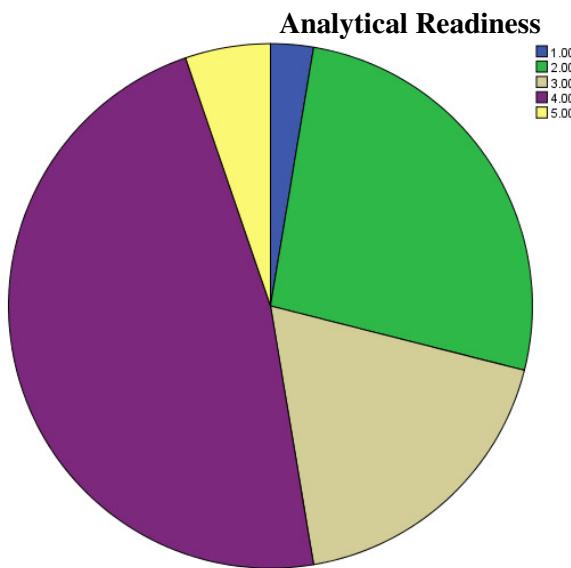
**With the percentage of 52.6% to the average score, there is a capability readiness of medium level in maximum organizations.**

### Calculating the Analytical Readiness

Statistics		
Analytical Readiness		
N	Valid	114
	Missing	0

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Analytical Readiness					
	Frequency	Percent	Valid Percent	Cumulative Percent	
Valid	1.00	3	2.6	2.6	2.6
	2.00	30	26.3	26.3	28.9
	3.00	21	18.4	18.4	47.4
	4.00	54	47.4	47.4	94.7
	5.00	6	5.3	5.3	100.0
	Total	114	100.0	100.0	

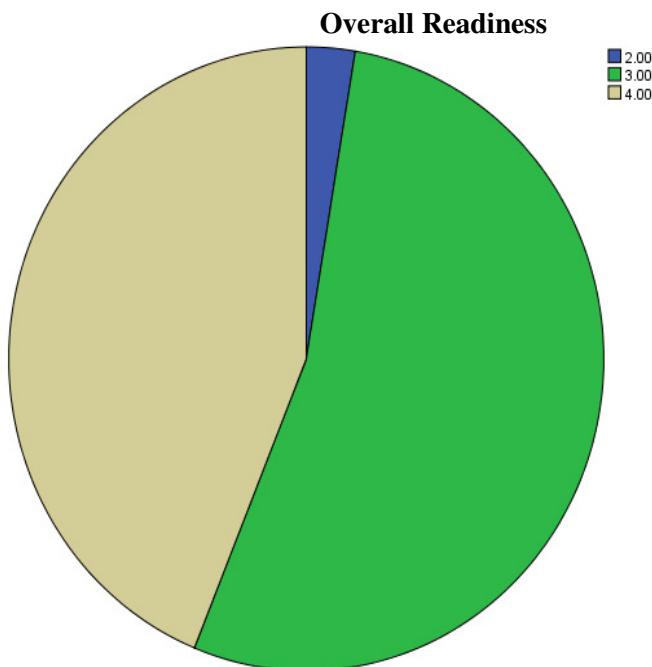


With the percentage of 47.7% to the average score, there is a analytical readiness of medium level in maximum organizations.

### 5.3.3. Overall Organizational Readiness

Statistics		
Overall Readiness		
N	Valid	114
	Missing	0

Overall Readiness					
	Frequency	Percent	Valid Percent	Cumulative Percent	
Valid	2.00	3	2.6	2.6	2.6
	3.00	61	53.5	53.5	56.1
	4.00	50	43.9	43.9	100.0
	Total	114	100.0	100.0	



**With the percentage of 53.5% to the average score, there is overall readiness of medium level in maximum organizations.**

## 6. SURVEY FINDINGS

Findings revealed that organizations at different levels have medium readiness for all the variables. Overall readiness at a medium level expresses that there is a lot to be done in implementing HR analytics in Indian organizations. Organizations are still trying to incorporate the strategies that can support the implementation. The most important factor is people. If people are involved for the change, organizations will have less resistance to implement analytics. With the human resources, all other resources can be planned. Compared to other researches in various industries in other countries, India lags behind for the implementation.

## 7. DISCUSSION

The findings of the study indicate that readiness level to implement HR analytics is medium. The readiness level suggests that Indian organizations may explore the area of analytics for human resources for better organizational growth through efficient decision making. In the coming years, organizations may seek structural changes to introduce technological integration in HR for tackling the challenges that this department faces. Advance data analytics tools can be used by organizations for evidence-based decision-making.

## 8. CONCLUSION

The study illustrates the readiness of Indian organizations for implementing HR analytics. The study is through convenient sampling, it solves the purpose of coming to a conclusion through the available data and responses received from professionals in the analytics field. The questionnaire provides useful responses from the industries of India about whether organizations are influenced by the data race taking place around the world. Various studies around the world may have contradictions with the study as per the availability of the data, resources availability and workforce to analyze the data.

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# **SWAYAM: An Overview of New Online Learning Opportunity**

**Sudha Upadhyay, Subhash Khode**

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## **ABSTRACT**

*Information communication technology (ICT) has changed the entire education system .ICT plays a vital role in making learning more effective, efficient and enjoyable. Today we live in the digital learning era; digital learning/ e-learning simply means learning with the help of technology. It is not bounded with the traditional type of classroom teaching but it has to give the freedom to both the teachers as well as students to choose their place and time. In this digital learning era, MOOC is the quality education tool to provide quality education to the mass at minimum cost. MOOC platforms are fast gaining popularity in India. The study has shown that India after the US the second-largest country in terms of enrolments in MOOCs. Indian Government launched an Indian MOOC platform called SWAYAM (Study Webs of Active Learning for Young Aspiring Minds) with three cardinal principles of education policy they are access, equity, and quality. The basic philosophy of MOOCs is 3A's learn any time, learn anyone, and learn anywhere. This paper highlighted basics concept of SWAYAM, its main features, coordinators and course contents.*

**Keywords:** SWAYAM, E-learning, Digital learning, MOOCs

## **1. INTRODUCTION**

SWAYAM is a self learning tool to provide quality education to learners at minimum cost with lot of choices It is as a one-stop web and mobile-based high quality, interactive, curriculum-based hosting course from High School to University level ((Class IX to post-graduation). It has been developed collaboratively by MHRD (Ministry of Human Resource Development) and AICTE (All India Council for Technical Education) with the help of Microsoft and is capable of hosting 2, 000 courses in multiple languages including regional languages. The platform is to provide a high-quality learning experience using multimedia on anytime, anywhere basis. It allows easy access, monitoring, and certification, peer group interaction through a discussion forum and web conferencing system to help learners in clarifying doubts. SWAYAM is helpful for improving the knowledge and developing and creating knowledge economy (Paul 2018). It designed to achieve the three cardinal principles of education viz- Access, Equity and Quality.

## 2. REVIEW OF LITERATURE

Monika Jayachithra (2019) reported in their study that all teachers and students of Humanities and Science in Tamil Nadu have a positive perception of massive open online courses. The study also revealed that postgraduate, urban area and science students and teachers were more aware of MOOCs compared to graduate students and teachers of humanities in the rural area. Santosh and Padmanabha (2019) conducted a study to examine the awareness, acceptance, challenges and experiences about massive open online courses in Bangalore among the faculty, research scholars and students of management education. The study revealed that the majority of students, faculty and research scholars were aware of massive open online courses. The study highlighted that the students need proper training, technical support and encouragement to complete the online courses.

Nayek (2018) in his study examined the awareness of SWAYAM among Library and Information Science professionals in India. The study revealed that the majority of students were aware and interested in the SWAYAM program but library science courses are very less in SWAYAM compare to other courses, so it is essential to add more recent topics, latest developments interactive and pioneering learning techniques in the library and information science courses. The study also suggested that it is prime duty of library professionals to have promoted online learning and play a vital role in the Digital India mission. Paul; Bhuimali; Tiwary and Aithal (2018) study highlighted that SWAYAM is an online self learning education instrument. This is helpful for those who are studying and also working. Many courses offered in this platform and virtually every course is for the school /college and university level and importantly most of the courses are offered by the teachers in India and elsewhere. These courses delivered by the reputed organizations and universities viz IIT Bombay, IIT Guwahati, IIT Madras, IIT Bangalore, IIT Kanpur, and University of Delhi etc. Study also suggested that in future bachelors and masters degree program may also be started in SWAYAM platform for better and smarter knowledge delivery.

Pramanik (2018) tried to find out the attitude of post graduate students of the University of Calcutta and reported that in India traditional education methods are preferred by most of the students. The study also revealed that language is also one of the barriers to participate in MOOCs courses. The study suggested that effective implementation of SWAYAM MOOCs is required basic IT infrastructure and a fast internet connection. Priyadeep; Balhara and Dalal (2018) conducted a study to carry out quality analysis of SWAYAM courses related to management education and explore scope of improvement in digital learning through SWAYAM program. The survey helped in analyzing the issues of ease of access, ease in understanding the study content, relevance, practical applicability and feedback management related to study content in SWAYAM program.

Hiremath, (2017) study explained the SWAYAM massive open online portal objectives, features, scope and advantages and suggested that every institution should have participated to

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promote these courses. Various research studies revealed that most of the researchers suggested that there is a need to develop the infrastructure and technical facilities for better utilization of SWAYAM. It was also observed that science and technology students and faculty are more aware compared to other fields.

### **3. OBJECTIVE OF THE STUDY**

The present study is conceptual and main objective of this study is to highlight the main features, course contents, benefits and challenges of SWAYAM. It is a Government of India's initiative and the world's largest MOOC platform.

### **4. SWAYAM: AN OVERVIEW**

The President of India Mr. Pranab Mukherjee launched the Study Webs of Active Learning for Young Aspiring Minds (SWAYAM) programme on 9<sup>th</sup> July 2017 to " Best teaching learning resources to all". SWAYAM offer excellent, interactive and curriculum based hosting of 2000 online courses from class 9<sup>th</sup> to PG level. The courses provided in this portal are interactive, prepared by the highly qualified teachers of the country and are available free of cost to the learners.



The course content developed on the portal follows four-quadrant approach [The Gazette of India, 17th Aug 2016].

**E-Tutorial:** Video and Audio Content in an organized form, Animation, Simulations, video demonstrations, Virtual Labs, etc.

**E-Content:** PDF, Text, e-Books, illustrations, video demonstrations, documents, and Interactive simulations wherever required.

**Web Resources:** Related Links, Wikipedia Development of Course, Open source Content on the Internet, Case Studies, books, including e-books, research papers & journals, Anecdotal information, Historical development of the subject, Articles, etc.

**Self-Assessment:** Problems and Solutions, which could be in the form of Multiple Choice Questions, Fill in the blanks, Matching Questions, Short Answer Questions, Long Answer Questions, Quizzes, Assignments and solutions, Discussion forum topics and setting up the FAQs, Clarifications on general misconceptions.

## 5. MAJOR FEATURES OF SWAYAM

**Course type and duration:** There are two types of courses offered through SWAYAM – Credit and Non-Credit. Credit course is a course taught for at least one semester as part of a subject. Non-credit courses include courses such as awareness programs and specific skill-set training, which are not part of any set curriculum. Such courses can be of shorter duration, usually ranging from two to four months.

**Course components:** Courses hosted on SWAYAM are available for students in four components: video lectures, downloadable/ printable reading material, self-assessment tests through quizzes and tests, and an online discussion forum for clearing doubts.

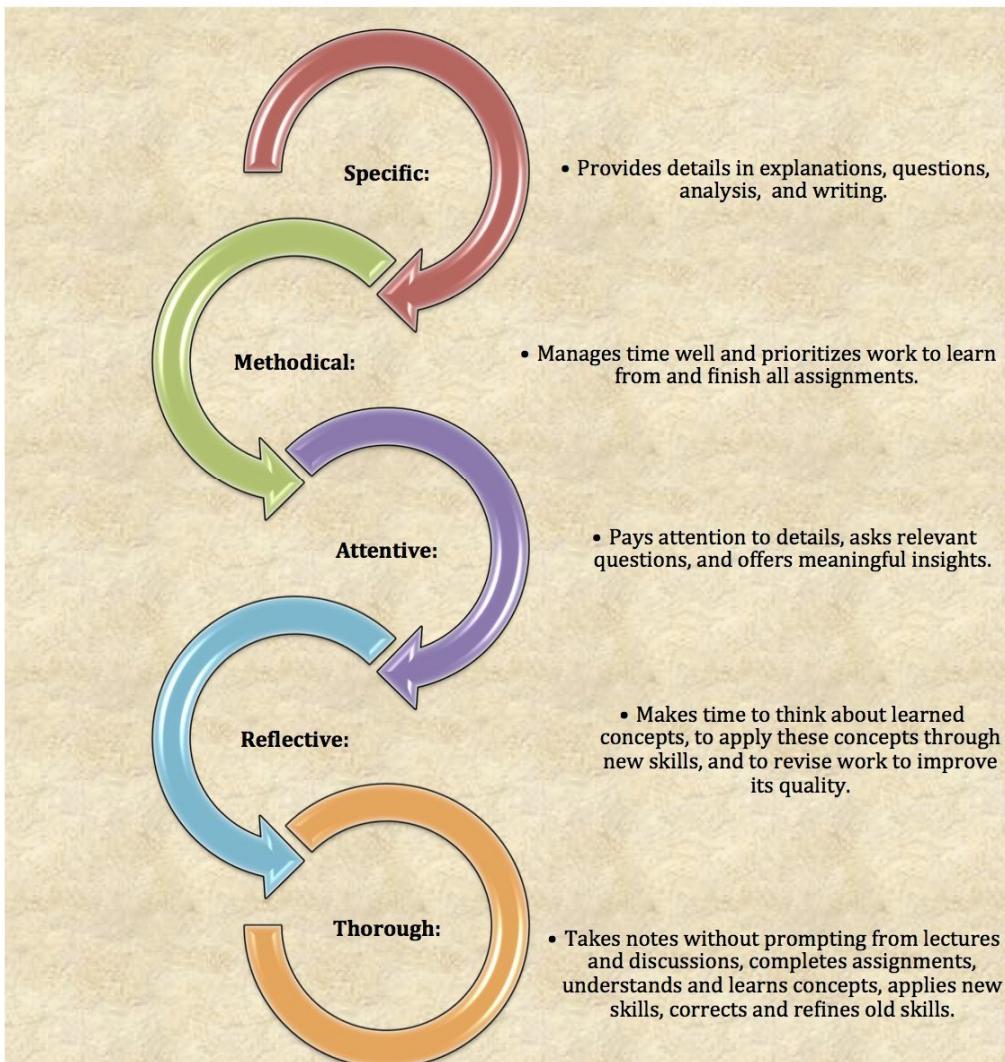
**Eligibility:** Online education courses offered through the portal of SWAYAM ([swayam.gov.in](http://swayam.gov.in)) can be accessed by anyone, anywhere, any time.

**Course fee:** Courses offered via SWAYAM are free of cost for residents of India. However, in order to obtain a certificate for a particular course student need to pay a nominal fee.

**Certification:** Students who wish to obtain certificates for their courses need to get themselves registered on SWAYAM portal. Also, certificates are awarded to students only after the successful completion of the course.

**Credits:** At the end of each course, students will be assessed through a proctored exam. Marks/ grades secured by students in the exam can be transferred to their academic records. To implement the same, UGC has issued UGC (Credit Framework for online learning courses through SWAYAM) Regulation 2016 recommending universities to identify courses in which credits can be transferred to students' academic records.

## The S.M.A.R.T. Student Model at Swayam Learning™



### Nine National Coordinators have been appointed to manage the SWAYAM courses:

- University Grants Commission (UGC). Non-Technology Post Graduate Degree Programmes.
- Indian Institute of Management Bangalore (IIMB). Management programmes All India Council of Technical Education (AICTE)

- Consortium for Educational Communication (CEC) Non Technology undergraduate Degree programmes:
- National Institute of Technical Teacher's Training (NITTR) Chennai for Teacher Training program
- Indira Gandhi National Open University (IGNOU) Diplomas and Certificates programs.
- National Council of Educational Research and Training (NCERT) School Educational Programmes from Class 9<sup>th</sup> to 12<sup>th</sup>.
- National Institute of Open Schooling (NIOS) Out of school children Educational Programmes from Class 9th to 12th
- National Programme on Technology Enhancement Learning (NPTEL) for Technical / Engineering UG & PG degree programs.

## **6. BENEFITS OF SWAYAM**

- SWAYAM provides great opportunities to learn and develop new skills and technology free of cost to the learners. However nominal fees have to be paid for the certificates.
- SWAYAM provides quality and affordable education to citizens of India, which can be accessible on anywhere, anytime basis.
- It has opened a new gateway to teaching learning and helps in improving knowledge and skills for employability.
- This platform provides interactive courses, prepared by the best teachers in the country. Over 1, 000 specially chosen teachers from all over the country have participated in preparing SWAYAM courses including many categories such as; Humanities, Programming, Computer Science, Engineering, Data Science, Business, Science, Health & Medicine, Social Science, Education & Teaching, Art & Design, Mathematics, Personal development etc.
- Reducing dropout rate in secondary and higher education.
- Improving technology adoption across India.

## **7. CHALLENGES IN ACCESSING SWAYAM**

- High Speed Internet Connections: The unavailability of high speed internet connection in rural areas and required technical infrastructure to access the content of SWAYAM are major challenges.
- Language Problems: The Language is also one of the challenges. Unless and until courses are made available in the regional languages the enrolment will be very restrictive. For

extensive uses of SWAYAM Course contents should be available in regional languages also.

## **8. SUGGESTIONS**

- Proper infrastructure and technical support should be provided to students for completion of courses.
- There is unavailability of high speed internet in rural area, therefore an alternative mobile App facility is being considered to extend the use of SWAYAM courses.
- Every institute should promote and provide e-learning courses.
- Faculty members should participate in enrolment of SWAYAM courses.
- Training and awareness programs should be conducted on a regular basis.
- An effective and efficient feedback system should be developed to know about students' doubts.
- Institutes should encourage the learners for course completion.
- The courses should also be made available in regional languages.

## **9. CONCLUSION**

SWAYAM offers wide range of courses; this is done through a platform that facilitates hosting of all the courses, taught in classrooms from Class 9 till post-graduation to be accessed by anyone, anywhere at any time. All the courses are interactive, prepared by the best teachers in the country and are available, free of cost to any learner. More than 1, 000 specially chosen faculty and teachers from across the country have participated in preparing these courses. Government of India, Ministry of Human Resource Development is promoting MOOCs in SWAYAM. It provides the opportunity to users to improve their knowledge and skills for employability. SWAYAM is a new gateway to teaching-learning.

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# **The Impact of Technical Analysis on the Returns in the Index-Bank Nifty**

**Hanish Kukreja, Swati Oza**

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## **ABSTRACT**

*It is usually believed that trading in stock market is similar to gambling and research cannot enhance the returns on the same. This research was aimed to explore the option of technical analysis through which the candlestick price pattern and trend can be studied, and thus can help to predict the price movement of stock market. The key issue in trading these days is people following herd mentality and they do not do their own research before taking action in stock market, which many a times leads to losses. This study was aimed to formulate some strategies, using technical indicators. The research used primary data, which was collected through purposive sampling and snowball sampling. Traders and researchers in Indore were approached for the same and were given a questionnaire, which helped figuring out a few strategies which can give consistent and significant profit in stock market. The strategies were applied on 'Bank Nifty' index and the returns from these strategies were compared with the 10 year CAGR of the same index. The information of the index price in different time periods was collected from authentic sources (like NSEIndia.com and Investing.com) and this formed the secondary data for the research.*

**Keywords:** Stock Market Trading, Technical Analysis, Trading Strategies, Technical Indicators

## **1. INTRODUCTION**

Finance is a science of managing money which centres on raising funds and efficient utilization of the same. A financial market is a place where people trade in financial negotiable instruments at prices that are calculated by the demand and supply forces. Participants in a stock market include retail individual investors, high net worth investors (HNI), institutional investors, etc. Initially, it was related only procurement of funds and flow of cash. But now, it is considered as a study that consists of not only acquiring of funds, but also better application of these funds. Thus, optimum utilization of funds is another important part of modern finance along with ways to acquire funds. Modern finance has also shifted the focus of managers from profit maximization to shareholder's wealth maximization. Usually, there are 2 sources of funds i.e. through equity (owner's funds) and through debt (borrowed funds).

A financial market is a place where trading of securities takes place. The term security means a negotiable financial instrument which holds monetary value. Securities can be categorized into

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*Research Scholar, SVVV, Indore  
Assistant Professor, SVVV, Indore*

2 types, equity and debt. An equity security gives a part of ownership to the shareholder in the company. This includes both common and preferred stock. Holders of equity are not entitled for regular returns but instead they get a part of the profit which the company makes (in the form of dividend) and they get capital gains when they sell the securities. A debt security is the money which is borrowed and must be repaid on a specific date (i.e. maturity) with some predefined annual interest payment. Thus, the company which borrows money in the form of debt securities provides regular payment of interest to the debt holders. Debt securities can be secured or unsecured.

Primary market is the new issue market where companies enter to raise fresh capital. The instrument usually used in primary market is IPO (Initial Public Offer). Secondary market is when the company has raised funds from the primary market and is now listed on a stock exchange. This is the market which makes the shares liquid, to help people who invested in the IPO exit whenever they want. The company raises the capital in the primary market, whereas, the fund flows from one investor to another investor in a secondary market. A stock exchange is a platform or an avenue that allows trading of shares. It is a common platform where buyers and sellers meet to execute their trades. There are two nationalized stock exchanges in India, NSE and BSE. BSE was established in 1875. It is the oldest stock exchange in whole Asia. There are 5500+ companies listed in BSE. Sensex is the index of BSE. It consists of top 30 stocks of the exchange by the market capitalization. NSE was established in the year 1992. This is the largest stock exchange in India in terms of daily number of trades. There are 1600+ companies listed in NSE. Nifty is the index of this exchange. It consists of top 50 stocks of the exchange, ranked by the market capitalization. The stock market is a financial market which provides a platform to the investors to buy and sell shares of publicly listed/traded companies. Stock market plays a very important role in any functioning of any economy by channelizing the funds from households or people with excess funds and provides to those who have productive need of the same. More than 90% of the traders enter the market without proper knowledge and usually lose their money (Gann, 1951). Thus, there is a need to form strategies which will enable a common man to make consistent profit out of the stock market.

Technical Analysis studies chart patterns and past and current price movements to predict future price movement. The importance of Technical analysis came into picture with the advent of Dow Theory. Hence Charles Dow, a Wall Street's journalist, laid down the foundation of technical analysis in stock market in 1900's. Before that, a similar study was being used by the Japanese rice traders to predict the future price of rice in 1700. However, its usage got increased immensely with the use of information technology and telecommunication revolution. Technical Analysis concentrates on historical price and volume to understand the market sentiments and to identify the trend of the market. It is to be noted that the movement and changes in the prices of stocks is majorly due to demand and supply of the stocks.

Following are the four assumptions of the Technical Analysis:

- a) Share prices move as a result of demand or supply, which is caused by news.
- b) Market discounts everything.
- c) Market always moves in trends.
- d) History tends to repeat itself.

## 2. CONCEPTUAL FRAMEWORK

A **candlestick chart** is a financial chart which combines the data like day's opening price, day's closing price, highest price and the lowest price of the stock of the day and forms a candle out of it. A candlestick chart is the combination of many such candles, each representing the OHLC (Open, High, Low and Close) of a specific day.

The important concepts in technical analysis are Support, Resistance and Trends. **Support** is an area which is formed by the excess demand at the price. Thus the stock tends to bounce back after touching this area. **Resistance** is an area which is formed by the excess supply. A **trend** is a channel at an angle, classified into an Uptrend and a Downtrend. An Uptrend is formed when the stock makes higher highs and higher lows. This is also known a bullish phase. A Downtrend is formed when the stock makes lower highs and lower lows. This is known a bearish phase.

There are two different types of **price patterns**, Continuation pattern and Reversal pattern. Continuation pattern makes the stock to continue to move in the trend prior to the formation of the pattern. Examples of continuation patterns are Triangles, Flags and Pennants. The trend tends to reverse after a reversal pattern is formed. Examples are Double\_top, Double\_bottom, Head and Shoulders, Triple top and bottom. Thus, technical analysis helps to identify the trend and price patterns through which one can analyse the future direction of stocks. Researchers believe that volume and trend go hand in hand. That is, an increasing stock price (up-trend) with an increasing volume signifies a strong up-trend.

**Moving Average** is an indicator and statistical tool that helps to forecast the price of a share. A moving average smoothens the uneven movement of the share and reduces the distortions. This average considers different time spans. For e.g., : 20 day moving average. **Relative Strength Index (RSI)** is an oscillator. It identifies technical strength and weakness of stocks. The strength and weakness is calculated by gains and losses in the current day's prices from the immediate previous day. The RSI value is calculated and graph is plotted to identify the overbought and\_ oversold stocks in the market.

## 3. REVIEW OF LITERATURE

Lu and Shiu (2016) tried to find the profitability of daily (1 day) candlestick patterns. This study took place considering the American stock market from 1974 till 2009. The author used the

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daily prices of stocks which were a part of Dow Jones Industrial Average. A four price level approach was developed to identify candlestick patterns. The returns obtained as a result of patterns were then analyzed using T test. It was concluded that daily candlestick patterns can be helpful in taking out good returns in stock market. They also concluded that buy signals were able to generate better returns than sell signals during their study.

Rajan & Parimala (2015) applied the technical analysis on the historic price movements of the three stocks (HUL, Britannia and Godrej) of FMCG sector and estimated the trend of future price. He analyzed the data of twelve months with the help of Simple Moving Average and Bollinger Bands to take decision regarding buying or selling position in the stocks. On the basis of Bollinger Bands, the author suggested that one could sell the stocks during February, 2012 and volume was highest particularly on 16th October, 2012 in case of HUL. On the other hand, the narrowing band of Britannia share price showed an opportunities of breakthrough and the investors were suggested to buy or sell in between the high and low points of the band. The movements of Godrej share price provided an obvious scene of the positive movement of target price. Moving average method explored the fluctuations of selling and buying levels for HUL from December, 2011 to July, 2012 and scrips of Britannia revealed a random nature from June to November of 2012 and a continuous rise was observed for the shares of Godrej.

Boobalan (2014) analysed a few stocks, WIPRO, SBI, GAIL, ONGC and ITC by using technical analysis tools. Using indicators, he observed that Wipro had a bullish trend in short and medium term. While he made these observations, Wipro was trading at 185, and today it is trading at 236, with a high of 300. He suggested buy above at 193 (split adjusted) in SBI, which is trading at 281 now (with a high of 373). Strong signal to buy in short, medium and long terms for GAIL, ONGC is technically strong according to MACD, short term bullish trend was detected on the basis of RSI and MACD for ITC. This study suggested investors that using technical analysis can help you forecast the trend of price movement of short & medium term. He also mentioned that fundamental knowledge was also observed as an important concept to find more accurate idea of investment pattern. Hence, he recommended that both analysis should be used to get better insight about the stocks.

Chitenderu, Tafadzwa and Maredza, Andrew and Sibanda, Kin (2014) tested the existence of Random walk hypothesis and efficient market hypothesis using monthly time frame of All Share Index (ALSI) in Johannesburg Stock exchange market, South Africa covering period of 2000 to 2001. The authors observed that ALSI followed Random walk hypothesis with a wide deviation between forecast and actual values. They concluded no one can outperform the market and making excess returns in the market is merely a game of chance. They also mentioned that if an investor profits from the market, this is merely because of luck and not analytical skills.

**Gap –** Review of literature has shown that there is still much ambiguity in which method or study such as technical analysis or fundamental analysis can actually affect the returns of a trader in the stock market.

#### **4. RESEARCH METHODOLOGY**

The research design was analytical in nature. The data was collected from both primary as well as secondary sources. Primary data was collected by surveying market researchers and traders. The secondary data, which is the stock price of index (Bank Nifty), was collected from NSEIndia.com and Investing.com.

##### ***Sample Size***

The sample size of primary data is 100. The responses were collected through questionnaire that includes 50 market researchers and 50 traders / investors.

##### ***Objectives of Study:***

The following were the objectives of the current study:

- To understand the psychology of the traders if they feel trading in stock market is pure gambling and to study if technical analysis can make difference in the returns of a trader
- To study the response of NISM certified research analysts towards the usage of technical analysis
- To formulate the trading strategies and applying it to Nifty Bank
- To compare the CAGR returns of the index in last 10 years with the trading strategies return for the same duration

The present study concentrates on 2 important indicators usually used by the researchers. These are moving averages and RSI. The current study is significant as a good increase in the number of traders has been observed in recent years. India has become a hub of investment instruments. As per an article in Business Today, only 18 million people trade in stock market out of the population of a billion. This study is being conducted to find out if technical analysis can actually create any difference in the returns of a trader. In this study, the returns by different technical strategies will be compared with two different returns:

- a) Return of the 10 years CAGR of the same index
- b) Opportunity cost (Return the person would have received if he invested the same amount in FD)

Moreover, as computer and internet are easily accessible to everyone, it has become very important to understand the strategies through which people can make out regular passive income through technical analysis. Also, this study is significant for the traders whose job or a part of income is dependent on technical analysis as many academicians have argued against the

significance of technical analysis, mentioning the same is not an efficient tool to predict the trend of the market.

## Hypotheses

The following hypotheses have been formulated for the present study:

$H_{01}$ : The market view is independent of the occupation of the responders

$H_{02}$ : Technical Strategies involving indicators like the Moving average always give same or less returns as the CAGR of the stock/index

$H_{03}$ : Technical Strategies involving indicators like the Relative Strength Index always give same or less returns as the CAGR of the stock/index

## 5. ANALYSIS AND RESULTS

According to the primary data received through the survey questionnaire filled by 100 people (50 traders and 50 researchers), the following are statistical observations made:

1. 98% researchers believed that the returns in stock market can be improved using technical analysis as a research tool, whereas, 47% traders felt the same.
2. The main sources of information for most of the people are Internet, newspaper and TV.
3. 85% researchers preferred\_technical analysis over news while trading in intraday.
4. 95% researchers believed that technical analysis is reliable.
5. More than 50% researchers trust support and resistance to be a reliable tool in technical analysis.
6. 85% researchers use candlestick charts among all the other types of charts.
7. 75% researchers use moving average, while only 31% researchers use RSI.
8. The most frequently used combination of slow and fast moving averages are 20 and 50.
9. 87% researchers felt that they have faith in moving average as a technical indicator.
10. 76% researchers felt that accuracy of technical analysis is much above 50%.
11. 56% researchers felt that accuracy of technical indicators is much above 50%.

**TABLE 1: Socio Demographic Profile of Respondents**

Categories	Classification	Frequency	Percentage
<b>Gender</b>	Male	73	72%
	Female	29	28%
<b>Age</b>	Below 30	68	67%
	30 to 40 years	25	25%
	41 to 50 years	8	8%
	Above 50 years	1	1%
<b>Occupation</b>	Student	3	3%
	Self-Employed	9	9%
	Employee	86	84%
	Freelancer	2	2%
	Retired Employee	0	0%
	Full-time Trader	2	2%
<b>Income</b>	Below 5 Lac	62	61%
	5 Lac to 10 Lac	7	7%
	10 Lac to 20 Lac	8	8%
	Above 20 Lac	1	1%
	Did not disclose	24	24%
<b>View about market</b>	It is pure gambling (The market is efficient enough as per the Efficient Market Hypothesis)	28	27%
	The return can be improved if proper research is involved (like Technical and Fundamental Analysis)	74	73%

The first null hypothesis ( $H_0$ -1) said that the ‘market view is independent of the occupation you do’. The occupation of respondents was being segregated in two categories:

- a) Researchers (which included researchers, brokers and advisors)
- b) Non – Researchers (which included all other occupations)

As the two available variables are categorical (Occupation and Market View), **Chi-Square test** was applied. If the market view is independent of the occupation, it was expected that 50%

researchers and 50% non-researchers should be with the view that trading is pure gambling, with the rest 50% of the sample with the view that returns can be enhanced when some research is involved. Below is the count of respondents who said that market's return can be predicted through a proper research:

	Expected	Observed
<b>Researchers</b>	25 (50% of 50)	49
<b>Non - Researchers</b>	25 (50% of 50)	22

$$\chi^2_c = \sum \frac{(O_i - E_i)^2}{E_i}$$

Applying the Chi-Square test formula, the resulted value (23.4) was much bigger than the critical value of 5% probability. Hence, the null hypothesis ( $H_0$ -1) was \_rejected, which meant that the view about market of researchers is different than \_that of non-researchers. While interacting with the researchers, a few strategies drew attention:

1. Buying when Bank Nifty (or that stock) hits the oversold level (the level of 40) in RSI in daily time frame
2. Buying when fast moving average (5 days) crosses slow moving average (21 days), and vice versa.

While implementing these 2 strategies on Bank Nifty (as an index is a benchmark of market movement and also a representative of a group of stocks), the following were the observations:

1. This isn't a strategy. The interest rates are taken as 8% (as in bank FD). Now, if someone would have bought Bank Nifty 10 years back (1<sup>st</sup> January 2009), the CAGR return he would have received would be 5.76%.
  - a. 1<sup>st</sup> Jan 2008 – 10, 103
  - b. 1<sup>st</sup> Jan 2018 – 25, 382
  - c. CAGR of Bank Nifty – 9.64%
  - d. Bank FD Rate – 8%
2. **Strategy 1** – The trading strategy using RSI involves buying Nifty Bank when RSI is oversold (RSI = 30) and selling it when RSI reaches the overbought zone (RSI = 78.5) the second time (skipping one high), such that there always is an open position. Refer the candlestick chart below to observe the returns. Trading amount of Rs. 2 Lac in 2008 would have become Rs. 7.92 Lac in 2018 Jan, resulting in a 14.75% CAGR.



**TABLE 2: Profit using RSI as Indicator**

Date	Buy	Date	Sell	Holding (in years)	Profit
11-Mar-08	7400	01-Oct-10	12000	2	4600
30-Jun-08	5500	01-Oct-10	12000	2	6500
24-Oct-08	4000	01-Oct-10	12000	2	8000
28-Jan-10	8600	17-Feb-12	11000	2	2400
23-Aug-11	9400	14-May-14	15300	3	5900
23-Nov-11	8600	14-May-14	15300	3	6700
11-May-12	9400	25-Jul-17	24500	5	15100
21-Feb-13	12300	25-Jul-17	24500	4	12200
20-Jun-13	11300	25-Jul-17	24500	4	13200
29-Jan-14	10600	25-Jul-17	24500	3	13900
25-Aug-15	17100	18-Jan-18	26500	3	9400
15-Jan-16	15300	18-Jan-18	26500	2	11200

The best part about this strategy is, in last 10 years, it has not given even a single loss making idea. But the limitation is that the trader will have to hold the position from duration of 1 year to 5 years.

**Strategy 2** – The second strategy involves SMA (simple moving averages) as the indicator. In this strategy, a combination of a slow moving average (50 weeks) and a fast moving average (5

weeks) was used. The time frame was weekly, i.e., each candle gives OHLC of a week. If someone started with an investment of Rs. 50, 000 on 11 May 2009, it would have become Rs. 3, 56, 000 by 26 March 2018, giving a CAGR of **21.68%**.



**TABLE 3: Profit using Moving Average as Indicator**

Date	Signal	Level	Date	Signal	Level	Investment	Output	Profit
11-May-09	Buy	5400	21-Feb-11	Sell	11000	50000	101852	51851.85
11-Jun-12	Buy	10200	08-Jul-13	Sell	11300	101852	112836	10984.02
03-Mar-14	Buy	7700	24-Aug-15	Sell	17500	112836	256445	143609.3
23-May-16	Buy	17000	26-Mar-18	Sell	23600	256445	356006	99561.07

Hence, the Null hypotheses (H0-3 and H0-4) have been rejected using technical indicators, and it was observed that the returns were much higher than the opportunity cost, i.e., the CAGR of the index and FD.

## 6. DISCUSSION

As already discussed during the review of literature, there was a gap in the researches already done about the market being efficient or it being predictable using different studies. The present research led to \_the conclusion that the view of a person about the market \_can differ according to the occupation they do. The people who are into the occupation of market research, have a view that the market can be predicted\_ (though with not 100% accuracy) by looking at the past price movement of the index or the stock. The current study was purely based upon the index – Bank Nifty.

The current study also indicated that respectable returns can be earned using proper research and some technical indicators. The indicators that were used in the current paper are RSI and Moving Average. The returns were compared with the 10 year CAGR of the index or the stock and the opportunity cost of the investment (bank FD) and it was found that these returns were beaten by the strategies which used technical indicators.

## 7. CONCLUSION AND IMPLICATION

The study aims to understand if the market returns can be improved using technical analysis or not. According to the primary data of the research, the researchers mentioned that the returns can be improved using different studies like technical analysis. The same results were observed when different technical indicators were implemented on the index, Bank Nifty. The indicators we used in the study are Moving Averages and RSI. It was found that it was easy to predict the trend by using moving average as the indicator, and trend reversals were easily identified by RSI. Thus, RSI helps to enter at lows and bottoms and exit at high prices. The implication of the study is that it helps the traders with a few strategies through which they can expect good returns in stock market, which is usually considered as the most risky and unpredictable platform of investments. The aim of the study was also to prove investors and traders that trading in market is about not always taking risks and losses, but it is also about making good returns. If a trader enters the market with good strategies and proper planning, one can make remarkable returns in stock market.

## SCOPE FOR FUTURE RESEARCH

The current research was focused on a few indicators. Further researches may investigate the performance of some other leading and lagging indicators. Further research can also focus on the performance of candlestick patterns, forming studies related to the same. Future research may also compare the returns received using fundamental analysis with that of technical analysis. Also, algorithmic trading can even be incorporated instead of manual observation feeding on excel to improve the accuracy of the results.

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## Epilogue

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The purpose of this part of the book is to draw the attention of the readers to the key indicators given in each of the proceeding chapters sequentially.

- The weakly compatible pair of mappings in fuzzy metric-like spaces have been introduced to prove a common fixed point result for such pairs in complete fuzzy metric-like spaces. The results generalize and extend several known results in fuzzy metric-like spaces.
- Natural dye is good alternative for harmful synthetic dye. However, the pH of dyeing bath has considerable effect on colour strength other than mordants. Usually mordants are used to improve the fastness of natural dyes. Natural colorants from beetroot when applied on wool fabric at different pH with different pre-mordants and assessed against the colour strength of the dyed wool fabric was found to give better results.
- The results of Bhaskar and Lakshmikantham have vast applications in existence of unique solution of initial value and boundary value problems and weaker notion of contaction key role in finding the solutions of many more such problems which could not be discussed so far because of weak C-contaction.
- The implementation of Industry 4.0 is the prime agenda for developing as well as developed economies in the context of the manufacturing industry. The future research needs to be focused on identifying major barriers for implementation of industry 4.0 concepts in Indian Manufacturing Industry.
- QCA Designer tool is concerned with the options for testing faults and defect tolerance in the design. The Heat maps generated must be used as tool for identifying the defect areas in the design and later design could be improved by applying defect tolerant strategies. Also there is no method that could predict the areas where fault tolerant mechanism can be applied. Again there is no front end tool, where digital design using logic gates, flip-flops etc. could be done and can later be transformed into layout.
- The topological differences are more marked in males than in females, especially in the right hand. The sample studied revealed that females present a significantly higher ridge density than men and, as such, have narrower ridges over the entire palmer surface. Research can determine whether some of these differences are caused by different manual activities and to assess the impact that differential growth and development rates during pre- and postnatal stages may have on epidermal ridge breadth.
- Shade nets are beneficial for higher yield with quality agro products and Indian farmers are slowly adopting shade net technology in various agricultural applications. However, scientifically justified technical parameters for nets used in specific agricultural applications have not been established yet.

- Presence of cannabis drug can be determined by using High performance liquid chromatographic analysis. HPLC technique is found suitable and useful technique to confirm the presence or absence of cannabis drug in the nails of drug abusers.
- Modified droop controller in parallel connected inverters can be taken in remaining frequency reference by applying the frequency droop methodology. A simplified model of single-phase inverter can be employed to research system stability in terms of output current and voltage. The proposed controller supplies a stable angular frequency for microgrids operating within the islanded mode.
- Iodine fuming method for detection of malathion was found to be rapid and suitable for routine laboratory analysis of malathion. The solvent used is non carcinogenic and comparatively less toxic. Moreover, no significant interference was observed in the bait sample.
- Customer's Voice is the most valuable input for any organization. Seven factors, namely convenience, satisfaction, product differentiation, value for money, service quality, latest technology and value added services were identified to contribute for brand switching behaviours.
- Fear is experienced as a consequence of complex interactions among sets of grouped variables. They are bodies, personalities, social subjects, environment, cultures, social structures. The interplay of these factors makes one feel afraid while they come across a particular stimulus, for example, going out in the dark.
- Pain has an integral psychological aspect, which needs to be essentially assessed. The scale gives inputs about the bodily areas in which pain is experienced by an individual, which can be an important input in the designing of therapeutic support. It can provide an important guideline to plan Counselling interventions for the sufferer, enabling him/her to lead a healthy and active life.
- The scale can be used by online sellers to collect information about customers' perspectives and using this information, marketing managers can develop marketing strategies for online shoppers.
- To satisfy credit cardholders, low annual fees, and domestic and worldwide credit card acceptance is necessary. However, in order to offer different services from competitors and to build long-term customer loyalty, bank marketers can initiate a marketing campaign with attractive installment plan choices and point redemption. Additionally, making credit cards to be more widely used in more domestic stores can increase credit card adoption. This requires collaboration among banks and other businesses to share higher benefits from greater numbers of card users.
- Organisation needs to have optimistic employees. Experienced employees are the source of Optimism for youngsters. Learned Optimism is influenced by the type of job contract. A contract which is long term enables an employee to feel associated with the organisation

and boosts Optimism in employees. Also, the profile or type of work is an influencing factor towards development of Optimism. Employees who are put to work in teams and groups tend to have better Optimism than employees who work in solitude. Optimism is contagious and can be used to influence group behavior.

- India is a country of rich traditional and cultural history. Since the days of remote past, the epics like *Ramayan*, *Mahabharat*, *Bhagavat Purana* have continued to evince the different arts in India. These epics have held the imagination of artists since long. Krishna has been a fascinating and mysterious character which has been a source of perennial inspiration to the poets and artists. Jamini Roy has taken up the theme of Krishna and Ram and has created a series of paintings with modern arts incorporated with primitive influence
- Collection development management is changing day-by-day. New structures for collection development are dominating the acquisition of reference tools, electronic journals and digital archives of historical materials in bundled packages. Collection development work does not stop at these acquisition functions. It includes the follow up of the selection decision, organizing it, and assisting patrons in their use and expanding access.
- The film should never be a mere replica of the literature but it must have its very own characteristics and techniques which motivate the viewer to cherish. While both are interdependent in some way, the two must be studied so that a film based on a piece of literature is fully understandable. Although many people can say in their literary form that it's a screenplay of the film, it may be wrong to look at a literary work like that. Even in the text form, it does have an impression of reality and once it appears on a silver screen, it increases its quality much more than it does in the written form.
- The readiness level suggests that Indian organizations should explore the area of analytics for human resources for better organizational growth through efficient decision making. In the coming years, organizations may seek structural changes to introduce technological integration in HR for tackling the challenges that this department faces. Advance data analytics tools can be used by organizations for evidence-based decision-making.
- SWAYAM offers wide range of courses; this is done through a platform that facilitates hosting of all the courses, taught in classrooms from Class 9 till post-graduation to be accessed by anyone, anywhere at any time. All the courses are interactive, prepared by the best teachers in the country and are available, free of cost to any learner.
- It is easy to predict the trend \_by using moving average as the indicator, and trend reversals can be easily identified by RSI. Thus, RSI helps to enter at lows and bottoms and exit at high prices. Traders with a few strategies can expect good returns in stock market, which is usually considered as risky and unpredictable platform of investments.

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