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## Focus: E-Commerce

E-Commerce to Mobile Enabled Services

Penetration of E-Commerce and M-Commerce in India

E-Commerce: Spread and Impact on Indian Economy

Relationship between Indian E-Commerce Transaction and GDP

Technology Initiatives Toward Financial Inclusion

Online Shoppers' Search Behaviour

Maize Crop across Regions in India

Women Empowerment through MGNREGA

Simulating Annealing Technique

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Global Retail Development Index

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# Econometric Analysis of the Relationship between Indian E-Commerce Transaction and GDP

BHAWNA JOHRI

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***Purpose/originality/value:** This study is an attempt to examine the impact of growing e-commerce transaction on Indian economic growth from 2006 to 2013.*

***Design/methodology/approach:** Annually data have been taken to test the stationarity of two variables (e-commerce sales and Gross Domestic Production [GDP]) by using Augmented Dickey Fuller (ADF) unit root and cointegration test and also applies the ordinary least square method to analysis the impact of increasing e-commerce sales on the economic growth of India.*

***Findings:** The study reveals the absence of stationarity in selected variables and t-Statistic indicates that e-commerce has a significant positive impact on GDP during the study period.*

***Research limitations/implications:** This study is limited to GDP as an indicator of economic growth. Therefore, such study which includes more numbers of economic indicators would be appropriated to replicate the results of this study.*

***Practical implications:** For improving the economic growth of the Indian economy, it's necessary to increase the volume of e-commerce sales by using existing resources, which will lead to increase in technological comprehension and a move towards being a developed country.*

*Dr. Bhawna Johri, Assistant Professor, Applied Business Economics, Faculty of Commerce, Dayal Bagh Education Institute (Deemed University), Dayalbagh, Agra.*

## Introduction

Econometrics is the application of mathematics, statistical methods, and computer science to economic data and is described as a branch of economics that aims to give empirical content to economic relations. More precisely, it is the quantitative analysis of actual economic phenomena based on the concurrent development of theory and observation, related by appropriate methods of inference. An introductory economics textbook describes econometrics as allowing economists to sift through mountains of data to extract simple relationships. The first known use of the term "econometrics" (in cognate form) was by Polish economist Pawe Ciompa in 1910. Ragnar Frisch is credited with coining the term in the sense in which it is used today.

Econometric theory uses statistical theory to evaluate and develop econometric methods. Econometricians try to find estimators that have desirable statistical properties, including unbiasedness, efficiency, and consistency. An estimator is unbiased if its expected value is the true value of the parameter; it is consistent if it converges to the true value as sample size gets larger, and it is efficient if the estimator has lower standard error than other unbiased estimators for a given sample size. Ordinary least squares (OLS) is often used for estimation since it provides the BLUE or "best linear unbiased estimator" (where "best" means most efficient and unbiased estimator) given the Gauss-Markov assumptions. When these assumptions are violated or other statistical properties are desired, other estimation techniques such as maximum likelihood estimation, generalized method of moments, or generalized least squares are used. Estimators that incorporate prior beliefs are advocated by those who favor Bayesian

statistics over traditional, classical, or "frequentist" approaches.

The critical edge for business today is e-commerce. E-commerce stands for electronic commerce. It means dealing in goods and services through electronic media and Internet. On the Internet, it relates to a Website of the vendor, who sells products or services directly to the customer from the portal using a digital shopping cart or digital shopping basket system and allows payment through credit card, debit card, or EFT (electronic fund transfer) payments. E-commerce or e-business involves carrying on a business with the help of the Internet and by using information technology, such as Electronic Data Interchange (EDI). More simply put, e-commerce is the

movement of business onto the World Wide Web. The effects of e-commerce are already appearing in all areas of business, from customer service to new product design. It facilitates new types of information-based business processes for reaching and interacting with customers like online advertising and marketing, online order taking, and online customer service. Nowadays, e-commerce uses the WWW at least at some point in its transaction lifecycle. It can also reduce costs in managing orders and interacting with a wide range of suppliers and trading partners, areas that typically add significant overheads to the cost of products and services. For developing countries like India, e-commerce offers considerable opportunity (please see Figure 1).

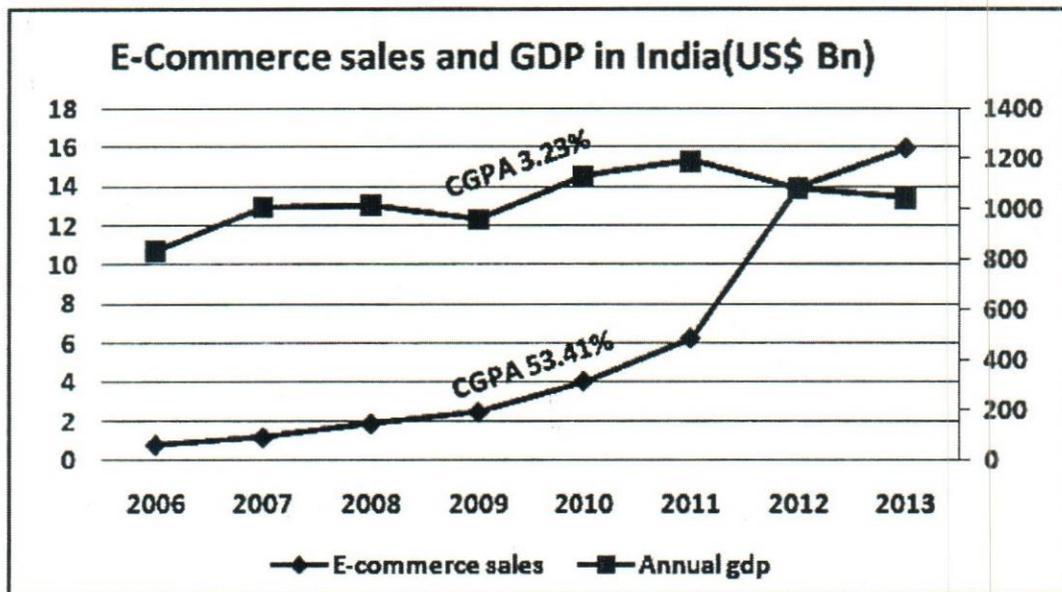


Figure 1: E-commerce sales and GDP in India

Figure 1 shows the growing trend of Gross Domestic Production (GDP) with 3.23% compound annual growth rate. On the other hand, e-commerce in India is also showing an increasing trend with 53.41% compound annual growth rate, which is higher and was almost double in the year 2012, which further indicates a boom period because of rise in the number of companies going the e-commerce way in the recent past. Major Indian portal sites have also shifted toward e-commerce instead of depending on advertising revenue. Many sites are now selling a diverse range of products and services from flowers, greeting cards, and movie tickets to groceries, electronic gadgets, and computers, etc. With stock exchanges coming online the time for true e-commerce in India has finally arrived.

### Benefits of increasing e-commerce sales to India

The benefits of increasing e-commerce sales in India can be divided in two parts: technological benefits and economic benefits, detailed of which are as follows.

#### Technological benefits

1. Increases in mobile access
2. Growth in broadband access
3. Social media explosion
4. Bid data
5. Cloud computing and big infrastructure
6. Search possibilities access all media

---

## Economic benefits

1. Mass usage of Internet, mobile, and social media
2. Rapid acceptance of online search
3. Increased educational levels
4. Demographic profiles
5. Increase aspiration levels and availability
6. Liberal policy (FDI in retail and infrastructure, etc.)
7. More employment opportunity, hence, more money in the wallet.

## Reviews of Earlier Studies

**Jonathan L. Willis (2004) "What Impact Will E-Commerce Have on the U.S. Economy?"** This analyzed the effect of e-commerce on the economy through its impact on productivity and inflation. Businesses and consumers that use e-commerce benefit from a reduction in costs in terms of time and effort required to search for goods and services and to complete transactions. This reduction in costs results in higher productivity. An even larger increase in economy-wide productivity levels may result from productivity gains by firms not engaged in e-commerce as they respond to this.

**Irene Bertschek, Helmut Fryges and Ulrich Kaiser (July 2004) "B2B or Not to Be: Does B2B E-Commerce Increase Labour Productivity?"** This studied the effects of Business-to-Business(B2B) e-commerce on labor productivity by using regression model. The results indicate the importance of B2B and labor productivity as simultaneous factors. The output elasticity with respect to ICT investment turns out to be significantly larger for firms using B2B. Thus, firms with B2B use ICT more efficiently. Moreover, the multifactor productivity is significantly larger for firms with B2B. These results hint at strategic complementarities between B2B and the input factors of the firms leading to labor-productivity enhancing impacts of B2B. The estimation of hypothetical productivity differentials reveals that firms with B2B are significantly better off if they engage in B2B than if they did not. The same is true for those firms without B2B: they would increase their labor productivity if they adopted B2B. However, the potential productivity gains turn out to be smaller than for those firms already using B2B.

**Dr. Sumanjeet Singh** analyzes the **impact of Internet and e-commerce on the labor market** and reveals that new technologies, especially Internet and e-commerce together with other important changes, such as the continued increase in the educational attainment of the work force, shift of employment to service sectors, increased employment opportunities for women, and formation of online trade unions are producing a labor market that differs greatly from the industrial labor market that characterized the 20th century. Further, increased competition, global access, and organizational change are affecting labor markets by influencing employment demand, wages, and skill requirements. Thus, the impact of Internet and e-commerce on the labor market is undeniable. At many fronts, labor market is a gainer and at some it is a loser. But it is expected that implications of these technologies will open new opportunities for the labor market and give a new shape to the future labor market. To make the best of these technologies, what really is needed is how to convert threats arising due to implications of these technologies into opportunities. In fact, it is only the labor that will decide where they want to stand. In this digital economy only the powerful can survive. Therefore, workers continuously need to develop IT skills and to be on alert to market them at every opportunity. Internet and e-commerce technologies are just tools; what the labor market is going to do with these tools will decide the future of labor market.

**Alison Cathles and Matteo Grazzi ("E-Commerce and Productivity: Evidence from Chile")** analyze the relationship between e-commerce and productivity. The findings seem to suggest that the biggest payoff to engaging in e-commerce comes at the transaction of B2B. In fact, e-buying B2B is presumably offering a reduction in transaction costs that are resulting in a positive payoff for the company. On the other hand, e-selling, B2C (Business-to-Consumers) may expand the customer base and generate a higher quantity of sales, but profits may be mitigated by a simultaneous decrease in the price of the products that are sold over the internet. This sets the stage for a research question that is formulated with the background knowledge that the relationship between ICT investment, adoption, and use and productivity may not have the same dimensions in developing countries as they do in developed countries. Will e-commerce have the same relationship with productivity in developing countries as it does in developed countries?

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**Dr. Bimal Anjum and Rajesh Tiwari (November 2011)** explores the **economic and social impact of e-commerce** and find that e-commerce is currently growing at 30%. Shopping site eBay Inc. is growing at 60%. The number of customers of the company has increased from one million users to 2.5 million in India in the last four years. Some of the popular imported items imported by Indians include home decor, branded and unbranded apparel, accessories, and technology products like laptops. Payments through PayPal and mobile (phones) are significantly contributing to the growth of e-commerce. Digitization of books, films, and video games are also driving the growth of e-commerce. People who buy on iPad buy items that are about 30% higher in price than people who buy on the iPhone or PC. For a country such as India, one of the most important benefits of e-commerce is its potential to help a developing rural community to leap-frog into the knowledge paradigm. E-commerce is providing useful resource for growth of microfinance and micro, small, and medium enterprises (MSMEs). The positive effects of e-commerce can be magnified beyond purely commercial growth to have a profound impact on all aspects of rural community.

**Muhammad Awais, "Advanced SWOT Analysis of E-Commerce"(2012):** This research paper describes how the invention and accessibility of Internet connectivity and powerful online tools has resulted into a new commerce era, that is e-commerce, which has completely revolutionized the conventional concept of business. E-commerce deals with selling and purchasing of goods and services through Internet and computer networks. E-commerce can enhance economic growth, increase business opportunities, and competitiveness, and better profitable access to markets. E-commerce is emerging as a new way of helping business enterprises to compete in the market and, thus, contributing to economic success. In this research paper we will discuss about advanced SWOT analysis of e-commerce which will comprise strengths, weaknesses, opportunities, and threats faced by e-commerce in current scenario. A developing country can be rationalized and mechanized if it introduces e-commerce effectively and efficiently. It will enhance its output and give competitive advantage. Information technology (IT) has boosted e-commerce worldwide. Now it's easier to enter to a new market and one can evaluate his/her product and company's performance. It reduces business overhead and enhances business management.

**Upasna Roshni and Santhosh Rebello, "E-Commerce Growth and Opportunities in Indian Scenario" (2014):** India is at the cusp of a digital revolution. Declining broadband subscription prices, aided by the launch of 3G services, have been driving this trend. This has led to an ever-increasing number of "netizens." Furthermore, the likely launch of 4G services is expected to significantly augment the country's Internet user base. Internet has become an integral part of this growing population segment for remaining connected with friends, accessing emails, buying movie tickets, and ordering food. The changing lifestyles of the country's urban population have also led many people relying on the Internet for their shopping needs. In this paper we are detailing the growth and opportunities of e-commerce in the Indian scenario. E-commerce players are banking on the Indian Internet growth story. The fact that an average online user is spending more time online gives these players the opportunity to draw more users to their Websites through innovative marketing strategies, such as those revolving around social media. Furthermore, to fully utilize the opportunity, players need to leverage the growing number of mobile devices in the country. They should focus on developing mobile-compatible Websites and applications. This would allow customers to log on to easy-to-access platforms and browse e-commerce Websites on their mobile devices. E-commerce players also need to focus on innovation to tackle challenges arising from low credit and debit card penetration.

### **Research Methodology**

Economic theory provides ample explanations of the possible interrelationships between Indian e-commerce transition and GDP. However, their validity appears to be an empirical issue. Following the recent literature, we investigate the impact of Indian e-commerce transition on economic growth by employing a number of econometric techniques. First, we test the stationarity of the variables using Augmented Dickey Fuller (ADF) test. Second, we test cointegration of the variables using Johansen method. Then, we proceed with the OLS method to know the impact of one variable to other variable.

### **Empirical Results**

#### **Unit Root Test**

The ADF test is one of the famous unit root tests to check the stationarity of economic variables. This test is based on the t-statistics on the coefficient of the lagged dependent variable (Table 1).

Table 1: ADF Unit Root Test

Unit Root Test Results (with intercept)				Unit Root Test (with intercept and time trend)				
Variable	ADF (level)	P value	ADF (1st difference)	P value	ADF (level)	P value	ADF (1st difference)	P value
E-commerce	1.39398[1]	0.9934	-3.6747[0]	0.04***	-2.5530[0]	0.3116	-4.1268[0]	0.0842
GDP	-2.8693[0]	0.096*	-2.9368[1]	0.1050	-1.9810[1]	0.5050	-4.3016[1]	0.1057

Source : Author's calculation using Eviews.

Notes:

1. The \*, \*\*, and \*\*\* indicate rejection the null hypothesis at 10%, 5%, and 1% significant levels.
2. The lag length of the ADF regression is specified in brackets [ ].

**Interpretation:** Table 1 reports the result of stationary, which suggest the acceptance of unit root null hypothesis of non stationary for all the variables even at their first difference, except for e-commerce sales in case of intercept only.

Figure 2 shows the stationarity graph of selected variables which also indicates the absence of stationarity among variables.

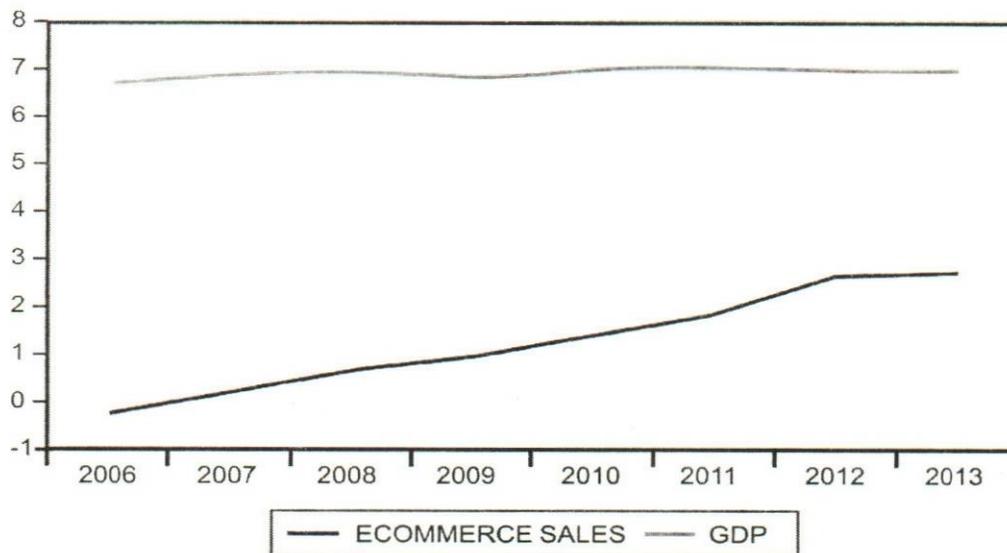


Figure 2: Stationarity of Selected Variables

**Cointegration Test Results**

Cointegration means that despite being individually non-stationary, a linear combination of two or more time series can be stationary. There are three main methods for testing cointegration: The Engle-Granger two-step method, the Johansen procedure, and the Phillips-Olivares Co-integration Test. The study includes Engle-Granger Co-integration test which is preferable when the number of variables in the study is limited to only two variables.

**Unrestricted Cointegration Rank Test**

**Table 2 Single Equation Cointegration Test**

Series: GDP ECOMMERCE SALES

Sample: 2006 2013

Included observations: 8

Null hypothesis: Series are not cointegrated

Cointegrating equation deterministic: C

Automatic lags specification based on Schwarz criterion (maxlag = 1)

Dependent	tau-statistic	Prob.*	z-statistic	Prob.*
GDP	-2.459348	0.3854	-19.59051	0.0000
ECOMMERCESALES	-1.520661	0.7591	-18.23402	0.0000

Source: Author's calculation using Eviews.

Note: \*MacKinnon (1996) p-values.

**Interpretation:** The results of tau Statistic are reported in Table 2. They suggest the acceptance of the null hypothesis of no cointegration at 5% level. This indicates the absence of long-term equilibrium relationship among selected variables.

Table 3 : Ordinary Least Square Method

Dependent Variable: GDP

Method: Least Squares

Sample: 2006 2013

Included observations: 8

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6.852140	0.048955	139.9669	0.0000
ECOMMERCESALES	0.065880	0.029957	2.199157	0.0702
Multiple R	0.66806	Mean dependent var		6.935976
R-squared	0.446305	S.D. dependent var		0.108087
Adjusted R-squared	0.354022	Akaike info criterion		-1.836428
S.E. of regression	0.086873	Schwarz criterion		-1.816567
F-statistic	4.836291	Hannan-Quinn criter.		-1.970378
Prob (F-statistic)	0.070184	Durbin-Watson stat		1.635817

Table 3 exerts the result of ordinary least square in which the coefficient of the dependent variable GDP at zero level of the explanatory of independent variable is given as 0.065880 which shows a positive and significant relation between the CAD and GDP at 10 % level of significance and indicates that one unit change in the amount of CAD will lead to an increase in GDP with .066 units. Durbin Watson statistic is 1.63817 exert that there is no auto correlation in the series and if this value is close to 2, it indicates that model is better fit. Schwarz criterion shows lesser value -1.816567 exert that the leg length we have selected for analysis purpose is correct and also there is opposite relation between Durbin-Watson stat and Akaike info criterion. The multiple ris also showing moderate positively and significant relationship between CAD and

### Ordinary Least Square Method

The gauge of relationship between e-commerce sales and economic growth of Indian economy a simple open macroeconomic debt growth model was applied. The functional relationship between variable and proxies can be expressed as:

$$GDP = f(\text{e-commerce})$$

The model employed in the study includes the following

$$GDP = \beta_0 + \beta_1 \text{e-com} \dots + \mu$$

GDP. There is no large difference between  $r^2$  and adjusted  $r^2$  which indicates that there is no some other significant variable which may influence the variation in the dependent variable. The t-Statistic is showing that e-commerce sales have a positive and significant impact on India's economic growth.

### Conclusion

On the basis of findings of this study the researcher concludes that the GDP of India is positively and significantly affected by e-commerce sales. Therefore, we should try to throw more spotlight on online transaction. As we know, e-commerce sales in India is increasing regularly but at a slow rate as compared to other countries. The main reason of it is the lack of trust among Indian

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customers and retailers. Therefore, we should try to trust each other and to reallocate to online purchasing by using the existing resources.

## References

- Jonathan L. Willis.** (2004). What Impact Will E-Commerce Have on the U.S. Economy? Federal Reserve Bank of Kansas City.
- Irene Bertschek, Helmut Fryges and Ulrich Kaiser.** July 2004. B2B or Not to Be: Does B2B E-Commerce Increase Labour Productivity? Discussion Paper No. 04-45.
- Sumanjeet Singh.** (2008). Impact Internet and E-commerce on the Labour Market, Working Paper.
- Alison Cathles and Matteo Grazi.** (2009). 'E-Commerce and Productivity: Evidence from Chile', working paper.
- Bimal Anjum and Rajesh Tiwari.** (2011). 'The Economic and Social Impact of E-commerce', *International Journal of Computing and Corporate Research*, ISSN, 2249-054X.
- E-Commerce Growth and Opportunities in Indian Scenario—** A Survey on Ecommerce Eco System Roshni Upasna, Santhosh Rebello AIMIT, St Aloysius College (Autonomous), Mangalore, India.
- V. Zwass.** (2001). 'Structure and Macro-level Impacts of Electronic Commerce: From Technological Infrastructure to Electronic Marketplaces,' [http://www.mhhe.com/business/mis/zwass/ecpa\\_per.html](http://www.mhhe.com/business/mis/zwass/ecpa_per.html) (accessed May 2001).
- Seideman.** (1996). 'What Sam Walton Learned from the Berlin Airlift,' *Audacity: The Magazine of Business Experience*, Spring 1996, 52-61.
- R. Boateng, R. Hinson, R. Heeks and A. Molla.** (2008). 'Ecommerce in LDCs: Summary Evidence and Implications', *Journal of African Business*, 9(2), 257-285.

*Communications is at the heart of eCommerce and community.*

—Meg Whitman, former CEO, Ebay

# India's Jumbo Jump from E-Commerce to Mobile Enabled Services (MES): A Review

SUNIL KUMAR GANDHI

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*Electronic commerce (e-commerce) refers to buying and selling of goods and services through electronic devices combined with the Internet. Mobile commerce (m-commerce) refers to the transactions of goods and services made through mobile devices like cell phone, PDAs etc., which are not only electronic but also mobile. On the other hand, mobile value-added services (MVAS) embraces the value-added services extended to mobile phone customers in addition to basic services by the mobile operators. On the other hand, MES encompass not only basic and value-added services, including m-commerce, but also all sorts of services rendered through mobile devices. Initiated at the fag end of the 20th century, the business is growing at a super speed. When Asia accounts for 50 percent of the total world m-commerce business, India cannot remain a spectator to the whole episode. Not only many big players have entered into the Indian market but they are very much aggressive in their strategy. It is true that India is catching up with China and the rest of the world, but whether the highly aggressive strategy will be disastrous or not needs to be examined. This paper examines all the issues in MES and suggests policy measures.*

## Introduction

E-commerce is a very important development in the field of marketing management. It broke the geographical barrier of marketing of goods and services with the help of technological advances. Initially e-commerce was limited to desktops. Further development of technology enabled transactions through mobile devices also. Thereafter, mobile operators started providing mobile value-added services (MVAS) in addition to basic services, to enhance their revenue. Now MVAS is growing at a high rate in India because mobile users, including smart phone users, are growing at a very fast rate. At the same time m-commerce war has started in India. Many players, including transnational players, are in the foray pursuing aggressive strategies. E-commerce, through desktops, was a non-starter in India but m-commerce has changed the entire scenario. This paper examines the issues, prospects, and challenges in this field and also forwards suggestions for policy measures.

## Conceptual Issues

The concept of m-commerce was presented in 1997 at the launch of the Global Mobile Commerce Forum, which implies e-commerce with the help of wireless technology. The growth potentiality of m-commerce is such gargantuan that at the age of 20 years (i.e., by 2017), m-commerce is expected to reach a worth of US\$230 billion in the world ([www.wikipedia.org](http://www.wikipedia.org)). Devices used for m-commerce are cell phones, PDAs etc. having Internet connection. With this development, e-commerce has been shifted from desktop to laptop/ palmtop. It is like having a sales counter in a customer's pocket. Use of tablets, smart phones has accelerated the growth of m-commerce.

The diversity of services through mobile devices has reached to such an extent that the concept of m-commerce

can no longer hold the whole gamut of activities through mobile devices. It is because activities now are not limited to buying and selling of goods and services. The new concept Mobile Enabled Services (MES) embraces all services availed through mobile devices. It is more than MVAS. According to TRAI, "Mobile Value Added Services are those services that are not part of the basic voice offer and are availed separately by the end user. They are used as a tool for differentiation and allow mobile operators to develop another stream of revenue" (<http://mukeshprajapats.blogspot.in>). In short, we can say that

Mobile Enabled Services (MES) = Basic Services provided by the mobile operators + MVAS provided by the mobile operators + Services directly availed by the customers through mobile Internet, including through m-commerce companies. On one hand mobile operators are trying to innovate newer services for value addition, and on the other hand m-commerce players are offering direct download of their Apps through mobile Internet. The concept of MES can be better understood with the help of the following chart.

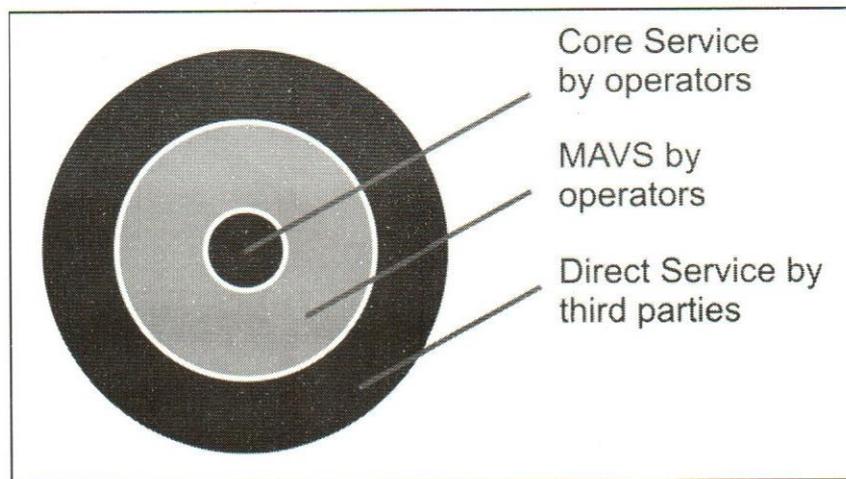


Chart 1: Showing Layers of Mobile Enabled Services (MES)

Source: Own Design

### Components of MES

A wide range of services are now enabled through mobile devices. Not only these services but newer and newer services are being added to this list. Innovations are going on and it will continue. Some of the MES, other than basic services like oral communications, SMS, MMS, and e-mail, are listed below:

- (i) mFinance: net banking, money transfer, OTP for payment through net banking/credit card, m-commerce transactions, payment alerts, Reminder Services, Stock Quotes, mobile wallet, bank balance confirmation, mobile advertisements, mobile billing service, gas booking, etc.
- (ii) mEntertainment: social networking service, video games, cinema and music, cricket, caller tunes, etc.
- (iii) mEducation: Distance education and tutoring service, examination alert service, examination result service, mobile Internet browsing for education and research, reading of books, etc.

- (iv) mHealth: Health and fitness tips, appointment and alert service, remote monitoring and diagnostic services, etc.
- (v) mTravel and Tourism: hotel booking, travel ticket booking, taxi booking, train running status, etc.
- (vi) mGovernance: services of government departments, local self-government, complaints and redresses, alerts on social issues, etc.
- (vii) Over-the-Top (OTT) Services: Internet voice call and video call (including through LTE Network), Internet SMS, etc.

[Source: Joint Report of the Internet and Mobile Association of India and WIPTO "Beyond the Tip of the Iceberg: The multi-billion dollar Indian MVAS market opportunity" (2012) in [https://www.wipro.com/documents/beyond\\_the\\_tip\\_of\\_the\\_iceberg.pdf](https://www.wipro.com/documents/beyond_the_tip_of_the_iceberg.pdf)]

Perhaps no one knows the end of the list of MES. We can realize this by looking into some of the upcoming services [source: Article by Mohammad Chowdhury "Mobile VAS is dead, long live Mobile Innovation" (2013)]

in [www.forbesindia.com](http://www.forbesindia.com)]:

- (i) A mobile application that allows property agents to see an aggregated view of bottom-of-pyramid housing stock availability in city slums
- (ii) A mobile news portal that aggregates the best of Bengali daily content across West Bengal and Bangladesh
- (iii) A personal financial planner enabled on your mobile available in Telugu
- (iv) A mobile-enabled supply chain integration package for tea growers in South India
- (v) A simple app which enables parents to monitor whether their child reached school safely on the school bus

Thus, the scope of innovations in mobile applications is unlimited.

### International Scenario

Mobile usage is the very basis of MVAS/MES market. On the basis of figures available with Wikipedia, the list of top 10 countries with the highest number of mobile users is given in Table 1.

Volume matters. It can be observed from the below table that the top 10 countries account for 57 percent of the total mobile users of the world. Of these ten countries, Asian countries alone account for 42 percent of the world users. Hence, it is obvious that MVAS/MES market will grow in Asian countries in comparison to other countries.

MVAS is growing throughout the world. According to the report by Infiniti Research Limited titled "Global Mobile Value-added Services (VAS) Market 2014–2018," "Global Mobile VAS market to grow at a CAGR of 10.62 percent

Table 1: Showing Mobile Users of Top 10 Countries

	Country	Mobile Users	Population	Connection per 100 Citizens	Survey Year
	World	6,800,000,000	7,012,000,000	97.0	2013
1	China	1,276,660,000	1,369,811,000	93.2	2014
2	India	960,579,472	1,267,402,000	77.58	2015
3	USA	327,577,529	317,874,628	103.1	2014
4	Brazil	284,200,000	201,032,714	141.3	2015
5	Russia	256,116,000	142,905,200	155.5	2013
6	Indonesia	236,800,000	237,556,363	99.68	2013
7	Nigeria	167,371,945	177,155,754	94.5	2014
8	Pakistan	140,000,000	180,854,781	77.0	2014
9	Bangladesh	130,843,000	157,497,000	80.55	2015
10	Japan	121,246,700	127,628,095	95.1	NA

Source: [www.wikepedia.org](http://www.wikepedia.org)

over the period 2013–2018" (September 2014, <https://www.reportbuyer.com>).

"The global market for Mobile Value Added Services (MVAS) is projected to reach US\$701.3 billion by 2020, driven by the growing penetration of smartphones and media tablets among mobile subscribers, increasing mobile Internet subscriber base and availability of high-speed 3G and 4G mobile broadband services. The change in consumer data consumption behaviour is additionally spurring growth in the market. Steep increase in the use of mobile apps, social networking platforms, Internet

search, and mobile payment systems, among others, is helping support consumer demand for mobile value-added services. Asia-Pacific represents the largest as well as the fastest growing market worldwide. The growth in the region is driven by increase in content consumption on mobile phones, and growing popularity of mobile gaming." ([www.strategyr.com](http://www.strategyr.com))

China has a high potential for growth of MVAS with 95 percent mobile penetration rate. According to "Ambient Insight's 2014-2019 China Mobile Learning Market-Report" (2015), "There were 1.37 billion people (19% of the world's

population) and over 1.3 billion mobile subscriptions (a 95% mobile penetration rate) in China by the end of 2014. Over 83% of all Internet users in China are now accessing the web with mobile devices. As of November 2014, there were over 500 million people using wireless broadband on 3G and 4G networks in China. In January 2015, the China Internet Network Information Center (CNNIC) reported that Internet usage is growing by 32 million people a year. The agency said the "online economy accounts for seven percent of GDP, up from 3.3 percent the previous year". Internet retail sales were up a stunning 55.6% in 2014 compared to the year before and online sales reached over \$53 billion." ([www. ambientinsight.com](http://www.ambientinsight.com))

Whereas the world growth rate is CAGR 10 percent, the growth rate of Europe is 7 percent. Above world average growth rates in Africa and Asia Pacific countries helped to maintain the average rate at 10 percent. [Source: Dawinderpal Sahota, "Mobile VAS on Decline in Europe, Growth Slowing Worldwide," (2013), [www.telecoms.com](http://www.telecoms.com)]. The article also iterates that "there is a slowdown in play due to third-party services offering apps and content for free. This is strongest in the European markets, with a negative seven per cent CAGR," said Neha Dharia, analyst for consumer telecoms at Ovum."

## The Indian Scenario

### Growth of Mobile Use

From the date given in Table 1 it is clear that India is the second largest country so far as mobile usage is concerned. However, usage by 78 percent of citizens is much lower than the world average of 97 percent, not to say the world's highest usage (Hong Kong at 240 percent). So there is much scope for growth of mobile usage. India's mobile growth rate at present is around 6 percent.

### Growth of Mobile Internet Use

From 200 million Internet users in 2013 to over 500 million Internet users by 2017—including **314 million mobile Internet users**—the growth story of mobile Internet in India is on the upsurge. A report by IAMAI and KPMG projected that India will reach 236 million mobile Internet users by 2016, and 314 million by 2017. Earlier this year, Mary Meeker compared India's Internet penetration of 2014 with China of 2008 and the US of 1996. Here are some of the highlights from "India on the Go—Mobile Internet Vision Report 2015." The 2G user base in India is projected to decline in the coming years as more and more customers are expected to migrate from

2G to 3G. The 3G user base in India is rapidly gaining market and is projected to grow at a CAGR of 61.3 percent from 2013–2017. There were approximately 82 million 3G subscribers in India by the end of 2014 and the number is projected to reach 284 million by end of year 2017. To increase user adoption, several telecom operators reduced their 3G tariffs by 80–90 percent in the second half of the year 2013 and brought 3G prices comparable to 2G prices. As of June 2015, Internet users in India stood at over 350 million. The 4G user base is also expected to grow at an annual growth rate of 344 per cent and a CAGR of 103 percent from 2013 to 2018 ([www. http:// yourstory.com](http://www.yourstory.com)).

According to the forecast by Cisco, "In India, mobile data traffic will grow 13-fold from 2014 to 2019, a compound annual growth rate (CAGR) of 67%." The emergence of 3G and 4G LTE services would play a vital role in the growth of data consumption over the next five years ([http:// tech.firstpost.com/news-analysis](http://tech.firstpost.com/news-analysis)).

### Growth of Smartphones

The growth of smartphones has a direct connection with development of m-commerce and other MVAS. According to the report published by International Data Corporation (IDC), "smartphone shipments grew 19 percent in the second quarter after a slow start in the first quarter. The Indian smartphone market saw 26.5 million units being shipped in the second quarter, which is up 44 percent from 18.4 million units shipped in the same period last year, according to IDC" ([www. http://gadgets.ndtv.com](http://gadgets.ndtv.com)). These data are related to 2015.

### Growth of MVAS

The value of the MVAS market grew by CAGR 25 percent during 2011 to 2015. As per Communications Today, "The Indian MVAS market is forecast to evolve at a compound annual growth rate (CAGR) of 18.5 percent during 2015–20. The consumer VAS and enterprise VAS markets are expected to generate a CAGR of 19.7 percent and 19.3 percent respectively, during the same period" ([http:// www.communicationstoday.co.in](http://www.communicationstoday.co.in)). On the other hand, TechNavio forecasted that during 2013–2018 the MVAS market in India will grow by CAGR 22.13 percent. Anyway, India's growth rate is much higher than the global average growth rate.

### Growth of Mobile Apps

The average mobile app usage in India has grown by at least 131 percent and has outpaced the global growth

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rate—this was the conclusion of the panelists participating in the Apps India Conference 2015. The panelists said apps are playing a pivotal role in creating employment and entrepreneurs, enabling ease in doing business and driving inclusive development through e-Education, e-Governance, e-Health Apps, and e-Commerce. “At present the app economy has created about 75,000 direct jobs in India, and has the potential to reach 600,000 over a period of time. India app ecosystem is estimated to be in the range of \$330 mn by 2016,” said Sandeep Ladda, partner and India technology and e-commerce sector leader, PwC. In addition, the number of smartphone owners using mobile apps of e-commerce companies has gone up from 1,680 (21 percent) in May 2014 to 4,320 (54 percent) in May this year, based on real-time mobile usage data across 8,000 handsets in the country. Around nine billion apps will be downloaded in India in 2015, more than five times the number of apps downloaded in 2012 (1.56 billion) at a cumulative annual growth rate (CAGR) of 75 percent (<http://www.appsindia.co.in>).

Direct services are provided by third parties through their apps for m-commerce. In most cases, these apps are downloadable free of cost, and have no relation with MVAS provided by the mobile operators and consequently do not add to their (mobile operators’) revenue.

#### ***App-only aggressive sales strategy***

Recently most of the e-commerce companies in India are shutting down their Websites (both mobile and desktop) and forcing buyers to shop through mobile apps. This is being done either by offering no choice or by offering higher discount in mobile apps. The companies are forwarding the argument that a major portion of their e-commerce sales are through mobile apps. They are saying that since mobile apps will dominate the future generation, it is better to jump to app-only sales strategy from right now. Moreover, they are claiming cost and technical advantage as well.

But this strategy of the Indian companies is not free from criticism. To quote from <http://gadgets.ndtv.com>, “Users are also concerned about privacy issues. Even if these are properly addressed by companies, the public is clearly worried. Commenter Bhaskar says: ‘The app only approach is to track you (location, call records etc). They are forcing users to use app only so that they get all free marketing information freely. It is all cheating public in the name of maintenance expenditure of website.’”

Another user, Vishwanath, neatly sums up many of the concerns with an app-only approach when most phones have extremely limited storage. He says: “As a retailer, who has built global brands with physical stores, all I can say is that there is immaturity in this decision and a gross underestimation of consumer psychology. This decision will be followed and repeated by many other e-commerce sites and that will ultimately kill the app industry! A vast majority of smartphones, this business banks on for business, are cheap android phones. Try loading half a dozen apps and see how your system hangs and craves for memory and battery! I bet the uninstall rate for apps will be easily upwards of 50 per cent within first two weeks. The only way these apps will be kept alive will be [by] giving more freebies which they can dish out as long as it is VC money till they fold up! Not pessimistic but being real. Who wants to share your privacy and location details to one commerce site/should I say one shop!” (<http://gadgets.ndtv.com/apps/features/taking-the-web-out-of-e-commerce-why-indian-companies-are-ditching-their-websites-678591>)

#### **Conclusion**

Mobile devices in general and cell phones in particular have changed (and continuing to change) the way of lives of citizens throughout the world. Basic service, MVAS, and m-commerce, all are growing at a very fast rate. This growth is spectacular in Asia Pacific countries. Devices usage, particularly smartphone usage, is growing at a fantastic rate. Though China is leading but India is not far behind. Recent developments in m-commerce business in India is noteworthy, particularly the apps-only strategy. Transnational companies also have joined the m-commerce war in India. There is a huge potential for inclusive growth with the growth of MES. We will have to wait to see how the final shape takes place.

#### **Policy Recommendations**

MVAS is growing in India, and there is a huge potential for growth in the coming years. But the mobile operators have to keep in mind that if they want to tap the revenue from potential growth, they must be innovative in providing newer and newer value added services to the customers. Otherwise they will not be in a position to earn additional revenue from MVAS, and will have to remain content with the revenue from basic services. Gain from growth of m-commerce, facilitated by big m-commerce companies, is marginal so far as the mobile operators are concerned.

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On the other hand, e-commerce also is growing at a very fast rate in India through the use of mobile apps. This path of technology adoption (i.e., apps-only) in India is unlike the developments in other advanced countries. In those countries, e-commerce matured through PCs and broadbands. Thereafter, they are shifting to mobile apps. But in our country companies are making jumbo jumps. E-commerce companies operating in India need to reassess their approach while jumping. They should learn a lesson from globalization of economy in India. Indian experience has proved time and again that globalization with conservative approach (and not reckless globalization) has paid dividend in the long run.

Growth of MES has a huge potential for inclusive growth in India and can contribute substantially to the GDP of the country. The Government of India, while keeping this aspect in mind, must channelize the developments toward this direction.

## References

- <http://gadgets.ndtv.com/apps/features/taking-the-web-out-of-e-commerce-why-indian-companies-are-ditching-their-websites-678591>
- <http://gadgets.ndtv.com>
- <http://mukeshprajapats.blogspot.in>
- <http://tech.firstpost.com/news-analysis>
- <http://yourstory.com>
- <http://www.appsindia.co.in>
- <http://www.communicationstoday.co.in>
- <https://www.reportbuyer.com>
- [www.ambientinsight.com](http://www.ambientinsight.com)
- [www.forbesindia.com](http://www.forbesindia.com)
- [www.strategyr.com](http://www.strategyr.com)
- [www.telecoms.com](http://www.telecoms.com)
- [www.wikipedia.org](http://www.wikipedia.org)
- [www.wipro.com/documents/beyond\\_the\\_tip\\_of\\_the\\_iceberg.pdf](http://www.wipro.com/documents/beyond_the_tip_of_the_iceberg.pdf)

*Leadership in telecommunications is also essential, since we are now in the age of e-commerce.*

*—Michael Oxley*

# Public Policies to Facilitate Higher Penetration of E-Commerce and M-Commerce in India for Higher Productivity

SUJATA P. DESHMUKH, ANIL Z. CHHANGANI AND G. T. THAMPI

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*E-commerce and M-commerce are ICT-enabled practices for doing global business, which offers multiple benefits to increase the productivity of business organizations, government organizations, and society. Higher usages and penetration of these practices by different stakeholder lead to the improvements in national productivity of India. This paper sheds light on the research question as to why customers are reluctant about online commerce though it provides many benefits to different stakeholders. These different attacks on electronic commerce (EC) and mobile commerce (MC) systems are discussed and security enhancement strategies are presented in realm of productivity. The needs of public policies are presented and related policies are discussed with its impact on penetration of EC and MC system in India.*

## Introduction

Electronic commerce (EC) is the buying and selling of goods and services on the Internet, by means of website using shopping cart and allows payments through cards or e-banking or cash on delivery. Mobile commerce (MC) includes all e-commerce transactions, using a mobile (hand held) device which always provides connectivity on move between employees, vendors, and customers. E-commerce and m-commerce are ICT-enabled practices for doing global business, which offers multiple benefits to increase the productivity of business organizations, government organizations, and society.

**Productivity** is expressed as a ratio of outputs to inputs. Depending on the context, data availability and the selection of input and output measures, productivity calculations can have different interpretations at different levels like business organizations, society, government, and individual citizens of a country. E-commerce and m-commerce provide multiple output improvements in terms of performances, quality, and efficiency with minimization of inputs—like that of cost, time, errors, land, and labor—for business organization, society and the government. The advantages provided by e-commerce and m-commerce practices are ubiquity, personalization, flexibility, distribution, instant connectivity, and immediacy. It improves people's ability to purchase goods and services as these technologies provide commerce anywhere, anytime, any device (3A), real time processing, information and multimedia data gathering and storage, in built intelligence (smart devices), and immediate decision making. There are many ways in which business, government, and citizens of India could benefit from e-commerce and m-commerce. Few examples are

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given below:

- Selling a product or service which is information based (delivery directly to devices) or location based.
- Improving productivity by gathering time-critical information (reports, photographs) in real time and SMS based up-to-date information. It saves time, cost of transportation, and people can enjoy leisure.
- The ability to access information on mobile, at affordable cost, can change people's lives and livelihoods in rural areas (for example, the latest weather report or health services). It can be used as a medium to educate and create awareness among rural people.
- Usages of Internet on mobile devices have lead to information access over coming geographical barriers and has removed the training cost of mobile technology.
- Device controlling (factory/home/office/vehicles) is possible as mobile technology works with sensor networks.
- The government is also providing many services to citizens electronically and is ensuring services availability by improving online infrastructure and by increasing Internet connectivity in a Digital India. This is an initiative by the Government of India.
- Many social networking sites are available online and on mobile. It helps people to contribute to social and environmental programs.

In this sense, e-commerce and m-commerce practices are helpful to improve business productivity, individual citizen productivity, and government organization productivity. At the national level, productivity growth raises living standards because more real income improves people's ability to purchase goods and services, enjoy leisure, improve housing and education, and contribute to social and environmental programs using e-commerce and m-commerce based practices. It shows that higher usages and penetration of these practices by different stakeholders lead to the improvements in national productivity of India. Higher usages and penetration of EC and MC-based practices can make it ubiquitous and pervasive.

### **Issues for making of EC and MC ubiquitous and pervasive for higher productivity in India**

The online commerce data shows that online movement has just started in India, but that users or customers are reluctant about online purchase due to the following:

- The acquisition process requires a lot of personal data and there is no safety on the usage of this data in the future.
- The information to make a decision to buy is insufficient, unclear, or wrong.
- Physical product shopping experience is missing in a digital world.
- There is doubt about delivery (delays, schedule), product quality (damaged product, product not working, chances of getting duplicate product, or lower quality).
- Order tracking systems are missing and shipping is expensive.
- There are payments security doubts.
- The search tool on the Website has difficulties finding the product.
- There is a lack of trust and awareness and lack of security policies on Web sites.
- Lack of compliance framework and after sales support.
- Business security policy is missing in Websites.

So there is a need to make EC and MC ubiquitous and pervasive as it shows a significant impact on improvement in national productivity. Most of these issues can be solved with the help of advanced technology and proper policies framework which can be provided by the government and organizations running the business.

### **Attacks on EC- and MC-based practices**

In EC- and MC-based practices, many messages are exchanged between web consumer and business web server using the Internet. Third party involvement (payment processing, logistics management, supply management) is with EC and MC. Due to network-based communication through public network this system is prone to security threats, such as the following:

- An attacker can monitor and examine the data between consumer and web server to extract the

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shopper's behavior, personal information, authentication of information, and payment-related information which can be used against the shopper. The attacker can further sell this information to other parties.

- An attacker can break protection features, to introduce malicious code, and to steal or modify information at consumer side and web server side.
- These attacks can gain unauthorized access to information at consumer side or business server side or to a system function at a later date.
- An attacker can be someone from the inside, such as a disgruntled employee, attacking the network. Insider attacks can be malicious. Malicious insiders intentionally eavesdrop, steal, or damage information; use information in a fraudulent manner; or deny access to other authorized users. No malicious attacks typically result from carelessness, lack of knowledge, or intentional circumvention of security for such reasons as performing a task.
- Attacker can attempt to get physically close to business server side resources like network components, data, and systems in order to learn more about a network. Close-in attacks consist of regular individuals attaining close physical proximity to networks, systems, or facilities for the purpose of modifying, gathering, or denying access to information.
- The attacker compromises the network or system through social interaction with a person, through an e-mail message, or phone.
- The hacker creates a fake Website that looks exactly like a popular site such as the e-commerce Website and then sends an e-mail message trying to trick the user into clicking a link that leads to the fake site. When the user attempts to log on with their account information, the hacker records the username and password and then tries that information on the real site.
- The hacker takes over a session between consumer and business server and disconnects the business server from the communication. Consumers may send private information to the hacker by accident, thinking that they are talking to the original party.
- The hacker modifies the source address of the packets he or she is sending so that they appear to

be coming from someone else. This may be an attempt to bypass your firewall rules.

- The attacker sends more data to an application than is expected. A buffer overflow attack usually results in the attacker gaining administrative access to the system in a command prompt or shell.
- The attacker knows of a security problem within an operating system or a piece of software and leverages that knowledge by exploiting the vulnerability.
- An attacker tries to crack the passwords stored in a network account database or a password-protected file.
- An attacker can disturb the functionality of a business web server due to a loophole in technology, like TCP, and may bring down the functionality of an EC system for hours which is a big loss for EC companies.

#### **Security tools and enhancements of EC- and MC-based system**

Security threats in EC and MC lead to disruption of business, loss of productivity, loss of privacy, theft of information, legal liability, and damage to business reputation and consumer confidence. Currently, most of the EC systems are using different security tools, like Firewalls—software and hardware, public key infrastructure, encryption software, SSL, digital certificates, digital signatures—Biometrics—retinal scan, fingerprints, voice etc, authentication with user id and passwords, locks and bars—network operations centers. Security can be further enhanced by choosing an e-commerce site on a platform that uses a sophisticated object-orientated programming language, SSL certificates, and SSL enabled connection. EC payment processing system requires customers' sensitive data, especially credit card numbers, expiration dates and card verification value (CVV) codes. Delete this data as soon as customers checks out. In case of charge backs and refunds, a minimal amount of data is enough. Create polies for strong password creation and allow users to write security question with some suggestions. More security to EC payment transactions is added with one time password (OTP) through email and on mobile device.

Define, identify suspicious activities, and set up system alerts for suspicious activities, for example, when the recipient name is different from the card holder's name. Apply layer-wise security, for example, application

layer (loginbox, search queries, structured query language [SQL] injections, and cross-site scripting [XSS]), business logic layer security, web server security, transport layer security, and network layer security. Define security policies of organizations and educate employees with proper training about privacy and security law, policies, customer data, and activities. Further, proper order tracking systems with unique order tracking number will enhance customer trust as they will know the status of orders when there is a third party involvement. For further security enhancement, use different real time analytical tools to observe the behavior of customers and to detect suspicious activities. To detect malware, virus, and harmful software in systems use different monitoring software regularly. If EC and MC systems are using third party software, then keep up with new version for security enhancement regularly. Use advanced technology like cloud computing, mobile computing, social media integration, and big data analysis for cost saving (reduction in investment in infrastructure), have innovative development (environment specific, location based), and carry out real-time analysis and intelligent smart commerce for enhanced productivity gains. EC and MC systems contain valuable information; it needs regular backup and disaster management plan. Business privacy and security policies should be displayed on Websites to enhance customer trust.

### **Need of policy framework**

EC and MC systems strengthen existing economic activities by creating new and innovative opportunities for stakeholders. There is a need to boost it with policy framework to minimize those risks associated with the development of EC and MC systems. Business conducted through the Internet caters to customers all over the world. This raises cross-border legal issues. Transactions that may be legal and valid in one jurisdiction may not be enforceable in others. There is a need to frame policies for EC and MC practices as it is based on Internet and wireless technology. The following section provides the need of legal policy framework for EC and MC systems:

- India is a developing country and the Indian government is a stakeholder in the online movement given the backdrop of current government initiatives, like Digital India and Make in India. Hence, the government must create an appropriate environment with legal policies and regulatory framework to enhance the aspect of data security, trust, and privacy protection.

- The Internet has become a weapon for political, military, and economic espionage.
- Organized distributed cyber attacks have been witnessed in the last few years. The software used to carry out these attacks indicates that they were clearly designed and tested with much greater resources than usual individual hackers.
- Most government agencies and companies around the world use common computing technologies and systems that are frequently penetrated by criminal hackers and malware.
- Traditional protective measures are not enough to protect against attacks such as those on Estonia, as the complexity and coordination in using the botnets was totally new. National networks with less sophistication in monitoring and defense capabilities could lead to serious problems in national security.
- Due to advancement in technology and growth in online users and transactions cyber law and cybercrime are important subjects for consideration by all stake holders in the digital and mobile ecosystem.
  - a. To prevent cyber attacks against the country's critical information infrastructures
  - b. To reduce national vulnerability to cyber attacks
  - c. To minimize damage and recovery time from cyber attacks
  - d. There must be a technical–professional body that certifies the security of a network to ensure the overall health of government systems.
- Findings indicate a blurred line between legal and illegal sales of software vulnerabilities.
- There is a strong need for cyber policing to reduce the Internet's abuse which are more harmful than physical destruction.

### **Legal framework and issues in EC and MC**

A series of legal issues need to be effectively addressed before e-commerce can be considered a safe and effective way of conducting business. Key legal issues arising out of e-commerce transactions include protection for authentication and non-repudiation. This means that there needs to be a manner of authenticating the identity of the person entering into the transaction. Further, there needs to be some protection that the person entering the

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transaction cannot repudiate the same at a later stage.

India realizes the importance of e-commerce, as this is an emerging practice of businesses in today's world. For adopting e-commerce, two requirements need to be catered to: physical connectivity and technology, and legal framework governing the flow of trade. To ensure a better connectivity, there has been an increase in the number of Internet service providers following advancement in the telecommunication sector such as 3G/4G and Wi-Max. The Indian government has set up National Task Force on Information and Technology to address trade issues related to EC.

### **Payment and dispatch of goods**

One of the major factors for e-commerce not taking off in India as expected is the dispatch of goods on time and payment issues. Merchants start order processing and shipping only after the receipt of money through credit card or online banking payment. Mostly, online payments are credited to the intermediaries, such as PayPal, which transfer these payments to merchants. To address this situation, the Reserve Bank of India (RBI) has issued new norms for facilitating e-commerce transactions. As per the RBI directives, the payment will be credited directly to the merchants and not to the intermediaries. With this arrangement, money will be available to the merchant within three days of transaction. This will expedite shipping of goods to the customer on time.

However, there is still an underlying problem of fixing responsibility for the goods delivered and the payment. Online retailers do not take full responsibility of a clear e-transaction. So, the customer problems still persist. However, India has taken a number of steps to facilitate e-commerce transactions and steadily the loopholes are being plugged.

### **Government regulations and policies**

The Government of India laid down the Information and Technology Act in 2000 and became the 12th country in the world to have cyberlaws. The IT Act of 2000 covered the following aspects:

- Legal recognition of electronic documents
- Legal recognition of digital signatures
- Offences and contraventions
- Justice Dispensation Systems for Cybercrimes

The IT Act 2000 was substantially modified through the

Information and Technology Amendment Act, 2008, which came into effect from October 27, 2009. The IT Act of 2008 covered amendments that provided additional focus on information security. It has added sections on offences, such as cyber terrorism and data protection.

### **Cyber laws and crimes as per the Indian IT Act**

The IT Act covers cyber laws and crimes which are subject to the Indian Penal Code. Such cyber crimes include:

- Crimes related to technical aspects, such as unauthorized access and hacking, Trojan attack, virus and worm attack, email-related attacks, like email spoofing and email spamming, email bombing, and denial of service attacks (DOS).
- Consumption of limited or non-renewable resources, such as network bandwidth and RAM, alteration or destruction of configuration information, destruction or alteration of network components, and pornography.
- Forgery, cyber stacking, identity theft, data diddling, and theft of Internet hours.
- Intellectual property, Intellectual Property Rights (IPR) violation, which include software piracy, copyright infringement, trademark violations, etc. This also includes cyber terrorism, banking, credit card-related crimes, e-commerce and investment frauds, sale of illegal articles, and defamation.
- Breach of privacy and confidentiality.

### **Monitoring of online payments by regulatory bodies**

Online transactions require use of electronic cards, either credit or debit. The credit card and debit-cum-ATM cards are widely used by account holders.

### **Steps by RBI to improve e-commerce transactions**

- Issue appropriate instruments (cards) to facilitate online payments: For example, all debit cards are ATM cards, but all ATM cards are not debit cards. Additionally, there are some cooperative banks offering Internet banking facilities. This facility is mostly for checking account balance, and this should be extended to online transactions as well.
- Take steps to improve debit and credit card penetration. RBI should specify a time frame to banks to issue credit cards and debit-cum-ATM cards.

- Improving the network connectivity of ATMs: Users can use one bank's ATM card for holding transactions with another bank because these ATMs are connected to BANCS ATM network. Several banks still need to be connected to this network. RBI should facilitate to expedite this connectivity.
- Improving payment gateway infrastructure: There is a need to improve payment gateway infrastructure in the country. The payment gateways should accept all credit cards, debit cards, and Internet banking facilities that all banks are offering. RBI should provide a mandate to the payment gateways to integrate such services of any new bank within some stipulated duration of the new bank operations going live.

## **FDI POLICY**

### **Consumer Protection Act 1986**

EC and MC security responsibilities are with the user, government, corporate, and academicians. But with this different regulation must consider for EC and MC system are like sector-specific regulators, subsidies, competition authorities, taxation issues, labor laws, national and local governments issues, investing firms issues, national security and issues relating to privacy and freedom of expression, company law and legal formalities for the firms starting EE- and MC -based system, list of product not allowed for selling online and product specific issues like techno legal issues of e-health and telemedicine.

### **Conclusion**

EC- and MC-based practices act as productivity multiplier for different stakeholders. But there are some issues that

need to be solved by technology advancements and proper legal framework which will enhance security, trust, and privacy for consumers and business organizations. Proper education, awareness, and implementation of technology advancement and legal framework for EC and MC can increase penetration of these practices in India which will further contribute toward national productivity. The private and public sectors should coordinate, share best practices, nationally and internationally, to make EC and MC ubiquitous and pervasive in India in light of digital India.

## **References**

- Niranjanamurthy M., and Dharmendra Chahar, "The Study of E-Commerce Security Issues and Solutions," *International Journal of Advanced Research in Computer and Communication Engineering*, Vol. 2, Issue 7, July 2013.
- Report, "Future of E-Commerce: Uncovering Innovation," [www.deloitte.com/in](http://www.deloitte.com/in)
- Bajaj, Kamlesh, "The Cybersecurity Agenda- Mobilizing for International Action," [www.dsci.in](http://www.dsci.in)
- IDSA Task Force Report, "India's Cyber Security Challenge," March 2012.
- Article, "Cyber Security Trends and Developments in India 2013," <http://perry4law.com>
- usufQarkaxhija, "E-Commerce Security: Attacks and Preventive Strategies," Economy-AAB University
- Ecommerce Industry in India—Government Regulations and Policies (<http://www.india-reports.com/summary/government-regulations-and-policies-towards-ecommerce-in-india-mht>)
- <http://www.cio.com/article/2384809/e-commerce/15-ways-to-protect-your-ecommerce-site-from-hacking-and-fraud.html>

*Globalization was a deep trend pushed by technology and right ideas, as much as anything else.*

*—Jeffrey Sachs*

# E-Commerce: An Analytical Study on Its Spread and Impact on Indian Economy

ROOPALI SHARMA

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*Economic reforms explicitly took place in India as a result of the opening up of the economy with a view to integrate the country with the global economy. With advancements in technology, there have been changes in the methodology of business transactions. India, being a rapid adaptor of technology, and in case of IT being an important base of technology application is a pace with the current scenario of electronic data exchanges that has taken to e-commerce. In the backdrop of this scenario, this paper presents a snapshot of the evolution of e-commerce business, characterisation of e-commerce business and the impact of e-business on the economy.*

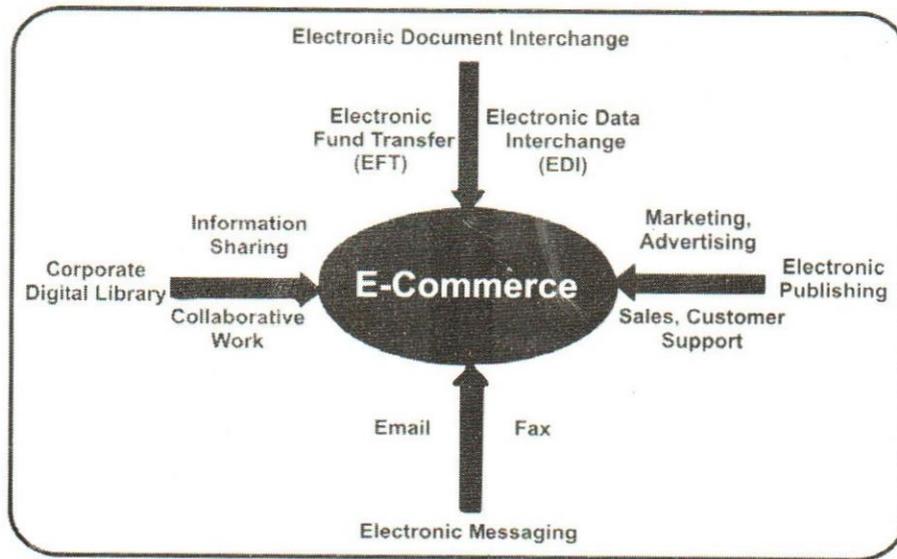
## Introduction

Although e-commerce is a very recent phenomenon of the late 1990s, it already has a brief, turbulent history. The early years of e-commerce were a period of explosive growth and extraordinary innovation, beginning in 1995 with the widespread use of the Web to advertise products. This period of explosive growth capped in 2000 when stock market valuations for dot.com companies reached their peak and thereafter began to collapse. A sobering period of reassessment occurred, followed by strong double-digit growth through the current period. The e-commerce sector has seen unprecedented growth in 2014. The growth was driven by rapid technology adoption led by the increasing use of devices such as smartphones and tablets, and access to the Internet through broadband, 3G, etc., which led to an increased online consumer base. Furthermore, favoured demographics and a growing internet user base helped this growth.

E-commerce or electronic commerce is a methodology of modern business which addresses the need of business organizations, vendors and customers to ease the business, reduce cost and improve the quality services while increasing the speed of delivery. E-commerce facilitates paperless exchange of business information using the following ways.

## Unique Features of E-commerce

There is a rising awareness among the business community in India about the opportunities offered by e-commerce. Ease of Internet access and navigation are the critical factors that will result in rapid adoption of Internet commerce. Some of the important and unique features as well as a comparison of both traditional



commerce and of e-commerce are mentioned below.

### **Ubiquity**

In traditional commerce, a marketplace is a physical place one visits in order to transact. For example, television and radio typically motivate the consumer to go someplace to make a purchase. E-commerce, in contrast, is characterized by its ubiquity: it is available just about everywhere, at all times. It liberates the market from being restricted to a physical space and makes it possible to shop from your desktop, at home, at work, or even from your car, using mobile commerce. The result is called a *marketspace*—a marketplace extended beyond traditional boundaries and removed from a temporal and geographic location. From a consumer point of view, ubiquity reduces transaction costs—the costs of participating in a market.

### **Global Reach**

E-commerce permits commercial transactions across cultural and national boundaries far more conveniently and cost-effectively than is possible in traditional commerce. As a result, the potential market size for e-commerce merchants is roughly equal to the size of the world's online population. The total number of users or customers an e-commerce business can obtain is a measure of its reach, which is increasing multifold.

### **Universal Standards**

One strikingly unusual feature of e-commerce is that the technical standards of the Internet and, therefore, the technical standards for conducting e-commerce are universal standards that are shared by all nations around

the world. In contrast, most traditional commerce practices differ from one nation to the next. The universal technical standards of the Internet and e-commerce greatly lower market entry costs—the cost merchants must pay just to bring their goods into market. At the same time, for consumers, universal standards reduce a search cost, that is, the effort required to find suitable products.

### **Interactivity**

Unlike any of the commercial practices of the twentieth century, with the possible exception of the telephone, e-commerce allows for multidimensional interactivity, meaning they enable two-way communication between merchant and consumer with voice as well as data. Interactivity allows an online merchant to engage a consumer in ways similar to a face-to-face experience, but on a much more massive, global scale.

### **Personalization**

E-commerce permits personalization of a transaction: merchants can target their marketing messages to specific individuals by adjusting the message to a person's name, interests and past purchases. It also permits customization, changing the delivered product or service based on a user's preferences or prior behaviour. Given the interactive nature of e-commerce, much information about the consumer can be gathered in the marketplace at the moment of purchase. With the increase in information density, a great deal of information about the consumer's past purchases and behaviour can be stored and used by online merchants. The result is a level of personalization and customization unthinkable in existing commercial practices.

### **Inventory Management**

Using e-commerce, inventory management of products becomes automated. Reports get generated instantly when required. Product inventory management becomes very efficient and easy to maintain.

### **24x7 Service Availability**

E-commerce automates business of enterprises and services provided by them to customers which are available anytime, anywhere. Here 24x7 refers to 24 hours of each of the seven days of a week.

**Summary of difference between traditional commerce and e-commerce, which makes e-commerce popular worldwide are listed below:**

<b>Sr. No.</b>	<b>Traditional Commerce</b>	<b>E-Commerce</b>
1.	Heavy dependency on information exchange from person to person.	Information sharing is made easy via electronic communication channels making little dependency on person to person information exchange.
2.	Communication/transaction are done in synchronous way. Manual intervention is required for each communication or transaction.	Communication or transaction can be done in a synchronous way. Electronics system automatically handles when to pass communication to required person or do the transaction.
3.	It is difficult to establish and maintain standard practices in traditional commerce.	A uniform strategy can be easily established and maintain in e-commerce.
4.	Communications of business depends upon individual skills.	In e-Commerce or Electronic Market, there is no human intervention.
5.	Unavailability of a uniform platform as traditional commerce depends heavily on personal communication.	E-Commerce website provides user a platform where all information is available at one place.
6.	No uniform platform for information sharing as it depends heavily on personal communication.	E-Commerce provides a universal platform to support commercial/business activities across the globe.

### **Different types of e-commerce used to make it pervasive in the economy**

There are a variety of e-commerce practices and many different ways to characterize these.

#### **Business-to-Consumer (B2C)**

The most commonly discussed type of e-commerce is Business-to-Consumer (B2C) e-commerce in which online businesses attempt to reach individual consumers. Even though B2C is comparatively small, it has grown exponentially since 1995, and is the type of e-commerce that most consumers are likely to encounter.

#### **Business-to-Business (B2B)**

Business-to-Business (B2B) e-commerce, in which

businesses focus on selling to other businesses, is the largest form of e-commerce. The ultimate size of B2B e-commerce could be huge. There are two primary business models used within the B2B arena: net marketplaces, which include e-distributors, e-procurement companies, exchanges and industry consortia, and private industrial networks, which include single firm networks and industry-wide networks.

#### **Business-to-Government (B2G)**

B2G model is a variant of B2B model. This method is used by the government to trade and exchange information with various business organizations. Such Websites are accredited by the government and provide a medium to businesses to submit application forms to the government.

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### **Consumer-to-Business (C2B)**

In this model, a consumer approaches a Website showing multiple business organizations for a particular service. Consumer places an estimate of amount they want to spend for a particular service. For example, comparison of interest rates of personal loan/car loan provided by various banks via the Website. Business organization that fulfills the consumer's requirement within the specified budget approaches the customer and provides its services.

### **Consumer-to-Consumer (C2C)**

C2C provides a way for consumers to sell to each other with the help of an online maker, such as the auction site eBay. In C2C e-commerce, the consumer prepares the product for the market, places the product for auction or sale and relies on the market maker to provide catalogue, search engine and transaction-clearing capabilities so that products can be easily displayed, discovered and paid for.

### **Peer-to-Peer (P2P)**

Peer-to-peer technology enables Internet users to share files and computer resources directly without having to go through a central Web server. In peer-to-peer's purest form, no intermediary is required, although in fact, most P2P networks make use of intermediary 'super servers' to speed operations.

### **Mobile commerce or m-commerce**

It refers to the use of wireless digital devices to enable transactions on the Web. M-commerce involves the use of wireless networks to connect cell phones, handheld devices and personal computers to the Web. Once connected, mobile consumers can conduct transactions, including stock trades, in-store price comparisons, banking, travel reservations and more.

### **The impact of e-commerce on the efficiency of the economy**

The growth of e-commerce industry has been phenomenally high. However, its growth is dependent on a number of factors and most important of these are Internet connectivity, advancement in mobile communication and changing social-cultural mind-set of the people. As per Forrester McKinsey Report of 2013, India has 137 million Internet users with penetration of 11 percent. Total percentage of online buyers to Internet users is 18 percent. However, compared to India, other fast developing countries,

such as China and Brazil, have Internet population of 538 (40 percent) and 79 (40 percent) millions, respectively. Therefore, lower internet density continues to remain a challenge for e-commerce as well as for economic growth.

According to Report of Digital Commerce, IAMA (2013), e-commerce is growing at the CAGR of 34 percent and is expected to touch US\$13 billion by end of 2013. Industry surveys suggest that e-commerce industry is expected to contribute around 4 percent to the GDP by 2020. In comparison, according to a NASSCOM report, by 2020, the IT BPO industry is expected to account for 10 percent of India's GDP, while the share of telecommunication services in India's GDP is expected to increase to 15 percent by 2015. With enabling support, the e-commerce industry too can contribute much more to the GDP.

The growing e-commerce industry can have a positive spillover effect on associated industries, such as logistics, online advertising, media and IT/ITES. Currently, e-commerce accounts for 15.20 percent of the total revenues for some of the big logistics companies. The revenue for logistics industry from inventory based consumer e-commerce alone may grow by 70 times to US\$2.6 billion (INR 14,300 crores) by 2020.

Currently, the inventory based consumer e-commerce model alone provides direct employment to approximately 40,000 people and is estimated to create one million direct and another 0.5 million indirect jobs by 2020. Low-entry barriers have attracted many young and enterprising individuals to try their hand at entrepreneurship. A significant 63 percent of e-commerce ventures have been started by first-time entrepreneurs. The Indian e-commerce industry is in a nascent stage but fast catching the league of big global players. Major domestic e-commerce companies are Flipkart, Snapdeal, Fashion and You, Deals and You, Homeshop18, etc.

Although many factors support the growth of e-commerce in India, the fledgling industry is faced with significant hurdles with respect to infrastructure, governance and regulation. Low Internet penetration of 11 percent impedes the growth of e-commerce by limiting the Internet access to a broader segment of the population. Poor last mile connectivity due to missing links in supply chain infrastructure is limiting the access to far flung areas where a significant portion of the population resides. High dropout rates of 25–30 percent on payment gateways, consumer trust deficit and slow adoption of online

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payments are compelling e-commerce companies to rely on costlier payment methods such as cash on delivery (COD).

As stated earlier, over 70 percent of all consumer e-commerce transactions in India are travel related, comprising mainly online booking of airline tickets, railway tickets and hotel bookings. The biggest players in the travel category are Makemytrip.com, Yatra.com and the IRCTC Website for railway bookings. Non-travel related online commerce comprises 25–30 percent of the B2C e-commerce market. The unfettered growth of online travel category has been possible because the regulatory and infrastructure issues do not impede its growth. Also, it does not face the infrastructure challenges since the goods need not be transferred physically.

Rapid technological progress in information and communication technologies (ICTs) along with their widespread diffusion have led to speculation about 'frictionless' economies in which transaction costs are nearly zero, barriers to entry and contestability disappear, and markets clear instantly. Some experts think that e-commerce with producers selling directly to consumers over computer networks, such as the Internet, will eliminate existing intermediaries ('disintermediation') and drastically reduce transaction costs. These lower production costs will encourage the entry of new businesses and thus increase competition and pressure to pass lower costs on to consumers as lower prices. In addition, consumers will be able to search among thousands of merchants for the lowest prices, thereby increasing the downward pressure on prices and leading to a shift in market power from producer to consumer. In general, it is thought that e-commerce can significantly improve the efficiency of economies, enhance their competitiveness, improve the allocation of resources and increase long-term growth.

### **Other Features of Impact of E-commerce on Economic Growth**

#### ***The impact of e-commerce on the reducing cost of information and communication technologies***

E-commerce is an Internet application. It runs on an infrastructure composed of computers, software and communication systems and uses the Internet's key infrastructure applications (e-mail, the World Wide Web, the browser). This constellation of technologies has supported the development of e-commerce and in turn is the source of much of e-commerce's value. The Internet and e-commerce use a mixture of information and

communication technologies to connect PCs to servers. Many of these contain huge databases and maintain sophisticated software applications that ensure that the entire system operates smoothly. Thanks to the digital capability of this network and its packet switching protocol, data, voice, audio and video transmission can use the same system simultaneously, thereby, vastly increasing the capacity and flexibility of the current communications system while undercutting the costs and prices of traditional modes of transmission. As such, e-commerce in turn supports the growth of communication technologies.

#### ***The impact of e-commerce on firms' cost structure***

The impact of e-commerce on firms' internal production and transaction costs falls into three broad categories: the cost of executing the sale, costs associated with the procurement of production inputs and costs associated with making and delivering the product. This list probably represents only a subset of the cost impacts associated with e-commerce as firms implement the technology, since by and large they only represent savings over existing processes and thus do not factor in quality improvements. Similarly, beyond mere substitution, it is likely that e-commerce techniques may foster completely new ways of conducting business. While these are hard to envision, they may lead to more significant cost savings.

The key areas of cost reduction when carrying out a sale via e-commerce rather than in a traditional bricks-and-mortar store involve physical establishment, order placement/execution, customer support and after-sales service, and staffing.

By placing the necessary information online in an accessible format, e-commerce merchants generally transfer transaction costs (for example, obtaining product information or selecting the product) to the customer. In addition, e-commerce is very effective at reducing the costs of attracting new customers. While far from 'friction-free', advertising is typically cheaper than other media and more targeted. Finally, the electronic interface allows e-commerce merchants to check that an order is internally consistent and that the order, receipt and invoice match.

#### ***The impact of e-commerce on customer support/after-sales services***

In knowledge-based economies dominated by sophisticated products, customer service and after-sales service are a major cost for many firms. Traditionally, this meant placing service personnel in the field to visit clients,

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staffing call centres, publishing extensive documentation or issuing software. For many firms, these costs are substantial, accounting for more than 10% of operating costs. Through e-commerce, firms are able to move much of this support online so that customers can access databases or 'smart' manuals directly; this significantly cuts costs while generally improving the quality of service.

#### ***The impact of e-commerce on purchase orders/ procurement***

Just as e-commerce can significantly reduce selling costs, it can also lower the costs associated with buying. While the actual transaction takes place outside the firm, the costs associated with procurement constitute significant internal costs. Internet-based e-commerce procedures now make it possible to apply EDI-type systems to relatively small purchases, thereby, drastically reducing errors, ensuring compliance with organisational norms and speeding the process.

#### ***The impact of e-commerce on firms' inventories***

Directly related to savings in time associated with procurement are savings in inventory carrying costs: the faster an input can be ordered and delivered, the less the need for a large inventory. A key factor in reducing the costs of inventories is improving the ability to forecast demand more accurately. E-commerce merchants who allow consumers to customise their order or select from a wide variety of choices obtain valuable information on consumer preferences. This should improve their ability to forecast demand and control the inventories.

#### ***The impact of e-commerce on firms' distribution***

Although shipping costs can increase the cost of many products purchased via e-commerce and add substantially to the final price, distribution costs are significantly reduced (by 50 to 90 per cent) for products like financial services, software and travel, which are important e-commerce segments. For these products, the cost reduction associated with e-commerce could have large economic impacts and further fuel the migration of these sectors to e-commerce. This reduction in distribution costs is especially important for international trade, as the ability to download some products without incurring shipping costs is thought to be a strong stimulus to trade, particularly, for small and medium-sized enterprises (SMEs).

#### ***The impact of e-commerce changing the cost structure of the value-added chain***

Just as e-commerce reduces the internal costs of many

transactions, it also changes the cost structure that dictates a firm's relationships with other businesses. This set of relationships is called the value-added chain, the network of upstream and downstream businesses, from raw materials to final sale, through which a product travels. At every stage of processing, an intermediary often performs a service which facilitates this flow—adding value but also adding cost. In many cases, this service is information intensive—matching a buyer to a seller, certifying parties in a transaction, providing support for the transaction (for example, financial or legal services)—and often involves some type of risk sharing. E-commerce, especially in intangible products, may reduce the involvement of intermediaries in the value added chain and thus lower costs.

#### ***The impact of e-commerce online payment***

The openness, global reach and lack of physical clues that are inherent characteristics of e-commerce also make it vulnerable to fraud and thus increase certain costs for e-commerce merchants as compared to traditional stores. While a variety of payment systems are being tested, the credit card is the dominant online payment method so far, and e-commerce merchants are exposed to potentially higher levels of fraud, resulting from stolen cards or illegally obtained card numbers. New techniques are being developed to protect the use of credit cards in e-commerce transactions, but the need for greater security and user verification leads to increased costs. The leading standard for these transactions is the SET (Secure Electronic Trading) system developed by MasterCard and Visa. Unlike normal credit card transactions, this system uses digital certificates to verify the user, making the system about three times slower (20 to 30 seconds) than traditional transaction processing.

#### ***The impact of e-commerce on prices***

The translation of lower costs into lower prices is not automatic. It depends on the presence of sufficient competition. So far, customers have tended to be affluent, young and well-educated who are experimenting with e-commerce and cite convenience as a primary reason for using it. Thus, online prices may be higher than offline in some cases because the consumers' affluence allows merchants to extract a higher price. However, the demographics of e-commerce are changing and as they reflect better the population at large and as additional e-commerce merchants increase competitive pressures the situation is changing. Ultimately, the impact of e-commerce

on prices will depend on competition. As the ability to search thousands of e-commerce stores in a few minutes or through an intelligent software agent improves, and as the expected growth of e-commerce generates more entrants, competition should be sufficient to transfer the cost savings associated with e-commerce into price savings.

### Conclusion

Undoubtedly, phenomenal development in communication technologies and consequently the power of the Internet to reach any part of the world hold terrific potential for enhancing international trade and boosting global economy. A key reason why e-commerce is growing so quickly is its significant impact on ease of business and its costs and productivity. In a nutshell, impact of e-commerce on economic growth can be summarised in following categories:

#### *Positive impacts : Main among them are:*

- i) It has compelled traditional business models to improve with respect to cost and quality of services.
- ii) It has supported growth in allied industries related to communication systems and computers.
- iii) It has eased out business considerably, which means saving of time, cost and energy.
- iv) It has generated new avenues of large-scale employment.

#### *Negative Impacts : Main among them are:*

- i) It is reducing market space of traditional businesses, especially, SMEs, traders, shop keepers, etc., which is a source of employment to common people.

- ii) Possibility of frauds if the source business entity and communication network are not reliable. A similar approach to address legal issues, effective risk management strategies coupled with adequate legal documentation will go a long way in protecting e-commerce companies and customers.

#### *Limitations : Main among them are:*

- i) It is dependent on technology and thus requires fast spread of communication technology.
- ii) It is dependent on users' ability to use it, thus, requiring an emphasis on improving Internet and mobile learning among common people.
- iii) It is mostly English language dependent. Hence, to overcome this language barrier a lot of effort has to be made either to make common people conversant with English or to promote e-commerce in Hindi and regional languages as well.

### References

- G. T. Waghmare (2012). "E-commerce: A Business Review and Future Prospects in Indian Business," *Internet Marketing in India: Indian Streams Research Journal*, Vol. 2, No. IV, 1-4.
- <http://www.studymode.com/essays/E-Commerce-1554293.html>, "E-Commerce-Essays-Hpandurang92"
- N. Edwards S.Handcock, and J.Mullen, (1997). "Electronic Commerce: Reality Bytes," *Supply Management*, Vol. 3, No. 8, 32-34.
- OECD (1999). "Economic and Social Impact of Ecommerce: Preliminary Findings and Research Agenda," *OECD Digital Economy Papers*, No. 40, OECD Publishing. <http://dx.doi.org/10.1787/236588526334>.

*It's amazing how easy the Internet makes it to destroy a business without creating another one in its place.*

*—Robert Levine*

# Mobile Financial Services: Technology Initiatives toward Financial Inclusion

JYOTI GOGIA AND JYOTI AGRAWAL

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*Making and receiving payments are important activities of an economic system. There are various modes to handle these financial activities. The Government of India envisions including all its citizens to the framework of financial services which is supported by limited formal infrastructure. Currently, mobile phones are commonly available and extensively used for a vast variety of purposes. Financial services that take improvement of this novel channel (mobile phones) can contribute significantly to financial inclusion as Mobile Financial Services (MFS) have the potential of reaching out considerably to a huge mass. But some uncertainties remain regarding the environment required to develop its potential.*

*The present paper focuses on the scope of MFS in India to achieve the vision of financial inclusion. It also stresses upon the benefitting concerns and hindering factors of MFS. The Government of India is planning to reduce inequities between people living in remote areas and urban areas in context of availing financial services. To check the possibility of spreading MFS in remote areas, it is primarily required to check its adaptability in urban areas where required technological knowledge is comparatively high. Therefore, the present study undertakes the level of customers' awareness and practice regarding various aspects of MFS in the urban areas. Finally, it proposes the future prospects of MFS.*

## Introduction

Scientific advancement should aim to affirm and to improve human life.

— Nathan Deal

People are looking for new unprecedented opportunities where they can save time and cost. Technological advancements provide essential tools which make one's life easier, comfortable, and better. They have brought about changes in our lifestyle. These vibrant changes in operations are the result of changing pace in human lives. Technological advancement in communication is an example which attracts both individuals and businesses. Mobile technology has evolved rapidly over the last few years. Mobile phones do not limit themselves to being merely a source of communication, but their uses are increasing dynamically from communication to commercial transaction, online banking, and in availing other financial services.

Earlier, traditional commerce used to have a narrow approach where a face-to-face interaction between supplier and buyer was mandatory with a restricted infrastructure and limited stock of goods and services. Consequently, electronic commerce replaced the restricted approach of traditional commerce and became popular amongst the youth. Later on, electronic commerce or e-commerce has been realized as immobile source with limited scope; therefore, now mobile commerce (m-commerce) is flourishing and introducing all types of services and facilities.

Financial management is a part of one's life. It helps a person to budget, save, and spend monetary resources efficiently over time. A person has to devote much time to manage his/her finance. With increasing complexities, people have less time to spend in long queues for availing

financial services. The Mobile Financial Services (MFS) is an innovative approach to reduce these complexities. It has proceeded the way for paperless economy. Earlier the work was restricted to a pile of files and papers, now it is in one's pocket.

MFS do not only facilitate those who wish to save time and cost, but it is a hope for those who are not even able to access financial services due to lack of formal establishments. India is still lagging behind in the process of providing financial services to the masses with nearly half the households remaining unbanked, and nearly 90 per cent villages not having bank branches (Singh, 2014). Therefore, they are not aware of the formal financial mechanism and its benefits. If we wish to attain sustainable development then we must ensure to include maximum participation from all sections of the society. MFS can be seen as a hope for the empowerment of the vast under privileged segment of the society with the mission of making them self-sufficient and well informed to take better financial decisions. MFS can provide fruitful solutions to an individual and also have added value to a business delivery model. However, the success relies on the widespread acceptability.

### Objectives

1. To know how far MFS can contribute to achieve the vision of financial inclusion.
2. To highlight the prominent issues related to MFS.
3. To know people's level of awareness and practice regarding prominent issues of MFS.

### Hypothesis Development

The following hypotheses have been framed:

- $H_0$ : There is no significant difference between people's level of awareness and practice regarding various issues related with MFS.  $\mu_1 = \mu_2$
- $H_1$ : There is a significant difference between people's level of awareness and practice regarding various issues related with MFS.  $\mu_1 \neq \mu_2$

### Research Methods and Materials

To check the possibility of spreading MFS in remote areas, it is primarily required to check its adaptability in urban areas. Therefore, to analyze the different dimensions of MFS, a sample of 175 respondents from Agra city has been undertaken. To collect primary data, a self-administered questionnaire has been used. The five-point

Likert Scale (1= perfectly disagree to 5 = perfectly agree) has been used to know the level of awareness and practice regarding MFS issues. Hypothesis has been tested at  $\alpha = 0.05$  with the help of Z-test of difference of means.

### Transformation of Financial Services

#### *Traditional–Electronic–MFS*

Transactions are imperative part of a person's life. It constitutes transaction from Business-to-Business (B2B), Business-to-Customer (B2C), Customer-to-Business (C2B), and Customer-to-Customer (C2C) (IBEF & Aranca, 2013). The underlying idea is that financial transactions should be safe and sound. Traditional mode of making financial transactions are payments through cash or check. But the insecurity in handling huge cash and complex method of check payment have encouraged people to find out other safe and accessible alternatives. Various initiatives have been undertaken by the Reserve Bank of India (RBI) and Board for Regulation of Payment and Settlement Systems (BRPS) to improve the accessibility and efficiency of financial services.

With the passage of time, technological enhancement has transformed the traditional method to electronic method. Banks have developed many channels of payments under e-financial services which enable customers to make easy payments and transactions. Banks have started providing high value transactions through Real Time Gross Settlement (RTGS). National Electronic Funds Transfer (NEFT) and National Electronic Clearing Services (NECS) have also been introduced to provide e-payment facilities. Electronic financial services are apart of e-commerce where people purchase goods, avail banking facilities, and make online investments.

Gradually, mobile phones have found place in people's lives. Various applications (apps) have started providing more convenient and spontaneous way to make financial transactions compared to what traditional institutions can provide. It has become comfortable to avail financial services through mobile phones, termed as Mobile Financial Services (MFS). According to Bilodeau et. al. (2011), it is important to recognize that MFS are not merely a technological phenomenon. In addition to the low-cost and widely distributed networks of local agents that are vital to the sustainable delivery of financial services, other intangibles such as the perceived trust in a brand, the personal relationship an individual holds with their local agent, and the endorsement from relevant peers—all play a role in adoption.

Financial services include a diverse range. There are six core functions that comprise financial services: Payments, Market Provisioning, Investment Management, Insurance, Deposits and Lending, and Capital Raising. MFS includes all the financial services that are delivered by using a mobile phone and are operated through the collaboration of banking and business institutions together with the mobile service providers and agents. According to Deloitte (2013), over the last decade, MFS, such as

M-Banking and M-Payments, have evolved from basic services such as information alerts to broader services such as money transfer, riding on regulatory initiatives, as well as initiatives from banks and telecom players. Mobile Payments Value Chain depicts the new mobile payment system. It is the latest technology in financial system that has replaced a wallet to mobile which is termed as mobile money. Figure 1 depicts the range of MFS.

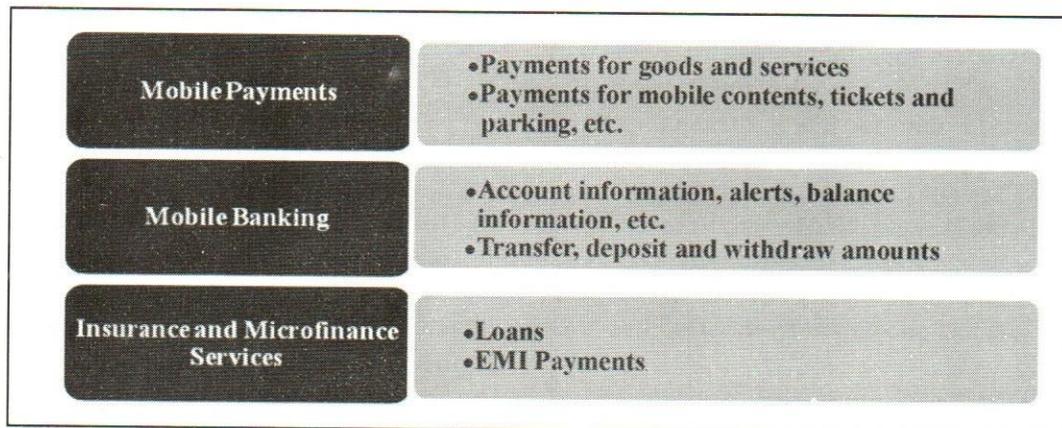


Figure 1: Mobile Financial Services

### Status of Mobile Usage

India ranks second after China in its consumption of mobile phones. The total number of mobile phone subscribers has reached 960.57 million as of February 2015. It has 77.58 mobile phones per 100 citizens (TRAI, April 10, 2015). Possessing a mobile phone is not anymore an issue of extravagance for people because mobile companies are launching various ranges for different segments of society. The usage of mobile phones has increased globally. The smart phone users have crossed the figure of 1 billion in less than seven years against 1.5 billion desktop users. Its popularity can be understood by knowing that out of a billion monthly active users, more than 819 million are accessing Facebook, a social networking site, on their mobile devices. Forty-one percent of its revenue was generated through mobile phone users in the second quarter of 2013. Google also generated around US\$1 billion out of its US\$13.9 billion revenue on being accessed through mobilephones in the first quarter of 2013 (Bhinde et al, 2013). The monthly growth rate of mobile subscriber is 0.71 percent, which results in 867.80 million mobile subscribers. This number is expected to grow to 1.2 billion till 2015 (Deshmukh et al., 2013). Apart from

accessing social networking sites and Internet surfing, people have also started operating financial and business services through mobile devices. As per the press release of TRAI (May 29, 2013), India can easily be expected to be the world's second largest mobile market after China because m-commerce is taking off faster than e-commerce.

### Financial Inclusion

The accessibility of financial services is very low amongst the Indian rural people which comprise 68.84 percent of total population (Census 2011). There is inadequate infrastructure with limited goods and services. Also, there is a chain of middlemen which augments the cost and complicates the method of utilising financial services. However, there is a need to include this significant percent of population into the financial framework.

According to the Planning Commission (2009), *Financial Inclusion refers to universal access to a wide range of financial services at a reasonable cost. These include not only banking products but also other financial services such as insurance and equity products.*

Financial inclusion or inclusive financing is the delivery of financial services, at affordable costs, to sections

of disadvantaged and low income segments of society as many research findings correlate and establish direct link between the financial exclusion and the poverty prevailing in developing nations (Sharma A. and Kukreja S., 2013). Generally weaker sections of society remain ignorant with the formal financial structure. In the race of profit, many financial institutions do not show interest to include these poor segments to the range of financial services. There are various challenges in including these people, such as financial illiteracy, unawareness regarding financial institutions and complex financial mechanism.

Financial inclusion is important for any nation as it is primarily helpful in mobilising savings of the people that are sometimes kept idle at home. It promotes economic growth by increasing capital formation. At the same time, financial institutions can help the poor and weaker section of society in their upliftment by providing loans and advances to them in the time of need. Many government policies, aiming to financially support the weaker section, can follow transparent mechanism if people have proper access to financial services.

Banking services have been treated as public good; therefore, it is the responsibility of the government to include the entire population of the country to access banking services. In order to remove the barriers of financial inclusion, banking sector has come forward with some innovative approaches such as Automated Teller Machines (ATM), credit and debit cards, e-banking etc. These advancements are undoubtedly supporting the urban society. But, the rural people are still far from these progressive approaches.

### Mobile Phones and Financial Inclusion

The penetration of financial services in India is very low and the problem is predominant in rural areas. Forty percent of Indian population is still without access even to the basic financial services (CRISIL Inclusix, 2013). In the absence of formal financial services, the people have option of money-lenders who charge high rates of interest and often make frauds. This not only increases risk exposure, but also perpetually marginalizes this segment of the population from the formal economy, as it is difficult and costlier for banks, insurance companies and government agencies to transact with them (Singh C. et al., 2014).

On the other hand, 74 percent of households possess a mobile phone, and out of the total subscription base of 933 million, about 40.5 percent comes from rural areas (Singh C. et. al, 2014). The widespread use of mobile

communications has created new channels, new instruments, and new business models for providing financial services to people who have traditionally been excluded from the formal financial system. MFS is not a product in itself, but rather a mode of accessing financial services. It has greater potential to become a common way of conducting financial transactions on a global scale. It offers opportunities to increase financial inclusion as it reduces operating and transaction expenses (such as time in which people would travel to carry out the transactions), as most mobile transactions do not currently have any additional cost for users. It is useful for low income groups and remote population where majority of people are unbanked and the financial infrastructure is immature, yet a huge fraction of this population possesses mobile phones.

There is a need to understand the mobile banking models in India for further strengthening of financial inclusion by using mobile phones. Mobile banking in India is primarily carried out through the following three models (Singh et al., 2014):

- a. **Bank-led Model:** Under this model, services are provided by banks to its account holders, where mobile phone is used plainly as a medium for operating banking services.
- b. **Joint Venture Model:** Telecom operators create bank accounts called as "open wallet" accounts, collaborating with banks, thereby providing basic financial services such as deposits and money transfers, through the mobile wallets.
- c. **Third-party Model:** Telecom operators collaborate with third party entities to create "semi closed wallets" accounts which are independent of banks. These wallets restrict withdrawal of cash and its usage is limited to specific services, often at the authorized outlets.

The use of these models separately or in combinations as per the requirement can accelerate the growth of financial inclusion.

### Prominent Issues Related to Mobile Financial Services

There are various issues that need to be highlighted in order to ensure the success of MFS in India:

**Educational Status:** To operate technological features and innovative techniques, it is required for a person to be

educated and well informed. It has been realized that education brings better understanding regarding technology usage. Therefore, educational status has been analysed and it has been found that most of the respondents (79 percent) are post graduate, and all respondents that were actively engaged in availing MFS, at least possessed an under graduate degree. But, the Indian population is not an absolute literate democracy. Eighty-five percent of total population in urban areas and 68.9 per cent in rural areas are literate (Census 2011).

**Customers' preference regarding Mobile Financial Services:** Traditional method comprises direct operations with banks, but now financial services can be operated through mobile phones via internet. Seventy-six percent

respondents believed that availing financial services through mobile phones is a far better option than accessing those with traditional mode. It is a good sign for bright future of MFS in India, as it is slowly becoming the people's choice and is winning their trust.

**Awareness regarding Mobile Financial Services:** Figure 2 depicts that 94 percent respondents are aware of the financial services that they can avail through their mobile phones, and the source of their awareness, as portrayed in Figure 3, is mass media, which is followed by friends and family, banks, mobile operators and agents. It indicates that by proper publicity of MFS, it can soon be in reach of all the Indians.

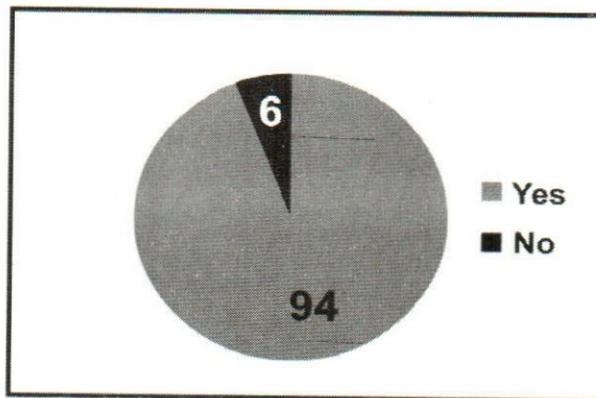


Figure 2: Awareness regarding Mobile Financial Services

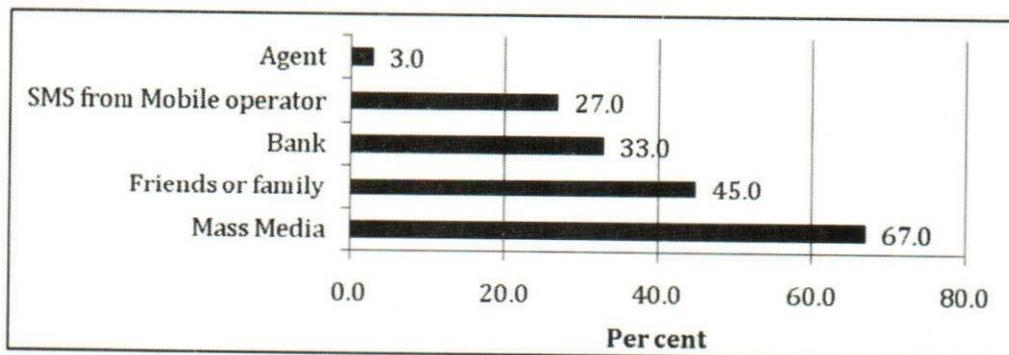


Figure 3: Source of awareness regarding Mobile Financial Services

**Consumption of Mobile Financial Services:** There are various financial services which a person can avail through mobile phones. Figure 4 represents that people mainly avail banking services (71 percent) that includes checking of account balances, transferring of funds, making deposits and bills payments etc. Mobile money transactions (56

percent) are also becoming significant in day to day life. It considers mobile recharge, savings, balance inquiry, bill payment, credit, purchasing etc., followed by insurance services (12 percent), investment services (8 percent) and other services (1 percent). It has been found that 12 percent respondents do not avail any of the mobile financial

services except those services that are essential in keeping their mobile functional. But, they have shown their willingness to use mobile financial services.

**Benefits of Mobile Financial Services:** There are various benefits (as shown in Figure 5) which persuade people to avail mobile financial services. It has been found that ubiquity and convenience are main advantages of MFS.

One can access financial services through mobile phones anytime and anywhere. Due to cashless approach, it also provides monetary security. Mobile phones are having many applications, alerts and feedback facility which are benefitting customers. Conversely, a few people opined that they may face frauds easily, if they handled MFS with a casual approach.

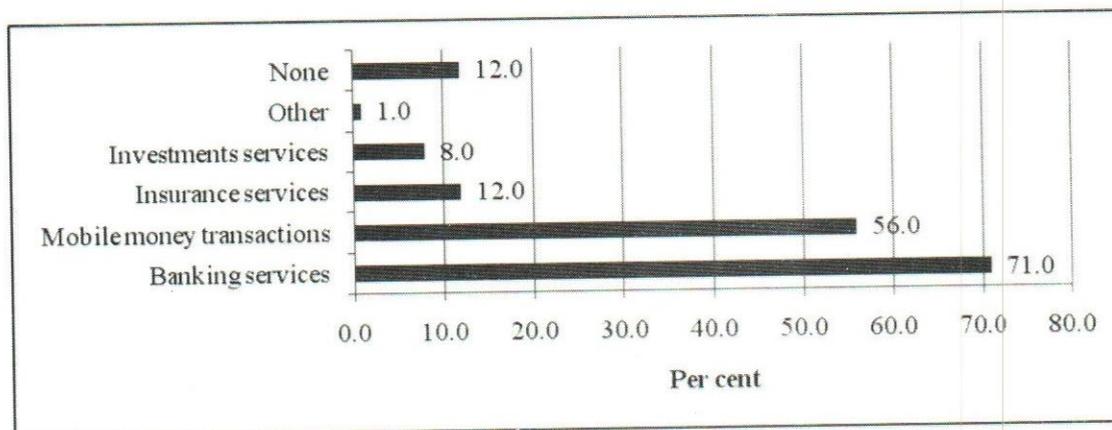


Figure 4: Usage of Mobile Financial Services

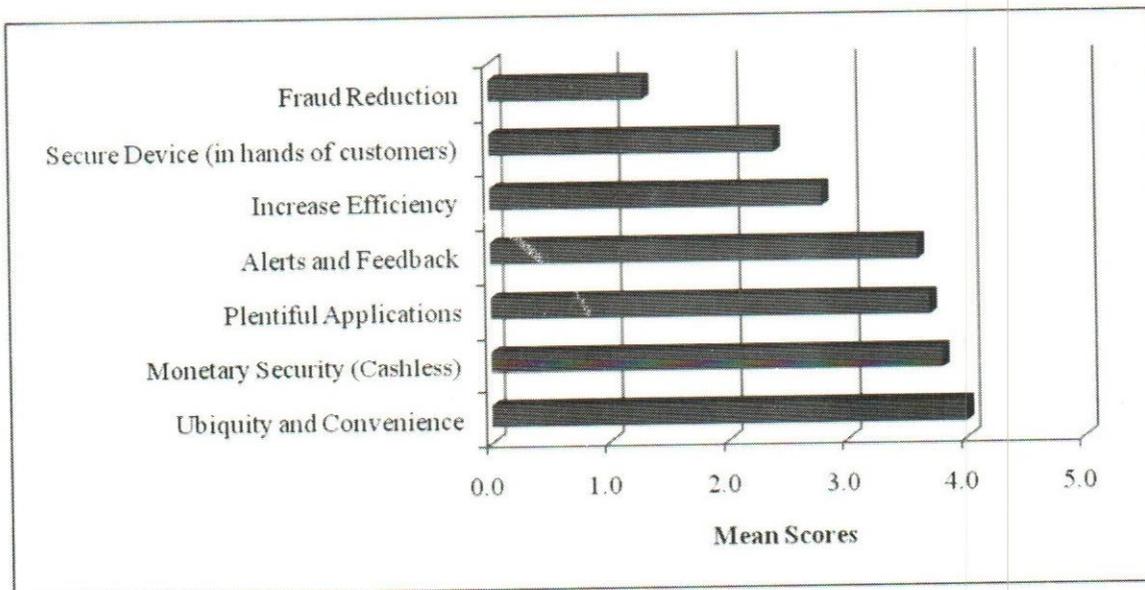


Figure 5: Benefits of Mobile Financial Services

### Factors hindering the use of Mobile Financial Services

Many people have mobile phones, but they are held back by certain obstructions, especially when it is about availing benefits from mobile financial services. There are various factors that hinder the frequent use of MFS. The respondents believe that the risk of scam is the major

fear in handling MFS. They also suppose that if their mobile phones get lost / stolen, then there is a certainty of getting the important data, passwords, and account details, leaked and hence misused. Due to lack of awareness and technical knowledge, they do not know how to access these services safely. Sometimes, non availability of internet or weak network hinders the MFS usage.

### Awareness and Practice regarding MFS issues

One of the prominent reasons for impeding the growth of MFS in India is lack of awareness. Therefore, it is required to know the level of people's awareness and also their practice level upon these services. Figure 7 depicts that in all issues, level of awareness is more than level of practice. It reflects that despite being significantly aware, people do not practice various aspects related with MFS. They are aware regarding privacy issues but while practicing, they sometimes ignore them. They are aware regarding benefits of MFS, various options available for financial facilities, technical knowledge required to handle

it but they comparatively practice less upon them. It is an indication to the government that only making people aware regarding various aspects is not enough for the successful implication of a technology, but it is required that the users get friendly with it.

The gap between the people's level of awareness and practice has been tested. It has been found that  $Z_{\text{calculated}} (2.73) > Z_{\text{tabulated}} (1.96)$ , therefore, the null Hypothesis has not been supported, which means that there is a significant gap between the level of awareness and practice regarding various dimensions related with MFS.

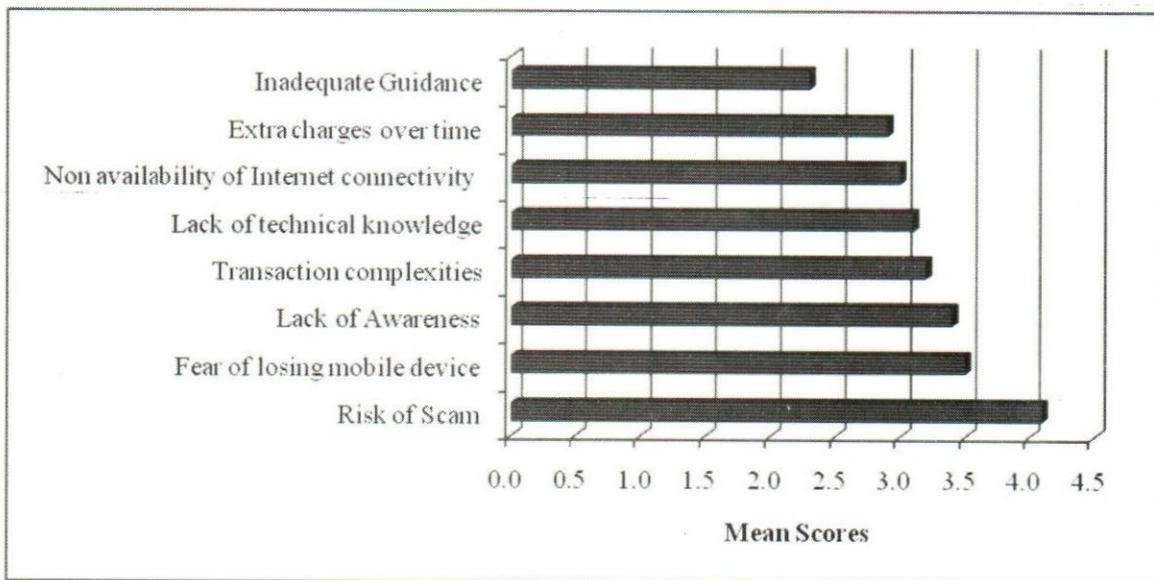


Figure 6: Factors hindering use of Mobile Financial Services

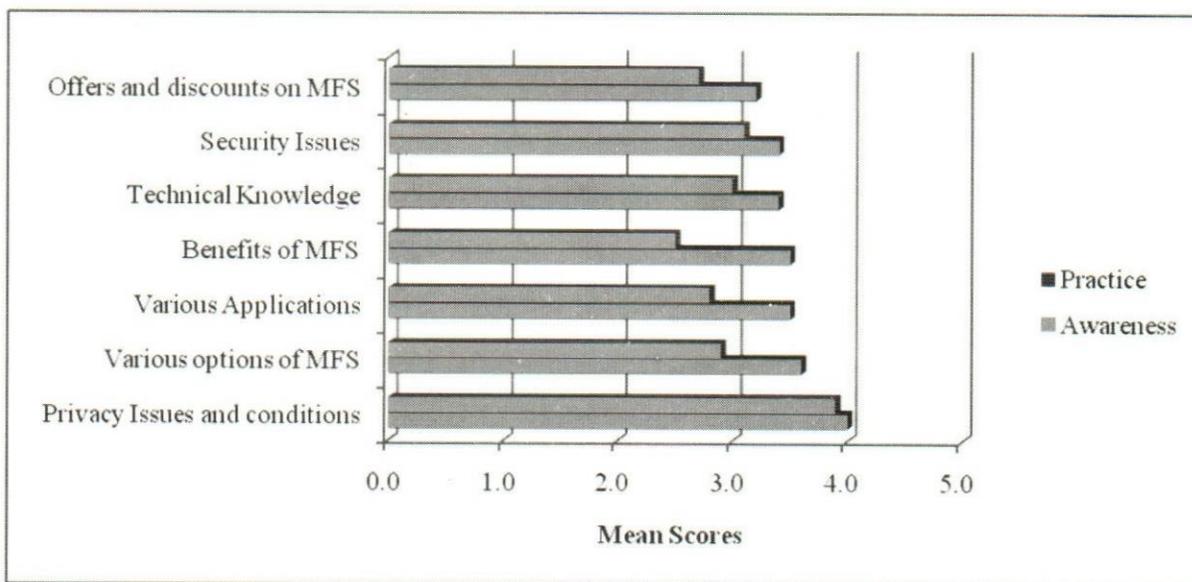


Figure 7: Awareness and Practice regarding Mobile Financial Services issues

## Conclusion

In the ongoing phase of globalization and fast-moving economies, people need to meet their financial requirements easily and safely at one side, and the government has been laying emphasis upon financial inclusion on the other end. India has an immense potential to build a cash light economy and to develop a financial market for financially excluded people. Mobile phones can enhance the accessibility, sustainability and intensification to financial services. Therefore, MFS stand as a hope for both.

There is a remarkable development in the arrangement of MFS. Therefore, the government has found MFS as appropriate strategic business services to reach straight to the customer group. People have started availing these services in urban areas. Its strategic execution in rural areas can be the most promising and cost-effective channel for financial inclusion.

## References

- Bhinde, A., Sharma, K., Rao, S., Mishra, K., N., P., & Nemani, N. (September 2013). *India's Mobile Internet: The Revolution Has Begun*. Avendus Capital Pvt. Ltd.
- Bilodeau, J., Hoffman, W., & Nikkelen, S. (2011). *The Mobile Financial Services Report*. Geneva, USA: World Economic Forum USA inc. Retrieved from <http://reports.weforum.org/mobile-financial-services-development-2011/content/pdf/wef-mfsd-report-2011.pdf> on July 3, 2014.
- Deloitte. (2013). *Can You Carry Your Money in Your Mobile? M-Banking & M-Payments: The Next Frontier*. Deloitte Touche Tohmatsu Limited. Retrieved from [http://www.deloitte.com/assets/Dcom-China/Local%20Assets/Documents/Industries/Financial%20services/cn\\_gfsi\\_canucarryyourmoneyinurmobile\\_040114.pdf](http://www.deloitte.com/assets/Dcom-China/Local%20Assets/Documents/Industries/Financial%20services/cn_gfsi_canucarryyourmoneyinurmobile_040114.pdf)(accessed June 4, 2014).
- Deshmukh, S. P., Deshmukh, P., & Thampi, G. T. (July 2013). "Transformation from E-commerce to M-commerce in Indian Context," *IJCSI International Journal of Computer Science Issues*, 10(4), 2.
- IBEF (India Brand Equity Foundation). (2013). *The Rise and Rise of E- Commerce in India*. Retrieved from <http://www.ibef.org/download/The-Rise-and-Rise-of-E-commerce-in-India.pdf> (accessed April 26, 2014).
- Sharma, A. & Kukreja, S. (2013). "An Analytical Study: Relevance of Financial Inclusion for Developing Nations," *Research Inveny: International Journal of Engineering and Science*, 2(6).
- Singh, C. et al. (2014). "Financial Inclusion in India: Select Issues," Working paper no. 474. Retrieved from <http://www.iimbernet.in/research/sites/default/files/WP%20No.%20474.pdf> (accessed July 12, 2015).

*The Internet has been the most fundamental change during my lifetime and for hundreds of years.*

*—Rupert Murdoch*

# An Empirical Study of Online Shoppers' Search Behaviour with Respect to Sources of Information in Northern India

PRATEEK KALIA, TEJINDERPAL SINGH AND NAVDEEP KAUR

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*Since the emergence of electronic retail in India, many new startups have mushroomed. These online retailers are competing for growth, existence and survival. Meeting the demands of prospective customers to offer them excellent product variety and service is important, but before making a purchase, today's online shoppers make informed decisions. They gather, sort, analyze and act on the basis of information available to them. Therefore, it has become very critical for an online vendor to understand what source of information an online shopper refers before making final purchase. This paper deciphers the preferred sources of information of online shoppers in Northern India. It was found that while searching for product information before shopping or buying products online, respondents mostly rely on search engines, review and company websites. Online retailer website, social networking sites, blogs and newspapers are not very popular sources of information. Demographic analysis revealed that source of information has statistical significant association with demographic variables like city, age, occupation, family income, gender and marital status. Information in this paper will be useful for policy and decision makers in e-commerce businesses.*

## Introduction

Due to increasing competition in retail environment even experienced buyers find it risky and challenging to make decisions regarding purchase of goods or services. To reduce this anxiety buyers search for information from a variety of sources (Kline and Wagner, 1994). Large international retailing organizations such as Tesco and Wal-Mart are investing heavily in knowledge management systems and processes (Lindblom, 2008). However, there has been very little research pertaining to mix of information sources in online retail. Retailers' decisions should be based on information about consumer attitudes and expectations. Due to scarcity of information retailer are forced to make product, service and promotional decisions in an information vacuum, leading to many of the unimaginative and imitative practices (Kelly and Stephenson, 1967). A number of studies have mentioned that consumers purchase online due to widespread availability of information on the Internet (Wolfenbarger and Gilly, 2001). It's not just the voluminous information but interactive experience that online retailers offer their customers by providing shopping aids, such as customer reviews or assistant agents. While making decisions, consumers may be influenced by recommendations but they also gather complementary information from other information sources such as advertising, store visit and sales people in order to determine the pertinent product attributes to consider (Senecal et al., 2005). The objective of this research is to decipher the preferred sources of information of online shoppers in Northern India. Detailed demographic analysis has been performed to understand the association between different sources of information and demographics such as city, education, age, gender, family income, occupation and marital status of respondents.

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## Literature review

For decision making, an online shopper relies on internal memory (consumer's memory, where knowledge from previous purchases is stored). If the stored memory is judged insufficient, the consumer may rely on his or her own knowledge. However, if the consumer thinks that his/her own knowledge is also insufficient, he/she tends to consult external information sources (Kline and Wagner, 1994).

Hirschman and Mazursky (1982) used unaided recall to find out the mix of information sources that affect retail buyers' decisions. They asked department store buyers to report information sources consulted in previous purchase decisions. They found buyer's own knowledge, trade press, sales representatives, buyers from other stores and selling records as most cited sources.

Upah (1983) suggested that firms selling less complex products may rely on less costly, non-personal sources of information because buyers' informational needs are likely to be less extensive when less complex products are involved. They advised for easy-to-understand well-designed order manuals and product information literature.

Kline and Wagner (1994) found that own knowledge was more important to the more-experienced buyers and they used fewer information sources. However, buyers with less product-specific experience may use more external sources to compensate for limitations in product knowledge.

Miyazaki and Fernandez (2001) mentioned five phases of the consumer purchasing process (problem recognition; information search via internal and external mechanisms; evaluation of alternatives; choice/purchase and post-purchase behaviour) in their literature review. They also quoted that purchasing over the Internet is different and the consumer associates the previous experiences of remote purchasing onto the Internet framework.

Novak et al. (2000) specified an explicit model for direct and indirect influences on flow and mechanism for determining how model constructs relate to external marketing variables such as product information search and online shopping behaviours that are relevant to the commercial online environment.

Janda et al. (2002) mentioned that information quantity and credibility as important elements of online retail service quality. Where quantity is referred as the ability to access relevant information in a purchase

situation (e.g., price comparisons) and credibility is degree to which consumers trust the information provided by an online retailer. Consumers prefer access to complete information that enables them to make competent and informed decisions about a product, service or purchase (Novak et al., 2000). Szymanski and Hise (2000) identified product information (richness and quality) as major component of e-satisfaction.

Cai and Jun (2003) mentioned that online buyers and information searchers are interchangeable. While reviewing an online retailers' website an information searcher may become an online buyer, if the customer while reviewing an online retailers' website, feels that purchasing over the Internet is the best option. However, an online buyer may get 'degenerated' into an information searcher by dissatisfying online purchasing experiences. He may seek information online but make purchase offline.

Senecal et al. (2005) mentioned how presence of new information sources such as recommender systems, intelligent-agent-based systems and less easily accessible sources offline (e.g., opinions of a large group of consumers on a specific product) may modify the way, in which consumers perform their external information search. Other researchers argue that the Web as a channel increasingly offers consumers full information about product alternatives (Häubl and Trifts, 2000; Novak et al., 2000).

The theory of reasoned action (TRA) model posits that human beings make rational decisions based on the information available to them. Therefore, information quality provided by the B2C e-commerce website contents can greatly affect the intention to purchase (Eid, 2011).

To et al. (2007) argued that goal-oriented consumers have a substantial shopping plan in their minds. They purposely search for information pertaining to products they want to buy. Whereas exploration-oriented consumers do not have a substantial plan in their minds and their purpose of the search is to browse or window shop only.

Park et al. (2009) conducted their research to understand how gender and product categories influence the consumer information search behaviour in the online context. They found that compared to males, females tend to search for various information including both product and customer reviews and to use an assistant agent more frequently in the online shopping process.

Cao (2012) highlighted the importance of marketing strategies and communication channels that allow

consumers to be aware of a product and to acquire product information from retailers. Their research revealed that for both Internet and traditional stores, the medium by which shoppers became aware of the product, searched product information, or tried the product were very likely to be the medium by which sales took place. Moreover, the medium of awareness was the most important factor among the three stages of communication.

Liao et al. (2011) highlighted that users often continue using a specific information technology out of sheer habit rather than a strong belief that the technology produces a desirable outcome. People use the Web not only to enhance performance, but also to increase pleasure and enjoyment. Their study depicted that perceived attractiveness of the Web portal has a significant effect on perceived usefulness, perceived playfulness and psychic cost perceptions. Websites with an attractive design stimulate more perceived usefulness and perceived playfulness than those with unattractive designs.

Literature review highlights the importance of online behaviour with reference to information search and decision making. With the boom in information technology, falling prices of personal computers and robust infrastructure, the number of Internet users in India have grown from a meagre 0.1% in 1998 to 19.19% in 2014 of the total Indian population, that is, 243,198,922 users. Websites like eBay, moneycontrol, shaadi, jeevansaathi and many more have impregnated in our daily life (Kalia et al., 2015). However, in the Indian context research pertaining to behaviour of consumer and the preferred sources of information online shoppers consider before making purchase is barely available. In the light of above setting, this research attempts to reveal the preferred sources of information of online shoppers in Northern India.

### Research Methodology

Under this paper, convenience sample of 308 online shoppers from three e-commerce hub cities of Northern

Table 1: Demographic Profile of the Respondents (N=308)

Demographic variables		Frequency	Valid Percent	Cumulative Percent
City	Delhi/NCR	108	35.1	35.1
	Jaipur	93	30.2	65.3
	Chandigarh/Tricity	107	34.7	100.0
Education	Undergraduate	52	16.9	16.9
	Graduate	82	26.6	43.5
	Postgraduate	109	35.4	78.9
	Professional	65	21.1	100.0
Age	18–24 Years	137	44.5	44.5
	25–31 Years	127	41.2	85.7
	32–38 Years	32	10.4	96.1
	39 Years & Above	12	3.9	100.0
Gender	Male	168	54.5	54.5
	Female	140	45.5	100.0
Monthly Income	Less than 50,000	66	21.4	21.4
	50,001–80,000	72	23.4	44.8
	80,001–1,10,000	34	11.0	55.8
	1,10,001–1,40,000	28	9.1	64.9
	More than 140,000	108	35.1	100.0
Profession	Business	28	9.1	9.1
	Service	173	56.2	65.3
	Student	107	34.7	100.0
Marital Status	Married	72	23.4	23.4
	Unmarried	236	76.6	100.0

India, that is, Chandigarh, Delhi and Jaipur has been taken to determine the relative importance of various information sources to online buyers in Northern India. Demographic profile of respondents is displayed in Table 1. Website questionnaire was designed and uploaded on Google drive. Link of this survey was sent to respondents through e-mail. *Kolmogrov-Smirnov one sample test* revealed that the data needs application of non-parametric tests. Therefore, data has been analyzed by deploying *Mann-Whitney U Test* and *Kruskal-Wallis H test*.

Table 1 shows that education-wise, majority of respondents were either postgraduates or graduates followed by professionals. Age-wise, around 85 percent of respondents were between the age of 18–31 years which shows that surveyed respondents were young in age, the target

segment of online retailers. Further, majority of respondents were from service category followed by students.

### Findings of the study

Respondents were asked how often and from where they search for product information and before shopping or buying a product online. They were given seven choices (source of information)—search engine, review websites, online retailer website, company websites, social networking sites, blogs and newspapers. Their responses were registered on five point likert scale (never, rarely, sometimes, often and always) and mean scores were calculated by assigning the weights from 1–5 respectively. Their responses have been shown in Table 2.

Table 2: Usage of Different Source of Information

Source of information	Never	Rarely	Sometimes	Often	Always	Total	Mean ± SD	Rank
Search engine	3 (1)	12 (3.9)	29 (9.4)	83 (26.9)	181 (58.8)	308	4.38±0.882	1
Review websites	13 (4.2)	23 (7.5)	58 (18.8)	102 (33.1)	112 (36.4)	308	3.89±1.106	2
Online retailer	20 (6.5)	34 (11)	67 (21.8)	100 (32.5)	87 (28.2)	308	3.64±1.186	4
Company websites	15 (4.9)	35 (11.4)	70 (22.7)	91 (29.5)	97 (31.5)	308	3.71±1.165	3
Social networking	33 (10.7)	55 (17.9)	83 (26.9)	79 (25.6)	58 (18.8)	308	3.24±1.250	5
Blogs	83 (26.9)	80 (26)	68 (22.1)	45 (14.6)	32 (10.4)	308	2.55±1.306	7
Newspaper	53 (17.2)	77 (25)	66 (21.4)	68 (22.1)	44 (14.3)	308	2.91±1.314	6

Table 2 brings out that respondents primarily look for information through search engines (4.38±0.882), followed by review websites (3.89±1.106), company websites (3.71±1.165), online retailer website (3.64±1.186), social networking sites (3.24±1.250), newspapers (2.91±1.314) and blogs (2.55±1.306).

It can be seen from Table 3 that, out of different sources of information search engine ( $M = 4.4907$ ), online retailer ( $M = 3.9444$ ), company websites ( $M = 3.9352$ )

have been preferred by respondents from Delhi/NCR, than respondents from Jaipur and Chandigarh/Tricity. Review websites ( $M = 4.0108$ ), social networking ( $M = 3.4624$ ), blogs ( $M = 2.7312$ ) and newspapers ( $M = 3.1398$ ) are preferred sources of information for Jaipur respondents. Kruskal-Wallis (H Test) statistics indicate that there have been significant differences in source of information between three cities with respect to 'online retailer' ( $H(2) = 17.86, p = 0$ ), 'company websites' ( $H(2) = 6.871$ ,

**Table 3: City-wise Usage of Different Source of Information**

Source of information	City			Kruskal-Wallis test		
	Delhi/NCR	Jaipur	Chandigarh/Tricity	$\chi^2$	df	p-value
Search engine	4.4907	4.4194	4.2523	2.583	2	0.275
Review websites	4.0093	4.0108	3.6916	4.628	2	0.099
Online retailer	3.9444	3.7742	3.2430	17.86	2	0*
Company websites	3.9352	3.7419	3.4673	6.871	2	0.032*
Social networking	3.2130	3.4624	3.0748	4.929	2	0.085
Blogs	2.6759	2.7312	2.2804	7.827	2	0.02*
Newspaper	2.9167	3.1398	2.7103	5.274	2	0.072

\*Significant at 0.05

**Table 4: Education-wise Usage of Different Source of Information**

Source of information	Education				Kruskal-Wallis test		
	Under Graduate	Graduate	Postgraduate	Professional	$\chi^2$	df	p-value
Search engine	4.3462	4.5732	4.2661	4.3846	5.02	3	0.17
Review websites	3.8462	3.8780	3.9174	3.9385	1.16	3	0.762
Online retailer	3.4038	3.5488	3.6514	3.9692	6.63	3	0.085
Company websites	3.5192	3.6220	3.7982	3.8462	3.37	3	0.337
Social networking	3.4615	3.1463	3.2569	3.1538	3.04	3	0.386
Blogs	2.7692	2.4390	2.5046	2.6154	2.5	3	0.475
Newspaper	3.0769	2.7073	3.0183	2.8615	3.77	3	0.287

\*Significant at 0.05

$p = 0.032$ ) and 'blogs' ( $H(2) = 7.827, p = 0.02$ ). However, no significant difference has been observed between different cities with other sources of information.

Table 4 indicates that out of different sources of information, search engines ( $M = 4.5732$ ) are used more by graduates; review websites ( $M = 3.9385$ ), online retailer's website ( $M = 3.9692$ ) and company website ( $M = 3.8462$ ) are preferred by professionals and social networking sites ( $M = 3.4615$ ), blogs ( $M = 2.7692$ ) and newspapers ( $M = 3.0769$ ) are preferred by under graduates. Kruskal-Wallis (H Test) statistics indicate that there is no significant difference between different educational categories with respect to source of information.

Table 5 indicates that out of different sources of information, search engine ( $M = 4.5833$ ), review websites ( $M = 4.2500$ ) and company websites ( $M = 4.0833$ ) are preferred by respondents in 39 years and above age group; online retailer website ( $M = 4.2813$ ) and newspapers ( $M = 3.2188$ ) by 32–38 years age group respondents and social networking ( $M = 3.3465$ ) and blogs ( $M = 2.7165$ ) by 25–31 years age group respondents. Kruskal-Wallis (H Test) statistics indicate that there has been significant differences in preference for source of information between different age groups with respect to 'online retailer' ( $H(3) = 15.2, p = 0.002$ ), 'social networking' ( $H(3) = 7.794, p = 0.05$ ) and 'blogs' ( $H(3) = 8.838, p = 0.032$ ). However, no significant difference has been observed between different age groups with respect to other sources of information.

**Table 5: Age-wise Usage of Different Source of Information**

Source of information	Age				Kruskal-Wallis test		
	18-24 Years	25-31 Years	32-38 Years	39 Years and Above	$\chi^2$	df	p-value
Search engine	4.3942	4.3386	4.4688	4.5833	2.477	3	0.479
Review websites	3.7956	3.9528	4.0000	4.2500	3.979	3	0.264
Online retailer	3.4088	3.7323	4.2813	3.8333	15.2	3	0.002*
Company websites	3.5255	3.8110	4.0000	4.0833	7.111	3	0.068
Social networking	3.2263	3.3465	3.2500	2.2500	7.794	3	0.05*
Blogs	2.4745	2.7165	2.5938	1.6667	8.838	3	0.032*
Newspaper	2.7883	3.0079	3.2188	2.5000	5.02	-3	0.17

\*Significant at 0.05

Table 6 depicts that out of different sources of information, search engines ( $M = 4.4019$ ) and social networking ( $M = 3.3925$ ) are used more by students; review websites ( $M = 3.948$ ), online retailer ( $M = 3.7861$ ) and newspaper ( $M = 2.9711$ ) by servicemen and company websites ( $M = 4$ ) and blogs ( $M = 2.6071$ ) by businessman. Kruskal-Wallis (H Test) statistics indicate that there has

been significant differences in preference for source of information between different occupational categories with respect to 'online retailer' ( $H(2) = 6, p = 0.05$ ). However, no significant difference has been observed between different occupational categories with respect to other sources of information.

**Table 6: Occupation-wise Usage of Different Source of Information**

Source of information	Occupation			Kruskal-Wallis test		
	Business	Service	Student	$\chi^2$	df	p-value
Search engine	4.3214	4.3873	4.4019	.257	2	.879
Review websites	3.7857	3.948	3.8505	1.206	2	.547
Online retailer	3.6786	3.7861	3.4206	6.000	2	.050*
Company websites	4	3.7803	3.5327	4.388	2	.111
Social networking	3.1071	3.1676	3.3925	2.691	2	.260
Blogs	2.6071	2.5896	2.486	.550	2	.760
Newspaper	2.8571	2.9711	2.8318	.844	2	.656

\*Significant at 0.05

Table 7 depicts that out of different sources of information, search engine ( $M = 4.4815$ ), review websites ( $M = 4.4815$ ), online retailer ( $M = 3.7870$ ), company websites ( $M = 3.8704$ ) and social networking ( $M = 3.3519$ ) are used more by respondents who have family income more than Rs. 140,000 per month; blogs ( $M = 2.6528$ )

and newspaper ( $M = 3.1071$ ) by respondents with family income in between 50,001–80,000 and 110,001–140,000, respectively. Kruskal-Wallis (H Test) statistics indicate that there has been significant differences in preference for source of information between different family income categories with respect to 'search engine' ( $H(4) = 13$ ,

**Table 7: Family Income-wise Usage of Different Source of Information**

Source of information	Family Income (Rs/Month)					Kruskal-Wallis test		
	Less than 50,000	50,001 –80,000	80,001 –110,000	110,001 –140,000	More than 140,000	$\chi^2$	df	p-value
Search engine	4.4697	4.4028	4.2647	3.9286	4.4815	13	4	0.01*
Review websites	3.8636	3.8750	3.9118	3.7143	3.9815	2	4	0.709
Online retailer	3.4394	3.6111	3.6765	3.6786	3.7870	4	4	0.343
Company websites	3.6061	3.7222	3.5000	3.6071	3.8704	4	4	0.361
Social networking	3.2273	3.2083	2.9412	3.2857	3.3519	3	4	0.497
Blogs	2.6212	2.6528	2.5588	2.5357	2.4537	1	4	0.834
Newspaper	2.8030	2.7917	2.8824	3.1071	3.0185	2	4	0.656

\*Significant at 0.05.

$p = 0.01$ ). However, no significant difference has been observed between different family income categories with respect to other sources of information.

Table 8 brings out that female respondents seek more information from social networking than male

respondents. Mann-Whitney test indicated that seeking information through search engines ( $M = 4.5298$ ),  $U = 9229.5$ ,  $p = 0$ , online retailer ( $M = 3.8512$ ),  $U = 9276.5$ ,  $p = 0.001$  and company websites ( $M = 3.8393$ ),  $U = 9992.5$ ,  $p = 0.018$  is greater in male respondents than females.

**Table 8: Gender-wise Usage of Different Source of Information**

Source of information	Gender			Mann-Whitney test		
	Male	Female	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)
Search engine	4.5298	4.2143	9229	19099	-3.7	0*
Review websites	3.9405	3.8500	11155	21025	-0.8	0.415
Online retailer	3.8512	3.4071	9276.5	19146.5	-3.3	0.001*
Company websites	3.8393	3.5643	9992.5	19862.5	-2.4	0.018*
Social networking	3.1429	3.3571	10651.5	24847.5	-1.5	0.144
Blogs	2.6190	2.4786	11213	21083	-0.7	0.47
Newspaper	2.9940	2.8143	10869	20739	-1.2	0.242

\*Significant at 0.05.

Table 9 reveals that out of different sources of information, unmarried respondents prefer social networking ( $M = 3.2585$ ) more than married respondents. Mann-Whitney test indicated that seeking information from online retailer is greater in married respondents ( $M = 3.9583$ ) than unmarried respondents ( $M = 3.5551$ ),  $U = 6158.5$ ,  $p = 0$ .

### Managerial Implications

Online retailers should make available richer information (more extensive and higher quality) which describes products in terms of customer value and benefit, because online customer very unlikely ask for help, instead they abandon the transaction and search for alternative supplier

Table 9: Marital Status-wise Usage of Different Source of Information

Source of information	Marital Status		Mann-Whitney U	Mann-Whitney test		
	Married	Unmarried		Wilcoxon W	Z	Asymp. Sig. (2-tailed)
Search engine	4.4306	4.3729	8312.5	36278.5	-0.3	0.753
Review websites	4.0139	3.8644	7781.5	35747.5	-1.1	0.257
Online retailer	3.9583	3.5551	6918.5	34884.5	-2.5	0.013*
Company websites	3.9722	3.6356	7309.5	35275.5	-1.9	0.063
Social networking	3.1806	3.2585	8196	10824	-0.5	0.642
Blogs	2.6250	2.5339	8178	36144	-0.5	0.621
Newspaper	2.9861	2.8898	8094	36060	-0.6	0.534

\*Significant at 0.05.

or buy through different channel. To provide high quality information and service, online retailers should set up service oriented concept for pre and post sales stages. E-retailers should focus on search engines, review websites and company websites as online shoppers rely on these sources to search for product related information. For instance search engine optimization (SEO) can be done, customers can be rewarded to write positive reviews about their positive experience or e-retailers can collaborate with product manufacturer to put 'buy it here' link on company's website. E-retailers can add value to their business by extending their traditional product range or they can go one step further by linking with other related services, products, suppliers or retailers to provide the ultimate one-stop shop experience to customers. Online retailers can also extend their presence through other communication channels such as e-mail and toll free telephone numbers. They may create communities and encourage customers to share their views on certain products, so that experts and other customers with similar interests can search and access them.

### Conclusion

While searching for product information before shopping or buying products online, respondents mostly rely on search engines, review and company websites. Online retailer website, social networking sites, blogs and newspapers are not very popular source of information. Source of information has statistical significant relationship with demographic variables like city, age, occupation, family income, gender and marital status.

### References

- Cai, S. and Jun, M. (2003). 'Internet users' perceptions of online service quality: a comparison of online buyers and information searchers', *Managing Service Quality*, Vol. 13 No. 6, pp. 504-519.
- Cao, X. (Jason). (2012). 'The relationships between e-shopping and store shopping in the shopping process of search goods', *Transportation Research Part A: Policy and Practice*, Elsevier Ltd, Vol. 46 No. 7, pp. 993-1002.
- Eid, M.I. (2011). 'Determinants of e-commerce customer satisfaction, trust, and loyalty in Saudi Arabia', *Journal of Electronic Commerce Research*, Vol. 12 No. 1, pp. 78-93.
- Häubl, G. and Trifts, V. (2000). 'Consumer decision-making in online shopping environments: the effects of interactive decision aids', *Marketing Science*, Vol. 19 No. 1, pp. 4-21.
- Janda, S., Trocchia, P.J. and Gwinner, K.P. (2002). 'Consumer perceptions of Internet retail service quality', *International Journal of Service Industry Management*, Vol. 13 No. 5, pp. 412-431.
- Kalia, P., Kaur, N. and Singh, T. (2015). 'Internet Marketing and B2C E-Commerce: The Indian Scenario', in Vashisht, A., Suri, G. and Kaur, R.B. (Eds.). *Innovation Management*, Excel India Publishers, Delhi, India, pp. 127-134.
- Kelly, R.F. and Stephenson, R. (1967). 'The Semantic Differential: An Information Source for Designing Retail Patronage Appeals', *Journal of Marketing*, Vol. 31 No. 4, pp. 43-47.
- Kline, B. and Wagner, J. (1994). 'Information sources and retail buyer decision-making: The effect of product-specific buying experience', *Journal of Retailing*, Vol. 70 No. 1, pp. 75-88.
- Liao, C., To, P.-L., Liu, C.-C., Kuo, P.-Y. and Chuang, S.-H. (2011). 'Factors influencing the intended use of web portals', *Online Information Review*, Vol. 35 No. 2, pp. 237-254.

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- Lindblom, A.** (2008). 'Information Sources Used by Contractually-Integrated Retail Entrepreneurs/ : A Preliminary Study', *Journal of Small Business and Enterprise Development*, Vol. 15 No. 3, pp. 527–539.
- Miyazaki, A.D. and Fernandez, A.** (2001). 'Consumer Perceptions of Privacy and Security Risks for Online Shopping', *The Journal of Consumer Affairs*, Vol. 35 No. 1, pp. 27–44.
- Novak, T.P., Hoffman, D.L. and Yung, Y.** (2000). 'Measuring Online the Customer Experience in A Structural Environments/ : Modeling Approach', *Marketing Science*, Vol. 19 No. 1, pp. 22–42.
- Park, J., Yoon, Y. and Lee, B.** (2009). 'The effect of gender and product categories on consumer online information search', *Advances in Consumer Research*, Vol. 36, pp. 362–366.
- Senecal, S., Kalczynski, P.J. and Nantel, J.** (2005). 'Consumers' decision-making process and their online shopping behavior/ : a clickstream analysis', *Journal of Business Research* 58, Vol. 58, pp. 1599–1608.
- Szymanski, D.M. and Hise, R.T.** (2000). 'E-satisfaction: an initial examination', *Journal of Retailing*, Vol. 76 No. 3, pp. 309–322.
- To, P.-L., Liao, C. and Lin, T.-H.** (2007). 'Shopping motivations on Internet: A study based on utilitarian and hedonic value', *Technovation*, Vol. 27 No. 12, pp. 774–787.
- Upah, G.D.** (1983). 'Product complexity effects on information source preference by retail buyers', *Journal of Business Research*, Vol. 11, pp. 107–126.
- Wolfenbarger, M. and Gilly, M.C.** (2001). 'Shopping Online for Freedom, Control, and Fun', *California Management Review*, Vol. 43 No. 2, pp. 34–55.

*If we can keep our competitors focused on us while we stay focused on the customer, ultimately we'll turn out all right.*

—Jeff Bezos

# Design of a Production System Using Simulating Annealing Technique

P. K. ARORA, ABID HALEEM AND M. K. SINGH

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*The primary objective of this paper is to develop a design methodology which addresses combinational complexity of Cellular Manufacturing (CM) design problem with non-linear objectives of the mathematical model. In this paper, a mathematical model is first developed. It considers the part flow time between machines, the processing time of the part and the throughput of the plant. With these variables objective function were developed with constraints. Simulating Annealing Technique was employed as a part of heuristic which handles large CM design problem in a reasonable amount of time. Results from the Simulating Annealing Techniques were also compared with respect to the three objective function, mean flow time and throughput to the conventional technique. It has been found that the performance of SA offers comparatively better results in terms of minimum mean-flow time and maximum throughput. Furthermore, the problem discussed in this paper involves several variables and a multi-objective function; therefore, the ability of SA to handle this type of objective functions and constraints make it a good approach to solve the problem. Finally, a graphical scheme has been used for a comparative study of all the techniques under each performance criterion.*

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## Introduction

Production is the transformation process of materials of nature into articles of use to mankind using machine, tool and labor on a large scale. If other supporting activities such as quality control, scheduling production planning, etc., are considered along with production process, it's known as manufacturing (Solimanpur et al., 1998). In a manufacturing system, the sequence of operations and a series of control measures are planned. The main objective of the manufacturing is to find a compromise at high efficiency between productivity and flexibility for different manufacturing system. To achieve the desired goal, manufacturers have to solve a number of problems at the manufacturing floor. These problems may have set-up time due to the variety of the product, fluctuation in plant capacity due to low system utilization, need of high throughput and problem of handling the material at long transportation distances (Srinivasan, 1990).

Traditional manufacturing systems, such as job shops and flow lines, are not capable of satisfying today's requirements where manufacturing systems are often required to be reconfigured to respond to changes in product design and demand (Richards, 1986). As a result, Cellular Manufacturing (CM), an application of group technology (GT), has emerged as a strong alternative manufacturing system (Purcheck, 1975). GT is defined as a manufacturing philosophy identifying similar parts and grouping them together into families to take advantage of their similarities in design and manufacturing. CM involves the formation of part families based upon their similar processing requirements and the grouping of machines into manufacturing cells to produce the formed part families (Taboun et al., 1998). This system has adopted the merits of both batch and job shop. In this paper, an attempt has been made to develop and validate a heuristic model for large CM design problem.

## Optimization Techniques

The existence of optimization methods can be traced to the days of Newton, Lagrange and Cauchy. The development of differential calculus methods of optimization was possible because of the contributions of Newton and Leibnitz to calculus. The foundations of calculus of variations, which deal with the minimization of functional, were laid by Bernoulli, Euler, Lagrange and Weirstrass. The method of optimization for constrained problems, which involves the addition of unknown multipliers, became known by the name of its inventor, Lagrange. Cauchy made the first application of the steepest descent method to solve unconstrained minimization problems (Kusaik, 1988).

The ever-increasing demand on engineers to lower production costs and to withstand competition has prompted engineers to look for rigorous methods of decision making, such as optimization methods, to design and produce products both economically and efficiently (McAuley, 1972). Optimization techniques, having reached a degree of maturity over the past several years, are being used in a wide spectrum of industries, including aerospace, automotive, chemical, electrical and manufacturing industries. With rapidly advancing computer technology, computers are becoming more powerful and, correspondingly, the size and the complexity of the problems being solved using optimization techniques are also increasing. Optimization methods, coupled with modern tools of computer-aided design, are also being used to enhance the creative process of conceptual and detailed design of engineering systems.

### Model Formulation

Flexibility measures the ability to adapt 'to a wide range of possible environments'. Today in the dynamic, probabilistic and individualistic world, competition makes flexibility an important ingredient for long-term survival. The term Cellular Manufacturing System or CMS refers to a set of machine tools and supporting workstations.

#### Minimize the mean flow time

For evaluating the sequence cell the objective function is to minimize the mean flow time by satisfying the technological constraints such as completion time and arrival time of parts. Thus, the expression for this objective function can be written as (Arora et al., 2013):

$$\text{Minimize MF} = \frac{\sum_{i \in SF} f_i}{SF} \quad \text{or} \quad \text{Minimize F1} = \frac{MF_{seq}}{MF_{max}} \quad \text{or}$$

$$\text{Maximize F1} = 1 - \frac{MF_{seq}}{MF_{max}}$$

Where  $MF_{seq}$  = mean flow time obtained corresponding to some part sequence

$MF_{max}$  = maximum value of mean flow time

$f_i$  = flow time of part  $i$ ,  $AR_i$  = Arrival time of part  $i$

$f_i = C_i - AR_i$ ,  $SF$  = Set of finished Parts

### Maximize Throughput

The number of parts, which have been completed during the scheduling period, measures the throughput. Therefore, if  $SF$  is the set of finished parts then the throughput will be:

$$TH = \sum_{i \in SF} \varepsilon_i \quad \text{or}$$

$$\text{Maximize F2} = \frac{\sum_{i \in SF} \varepsilon_i}{\sum_{i=1}^I \varepsilon_i} \quad \text{or}$$

$$\text{Maximize F2} = \frac{TH_{seq}}{TH_{max}} \quad (4.2)$$

$TH_{seq}$  = Throughput value obtained corresponding to some part sequence.

$TH_{max}$  = Maximum value of Throughput.

### Combination of Minimization of Mean Flow Time and Maximization of Throughput

This combined objective function yields a cell formation sequence in a schedule and such that decrease in mean flow time is accompanied by a substantial increase in throughput. To take care of these facts, the following fitness function is maximized, which is a combination of the fitness functions, F1 and F2.

$$\text{Maximize F}_3 = \frac{(W_1 \times F_1) + (W_2 \times F_2)}{(W_1 + W_2)} = \frac{\left( W_1 \times \left( 1 - \frac{MF_{seq}}{MF_{max}} \right) \right) + \left( W_2 \times \left( \frac{TH_{seq}}{TH_{max}} \right) \right)}{(W_1 + W_2)} \quad (4.3)$$

**Constraints:** The aforementioned objective function is subjected to following set of constraints, given as:

- Completion time of the part must be a positive quantity, i.e.,  $f_i > 0 \forall i \in I$
- Processing time of each operation of the part must be a positive quantity.  $P_{ij} > 0 \forall i \in I, \forall j \in J$
- No machine can perform more than operation of the part at certain time span.  $A_{jom} \leq 1$
- No machine can perform the next scheduled operation unless the current operation of the part gets completed.  $P_{jom} - P_{jmm} + \partial(1 - B_{nom}) \geq P_{jo}$

The aforementioned model has been solved by various simplistic and advanced approaches. Some of them are situation specific whereas others are based on random search techniques like Genetic Algorithm (GA) and Simulated Annealing. In such cases, the objective functions were implemented. It has been established from the literature that no single cell formation has been proven to be optimal for a particular cell manufacturing system. Also, in this work, a SA model has been constructed to demonstrate effectively the formulation difficulties related to cell routing options, tool slot constraints and concurrency and lot sizes.

### Solution Methodology in Simulated Annealing

Simulated Annealing has been attempted by various researchers in different engineering situation. On the basis following step of Simulated Annealing application to our problem has been designed and presented below.

- Generate a random string.
- Initialization:
  - Set initial temperature  $t = T_{max}$ .
  - Set final temperature  $T = 0$ .
  - Randomly generate the initial population of solution.
  - Calculate the fitness value for initial population.
  - Set the best solution =  $S_1$ .
- Diversification of solution space.
  - Generate new population using chaotic variable.
  - Select the best solution with fitness value  $S_2$ .
- Calculate  $\Delta S = S_1 - S_2$
- If  $\Delta S \geq 0$  (maximization case), expect the new solution for next generation.
- If  $\Delta S < 0$ , select the solution with a probability.
- Reduce the temperature as;  $t = \lambda * t$ ,  $\lambda \in [0, 1]$

### Parameter and Model Solution

#### Search Parameters

The proposed SA-based technique is to be implemented in the problem of maximization nature. The algorithm runs with any random sequence of part types as an initial solution, but it is experimentally observed that the search, if started with the SA, performs better. This sequencing part type in the cell may be different for different types of CMS and normally it is used to be experimentally determined. The performance of the algorithm is governed by various parameters, which are discussed in next subsection (Seifoddini, 1986, 87).

#### Perturbation Schema

The method used in this thesis to generate new solution performs is better than the methods available in literature. In adjacent interchanged method proposed by them, a random number is generated between one cell and the total number of cell with part types and the part types corresponding to this position are interchanged with one of its adjacent neighbourhood at random. The beauty of implementing the perturbing schema is that it does not destroy seed sequence entirely. The part types in the cell occupying these positions are interchanged and hence an entirely new solution is generated. MIS was successful in overcoming the above drawback however; it may interchange two previously assigned part types which lead to little improvement in the solution quality. In this thesis, an attempt has been made to overcome these drawbacks by another perturbation method, in which the position, a randomly selected assigned part in the cell, is interchanged with that of an unassigned one in the candidate solution. This adds to the stochastic nature of the algorithm in searching newer solution (Luong, 2002).

#### Transition probability

When a random neighbouring solution is generated, its function value is evaluated. If the function value is improving, it is accepted; otherwise, it is accepted only if the *transition probability* is higher than a uniform random number. For every perturbed solution that is inferior to the candidate solution, transition probability ' $TP$ ' is calculated, which is given by  $TP = \exp(-\Delta S / T_{max})$

where,  $\Delta S$  is the difference of function values of current solution and the neighbouring solution and  $T$  is the temperature. Depending on this probability, the solution

is rejected or accepted. The probability function has higher value at small  $\Delta S$  and larger  $T$  and lower value at large  $\Delta S$  and small  $T$ , owing to which the inferior solutions are easily accepted at the initial stages of search, but not at last as the algorithm assumes that the best solution obtained so far is near optimal.

The search initially starts with a high temperature with a better chance of escaping local optima (i.e., transition from a low cost solution to a high cost solution). As the temperature reduces, the transition probability approaches to zero. When the temperature approaches zero, the search is no longer able to escape local optima and neighbouring solution is accepted only if it shows improvement in function value. If the transition from the current solution to the neighbouring solution is rejected, another solution in the neighbourhood is selected and evaluated.

#### Annealing Schedule

The temperature decline is performed using a function known as *annealing schedule*, that is,  $T = T_0 / (1 + \ln i)$

where,  $T$  is the current temperature,  $T_0$  the initial temperature and  $i$  the number of iterations. In the annealing schedule adopted in this article, the cooling rate is high in the beginning and low in the end.

This schedule is adopted keeping in mind the fact that the chances of getting better results is higher in the

beginning and low therefore there is not much use of higher transition probability to escape the local optima. After a few iterations, an attempt has been made to prevent the temperature from decreasing abruptly, which may result in frequent rejection of perturbed solution.

#### Reject

The variable '*Reject*' is a counter that stores the number of rejection of perturbed solutions. It gets increased by 1 whenever a solution is not selected through the probability consideration. If it reaches a predetermined fixed value, it signifies that there are no superior solutions in the neighbourhood i.e. search has reached a near-optimal solution. At this moment the search is stopped or started again depending upon the other criteria.

#### Stopping Criteria

To stop the search procedure from exploring the solution space, two criteria are incorporated in this approach:

- i) Variable '*Reject*' acquires its value equal to a predetermined fixed value (3 in this article), because it indicates that no optimal/near-optimal solution has been achieved during the last three steps, thereafter the probabilities of getting any better solution is small.
- ii) Number of iterations reaches the value 15 or equivalently temperature falls to  $0.1^\circ\text{C}$  (in this approach). Any further reduction in temperature

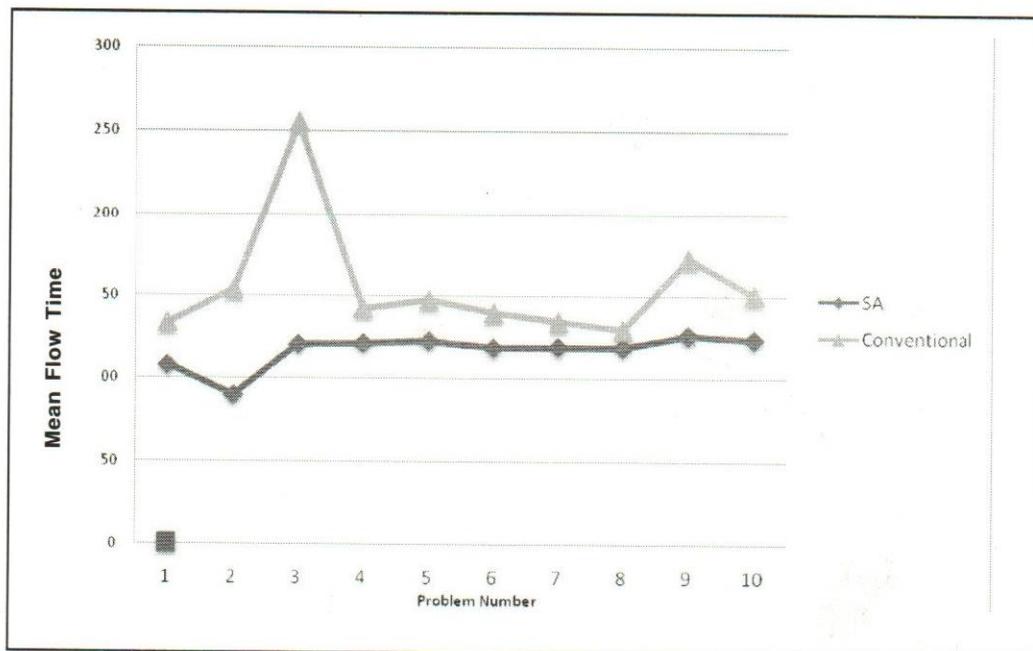


Figure 1. Comparison of Mean Flow Time of Conventional and SA Techniques

would not be useful because at this low temperature the possibility of accepting inferior solutions is very small.

## Result and Discussion

The working principle of this algorithm is assessed at each iteration according to the objective function  $F_3$ , which is a logical combination of minimization of mean-flow time and maximization of throughput. In order to ensure that the results did not have extraordinary variance, each problem

was allowed to run ten times and the mean of the performance criteria has been calculated.

Various data obtained from both the techniques has been compared in Figures 1 and 2. It is found that SA technique is giving better result than Conventional Technique. Conventional and SA are also compared with respect to objective function  $F_1$ ,  $F_2$ ,  $F_3$  and mean flow time of the parts and throughput or production capacity of the plant. SA technique seemed to perform better than the primitive part type in the cell based measures. As the optimal sequence was generated by the SA for each

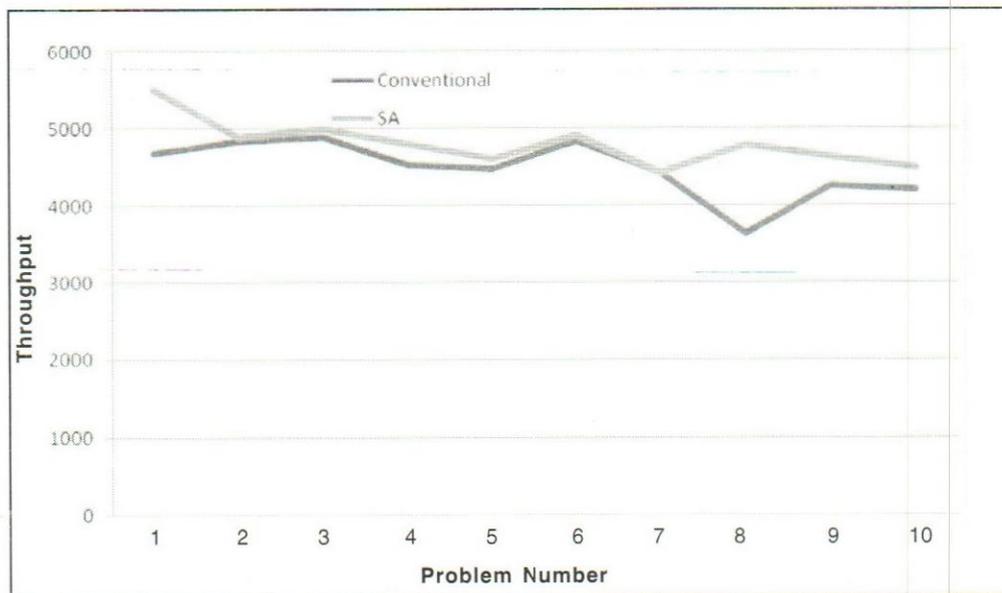


Figure 2. Comparison of Throughput of Conventional and SA Techniques

problem, the problem was repeatedly run for many times to ensure the integrity and consistency of the solution and the mean of the performance measures, throughput and mean-flow time for the system is evaluated and it is used to compare the overall performance of all the techniques.

## Conclusion

The mean flow time and throughput were compared for the conventional method and Simulating Annealing techniques. It was found that with the help of simulated annealing techniques mean flow time has reduced and production capacity of the plant has increased. Solution can also be obtained by varying parameter like initial temperature or Annealing Schedule. The authors have taken 10 problems from different industries and solved them with Conventional method and Simulated Annealing Techniques.

## References

- Arora, P. K, Haleem, A., Singh, M. K. (2013). Recent Development of Cellular Manufacturing Systems. *Sadhana - Academy Proceedings in Engineering Science*, **38**: 421–428.
- Arora, P. K, Haleem, A., Singh, M. K. and Kumar, H. (2013). Optimization of Cellular Manufacturing Systems Using Genetic Algorithm: A Review. *Advanced Material Research Journal*, **622**: 60–63.
- Arora, P. K, Haleem, A., Singh, M. K. and Kumar, H. (2013). Proposed Model for Optimizing Production System Using CMS. *Applied Mechanics and Materials*, **281**: 673–676.
- Burbidge, J. L. (1971). Production Flow Analysis. *Production Engineer*, April–May, 139–152.
- Burbidge, J. L.. (1975). *The Introduction of Group Technology*. Heineman, London.
- Burbidge, J. L.. (1977). A Manual Method for Production Flow Analysis. *Production Engineer*, 34–38.

- Kusaik, A.** (1983). Part Families Relation Model for Flexible Manufacturing Systems. *Proceeding of Annual Industrial Engineering Conference*. Louisville, Ky.
- Kusaik, A.** (1988). EXgt-S: A Knowledge Based System for Group Technology. *International Journal of Production Research*, 26(5): 887–904.
- Kusaik, A.** (1985). Part Families Problems in FMS. *A Journal of Operational Research*, 3: 279–300.
- McAuley, J.** (1972). Machine Grouping for Efficient Production. *The Production Engineer*, 51: 53–57.
- Mahdavi, I. and Mahadeven, B.** (2008). CLASS: An Algorithm for Cellular Manufacturing System and Layout Design Using Sequence Data. *Robotics and Computer Integrated Manufacturing*, 24(3): 488–497.
- Purcheck, G.** (1975). A Mathematical Classification on the Basis for the Design of Group Technology Production Cells. *The Production Engineer*, 54: 35–48.
- Rajamani, D., Singh, N. and Aneja, Y. P.** (1990). Integrated Design of Cellular Manufacturing System in the Presence of Alternate Process Plan. *International Journal of Production Research*, 28(8): 1541–1554.
- Richards, C. W.** (1996). Agile Manufacturing Beyond Lean. *Production and Inventory Management Journal*, 37: 60–64.
- Sankaran, S.** (1990). Multiple Objective Decision Making Approach to Cell Formation: A Goal Programming Model. *Mathematical Computer Modeling*, 3(9): 71–76.
- Sarker, B. R. and Yu J.** (1994). A Two-Phase Procedure for Duplicating Bottle Neck Machines in a Linear Layout, Cellular Manufacturing System. *International Journal of Production Research*, 32(9): 2049–2066.
- Seifoddini, H.** (1989). Duplication Process in Machine Cells Formation in Group Cell Formation in Group Technology. *IIE Transactions*, 21(4): 382–388.
- Seifoddini, H. and Wolfe, P. M.** (1986). Application of Similarity Coefficient Method in GT. *IIE Transaction*, 18(3): 271–277.
- Solimanpur, M., Vrat, P. and Shanker, R.** (2004). Ant Colony Optimization Algorithm to the Inter-Cell Layout Problem in Cellular Manufacturing. *European Journal of Operational Research*, 157(3): 592–606.
- Srinivasan G., Narendran, T. T. and Mahadevan, B.** (1990). An Assignment Model for the Part Families Problems in Group Technology. *International Journal of Production Research*, 28(1): 145–152.
- Taboun, S. M., Merchawi, N. S. and Viger, T.** (1998). Two-Stage Model for Cost Effective Part Family and Machine Cell Formation. *Computer & Industrial Engineering*, 34(4): 759–776.

*For e-commerce firms, the three most important infrastructure items are information flow, cash flow and delivery.*

*—Jack Ma*

# Trends, Growth and Instability in Area, Production and Productivity of Maize Crop across Regions in India

GEETA SHARMA AND SWATI MEHTA

*In the present study, an attempt has been made to analyze the trend, growth and variability in area, production and productivity of maize crop at all-India level and regional level by comparing with pre-reform period (from 1980–81 to 1989–90) and post-reform period (from 1990–91 to 2011–12). The study observed that after the economic reforms maize production in India recorded remarkable growth due to adoption of single cross hybrids and continuous demand in domestic and export market. Similarly, the central and southern regions showed significant improvement in raising maize production and productivity after economic reforms due to accelerated growth in area, production and productivity. The performance of the north-western, region which had pioneered the green revolution period, and the eastern region was not satisfactory in raising maize production after the economic reforms because of declining trend of maize production and negative growth in its maize area and rising instability. The study further concluded that after the economic reforms, India's ranking in the world improved in case of area and production, but performance of yield in India was very low and remained at last position as compared to other major maize growing countries in the world. Thus, there is a dire need to sustain the production of maize crop.*

## Introduction

Maize is one of the most widely distributed crops in the world and it contributes to food stock in most of the developing nations. It is used directly for human consumption, animal feed, corn starch industry, corn oil production, baby corn and in industrially processing foods. India is the fifth largest producers of maize in the world and contributes 2.5 percent of the global production and has 4.87 percent of the global area. In India, maize is emerging as the third most important crop after rice and wheat. It contributes about 8.9 percent to the total cereal production and about 51.7 percent to the total coarse cereals. By cultivating maize, farmers can protect the worsening quality of soil, save 90 percent of water and 70 percent of power as compared to paddy and earn far more than they are earning through paddy and wheat. Hence, it can play an important role in crop diversification policy of upland areas of India (Joshi et. al, 2005). The pre-dominant maize growing states that contribute about 92.64 percent to the total maize production are Andhra Pradesh (16.8%), Karnataka (18.7%), Maharashtra (11.1%), Tamil Nadu (7.78%), Rajasthan (7.6%), Bihar (7.3%), Uttar Pradesh (6%), Madhya Pradesh (5.9%), Gujarat (3.6%), Himachal Pradesh (3.2%), Jammu and Kashmir (2.3%) and Punjab (2.3%); these states jointly account for 90.6 percent area under maize cultivation (GOI, 2012). For the analysis, all these major maize producing states have been selected and clubbed into the four regions, that is, north-western region, eastern region, central region and southern region.<sup>1</sup>

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<sup>1</sup>North-Western region comprises Jammu and Kashmir, Himachal Pradesh, Punjab and Uttar Pradesh; Eastern region comprises only Bihar, Central region includes Maharashtra, Madhya Pradesh, Gujarat and Rajasthan and Southern region includes Andhra Pradesh; Karnataka and Tamil Nadu. Selection of states in the regions is based on the study conducted by Bhalla and Singh (2009).

In the modern era, agricultural growth with stability has become a matter of great concern for the planning of agricultural development in the country. An analysis of variability of crop, apart from growth is of importance for underlying the nature of food security and income stability (Wasim, 2011). A number of attempts made earlier on growth and instability of productivity and production of crops theoretically as well as empirically.

While some studies (Wasim, 1999, 2002; Chand, 2008; Hasan, 2008; Wasim, 2011; Darvishi, 2013; Madusudan, 2013; Ranum, 2014 and Ahmad, 2015) examined growth and variability of different crops at world level or country level others (Mitra, 1990; Vani, 1996; Barakede, 2011; Acharaya, 2012; Paul, 2013; Paltasingh, 2013; Sihmar, 2014; Kondal, 2014; Naidu, 2014) attempted to find out the trends, growth and instability of area, production and productivity of selected agricultural crops for a single state. But very few researchers have tried to study the growth and instability in area, production and yield/productivity of maize crop at all-India level as well as regional level. The rate of increase in area, production and productivity of maize should be stable and steady at national level as well as in regions. But in reality instability exists in area, production and productivity of maize that need to be studied. Therefore, the present study has been undertaken with the following specific objectives:

- (a) To examine trends of average area, production and productivity of maize crop at national as well as regional levels.
- (b) To determine the growth rate of area, production and productivity of maize in India and at regional level.
- (c) To analyze the magnitude of instability in area, production and productivity of maize crop in India and its regions.

The paper is divided into seven sections. Section one gives a brief review of data base and methodology adopted for the study. Section two explains the trends in area, production and productivity of maize at all-India level and regional level during total period and its sub periods. Section three examines the compound growth rates of area, production and productivity of maize at all-India level and regional level during total period and its sub periods. Instability/variability in maize area, production and productivity at all-India level and regional level during total period and its sub periods have been analyzed in section fourth. Section five analyzes the global scenario of area, production and productivity of maize. Section six presents

discussion about the overall performance of each region in terms of area, production and productivity during pre and post-reform period. Section seven concludes the paper and suggests some policy implications.

## 1. Data Sources and Methodology

The study is based on the time series data of area, production and yield/productivity of maize crop for 32 years from 1980–81 to 2011–12. In this paper, the entire period is divided into broadly two periods: (a) pre-reform period from 1980–81 to 1989–90 and (b) post-reform period from 1990–91 to 2011–12, where further post-reform period divided into two sub-periods: (i) post-reform period-I from 1990–91 to 1999–00 and (ii) post-reform period-II from 2000–01 to 2011–12. The data for the present study has been compiled from the secondary sources, such as various reports of Government of India on *Area and Production of Principal Crops in India and Agricultural Statistics at a Glance*. For the analysis, triennium averages of area, production and productivity of maize have been calculated for the early 1980s, 1990s and 2000s and 2009s. While the first triennium of 1980–83 represents the picture prevails during pre-reform period, second, third and fourth triennium, that is, 1990–93, 2000–03 and 2009–12 represent the post-reform period. The annual compound growth rates were calculated for all the periods separately, that is, pre-reform period, post-reform period-I and post-reform period-II and also to the total period from 1980–81 to 2011–12.

The equation was used to calculate growth rate:

$$\log Y_t = a + bt$$

Where

Y = acerage/production/productivity of maize

a = constant

b = expresses the rate of change and when multiply by 100 gives the percentage growth rate

t = time variable in year (1,2,...,n)

The growth rate is then given by the formula.

$$r = \text{antilog} (b^{\wedge} - 1) \cdot 100$$

Where  $b^{\wedge}$  = estimated value of b.

The compound growth rates were tested for their significance by the student's t test.

There are a number of techniques available to measure the index of instability. Many researchers—such as Paul,

2013; Coppock, 1962; Mac-Bean, 1966; Weber and Sievers, 1985; Massel, 1970; Singh and Byerlee, 1990 and Cuddy-Della Valle, 1978—described different techniques to measure the instability. In the present study, instability/variability in area, production and productivity/productivity is measured in relative terms by Cuddy DellaValle index. Cuddy Della Valle Instability index (Cuddy and Della Valle, 1978; Della Valle, 1979) is a modification of CV to accommodate for trend, which is commonly present in time series economic data. This method is superior over other scale dependent measures such as standard deviation or Root Mean Square of the residuals (RMSE) obtained from the fitted trend lines of the raw data, and hence suitable for cross comparisons. The Cuddy Della Index ( $I_x$ ) was calculated as follows:

$$I_x = \frac{SEE}{\bar{Y}} * 100$$

Where,  $I_x$  = Instability index

SEE<sup>2</sup> = Standard error of the trend line estimates

$\bar{Y}$  = Average value of the time series data

## 2. Region-Wise Analysis of Area, Production and Productivity of Maize in India: From 1980–81 to 2011–12

Table 1 presents the comparative analysis of area, production and productivity of maize crop at national as well as regional level. During 1980–83, the central region has the highest contribution in average maize area of over 35.2 percent followed by north-western region (35.10 percent), eastern region (14.33 percent) and southern region (8.5 percent). Average production of maize has highest in north-western region (35.52 percent) followed by central region (29.2 percent), southern region (16.49 percent) and lowest share of 12.62 percent recorded by eastern region out of total Indian maize production. Southern region registered highest productivity followed by north-western region and central region whereas, eastern region recorded lowest productivity during this period.

During initial period of economic reforms (1990–93), it is clear from Table 1 that the average area of maize

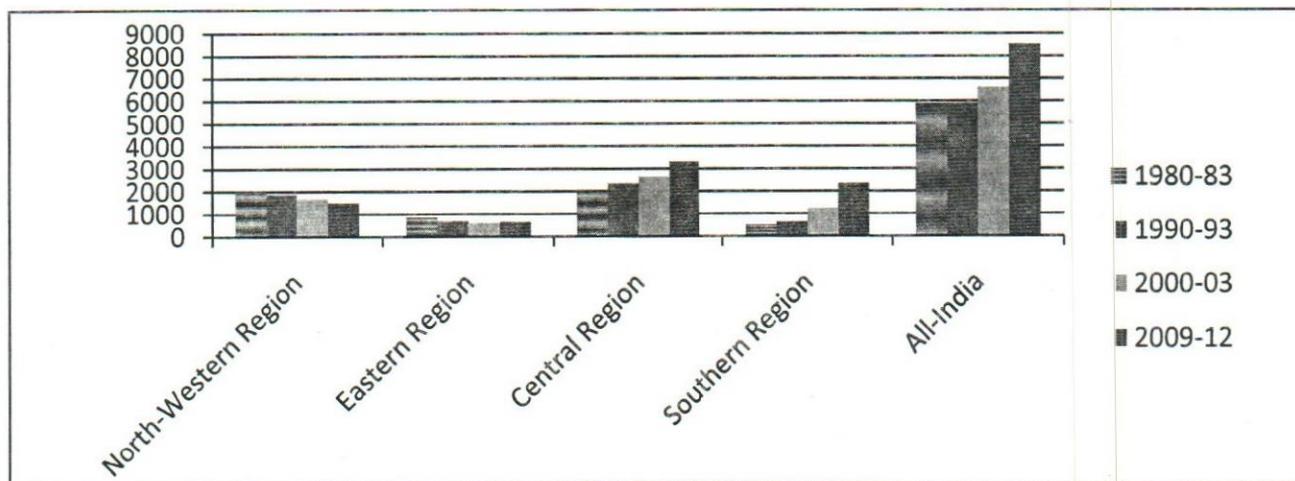


Figure 1: Trends in Average Area of Maize among Regions in India from 1980 to 2012.

Source: Calculated from Government of India, *Area and production of Principal Crops in India (Various Issues)*, Ministry of Agriculture, New Delhi.

$$SEE = \sqrt{\frac{\sum_{i=1}^n e_i^2}{n-k}}$$

$e_i$  = value of residuals of  $i$ th observation

$n$  = no of observations

$k$  = no of variable

cultivation increased only 0.37 percent at all-India level and central and southern region recorded 12.8 percent and 25.8 percent increase in their average maize area respectively, while north-western and eastern region registered decline in their average maize area. In India

average maize production registered 32.44 percent increase in maize production, while central region, southern region, eastern region and north-western region recorded 43.6 percent, 41.9 percent, 34.9 percent and 19.7 percent increase in their average maize production respectively

Table 1: Period-Wise Trends in Average Area, Production and Productivity of Maize in India from 1980-81 to 2011-12.

SN Selected States & Region	(1980-83)		(1990-93)		(2000-03)		(2009-12)					
	Area	Prod.	Productivity	Area	Prod.	Productivity	Area	Prod.	Productivity			
1. Jammu & Kashmir	227.57 (4.68)	4583 (6.67)	1646.6	296.27 (4.48)	480.30 (5.33)	1621.3	328.7 (4.97)	509.67 (4.2)	1550.67	311.07 (3.64)	506.57 (2.52)	1628.6
2. Himachal Pradesh	287.27 (4.8)	460.53 (6.77)	1602.6	310.13 (5.24)	625.57 (6.94)	1997.3	299.7 (4.53)	645.03 (5.32)	2151.67	295.33 (3.46)	645.03 (3.20)	2178
3. Punjab	340.67 (5.78)	590 (8.67)	1738.6	184.27 (3.12)	372.33 (4.13)	2014.3	160.6 (2.43)	406.67 (3.35)	2518	132.67 (1.55)	406.67 (2.43)	3697.6
4. Uttar Pradesh	1160.5 (19.71)	911.43 (13.40)	1155.3	1074.8 (18.1)	1413.53 (15.65)	1523.3	864.7 (13.1)	1275.1 (10.5)	1834.33	750 (8.79)	1275.13 (5.74)	2347.3
<b>North-Western Region</b>	<b>2064.1 (35.1)</b>	<b>2415.79 (35.5)</b>	<b>6143.3</b>	<b>1865.9 (31.5)</b>	<b>2891.73 (32.1)</b>	<b>7106.3</b>	<b>1653.8 (25.0)</b>	<b>2836.5 (23.4)</b>	<b>8054.67</b>	<b>1489.07 (17.4)</b>	<b>2792.74 (13.91)</b>	<b>9851.6</b>
1. Bihar	844.1 (14.33)	858.7 (12.62)	1021	684 (11.5)	1158.53 (12.86)	1692.6	606.13 (9.17)	1445.1 (11.9)	2384.33	650.73 (7.62)	1509.66 (7.52)	2319
<b>Eastern Region</b>	<b>844.1 (14.33)</b>	<b>858.7 (12.62)</b>	<b>1021</b>	<b>684 (11.5)</b>	<b>1158.53 (12.86)</b>	<b>1692.6</b>	<b>606.13 (9.17)</b>	<b>1445.1 (11.9)</b>	<b>2384.33</b>	<b>650.73 (7.62)</b>	<b>1509.66 (7.52)</b>	<b>2319</b>
1. Maharashtra	78.86 (1.33)	128.3 (1.88)	1622	134.07 (2.26)	179.67 (1.99)	1301.6	342 (5.17)	544.7 (4.4)	1576.33	855.33 (10.02)	2287.67 (11.39)	2661.3
2. Madhya Pradesh	786.97 (13.3)	762.47 (11.21)	988.67	887.6 (15.1)	1175.77 (13.05)	1321.6	851.37 (12.88)	1464.2 (12.1)	1718.33	841.9 (9.86)	1128.0 (3.5.62)	1338
3. Gujarat	308.76 (5.24)	368.43 (5.41)	1192.6	360 (6.09)	479.2 (5.32)	1324.3	430.3 (6.51)	655.23 (5.40)	1484.67	504.67 (5.91)	713.1 (3.55)	1410.6
4. Rajasthan	902.63 (15.33)	733.2 (10.78)	812	962.3 (16.28)	1026.73 (11.40)	1063.67	990.97 (14.9)	1122.6 (9.26)	1128.67	1095.2 (12.83)	1621.87 (8.08)	1478
<b>Central Region</b>	<b>2077.2 (35.2)</b>	<b>1992.4 (29.2)</b>	<b>4595.3</b>	<b>2343.9 (39.6)</b>	<b>2861.37 (31.77)</b>	<b>5011.34</b>	<b>2614.6 (39.5)</b>	<b>3786. (31.2)</b>	<b>5908</b>	<b>3297.1 (38.6)</b>	<b>5750.67 (28.65)</b>	<b>6888</b>
1. Andhra Pradesh	328.43 (5.57)	700.4 (10.29)	2134	316.23 (5.35)	712.3 (7.90)	2249.33	494 (7.47)	1508 (12.4)	3074.33	797 (9.34)	3458.66 (17.23)	4359.3
2. Karnataka	153.33 (2.60)	378.87 (5.57)	2474.3	282.2 (4.7)	823.3 (9.14)	2897	632.83 (9.57)	1643.4 (13.5)	2857.67	1292.3 (15.1)	3847.33 (19.17)	2969.3
3. Tamil Nadu	21.57 (0.31)	42.67 (0.62)	1940	34.83 (0.58)	56.13 (0.12)	1609	91.87 (1.39)	149.83 (1.23)	1638.33	251.77 (2.95)	1289.1 (6.42)	5061.6
<b>Southern Region</b>	<b>503.33 (8.50)</b>	<b>1121.94 (16.49)</b>	<b>6548.3</b>	<b>633.26 (10.71)</b>	<b>1591.73 (17.67)</b>	<b>6755.33</b>	<b>1218.7 (18.4)</b>	<b>3301.3 (27.2)</b>	<b>7570.33</b>	<b>2341.07 (27.4)</b>	<b>8595.09 (42.82)</b>	<b>12390</b>
<b>All India</b>	<b>5886.6 (100)</b>	<b>6800.83 (100)</b>	<b>1155.3</b>	<b>5908.7 (100)</b>	<b>9006.07 (100)</b>	<b>1523.33</b>	<b>6609.3 (100)</b>	<b>1211.8 (100)</b>	<b>1834.33</b>	<b>8532.23 (100)</b>	<b>20068.2 (100)</b>	<b>2347.3</b>

Area: '000' hectares, Production: '000 tonnes', Yield/Productivity: Kg per Hectare.

Source: Calculated from Government of India, Area and Production of Principal Crops in India (Various Issues), Ministry of Agriculture, New Delhi.  
Note: Figures in parenthesis are percentage of total area and production.

during this period as compared to earlier period. The average productivity of maize registered an increase of 31.8 percent at all-India level whereas all regions also recorded acceleration in productivity and it was highest in north-western region followed by southern, central and eastern region during this period.

During 2009–12, India recorded 29.09 percent, increase in average maize area and southern region showed remarkable increasing of 92.2 percent followed by central (26.12 percent) and eastern region (7.35 percent) as compared to 2000–03. The share of maize area out of total Indian maize area was highest in central region (38.6

percent) followed by southern region (27.4 percent), north-western region (17.4 percent) and eastern region (7.6 percent) during this period (Figure 1). In case of production, a remarkable increase of 65.6 percent is visible in India during 2009–12 from the period 2000–03. Similarly, southern region showed steep increase in maize production i.e., 160.3 percent followed by central region (51.8 percent). Eastern region showed only 4.4 percent increase in their maize production while, north-western region showed declining trend during the same period (Figure 2). Southern region recorded highest share of 42.82 percent out of total maize production followed by central

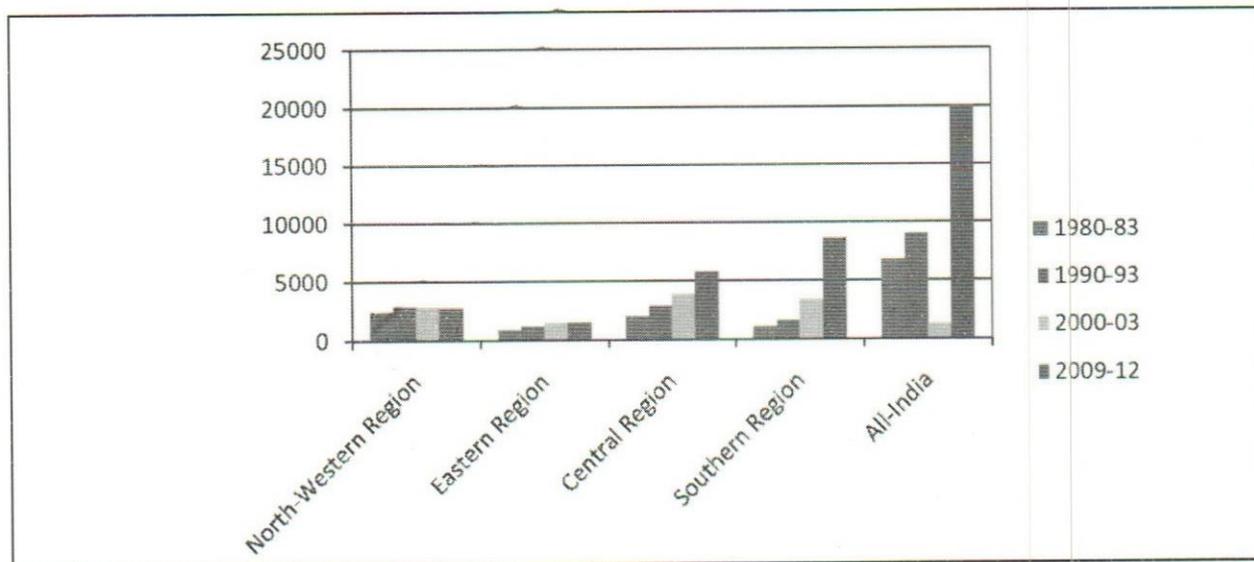


Figure 2: Trends in Average Production of Maize among Region in India from 1980 to 2012.

Source: Calculated from Government of India, *Area and Production of Principal Crops in India* (Various Issues), Ministry of Agriculture, New Delhi.

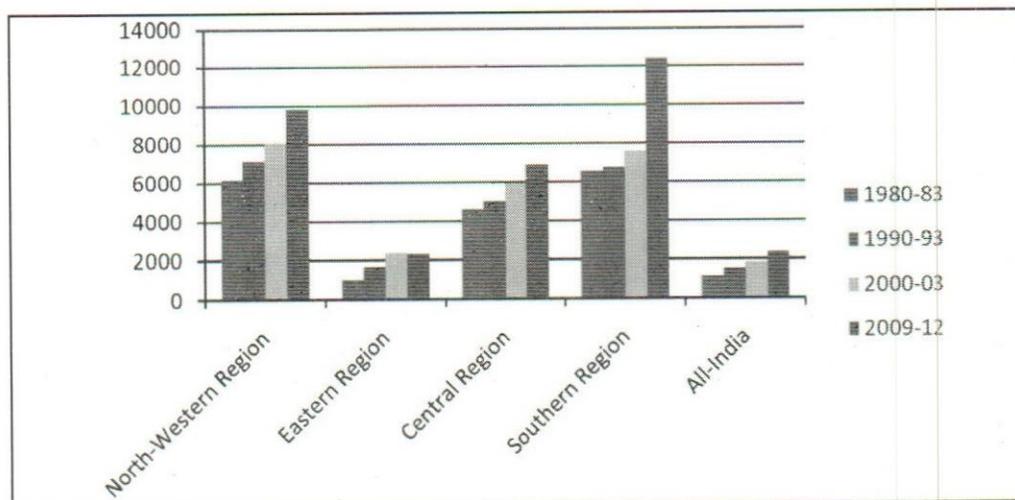


Figure 3: Trends in Productivity of Maize among Regions in India: From 1980 to 2012.

Source: Calculated from Government of India, *Area and Production of Principal Crops in India* (Various Issues), Ministry of Agriculture, New Delhi.

region (17.23 percent), north-western region (13.91 percent) and eastern region (11.39 percent) during 2009–12. As far as productivity is concerned, data showed that average productivity accelerated to 27.9 percent from 2000–03 to 2009–12 at all-India level and it was highest in southern region followed by north-western region, central region and eastern region during 2009–12 (Figure 3).

### **3. Trends in Growth rates of Area, Production and Productivity of Maize across Regions in India during 1980–81 to 2011–12**

This section gives a detailed account of compound growth rates of area, production and productivity of maize crop for the whole country and region-wise during 1980–81 to 2011–12 and its various sub-periods.

#### **Pre-Reform Period from 1980–81 to 1989–90**

During the pre-reform period, it can be observed from Table 2 that the compound growth rates of area, production and productivity of maize in India were  $-0.21$  percent per annum, 1.78 percent per annum and 2 percent per annum, respectively. This implies that increase in growth rate of maize production was in India due to increase in maize productivity growth rather than area growth during this period. The region-wise analysis showed that production of maize crop in eastern, central and southern regions increased at the rate of 2.68, 0.16 and 1.95 percent per annum respectively, while north-western region recorded negative growth rate of  $-0.27$  percent per annum during this period. The increase in production of maize in eastern region was mainly occurred through growth in increase in maize productivity rather than growth in maize area, whereas in central and southern region increase in area contributed more than increase in productivity. Negative growth rate in maize production in north-western region was due to negative growth rate in productivity as well as low growth in maize area.

#### **Post Reform Period-I from 1990–91 to 1999–00**

During post-reform period-I, the compound growth rates of area, production and productivity were 0.95, 3.28 and 2.31 percent per annum respectively and all are statistically significant at 1 percent level. This illustrated that acceleration in production growth in India was due to acceleration in growth rate of both productivity and area. As shown in Table 2, between pre-reform period and post-reform period-I, the growth rate in maize production in north-western, eastern, central and southern regions accelerated from  $-0.27$ , 2.68, 0.16 and 1.95 percent to

0.11, 3.68, 5.05 and 10.74 percent per annum, respectively. In case of eastern and southern regions, acceleration in growth of production mainly due to acceleration in growth rate of maize area only, while in case of central and north-western region, acceleration in the growth of production came through the improvement in both productivity and expansion in area. Hence, this period marked the remarkable improvement in maize production.

#### **Post-Reform Period-II from 2000–01 to 2011–12**

During this period, compound growth rates of area, production and productivity were 2.79, 5.80 and 2.93 percent per annum at all-India level and all are significant at 1 percent level. This accelerated and significant growth in production was due to both accelerated area and productivity growth during this period. The factors such as minimum labour costs, lowering the level of water in rice belt of India, adaptability to various agro-climatic conditions may be contributed to the rise in acreage and use of improved technology, high productive varieties and extension services led to growth of production and productivity in India during this period. Region-wise comparative analysis showed that between post-reform periods-I and II, the growth of maize production in north-western region, central region and southern region accelerated from 0.11, 5.05 and 10.74 percent to 0.31, 5.53 and 16.2 percent per annum, respectively. On the other hand, eastern region recorded deceleration in production growth from 3.68 percent to 0.74 percent per annum. The decelerated production growth in eastern region was due to negative and decelerated growth rate in maize area. Acceleration of growth rate of maize production in central region was due to acceleration in growth rate of both area and productivity per hectare. In case of southern and north-western regions, acceleration in growth of production occurred through the acceleration in the growth of productivity only.

#### **Total Period from 1980–81 to 2011–12**

It can be seen from Table 2 that compound growth rates of area, production and productivity of maize were 1.34, 3.77 and 2.40 percent per annum respectively in India and statistically significant at 1 percent level during whole study period. This revealed that increase in production of maize in India was mainly occurred through the increase in productivity growth as compared to area growth. During this period, production in north-western, eastern, central and southern regions increased at the rate of 0.61, 2.30, 4.53 and 9.55 percent per annum, respectively. In north-western and eastern regions, growth in production was

Table 2: Period-Wise Compound Growth rates of Area, production and Productivity of Maize in India during 1980-81 to 2011-12.

SN Selected States and Region	Pre-Reform Period (1980-81 to 1989-90)			Post-Reform Period-I (1990-91 to 1999-00)			Post-Reform Period-II (2000-01 to 2011-12)			Total Period (1980-81 to 2011-12)		
	Area (Thousand Hectare)	Prod. (Thousand Tonnes)	Productivity (Kg. per Hectare)	Area (Thousand Hectare)	Prod. (Thousand Tonnes)	Productivity (Kg. per Hectare)	Area (Thousand Hectare)	Prod. (Thousand Tonnes)	Productivity (Kg. pe Hectare)	Area (Thousand Hectare)	Prod. (Thousand Tonnes)	Productivity (Kg. per Hectare)
1. Jammu & Kashmir	0.84* (6.87)	-0.59 (0.24)	-1.42 (0.60)	0.78* (6.22)	-0.08 (0.08)	-0.86 (0.85)	-0.61* (4.30)	0.18 (0.23)	0.80 (1.02)	0.50* (9.05)	0.76* (2.82)	0.25 (0.92)
2. Himachal Pradesh	0.97* (4.01)	1.48 (0.79)	0.51 (0.29)	-0.35*** (1.90)	0.53 (0.85)	0.97 (1.58)	-0.22 (1.03)	0.16 (0.10)	0.38 (0.26)	0.11 (0.18)	1.16* (4.14)	1.15 (4.47)*
3. Punjab	-5.49* (10.03)	-6.67* (4.28)	-1.26 (0.71)	-2.05* (4.51)	0.51 (0.41)	2.62 (2.33)**	-1.94* (5.82)	2.15*** (2.04)	4.18* (4.60)	-2.88* (14.27)	-0.18 (0.44)	2.78 (9.98)*
4. Uttar Pradesh	-0.30 (0.65)	4.69*** (1.85)	5.00*** (2.10)	-1.04** (2.99)	-0.49 (0.28)	0.55 (0.33)	-1.67** (2.82)	-1.24 (0.84)	0.44 (0.41)	-1.54* (12.77)	0.68 (0.17)	1.63 (5.01)*
<b>North-Western Region</b>	<b>-0.99</b>	<b>-0.27</b>	<b>0.71</b>	<b>-0.66</b>	<b>0.11</b>	<b>0.82</b>	<b>-1.11</b>	<b>0.31</b>	<b>1.45</b>	<b>-0.95</b>	<b>0.61</b>	<b>1.45</b>
1. Bihar	-3.01* (4.11)	2.68*** (1.94)	5.86* (4.96)	0.74 (0.80)	3.68* (3.30)	2.91 (3.22)**	0.80* (4.53)	0.74 (1.16)	-0.06 (0.10)	-0.68* (4.14)	2.30* (9.17)	3.00* (12.46)
<b>Eastern Region</b>	<b>-3.01</b>	<b>2.68</b>	<b>5.86</b>	<b>0.74</b>	<b>3.68</b>	<b>2.91</b>	<b>0.80</b>	<b>0.74</b>	<b>-0.06</b>	<b>-0.68</b>	<b>2.30</b>	<b>3.00</b>
1. Maharashtra	2.70*** (2.16)	-2.38 (1.11)	-4.94* (3.84)	10.99* (4.57)	14.30* (4.31)	2.43 (1.49)	10.92* (18.2)	18.69* (11.83)	7.00* (4.34)	8.89* (26.3)	11.28* (16.55)	2.16* (5.05)
2. Madhya Pradesh	1.22 (7.20)	4.97*** (1.97)	3.70 (1.5)	-0.23 (0.77)	1.17 (0.51)	1.40 (0.68)	-0.22 (0.93)	-3.18*** (2.01)	-2.97*** (1.97)	0.16** (2.32)	1.23* (2.83)	1.08** (2.69)
3. Gujarat	0.25 (0.42)	-2.92 (0.42)	-3.16 (0.49)	1.45* (4.49)	4.16 (1.41)	2.67 (0.99)	1.69** (2.83)	2.69 (0.84)	0.98 (0.32)	1.92* (16.5)	2.90* (3.47)	0.97 (1.25)
4. Rajasthan	0.01 (0.01)	0.98 (0.18)	0.97 (0.19)	-0.21* (6.74)	0.55 (0.23)	0.76 (0.35)	0.84** (2.51)	3.92 (1.63)	3.05 (1.39)	0.64* (7.17)	2.69* (4.31)	2.03* (3.53)
<b>Central Region</b>	<b>1.05</b>	<b>0.16</b>	<b>-0.85</b>	<b>3.00</b>	<b>5.05</b>	<b>1.82</b>	<b>3.31</b>	<b>5.53</b>	<b>2.02</b>	<b>2.90</b>	<b>4.53</b>	<b>1.56</b>
1. Andhra Pradesh	-1.39* (3.26)	-3.86*** (1.39)	-2.51 (2.05)	4.08* (16.11)	9.75* (9.31)	5.44* (5.28)	5.20* (4.89)	9.75* (5.78)	4.32* (3.65)	3.82* (11.1)	7.58* (14.5)	3.62* (11.1)
2. Karnataka	6.60* (7.50)	7.20* (4.32)	0.56 (0.59)	10.25* (12.5)	10.49* (10.79)	0.21 (0.21)	8.37* (10.5)	10.37* (4.95)	1.84 (1.33)	7.85* (44.6)	8.30* (23.6)	0.41 (1.64)
3. Tamil Nadu	5.48*** (1.91)	2.53 (0.61)	-2.79 (1.27)	12.01* (5.51)	11.98* (5.56)	-0.03 (0.21)	11.92* (6.48)	28.48* (10.60)	14.79* (5.36)	10.04* (19.7)	12.76* (12.65)	2.46*** (1.84)
<b>Southern Region</b>	<b>3.56</b>	<b>1.95</b>	<b>-4.74</b>	<b>8.78</b>	<b>10.74</b>	<b>1.87</b>	<b>8.50</b>	<b>16.2</b>	<b>6.98</b>	<b>7.24</b>	<b>9.55</b>	<b>2.16</b>
<b>All India</b>	<b>-0.21 (0.86)</b>	<b>1.78 (1.10)</b>	<b>2.00 (1.38)</b>	<b>0.95* (6.21)</b>	<b>3.28* (4.66)</b>	<b>2.31* (3.43)</b>	<b>2.79* (14.5)</b>	<b>5.80* (7.30)</b>	<b>2.93* (4.08)</b>	<b>1.34* (11.5)</b>	<b>3.77* (16.6)</b>	<b>2.40* (13.7)</b>

Source: Calculated from Government of India, Area and Production of Principal Crops in India (Various Issues), Ministry of Agriculture, New Delhi.

Notes: \* significant at 1% level, \*\* significant at 5% level and \*\*\* significant at 10% level; figures in the parentheses are the t-values.

mainly due to increase in growth in productivity than increase in growth in area, whereas in central and southern region high growth rate in production occurred through the increase in growth in area than increase in growth in productivity.

#### **4. Instability in Area, Production and Productivity of Maize Across Regions in India from 1980–81 to 2011–12**

Instability in agriculture shows different pattern in different agro-ecological settings prevailing in different regions and states (Chand, 2008). The present section examines the instability in area, production and productivity of maize crop in different regions for the whole study period and its various sub-periods.

##### **Pre-Reform Period from 1980–81 to 1989–90**

It can be seen from Table 3 that in pre-reform period instability in area, production and yield were 2.06, 13.35 and 12.28 respectively at all-India level. This implies that the fluctuations in production in India are the result of fluctuations in crop productivity only. Highest instability in production of maize registered by central region (29.94) followed by southern region (20.15) and north-western region (17.12), while, eastern region recorded lowest instability in production. During this period productivity fluctuations contributed more than area fluctuations in the production fluctuations of maize crop among the regions.

##### **Post Reform Period-I from 1990–91 to 1999–00**

During post-reform period-I, instability in area, production and productivity of maize declined by 36.8, 58.6 and 56.02 per cent respectively at all-India level and fluctuations in both area and productivity turned out to be behind this instability. Instability in production also decline in all the four regions during this period. Productivity fluctuations contributed most in the production fluctuations in north-western, central and southern region. In case of eastern region, fluctuations in production are the compound results of fluctuations in crop maize acreage and maize productivity.

##### **Post Reform Period-II from 2000–01 to 2011–12**

From Table 3 it is clear that between post reform periods-I and II, instability in area, production and yield increased by 87.3, 103 and 23.2 percent, respectively. Increase in production instability of maize occurred through

acceleration of instability in both area and productivity. Amongst the regions, magnitude of fluctuations in production was highest in the case of central region followed by southern region and lowest for north-western region and eastern region. During this period, area fluctuations contributed most in production fluctuations in most of the regions of India.

##### **Period IV—Total Period from 1980–81 to 2011–12**

It may be found that during the whole study period, instability in area, production and productivity of maize was 5.96, 11.79 and 8.38 respectively in India. Fluctuations in production were more than fluctuations in area and productivity of maize at all-India level during the whole study period. During the same period, region-wise comparison revealed that production of maize showed highest instability in southern region followed by central region and lowest instability in north-western region and eastern region. In all the regions, except north-western region, fluctuations in productivity contributed more than fluctuations in area in the production fluctuations of maize crop. The table further revealed that in majority of regions and states instability in yield was less than instability in production in all the four periods. It showed the importance of area instability.

#### **5. Trends in Area, Production and Productivity of Major Maize Producing Countries in the World**

Table 4 compares the area, production and productivity of maize in major maize producing countries in the world from 1980 to 2012. As far as area is concerned, USA has the first position and Canada has the last position in 1980. India with 6,004 thousand hectares of area under maize cultivation ranked sixth position in this period. During 2012, USA again occupied first position followed by China and Brazil. India, ranked fifth position, accounted for 24.6 percent of USA area in this period. In case of production, USA ranked first position and Indonesia has last position whereas, India ranked seventh position during this period. In 2012, USA has the highest position followed by China, Brazil and EU-27. Thus, USA has consistently been the top maize producer in the world. India ranked fifth position and has 8.12 percent, 10.82 percent, 31.3 percent and 37.5 percent of USA, China, Brazil and EU production respectively during 2012. As far as the productivity level of the maize crop is concerned, USA here again ranked first position followed by Canada, EU-27, China and Argentina during 1980 and India registered lowest productivity. In 2012, Canada ranked first position followed by USA, EU-27, China and Argentina. India again ranked least position

Table 3: Period-Wise Compound Growth rates of Area, Production and Productivity of Maize in India during 1980-81 to 2011-12.

SN	Selected States and Regions	Pre-Reform Period (1980-81 to 1989-90)			Post-Reform Period-I (1990-91 to 1999-00)			Post-Reform Period-II (2000-01 to 2011-12)			Total Period (1980-81 to 2011-12)		
		Area ('000' Hectare)	Prod. ('000' Tonnes)	Productivity (Kg. per Hectare)	Area ('000' Hectare)	Prod. ('000' Tonnes)	Productivity (Kg. per Hectare)	Area ('000' Hectare)	Prod. ('000' Tonnes)	Productivity (Kg. per Hectare)	Area ('000' Hectare)	Prod. ('000' Tonnes)	Productivity (Kg. per Hectare)
1.	Jammu & Kashmir	1.02	18.49	18.09	1.06	8.41	8.70	1.58	9.30	9.30	2.96	12.20	12.53
2.	Himachal Pradesh	2.06	15.5	14.35	1.58	5.15	5.16	2.49	15.77	15.29	3.03	13.71	12.80
3.	Punjab	4.7	12.19	13.95	4.04	11.01	9.63	9.67	10.44	8.36	12.33	20.91	12.41
4.	Uttar Pradesh	3.96	22.32	21.16	2.93	14.24	13.23	6.72	15.90	11.72	66.62	19.53	15.50
	<b>North-Western Region</b>	<b>2.93</b>	<b>17.12</b>	<b>16.88</b>	<b>2.32</b>	<b>9.70</b>	<b>9.77</b>	<b>5.11</b>	<b>12.85</b>	<b>11.16</b>	<b>21.23</b>	<b>16.58</b>	<b>13.31</b>
1.	Bihar	6.10	11.78	9.70	8.43	9.35	7.45	2.01	7.38	7.20	8.94	12.83	12.54
	<b>Eastern Region</b>	<b>6.10</b>	<b>11.78</b>	<b>9.70</b>	<b>8.43</b>	<b>9.35</b>	<b>7.45</b>	<b>2.01</b>	<b>7.38</b>	<b>7.20</b>	<b>8.94</b>	<b>12.83</b>	<b>12.54</b>
1.	Maharashtra	10.9	17.40	9.63	20.16	26.21	13.42	6.49	15.27	13.55	13.46	37.48	20.06
2.	Madhya Pradesh	1.43	21.55	20.80	2.58	18.49	16.53	2.72	18.76	17.36	3.41	22.76	20.77
3.	Gujarat	5.00	42.07	39.87	2.71	23.64	21.70	6.43	32.17	31.87	5.82	31.97	30.74
4.	Rajasthan	5.43	38.75	38.55	2.40	20.12	18.07	3.86	26.88	24.37	4.50	28.80	26.71
	<b>Central Region</b>	<b>5.69</b>	<b>29.94</b>	<b>27.21</b>	<b>6.96</b>	<b>22.11</b>	<b>17.43</b>	<b>4.87</b>	<b>23.27</b>	<b>21.78</b>	<b>6.79</b>	<b>30.25</b>	<b>24.57</b>
1.	Andhra Pradesh	3.70	16.20	15.61	5.63	8.41	8.68	10.87	19.67	14.03	16.75	26.05	15.46
2.	Karnataka	7.54	13.16	7.82	7.64	7.58	8.30	7.03	17.09	14.73	8.73	19.64	12.33
3.	Tamil Nadu	23.5	31.11	122	26.9	26.19	1.34	19.02	30.07	21.42	25.36	86.85	95.04
	<b>Southern Region</b>	<b>11.58</b>	<b>20.15</b>	<b>48.47</b>	<b>13.39</b>	<b>14.06</b>	<b>6.10</b>	<b>12.30</b>	<b>22.27</b>	<b>16.72</b>	<b>16.94</b>	<b>44.18</b>	<b>40.94</b>
	<b>All India</b>	<b>2.06</b>	<b>13.35</b>	<b>12.28</b>	<b>1.30</b>	<b>5.52</b>	<b>5.40</b>	<b>2.03</b>	<b>8.64</b>	<b>7.87</b>	<b>5.96</b>	<b>11.79</b>	<b>8.38</b>

Source: Calculated from Government of India, Area and Production of Principal Crops in India (Various Issues), Ministry of Agriculture, New Delhi.

in maize productivity and has only 2.7 percent of Canada, 3.3 percent of USA, 4.2 percent of EU-27, 4.3 percent of China and 4.4 percent of Argentina during 2012. The probable factors could be technological, environment, economic and organizational factors are responsible for variations in productivity level across the globe. The productivity in India remain very low as compared to other major maize growing countries due to limited adoption of improved production-protection technology, lack in production and distribution system of quality seed, small farm holding, limited resource availability with farmers and lack of development of single cross hybrids technology which is a key to higher productivity gains like USA, China and other countries.

## 6. Overall Performance of Each Regions in Terms of Area, Production and Yield of Maize During Pre- and Post-Reform Periods

In this section, the study broadly discusses about the comparative performance of maize crop in before and after economic liberalization in India and its regions. The study experienced increasing trend of area and production of maize crop in India over the period of time (Figure 4). Productivity of maize also showed increasing trend up to post-reform period-I but after than it recorded large fluctuations during post-reform period-II. The study found that maize production in India showed significant improvement in post-reform period-I due to accelerated

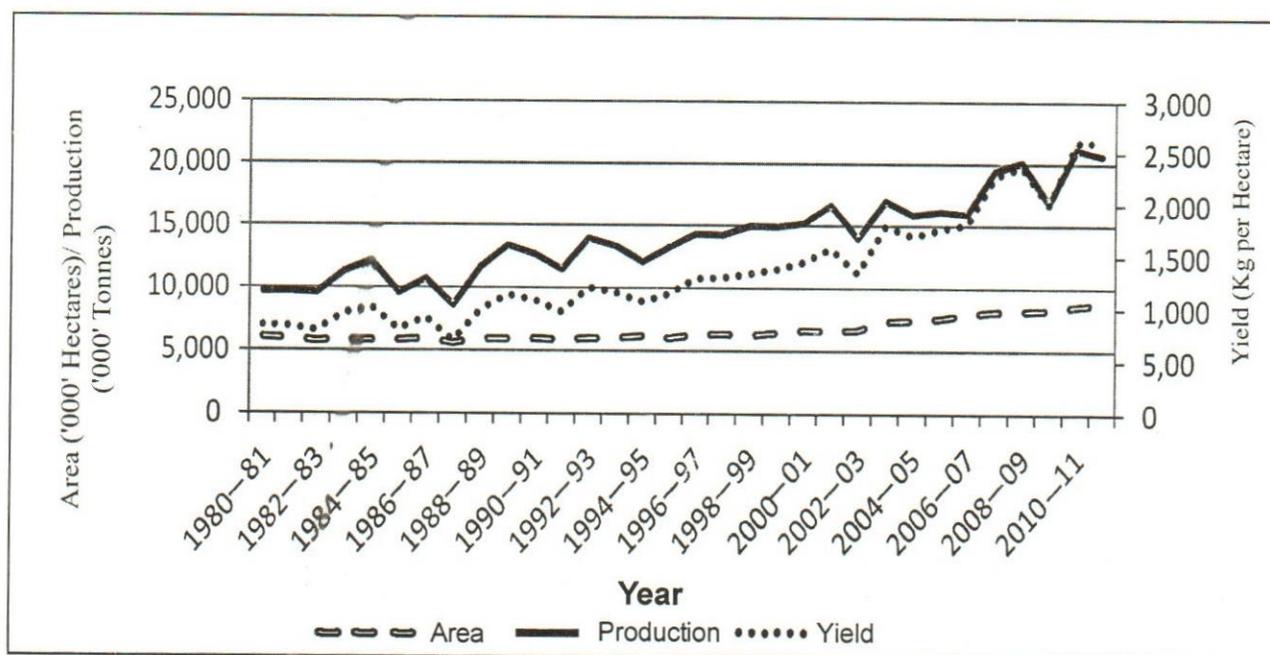


Figure 4: Trends in Area, Production and Productivity of Maize in India: From 1980-81 to 2011-12.

area and productivity growth as well as declining trend of their instability whereas, during post-reform period-II growth rates in area, production and productivity showed an increasing trend but this was possible at the cost of increasing instability. This implies that rate of increase in area, production and productivity of maize was not stable and steady during post-reform period-II at all-India level. After economic reforms India's ranking in the world improved in case of area and production, but performance of yield in India was very low and remained at last position as compared to other major maize growing countries in the world. This is a matter of great concern.

The study analyzed that the north-western region which had pioneered the green revolution showed declining

trend in its maize area over the period of time, while production and productivity of maize showed increasing trend in post-reform period-I and after that both declined during post-reform period-II (Figure 5). This region has the highest share in average maize production among all the regions in total Indian maize production in pre-and post-reform periods-I (Figure 2). Productivity was highest in this region during post-reform period-I due to increasing trend of its growth rate and decelerated instability (Figure 3). Due to negative growth rate in maize area, declining share of maize production among regions and increasing trend of instability in area, production and productivity, the performance of this region in terms of raising maize production was not satisfactory during post-reform

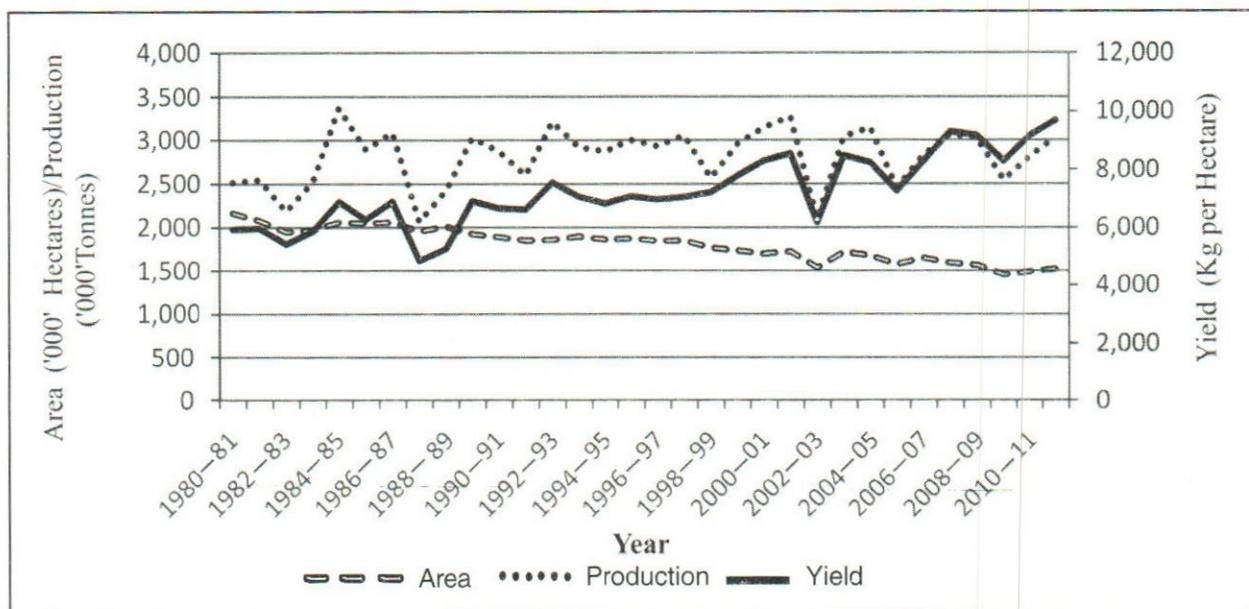


Figure 5: Trends in Area, Production and Productivity of Maize in North-Western Region: From 1980-81 to 2011-12

period-II as compared to post-reform period-I and pre-reform period.

In the case of central region, the study found that this region occupied highest position in the share of average maize area and second position in the share of average maize production in the total Indian maize area and production respectively in pre- and post- reform periods-I

and II (Figures 1, 2 and 3). Area and productivity of maize showed increasing trend and acceleration in their growth rate in both post-reform period I and II (Figure 6). But maize productivity trend depicted wider fluctuations over the time period probably due to the fluctuations in instability. Thus, the central region showed significant improvement in raising maize production after economic reforms and remained

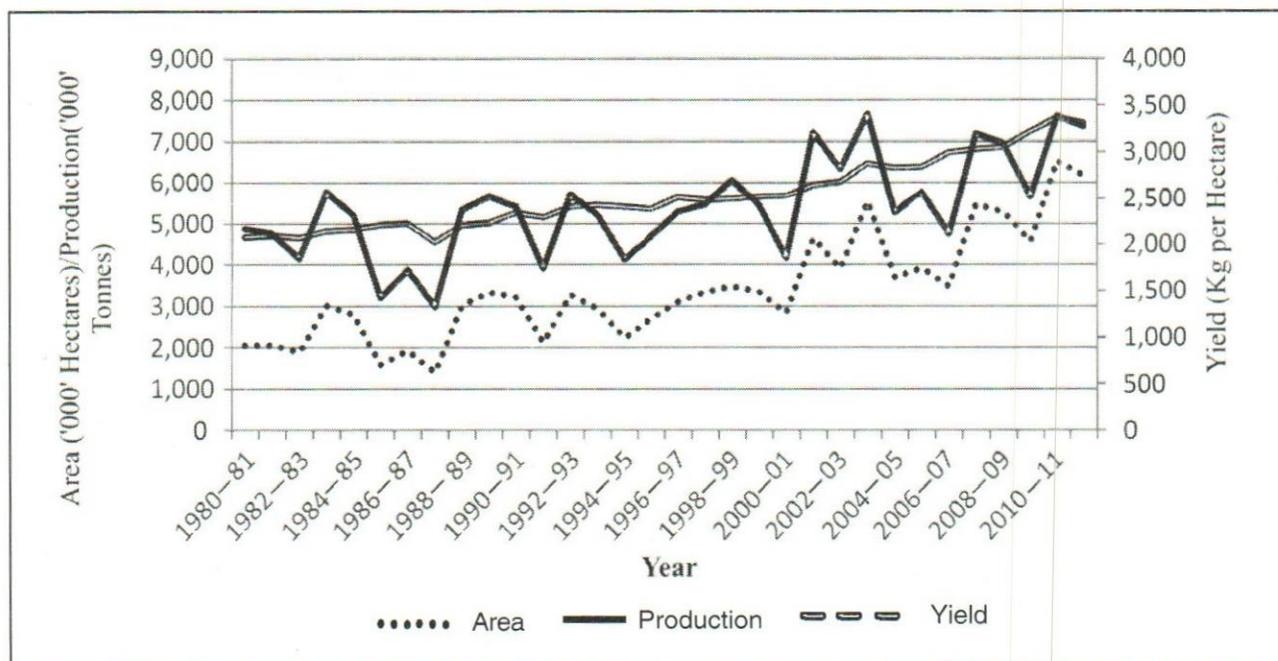


Figure 6: Trends in Area, Production and Productivity of Maize in Central Region: From 1980-81 to 2011-12

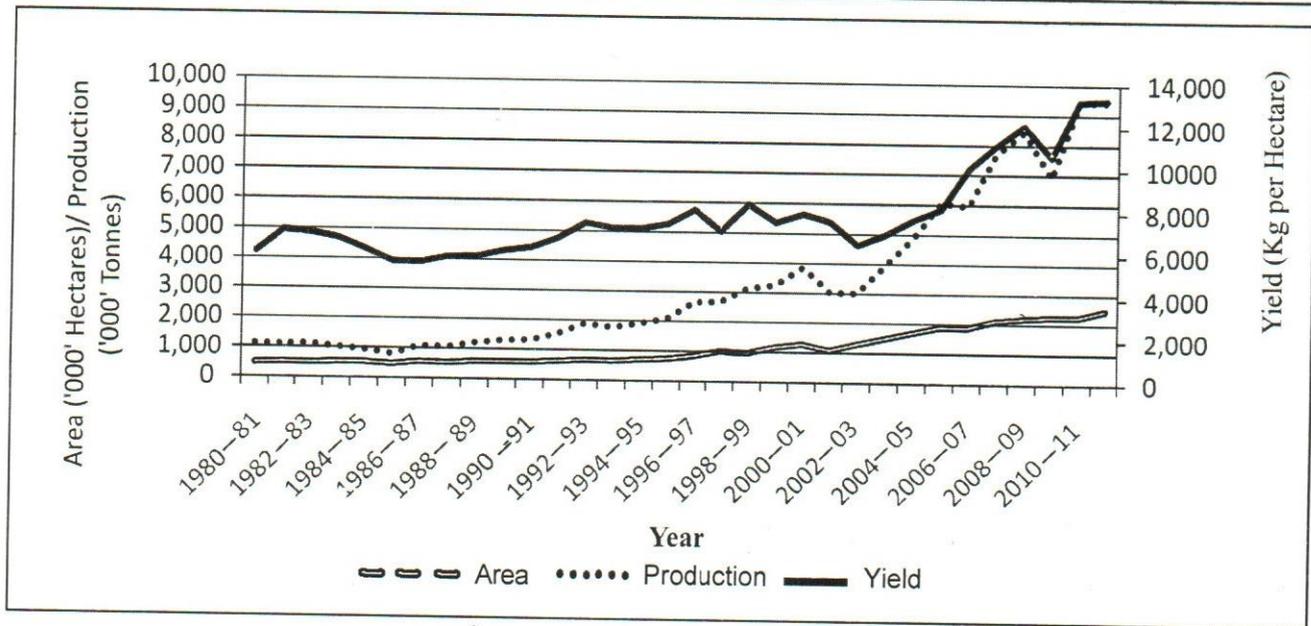


Figure 7: Trends in Area, Production and Productivity of Maize in Southern Region: From 1980-81 to 2011-12.

on higher position among other regions in the share of average maize production in the total Indian maize production.

In case of southern region, area, production and productivity showed increasing trend over the whole study period (Figure 7). The study found that in pre-reform period- I this region recorded third highest share in average maize production and lowest share in average maize area among regions out of total maize production and area and has highest maize productivity in pre-reform period. A remarkable improvement showed in southern region during post-reform period-II. In this period, this region has highest

share in average maize production and second highest share in average maize area in total Indian maize production and area respectively and again recorded highest productivity of maize during this period. Although, the growth rate in maize area marginally decreased, but production and productivity registered very high growth rate during this period. There exists a positive relationship between trends in instability and growth rate in area, production and productivity during post-reform period-II. Thus, the performance of this region in raising production and productivity has improved after the economic reforms.

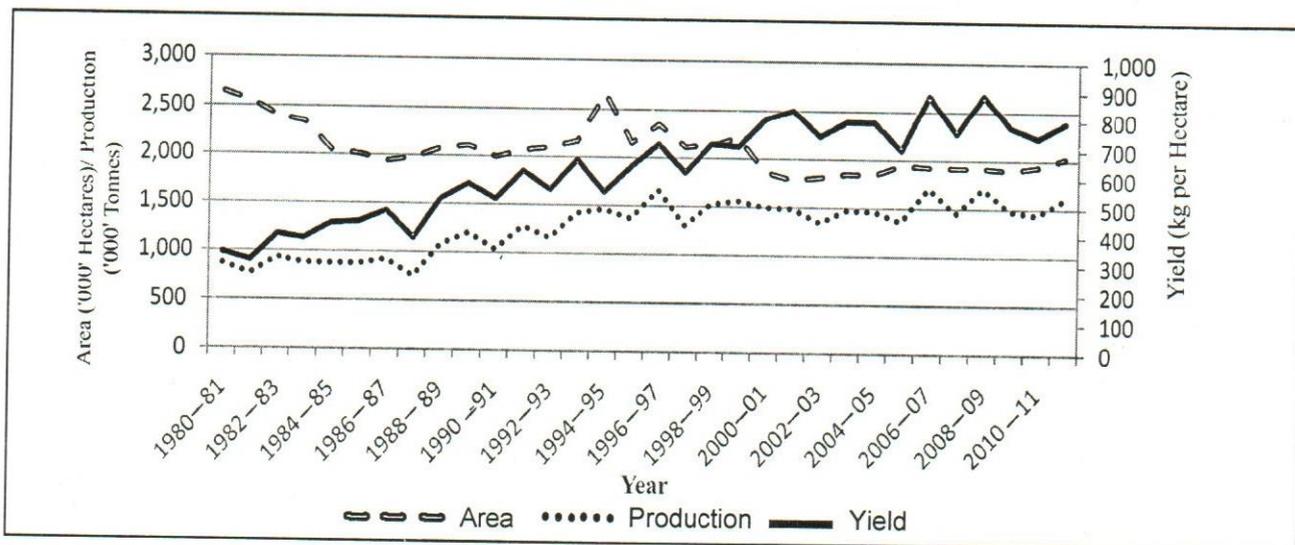


Figure 8: Trends in Area, Production and Productivity of Maize in Eastern Region: From 1980-81 to 2011-12.

In case of eastern region, maize area showed declining trend, while production and productivity showed increasing trend over the time period (Figure 8). This region recorded decline in production and productivity growth and negative growth rate in maize area, whereas instability in area, production and productivity declined during post-reform period I and II. The share of average maize area and production in total Indian maize area and production among regions remain lowest and recorded low productivity during the both post-reform periods. Thus, performance of eastern region in raising maize production was not satisfactory after the introduction of economic reforms.

### Conclusion and Policy Implications

The present study has been undertaken with a view to analyze trend, growth and variability in area, production and productivity of maize crop at all-India level and regional level by comparing with pre-reform period (from 1980–81 to 1989–90) and post-reform period (from 1990–91 to 2011–12). Presently, maize is the third most important cereal crop in India after rice and wheat. The study found that after the economic reforms maize production in India grew phenomenally by using single cross hybrids in late 1980s and continuous demand in domestic and export market. However, despite this remarkable production growth, Indian maize productivity is significantly lower than the major maize producing countries. Differences in productivity across the globe is mainly due to limited adoption of improved production-protection technology, lack in production and distribution system of quality seed, small farm holding, limited resource availability with farmers and lack of development of single cross hybrids technology. Region-wise analysis showed that central and southern regions showed significant improvement in raising maize production and productivity after economic reforms due to accelerated growth in area, production and productivity. But this was possible at the cost of increasing instability. The performance of north-western region which had pioneered the green revolution period was not satisfactory after the economic reforms because of declining trend of maize production and negative growth in its maize area as well as increasing trend of instability in area, production and productivity. Similarly, performance of eastern region in raising maize production was also not satisfactory because of negative growth rate in maize area and deceleration in production and productivity growth despite the declining trend of their instability.

According to the maize summit 2014, there is immense scope for an increase in India's corn production by increasing area under hybrids, adoption of better

genetics and improved agronomic practices. Growth rate of production and productivity could be increased by minimizing their instability. Productivity stabilization measures should be prioritized. Productivity of maize could be enhanced through science-based technological interventions like single cross hybrids technology, techniques in maize improvement, investment on R&D, better utilization of skilled labour and technical knowledge, providing better irrigation facilities, etc. Furthermore, the changing growth pattern of the economy and policy changes with respect to subsidy in agricultural inputs, commodity export-import, industrialization, foreign direct investment in agriculture, etc., are likely to affect the growth pattern of the maize crop. Special focus should be given to the eastern and north-western regions so that regional disparity in maize production could be minimized. Growth as well as stability should go hand in hand for maintaining long term equilibrium. Thus, there is dire need to sustain the production of maize crop.

### References

- Acharya, S.P., H. Basavaraja, L.B. Kunnal, S.B. Mahajanashetti and A.R.S. Bhat. (2012). 'Growth in Area, Production and Productivity of Major Crops in Karnataka', *Karnataka Journal of Agricultural Science*, 25(4),431–436.
- Ahmad, I.M., E. Samuel, S.A. Makama, V.R. and Kiresur. (2015). 'Trends of Area, Production and Productivity of Major Cereals; Indian and Nigeria Scenario', *Research Journal of Agriculture and Forestry Sciences*, 3(2), 10–15, February.
- Barakede, A.J. and T.N. Lakhande. (2011). 'Trends in Area, Production and Productivity of Onion in Maharashtra', *International Referred Research Journal*, II (26), 7–9.
- Bhalla, G.S. and Gurmail Singh. (2009). 'Economic Liberalisation and Indian Agriculture: A State Wise Analysis', *Economic and Political Weekly*, XLIV, December 26, 34–43.
- Chand, R. and S.S. Raju. (2008). 'Instability in Indian Agriculture During Different Phases of Technology and Policy', Discussion paper: WPP 01/2008, National Centre for Agricultural Economics and Policy Research, Library Avenue, Pusa, New Delhi.
- Coppock, J.D. (1962). *International Economic Instability*. New York: McGraw-Hill.
- Cuddy, J.D. and P.A. Della Valle. (1978). 'Measuring the Instability of Time Series Data', *Oxford Bulletin of Economics and Statistics*, 40(1),70–85.
- Darvishi, G.A. and M. Indira. (2013). 'An Analysis of Changing Pattern in Area, Production and Productivity of Coffee and Tea in India', *International Journal of Marketing, Financial*

- Services and Management Research*, 2(9), September, 46–60.
- Della Valle, P.A.** (1979). 'On the Instability Index of Time Series Data: A generalization', *Oxford Bulletin of Economics and Statistics*, 41(3): 247–248.
- GOI.** (2012). Area and Production of Principal Crops in India (Various issues), Ministry of Agriculture, New Delhi.
- Hasan, M.N., M.A Manayem Miah, M.S. Islam, Q.M. Alam and M.I. Hossain.** (2008). 'Change and Instability in Area and Production of Wheat and Maize in Bangladesh', *Bangladesh Journal of Agriculture Research*, 33(3), September, 409–417.
- Joshi, P.K., N.P. Singh, N.N. Singh, R.V.C. Gerpacio and P.L. Pinglai.** (2005). 'Maize in India: Production Systems, Constraints and Research Priorities', Project conducted by International Maize and Wheat Improvement center (CMMYT), Laguna, Philippines.
- Kondal, K.** (2014). 'Growth Rate of Area, Production and Productivity of Onion Crop in Andhra Pradesh', *Indian Journal of Applied Research*, 4(3), March, 4–6.
- MacBean, A.I.** (1966). *Export Instability and Economic Development*. Cambridge: Harvard University Press.
- Madhusudan, B.** (2013). 'A Survey on Area, Production and Productivity of Groundnut Crop in India', *IOSR Journal of Economics and Finance*, 1(3), 1–7.
- Massell, B.F.** (1970). 'Export Instability and Economic Structure', *American Economic Review*, 60, 618–630.
- Mitra, A.K.** (1990). 'Agricultural Production in Maharashtra: Growth and Instability in the Context of New Technology', *Economic and Political Weekly*, 25 (52): A146–A164.
- Naidu, V.B., A.S. Sankar and C. Leelavathi.** (2014). 'Trends in Area, Production and Productivity of Selected Oilseed Crops in Andhra Pradesh', *International Journal of Multidisciplinary Research and Development*, 1 (7): 366–369.
- Paltasingh, K.R. and P. Goyari.** (2013). 'Analyzing Growth and Instability in Subsistence Agriculture of Odisha: Evidence from Major Crops', *Agricultural Economics Research Review*, 26, (Conference number), 67–78.
- Paul, K.S.R., Md. Farukh and V.S. Rambabu.** (2013). 'Trends, Growth and Variability of Groundnut Crop in Andhra Pradesh', *Abhinav, National Monthly referred Journal of Research in Arts and Education*, 2(6), June, 74–78.
- Ranum, P., J.P. Pena Rosas and M.N. Garcial-Casal.** (2014). 'Global Maize Production Utilization and Consumption', *Annals of the New York Academy of Sciences*, 1312, 105–112.
- Sihmar, R.** (2014). 'Growth and Instability in Agricultural Production in Haryana: A District level Analysis', *International Journal of Scientific and Research Publications*, 7(7), July, 1–12.
- Singh, A.J. and D. Byerlee.** (1990). 'Relative Variability in Wheat Yields across Countries and Over Time', *Journal of Agricultural Economics*, 14(1): 21–32.
- Vani, B.P. and V. Vyasulu.** (1996). 'Growth, Variability and Instability of Three major Crops in Karnataka: A District Level Analysis from 1955-56 to 1989-90', *Economic and Political Weekly*, 31 (26): 74–83.
- Wasim, M.P.** (1999). 'Growth Rates and Fluctuations in Area, Production and Productivity: A Study of Major Crops in Sindh', *Pakistan Economic and Social Review*, 37(2), 155–169.
- Wasim, M.P.** (2002). 'A Study of Rice in Major Growing Countries in the World: Their Growth Instability and World Share', *Pakistan Economic and Social Review*, 40(2), 153–183.
- Wasim, M.P.** (2011). 'Trends, Growth and Variability of Major Fruit Crops in Baluchistan-Pakistan', *ARPN Journal of Agricultural and Biological Science*, 6(12), December, 27–36.

What we do know now is that the 'E' in E-commerce doesn't stand for 'easy'.

—John Hagel

# A Study of Women Participation in MGNREGA in Himachal Pradesh

S. L. KAUSHAL AND BALBIR SINGH

*Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) is becoming a milestone in empowering women. MGNREGA provides a legal guarantee of 100 days of wage employment in a financial year to volunteer household adults by ensuring at least 33% women workers. It has vital potential to check prejudice and disparities might it be economic or gender based. The gamut of the present paper is to explore the reach and impact of MGNREGA on economic empowerment of women in rural India in general and Himachal Pradesh in particular. From the findings, it is clear that in India, the share of women participation in MGNREGA work has increased to 50.24% in 2014-15 as compared to 47.07% in FY 2012-13. Among states, Tamilnadu is leading in the country where women have generated 3086.82 lakh persondays in 2013-14 followed by Andhra Pradesh 1756.56 lakh persondays and Rajasthan 1245.75 lakh persondays. In Himachal Pradesh, the share of women worker has been 58.09% in MGNREGA in 2014-15 and 176.60 lakh persondays generated in 2013-14 which was 118.8 lakh in 2011-12. The data revealed that Mandi district has generated the highest persondays in the last three years followed by district Kangra. In a nutshell, we can say that both at national and state levels, women participation in MGNREGA is increasing with the passage of time and they are sharing financial burden with men in shouldering family responsibilities. However, a need is felt to improve awareness amongst women and timely payments to beneficiaries will add fillip to success of the scheme.*

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## Introduction

*Gandhi ji once said, "In a country like India women are the part and parcel of the vast Indian society. They should be alerted with proper education and also they should be entrusted with all sorts of jobs as per their physical ability."*

According to the United Nations Millennium Campaign the overwhelming majority of the labour that sustains life-growing food, cooking, raising children, caring for the elderly, maintaining a house, hauling water—is done by women and universally this work is accorded low status and no pay. The role of women in protecting the family members from hunger and poverty had been highlighted by Rosi Braidotti (1994)<sup>1</sup> and Caroline Moser (1989)<sup>2</sup> According to them, in 1980s, the international economic conditions and debt crisis led to increasing poverty among people in the south which was termed as "feminization of poverty". An increasing number of women became providers of family subsistence, while men often migrated in search of employment. In many societies around the world, women never belong wholly to themselves; they are the property of others throughout their lives. Their physical well-being—health, security and bodily integrity—is often beyond their own control. Where women have no control over money, they cannot choose to get health care for themselves or their children.

No one knows that how many women work in domestic services in India. Official figures suggest 5 million. A study assesses the number at 40 million and the international labour office (ILO) recons it somewhere between 20 and 80 million. If it is true than it indicates that up to ten percent of the female population above 12 years of age are employed in domestic services. There has never been a systematic count, although it is the second largest employer of women after agriculture labour. Invisible, unregulated, poorly paid, even a definition of domestic servant proves elusive and contradictory.

Helpless girls from the tribal regions are especially in demand. They are simple, innocent and crucially without a support structure. So abuse is rarely reported. Often the parents have no idea where the girls have been taken by agencies and, being illiterate, they are open to all sorts of exploitations. A survey in Mumbai two years back found nearly 60,000 girls (age between 5-14) employed as domestic workers.<sup>3</sup>

### **Women Empowerment**

Women comprise almost half of the population so without their upliftment and progress, there cannot be true development in the world. It is also obvious that greater gender inequality undermines the process of economic development of the developing and the underdeveloped countries. So it is dire need for equality and empowerment of women in the society. Women empowerment is a multi-faceted concept involving varied dimensions such as political, social, economic, legal and cultural etc.<sup>4</sup> Women empowerment has been emphasized since the ninth Five Year Plan. The social development and women-centric initiatives have made some dent in reducing the gender imbalances at the household and community levels. As most of the rural (poor) women earn their livelihoods largely from agriculture and allied activities as workers, the gainful employment opportunities from this sector and improvements in labour market functioning are expected to enhance the socio-economic status of women. But rise in unemployment and underemployment of rural women is cause of concern. The gender disparities prevailing in our rural society have been adversely affecting the quality of life of rural women. The launching of gender sensitive, demand-led and massive wage employment programme, i.e., MGNREGA has the potential to correct the anomalies in labour market functioning as also the gender based discrimination.

The term "women empowerment" essentially means that the women have the power or capacity to regulate their day-to-day lives in the social, political and economic terms—a power which enables them to move from the periphery to the centre stage. When women have economic empowerment, others see them as equal members of society. Through this, they achieve more self-respect and confidence by their contributions to their communities. When women have the capacity of doing what she wants, a higher equality between men and women is established. The national commission for women was set up by an Act of parliament in 1990 to safeguard the rights and legal entitlements of women. The 73<sup>rd</sup> and 74<sup>th</sup> Amendment

(1993) to the constitution of India have provided for reservation of seats in the local bodies of Panchayats and Municipalities for women, laying a strong foundation for their participation in decision making at the local level.

The Constitution of India guarantees to all Indian women equality (Article 14), no discrimination by the State (Article 15(1)), equality of opportunity (Article 16), and equal pay for equal work (Article 39(d)). Women today are demanding their position in the society. Women have become much aware of sexual inequalities in every sphere of existence and are in search of ways to battle them. In view to achieve this women empowerment various initiatives and policies have been launched from time to time, among them MGNREGA is one of them.

### **MGNREGA Inception**

In an era of growing globalization and rising inequality, the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) stands out as a unique attempt to provide a social safety net via a massive public works programme. The MGNREGA is a scheme in post-independence period of our country which raised hopes in the minds of poor and unemployed people to earn something. It is one of the most ambitious schemes launched by India on 2<sup>nd</sup> February 2006 in 200 poorest districts of the country, which mandate to provide at least 100 days of guaranteed wage employment to every rural household in a financial year whose adult member volunteer to do unskilled manual work. The Act was notified in 200 rural districts in its first phase of implementation w.e.f. 2<sup>nd</sup> February 2006. In financial year 2007-08, it was extended to an additional 130 districts. The remaining districts were notified under MGNREGA w.e.f. 1<sup>st</sup> April 2008. Presently MGNREGA is working in entire rural area of the country which covers 28 states, 7 union territories, 619 districts, 6,096 villages and 2.65 lakh gram Panchayats. The data indicated that MGNREGA has been scattered throughout the country and showing good results and the fact is that now it has become the world's largest employment generation scheme. It is pertinent to mention that one of the major goals of MGNREGA has been to target the weaker sections, including women. So the present paper is an attempt to assess the access and impact of MGNREGA on status of women.

### **Objectives and Methodology**

- To examine the participation of women in MGNREGA in India in general and H.P. in particular.

In light of the objectives, the secondary data has been

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collected from the official website of government, MGNREGA related books, articles published in reputed newspapers, magazines and journals and official reports. An attempt has been made to analyse the trend in terms of persondays generated, percentage women share, with the help of percentage method.

### ***Women Empowerment and MGNREGA- Literature Review***

Empowerment of women is closely linked to the opportunities they have in education, health and economic and political participation. Government has been operationalizing this approach through legislative and programmatic interventions as well as by mainstreaming gender into the developing planning process. As part of economic participation, MGNREGA is vital in its importance. It is to be noted that MGNREGA is not designed with the objective of promoting gender equality. As far as women's role in MGNREGA is concerned, it offers 33 percent employment to women, guarantees child care facility at the worksite and provides scope to participate in planning and implementation of MGNREGA and in conducting social audit as members of Gram Sabha and of Gram Panchayat.<sup>6</sup> In fact, a large number of studies have shown that women have benefited under MGNREGA in many ways (Khera and Nayak: 2009, Datar: 2008, Pankaj and Tankha: 2010, Sudarshan: 2009, Hanumantha Rao: 2008). These studies have shown that women have participated in MGNREGA on a large scale in most states in India and received equal wages as men and earned incomes of their own. Single women households or female-headed households have particularly benefited by MGNREGA as it provided them minimum incomes and food security and they are now participating in decision making as well.

In the area of economic empowerment, there is no doubt that MGNREGA has made dramatic changes in the economic status of women in the village. It has provided employment to women in more than half the households in the village at a wage rate that is much higher than the prevailing wage rate in the local economy. About 64 percent of MGNREGA workers were full time housewives before MGNREGA came into force, and the remaining women were employed in scattered casual work in agriculture (mainly weeding, transplanting and harvesting paddy) and in other manual work. About 80 per cent of women working under MGNREGA and consequently having their own bank account, and have direct control over their earning and moreover, have started to move freely in

society and taking their decision.<sup>6</sup>

The survey data suggests that women workers are more confident about their roles as contribution to family expenditure and their work decision; they are also becoming more assertive about their space in the public sphere. The significant contribution of MGNREGA is that it has removed these constraints as the wage employment was made available within or closer to the village. It has provided them with an opportunity to earn and forgo their other familiar obligations. Examining the response from widows separately, MGNREGA was also considered very important scheme as more than two third (69%) of the sample workers stated that MGNREGA helped them to avoid hunger, while 57 percent stated that MGNREGA helped them avoid migration and equal proportion of workers also said they used MGNREGA wages to buy medicines in the last 12 months.<sup>7</sup> According to Thomes, EM. (2005)<sup>8</sup> all the women workers are fully satisfied with MGNREGA works. The main reason for their satisfaction is that; today they are assured of 100 days of jobs. It means that no longer they need to fear regarding the occurrence of seasonal unemployment and poverty. Likewise all of them unanimously opine that the MGNREGA enabled them to participate effectively in the civil society. Now, they have no fear in entering a commercial bank or government office to hold discussions with the officials. The overall impact of MGNREGA on women's life is quite positive in many ways, whether it is by enhancing their economic independence and self-confidence, contributing to food security, helping to reduce distress migration, or fostering better awareness (and wider enforcement) of minimum wages. The role of MGNREGA as a tool of women's empowerment deserves much more attention than it has received so far. Account payment of wages also creates some other effects. Apart from increasing the changes for greater control over earnings, it leads to the development of a saving habit. Initially, most of these workers used to withdraw their entire wages at one go. Gradually, they have started withdrawing as per their needs. This has added to advantages as women are able to save money from wasteful expenditure, if husbands or other male members tend to spend on items like liquor. Women were also found to invest in fixed deposit schemes in the same bank.<sup>9</sup>

Richard Mahapatra (2010) mentions that unique features of the public wage programme turned it into a magnet for women. More women than men work under the national programme that guarantees work to rural people. Their participation has been growing since the

inception of MGNREGA in 2006. In Kerala, Tamil Nadu and Rajasthan, history of women mobilization for schemes and campaigns for social audits, in which women play a major role, has contributed to enhanced awareness and increased participation under MGNREGA. The State's MGNREGA worksites have good facilities for children and women. In Kerala, management of worksites and other logistics for implementation is placed in the hands of women self-help groups under the poverty eradication mission, Kudumbasree.<sup>10</sup> This study entitled, "Socio-economic impacts of Implementation of MGNREGA" by Council for Social Development, 2010, noted an increase in the frequency of gram sabha meeting in most of the places in the post MGNREGA situation. There has been a significant improvement in the participation of women in almost all the places.<sup>11</sup>

Pankaj and Tanka (2010) examined the facts of MGNREGA on rural women empowerment in Bihar, Jharkhand, Rajasthan and Himachal Pradesh. They found that women workers have gained from this scheme primarily because of paid employment opportunities and benefits have been realized through income-consumption effects, household effects and the enhancement of choice and capability. A study conducted by the "National Federation of Indian Women (2008)" on "Socio-economic Empowerment of Women under MGNREGA" in selected districts of Chhattisgarh, Madhya Pradesh, Odisha and Tamil Nadu that there was enhanced women's identity and empowerment as MGNREGA provided an economic opportunity. Respondents in all the states have been found to be very optimistic about the importance of MGNREGA in their lives. Another aspect of understanding MGNREGA is the growing contribution of women workers to the sources of their household's livelihood. The study reveals that in spite of all the grey areas in the implementation of MGNREGA, a silent revolution is taking place in rural India with respect to women in disguise.<sup>12</sup> MGNREGA is one of the most progressive legislation enacted since

independence. It is the first ever law internationally, that guarantees wage employment at unprecedented scale. The primary objectives of the Act are augmenting wage employment. In a country where labour is the only economic asset, the provision of gainful employment for millions of people is a pre requisite for the fulfilment of other basic right, right to life, right to food and the right to education. Another study reveals that women on an average spend four hours per day to fetch water, walk 7 km/day to gather fuel and majority of their remaining time in cooking and looking after children.

### **Women Participation in MGNREGA in India- Changing Scenario**

MGNREGA plays a significant role to meet the practical as well as strategic needs of women's participation. There are various factors which encourage the women worker's participation under this scheme. Some of them are like nature of work, limited hours of work, availability of work locally within the radius of 5 kilometres and substantial jump in the wage rate, etc. Participation of women varies widely across states. Women workforce participation under the Scheme has surpassed the statutory minimum requirement of 33 percent. At the national level women participation has increased significantly to 54.76 percent in 2014–15 as compared to 52.8 in FY2013–14 and 51.3 in FY 2012–13. The Act stipulates that priority shall be given to women. In terms of implementation it mandates that a minimum of one-third of the beneficiaries are women who have registered and requested for work. However, there should be gender equality in participation in MGNREGA. The Act also provides some explicit entitlements for women to facilitate their full participation which includes equal wages for men and women, participation in management and monitoring of the programme, participation in social audit, providing support for child care and convenience to households and by recognizing a single person as a 'household', the Act makes it possible for widows and other single women to access for work. The details about

**Table 1: MGNREGA at a Glance in India: Recent Trends**

Indicators	2012-13	2013-14	2014-15
Persondays Generated so far (in Crore)	230.41	220.36	162.71
Women Persondays out of Total (%)	51.3	52.8	54.76
Total Households Worked (in Crore)	4.99	4.79	4.1
Total Individuals Worked (in Crore)	7.97	7.39	6.16
% of Men Worked	52.93	52.03	49.76
% of Women Worked	47.07	47.97	50.24

Source: [http://mnregaweb4.nic.in/netnrega/all\\_lvl\\_details\\_dashboard\\_new.aspx](http://mnregaweb4.nic.in/netnrega/all_lvl_details_dashboard_new.aspx),

emerging trends of MGNREGA women beneficiaries have been discussed below with the help of table.

It is clear from Table 1 that women have generated 54.76% persondays in FY 2014-15 which was 52.8% in FY 2013-14 and 51.3% in FY 2012-13 throughout the country. So the participation of women in MGNREGA

seems to be increasing over the previous years. Again the table shows that total 6.16 crore individuals have worked in MGNREGA in FY 2014-15 in which women constitute 50.24% participation, 7.39 crore worked in FY 2013-14 in which women participation was 47.97% and in FY 2012-13, 7.97 crore worked under the MGNREGA in

**Table 2: Number of Persondays Generated by Women in MGNREGA in India**

SN	State	No. of Persondays Generated (in Lakh)			% of Persondays Generated (in Lakh)		
		2011-12	2012-13	2013-14	2011-12	2012-13	2013-14
1	Andhra Pradesh	1599.58	1909.54 (19.37)	1756.563 (-8.01)	15.70	16.15 (2.86)	15.09 (-6.56)
2	Arunachal Pradesh	0.21	13.16 (6166.6)	11.095 (-15.7)	0.002	0.11 (5400)	0.095 (-13.63)
3	Assam	88.07	81.691 (-7.24)	73.875 (-9.5)	0.86	0.69 (-19.76)	0.63 (-8.69)
4	Bihar	179.49	288.522 (60.74)	301.521 (4.5)	1.76	2.44 (38.63)	2.59 (6.14)
5	Chhattisgarh	548.83	560.547 (2.13)	630.359 (12.45)	5.38	4.74 (-11.89)	5.41 (14.13)
6	Goa	2.35	0.542 (-76.93)	0.868 (60.14)	0.02	0.004 (-80)	0.007 (75)
7	Gujarat	140.75	120.829 (-14.15)	101.244 (-16.2)	1.38	1.02 (-26.08)	0.88 (-13.72)
8	Haryana	39.7	51.367 (29.38)	49.173 (-4.27)	0.38	0.43 (13.15)	0.42 (-0.23)
9	Himachal Pradesh	155.37	159.06 (2.37)	176.604 (11.02)	1.52	1.34 (-11.84)	1.51 (12.68)
10	Jammu & Kashmir	28.76	72.69 (152.74)	78.291 (7.70)	0.28	0.61 (117.85)	0.67 (9.83)
11	Jharkhand	188.06	185.306 (-1.46)	139.131 (-24.91)	1.84	1.56 (-15.21)	1.19 (-23.71)
12	Karnataka	321.32	285.744 (-11.07)	334.917 (17.2)	3.15	2.41 (-23.49)	2.87 (19.08)
13	Kerala	586.75	779.047 (32.77)	808.593 (3.79)	5.75	6.59 (14.60)	6.95 (5.46)
14	Madhya Pradesh	671.42	593.331 (-11.63)	524.389 (-11.61)	6.59	5.01 (-23.97)	4.50 (-10.17)
15	Maharashtra	299.43	388.618 (29.78)	226.01 (-41.84)	2.93	3.28 (11.94)	1.94 (-40.85)
16	Manipur	68.63	96.957 (40.75)	39.909 (-58.83)	0.67	0.82 (22.38)	0.003 (-99.63)
17	Meghalaya	67.24	71.592 (6.47)	89.828 (25.47)	0.66	0.60 (-9.09)	0.77 (28.33)

*To be continued....*

...continuation from

SN	State	No. of Persondays Generated (in Lakh)			% of Persondays Generated (in Lakh)		
		2011-12	2012-13	2013-14	2011-12	2012-13	2013-14
18	Mizoram	29.01	40.159 (38.43)	40.363 (0.5)	0.28	0.03 (-89.28)	0.34 (1033.33)
19	Nagaland	57.96	63.804 (10.08)	53.179 (-16.65)	0.56	0.53 (-5.35)	0.45 (-15.09)
20	Odisha	175.36	196.251 (11.91)	238.941 (21.75)	1.72	1.66 (-3.48)	2.05 (23.49)
21	Punjab	27.83	30.292 (8.84)	71.027 (134.47)	0.27	0.25 (-7.40)	0.61 (144)
22	Rajasthan	1458.01	1519.05 (4.18)	1245.758 (-17.99)	14.31	12.85 (-10.20)	10.70 (-16.73)
23	Sikkim	14.65	15.872 (4.18)	19.749 (24.42)	0.14	0.13 (-7.14)	0.16 (23.07)
24	Tamilnadu	2231.01	3026.42 (35.65)	3086.822 (1.98)	21.09	25.60 (21.38)	26.53 (0.36)
25	Telangna	-NIL-	-NIL-	-NIL-	-NIL-	-NIL-	-NIL-
26	Tripura	189.43	211.165 (11.43)	245.647 (16.32)	1.85	1.78 (-3.78)	2.11 (18.53)
27	Uttar Pradesh	454.63	278.112 (-38.82)	388.732 (39.77)	4.46	2.35 (-47.30)	3.34 (42.12)
28	Uttarakhand	84.86	90.097 (6.17)	74.33 (-17.5)	0.83	0.76 (-8.43)	0.63 (-17.1)
29	West Bengal	465.08	680.468 (46.31)	816.015 (19.91)	4.56	5.75 (26.09)	7.01 (21.91)
30	Andaman and Nicobar	3.75	2.983 (-21.48)	3.781 (26.75)	0.036	0.025 (-30.55)	0.032 (2.8)
31	Dadra & Nagar Haveli	0	0(0)	0(0)	0	0(0)	0(0)
32	Daman & Diu	0	0(0)	0(0)	0	0(0)	0(0)
33	Chandigarh	0	0(0)	0.001(0)	0	0(0)	0(0)
34	Lakshadweep	0.58	0.144 (-75.17)	0.032 (-77.77)	0.005	0.00 (-80)	0.0002 (-80)
35	Pondicherry	8.68	7.287 (-16.04)	7.24 (-0.64)	0.085	0.061 (-28.23)	0.062 (1.63)
	Total	10186.8	11820.667 (1.60)	11633.98 (-1.57)	100%	100%	100%

Source: [http://164.100.129.6/netnrega/MISreport4.aspx?fin\\_year=2013-2014&rpt=RP](http://164.100.129.6/netnrega/MISreport4.aspx?fin_year=2013-2014&rpt=RP), GoI, MoRD, 26-12-2014

which women participation was 47.07%. So it is stated that since FY 2012-13 to FY 2014-15 women have participated significantly and have shown their interest to participate under MGNREGA.<sup>13</sup>

By putting cash incomes into hands, MGNREGA is beginning to create a greater degree of economic independence among women. The survey data (both qualitative and quantitative) suggest that women workers

are more confident about their roles as contribution to family expenditure and their work decision, and that they are also becoming more assertive about their space in the public sphere. More than half of the respondents felt that the MGNREGA has brought a significant change in their village as well as in their own lives. This is because employment is being provided within their village, generating community assets and enhancing their spending capacity.

Table 2 shows the total no. of persondays generated by women and their respective ratio throughout the country. The data in brackets indicates the percentage change over the year. So it is clear from the table that in FY 2013–14 and 2012–13 Tamil Nadu is the most leading state in the country to generate highest number of persondays followed by Andhra Pradesh and Rajasthan in both the years. The union territory like Daman and Diu, Dadra and Nagar Haveli and Chandigarh showed no women participation in MGNREGA. If participation exists it was very less. Again the table indicates that Punjab has shown tremendous improvement in terms of persondays generation by women as it was 8.84 percent in FY 2012–13 which have increased to 134.47 percent in FY 2013–14. Similarly, the states likes Uttar Pradesh (-38.42% in 2012–13 to 39.77% in 2013–14), Karnataka (-11.07% in 2012–13 to 17.2% in 2013–14) and Himachal Pradesh (2.37% in 2012–13 to 11.02% in 2013–14) have shown that total no. of persondays generated by women have increased significantly. But some states like Arunachal Pradesh, Haryana, Maharashtra and Uttarakhand showed the decreased level of persondays generated over the year by women in MGNREGA.

Table 2 also shows the percentage of women's participation in MGNREGA. It is clear from the table that in FY 2013–14 and FY 2012–13, Tamil Nadu was most leading state in which women were generated highest 26.53% Persondays followed by Andhra Pradesh(15.09% & 16.15%) and Rajasthan (10.70% & 12.85%). Whereas UTs like Dadra and Nagar Haveli, Daman and Diu and Chandigarh generated no persondays of women through MGNREGA.

### **Women Participation in MGNREGA in H.P – Changing Scenario**

Himachal Pradesh is predominantly a hilly state where 90 percent of its population is living in villages. The state consists of 12 districts, 82 tehsils, 77 blocks and 3243 panchayats. The total population of the state is 6,856,509

which consist of total 17,495 households as per 2011 census. Here, 70 percent of the population depends on agriculture and horticulture for their livelihood and these sectors are the major sources of employment and income.

In Himachal Pradesh, MGNREGA was firstly introduced in two poor districts Sirmour and Chamba on 2<sup>nd</sup> February 2006. In the second phase MGNREGA was started in district Kangra and Mandi on 1<sup>st</sup> April 2007 and in the third phase all the remaining eight districts of the state have been covered under the scheme w.e.f. 1<sup>st</sup> April 2008. It is felt that MGNREGA scheme is contributing to engage local adult men and women to provide the employment with livelihood security by generating durable assets. The details explanation about emerging trends of MGNREGA women beneficiaries have been discussed below with the help of table.

It is clear from Table 3 that women have generated 61.18% persondays in FY 2014–15 which was 62.52% in FY 2013–14 and 60.69% in FY 2012–13 in the state. So the participation of women in MGNREGA seems to be increasing over the previous years. Again the table shows that total 5.68 lakh individuals have worked in MGNREGA

**Table 3: MGNREGA at a Glance in Himachal Pradesh: Recent Trends**

Indicators	2012–13	2013–14	2014–15
Persondays Generated so far (in Lakh)	262.1	282.5	186.11
Women Persondays out of Total (%)	<b>60.69</b>	<b>62.52</b>	<b>61.18</b>
Total Households Worked (in Lakh)	5.15	5.39	4.47
Total Individuals Worked (in Lakh)	6.44	6.82	5.68
% of Men Worked	43.42	42.41	41.91
% of Women Worked	<b>56.58</b>	<b>57.59</b>	<b>58.09</b>

Source: [http://mnregaweb4.nic.in/netnrega/all\\_lvl\\_details\\_dashboard\\_new.aspx](http://mnregaweb4.nic.in/netnrega/all_lvl_details_dashboard_new.aspx)

in FY 2014–15 in which women constitute 58.09% participation, 6.82 lakh worked in FY 2013–14 in which women participation was 57.59% and in FY 2012–13, 6.44 lakh worked under the MGNREGA in which women participation was 56.58%. So it is stated that since FY 2012–13 to FY 2014–15 women have participated significantly and have shown their interest to participate

under MGNREGA.

Table 4 shows the data pertaining to Himachal Pradesh. The data in brackets show the percentage change over the previous year. It shows that in the state through MGNREGA 176.60 lakh persondays have been generated in FY 2013–14, 159.05 lakh in FY 2012–13 and 118.8 lakh persondays were generated in FY 2011–12. It again shows that the district Mandi generated highest persondays in the last three years which was 56.49 lakh in FY 2013–14, 54.69 lakh in FY 2012–13 and 40.6 lakh persondays in FY 2011–12 followed by Kangra district

which was 40.81 lakh in FY 2013–14, 31.49 lakh in FY 2012–13 and 29.22 lakh in FY 2011–12. The district Lahul & Spiti generated least persondays of women through MGNREGA in the state. Table 4 also represent the percent wise data of persondays generated by women in the state. It shows that Mandi is the leading district in the state where women have generated highest no of persondays which was 31.99% in FY 2013–14, 34.38% persondays in FY 2012–13 and 21.50% in FY 2011–12 followed by Kangra district which constitute 23.11% in FY 2013–14, 19.79% in FY 2012–13 and 24.59% in FY 2011–12.

Table 4: Number of Persondays Generated by Women in MGNREGA in H.P

SN	Districts	Women Population 2011 Census	No. of Persondays Generated (in Lakh)			% of Persondays Generated		
			2011–12	2012–13	2013–14	2011–12	2012–13	2013–14
1	Bilaspur	189229	2.19	6.94 (216.89)	7.80 (12.39)	1.84	4.36 (136.95)	4.41 (1.14)
2	Chamba	257996	9.26	17.26 (86.39)	16.20 (-6.14)	7.79	10.85 (39.28)	9.17 (-15.48)
3	Hamirpur	237551	7.43	9.28 (24.89)	10.22 (10.14)	6.50	5.83 (-10.30)	5.78 (-0.85)
4	Kangra	758664	29.22	31.49 (7.76)	40.81 (29.62)	24.59	19.79 (-19.52)	23.11 (16.18)
5	Kinnaur	37934	2.03	2.55 (25.61)	3.55 (39.12)	1.70	1.60 (-5.88)	2.01 (25.62)
6	Kullu	213154	7.45	9.79 (31.40)	12.20 (24.62)	6.27	6.15 (-1.91)	6.90 (12.19)
7	Lahul & Spiti	15073	0.68	0.78 (14.70)	1.06 (35.02)	0.36	0.49 (36.11)	0.60 (22.44)
8	Mandi	502731	40.6	54.69 (34.45)	56.49 (3.29)	21.50	34.38 (59.90)	31.99 (-6.95)
9	Shimla	388898	7.94	11.23 (41.43)	10.68 (-4.95)	6.68	7.06 (5.68)	6.04 (-14.44)
10	Sirmour	253363	3.03	4.82 (59.07)	5.80 (20.31)	2.55	3.03 (18.82)	3.28 (0.82)
11	Solan	270508	4.68	4.92 (5.12)	5.13 (4.34)	2.47	3.09 (25.10)	2.90 (-6.14)
12	Una	257516	4.28	5.26 (22.89)	6.61 (25.63)	3.60	3.30 (-8.33)	3.74 (13.33)
	Total	3382617	118.8	159.05 (33.83)	176.60 (11.02)	100%	100%	100%

Source: [http://164.100.129.6/netnrega/state\\_html\\_empstatusnewall\\_scst.aspx?page=S&lflag=eng&state\\_name=HIMACHAL+PRADESH&state\\_code=13&fin\\_year=2013-2014&source=national&Diges\\_t=/HGjgWohFVdRn4h0jiJqGg](http://164.100.129.6/netnrega/state_html_empstatusnewall_scst.aspx?page=S&lflag=eng&state_name=HIMACHAL+PRADESH&state_code=13&fin_year=2013-2014&source=national&Diges_t=/HGjgWohFVdRn4h0jiJqGg)

Again percentage change over the year data indicates that the districts like Mandi (7.76% in FY 2012–13 to 29.62 in FY 2013–14), Lahul & Spiti (14.70% in 2012.13 to 35.02% in FY 2013-14) and Una (from 22.89% in FY 2012–13 to 25.63% in FY 2013–14) have increased the no of persondays over the previous year. But some districts like Bilaspur (216.89% in FY 2012–13 to -4.95% in FY 2013–14), Chamba (86.39% in FY 2012–13 to -6.14% in FY 2013–14) and Shimla (41.43% in FY 2012–13 to -4.95% in FY 2013–14) have shown poor participation of women in terms of persondays generation where the participation have fallen as compared to previous year.

#### 4. Observations, Conclusion and Suggestions

From the data and findings it is concluded that MGNREGA has become a powerful instrument for women empowerment in rural India through its impact on social protection, livelihood security and democratic governance. The data indicated that MGNREGA has scattered throughout the country and showing good results and matter of the fact is that now it has become the world's largest employment generation scheme. MGNREGA has become an important work opportunity for women who would have otherwise remained unemployed or underemployed. Independent and monetized earning have increased their consumption choices and reduced economic dependence.

It is observed that in the year 2014-15 Tamilnadu has the highest women participation rate at 26.99% in Persondays generation while Daman and Diu, Dadra and Nagar Valley and Chandigarh have shown lowest participation. It is felt that MGNREGA scheme is contributing to engage local adult men and women to provide the employment with livelihood security by generating durable assets. Also in Himachal Pradesh it has been observed that MGNREGA scheme is working in all the districts and Mandi is the most leading district in terms of employment providing to women followed by Kangra. So MGNREGA is proving to be an important scheme for women empowerment throughout the country. Thus, it is said that both at national and state level women participation is increasing with the passage of time and then are sharing financial burden with males. It is concluded that MGNREGA is contributing significantly in empowering women in rural areas especially a hill state like H.P. But a need is felt to ensure timely payment of wages in view to attain the objectives of MGNREGA in practice.

For the empowerment of women it is suggested that the government should run awareness programme for rural women so that they could know the important provisions made for them in MGNREGA and payments be made through bank accounts only and on time in particular. It may be proposed that other local need based women friendly tasks may be included so that more women folk may be covered in the umbrella of MGNREGA and consequent they may have more economic and decision freedom.

#### References

- Beg Ahmad Masroor (2014), *"Economic empowerment of women in India with Special reference to MGNREGA"*, Edited Book, MGNREGA: empowering rural poor through wage employment, 2014, pp: 81-95.
- Council for Social Development (2010). *The study on Socio-Economic Impacts of Implementation of Mahatma Gandhi NREGA.*
- Mahapatra Richard (2010). "How Women Seized NREGA", <http://www.downtoearth.org.in/node/2282>
- Khera, Reetika and Nayak, Nandini. (2009). "Women Workers and Perceptions of the National Rural Employment Guarantee Act", *Economic & Political Weekly*, xliv no 43 OCTOBER 24.nrega.nic.in
- Mallick Anupriyo (2013). "Plight of Women Domestic Workers in India", *kurukshetra*, vol.61, no.4, February 2013, p:16.
- Moser, Carline O.N. (1989). "Gender Planning in the Third World: meeting Practical and Strategic Gender Needs", *World Development Vol. 17-11.*
- Pangannavar, A. Y. (2012). *"Self-Help Group and Women Empowerment in India, New Century Publications"*, New Delhi.
- Pankaj, Ashok, Tankha and Rukmini. (2010). "Empowerment Effects of the NREGS on Women Workers: A Study in Four States", *Economic & Political Weekly*, July 24.
- Pankaj and Tankha (2010). "Empowerment Effects of the NREGS on Women Workers: A Study in Four States", *Economic and Political Weekly*, July 24, 2010, pp. 45-55.
- Rosi Bradiotti et al. (1994). *"The Environment and Sustainable Development: Towards the Theoretical Synthesis"* Zed Books, London.
- Sharma, A. (2012). "SC/ST Employment Guarantee: Women's Empowerment in Rural India by MGNREGA", *International Journal of Human Development and Management Sciences*, Vol. No.1, January-December 2012, ISSN: 2250-8714, Mind Reader Publications.
- Thomas, E.M (2005). "The Relevance of NREGA in Ensuring a Corruption Less Wage Employment Programme and Women Empowerment - A Case Study", *Network of Asia Pacific*

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School and Institute of Public Administration and Governance, Research Paper, September 7, 2005.

[http://www.napsipag.org/pdf/EM\\_THOMAS.pdf](http://www.napsipag.org/pdf/EM_THOMAS.pdf)

[http://mnregaweb4.nic.in/netnrega/all\\_lvl\\_details\\_dashboard\\_new.aspx](http://mnregaweb4.nic.in/netnrega/all_lvl_details_dashboard_new.aspx), 30-12-2014.

[http://164.100.129.6/netnrega/MISreport4.aspx?fin\\_year=2013-2014&rpt=RP](http://164.100.129.6/netnrega/MISreport4.aspx?fin_year=2013-2014&rpt=RP) Gol, MoRD, 26-12-2014

[http://164.100.129.6/netnrega/MISreport4.aspx?fin\\_year=2013-2014&rpt=RP](http://164.100.129.6/netnrega/MISreport4.aspx?fin_year=2013-2014&rpt=RP), Gol, MoRD, 26-12-2014

[http://164.100.129.6/netnrega/state\\_html/empstatusnewall\\_scst.aspx?page=S&lflag=eng&state\\_name=HIMACHAL+PRADESH&state\\_code=13&fin\\_year=2013-2014](http://164.100.129.6/netnrega/state_html/empstatusnewall_scst.aspx?page=S&lflag=eng&state_name=HIMACHAL+PRADESH&state_code=13&fin_year=2013-2014)

[http://164.100.129.6/netnrega/state\\_html/empstatusnewall\\_scst.aspx?page=S&lflag=eng&state\\_name=HIMACHAL+PRADESH&state\\_code=13&fin\\_year=2013-2014](http://164.100.129.6/netnrega/state_html/empstatusnewall_scst.aspx?page=S&lflag=eng&state_name=HIMACHAL+PRADESH&state_code=13&fin_year=2013-2014)

*We were not thinking about numbers then, but we knew something big can be built out of e-commerce.*

*—Binny Bansal and Sachin Bansal*

# Research Output on Food and Nutrition Literature in India and China: A Scientometric Study

R. JEYSHANKAR

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*This study attempts to quantify the growth and development of food and nutrition research in India and China in terms of publication output as reflected from SCOPUS database. This study covered in India has 1,321 records and China has 1,045 records during the period of 1983 – 2012. It also analyzed the Relative Growth Rate, Doubling Time, Authorship Pattern, degree of Collaboration, Co-Authorship Index, Length of Papers, Mostly Cited Journals and Active Institutions in India and China. The study displayed the ranking list of most cited journals in India-Journal of Nutrition had 599 (10.48 percent)– followed by China-Nutrition Journal had 699 (12.83 percent)– and China had contributed more number of multi authored papers when compared to India (86.79 percent vs. 60.71 percent), followed by two authored papers which were mostly presented in India as compared to China (23.62 percent vs. 9.19 percent). This study also examined the active research institutions in this field in both the countries. This study used various scientometric indicators and related statistical tools.*

## Introduction

Scientometrics is an emerging thrust area of research in the field of Library and Information Science. It is a tool by which the state of science and technology can be observed through the traces of communication in the science technology system, most notably the published documents which comprise books, monographs, reports, theses, papers in serials, and periodicals (Seeman, 2013). Scientometrics is defined as the application of those quantitative methods which deal with the analysis of science viewed as information process. Pritchard (1969) described the bibliometrics as the application of mathematics and statistical methods to books and other media. Scientometrics applies the bibliometric techniques to science and examines the development of the sciences (Rajendran and Elango, 2011). Various aspects of nutrition research in Bangladesh from 1972 to 2006 have been analyzed using bibliometrics (Zabed Ahmed and Rahman, 2008). The term scientometrics is often used with the meaning as bibliometrics, originated in Russia. The bibliometric/scientometric/informetric techniques used to analyze various quantitative or qualitative aspects of a publication. It is a scientific field that studies the evolution of science through some quantitative measures of scientific information, as the number of scientific articles published in a given period of time, their citation impact, etc. (Diodato, 1994). Scientometricians explain the inputs and outputs resources in terms of organizational structure. They develop benchmarks to evaluate the quality of information resources and packages of information for decision making in science. It provides a key opportunity to the researcher to publish their articles with new strategies, innovations, new methods, and new ideas (Nattar, 2009). There have been many bibliometric studies of the literature in the sciences in the last 40 years. In

Chemical Information and Computer Sciences (CICS), a bibliometric approach was used to survey state-of-the-art of research. The *Journal of Chemical Information and Computer Sciences (JCICS)* has been the leading journal in this area for the last 30 years (Onodera, 2001).

### Objectives of the Study

The following objectives were formulated for the present study:

- To find out the research productivity in the field of food and nutrition (year-wise) during 1983–2012
- To analyze the authorship pattern and degree of collaboration
- To measure the length of papers
- To calculate author productivity and co-authorship pattern
- To find out active institutions in the field of study in India and China

### Materials and Methods

The present study covered 2,366 records (1983–2012) out of which 1,321 records in India and 1,045 records in China. The data was downloaded from Scopus database. Scopus is the largest abstract and citation database of research literature and quality web-only journals. It is designed to enable not only the researchers for accessing scientific information but provide information scientists to study the literature for different information analyses purposes. Scopus provides quick, easy, and comprehensive superior support of the research literature process. The collected data has been analyzed with MS excel spreadsheet and presented in the form of tables. Further, scientometric indicators such as Exponential Growth, Authorship pattern, Co-Authorship Index, Doubling Time, and Degree of Collaboration have been used.

### Scientometric Indicators

#### Relative Growth Rate

The Relative Growth Rate (RGR) is a measure to study the increase in the number of articles/pages per unit articles/pages per unit of time (Mahapatra, 1985). The RGR of articles over a specific period of interval is calculated mathematically as:

$$R(P) = \frac{\text{Log}_e 2^p - \text{Log}_e 1^p}{2^p - 1^p}$$

#### Doubling Time

The Doubling Time (DT) is defined as the number of publications/how the pages of a subject doubles during a given period; then the difference between the logarithm of the numbers at the beginning and at the end of the period must be the logarithms of the number 2. If one uses a natural logarithm, this difference has a value of 0.693. The corresponding doubling time for publications and pages can be calculated by using the following formula.

$$DT = \frac{0.693}{R}$$

#### Degree of Collaboration

The Degree of Collaboration of authors (year-wise) is shown in Table 5. The extent or degree of collaboration can be ascertained by the formula by K. Subramanian (1983). The degree of collaboration (collaboration coefficient) among authors is measured mathematically as:

$$C = \frac{Nm}{Nm + Ns}$$

Where,

C = degree of collaboration

Nm = number of multi authored papers

Ns = number of single authored papers

#### Co-Authorship Index

The Co-Authorship Index (CAI) is obtained by calculating proportionately the publication by single, two, and multi-authored papers.

$$CAI = \frac{N_{ij}/N_{io}}{N_{oj}/N_{oo}} * 100$$

Where,

N<sub>ij</sub> = Number of papers having authors in block I

N<sub>io</sub> = Total output of block I

N<sub>oj</sub> = Number of papers having J authors for all blocks.

N<sub>oo</sub> = Total number of papers for all authors and all blocks

#### Data Analysis

The literature growth occupies an important place in metric studies. Table 1 and Figure 1 depict the growth trend on Food and Nutrition (F&N) research literature output of India and China. India published a total of 1,321 research papers and China took out 1,045 research papers during the period 1983–2012. It is observed that both the countries show an increasing trend after 1983–1987.

Table 1: Food and Nutrition Literature Growth in India and China

	India				China		
	Block Period	Output	%	Cumulative %	Output	%	Cumulative %
1	1983-1987	32	2.42	2.42	5	0.48	0.48
2	1988-1992	53	4.01	6.43	11	1.05	1.53
3	1993-1997	80	6.06	12.49	39	3.73	5.26
4	1998-2002	168	12.72	25.21	81	7.75	13.02
5	2003-2007	468	35.43	60.63	350	33.49	46.51
6	2008-2012	520	39.36	100	559	53.49	100
	<b>Total</b>	<b>1,321</b>	<b>100</b>		<b>1,045</b>	<b>100</b>	

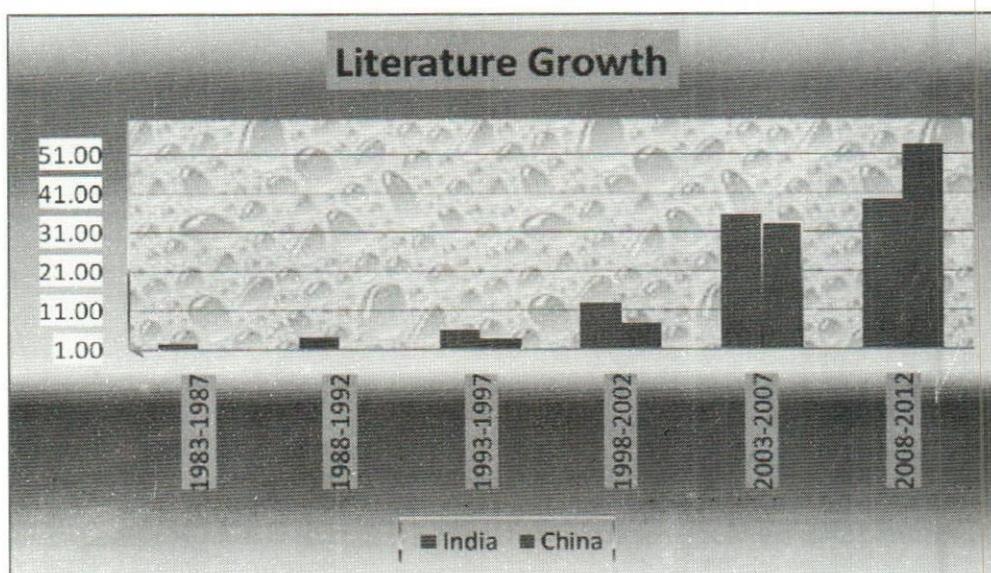


Figure 1: Literature Growth in India and China

Table 2: RGR and Doubling Time in F&N Research (India and China)

Block Period	Output	India				China				
		Log <sub>e</sub> 1 F	Log <sub>e</sub> 2 F	[R(P)]	DT	Output	Log <sub>e</sub> 1 F	Log <sub>e</sub> 2p	[R(P)]	DT
1983-1987	32	-	0.88	0.88	0.78	5	-	-0.73	-0.73	-0.94
1988-1992	53	0.88	1.86	0.98	0.71	11	-0.73	0.43	1.16	0.60
1993-1997	80	1.86	2.52	0.66	1.04	39	0.43	1.66	1.23	0.56
1998-2002	168	2.52	3.23	0.70	0.99	81	1.66	2.57	0.91	0.76
2003-2007	468	3.23	4.10	0.88	0.79	350	2.57	3.84	1.27	0.54
2008-2012	520	1.00	4.61	3.61	0.19	559	1.00	4.61	3.61	0.19

Table 3 shows the bibliographic forms of documents found in the collected records in India and China. It is evident that the journal is the most preferred medium of all the

forms. The largest number of the journal indicates a continued trend of primarily on this form of publication. Out of the total research literature output in F&N, 76.38

**Table 3: Bibliographic forms of Documents**

Sl. No	Type	No. of Research Output			
		India	%	China	%
1	Article	1,009	76.38	864	82.68
2	Conference Paper	171	12.94	85	8.13
3	Review	54	4.09	83	7.94
4	Short Survey	35	2.65	7	0.67
5	Article in Press	18	1.36	3	0.29
6	Letter	16	1.21	1	0.10
7	Note	12	0.91	1	0.10
8	Book	6	0.45	1	0.10
	<b>Total</b>	<b>1,321</b>	<b>100</b>	<b>1,045</b>	<b>100</b>

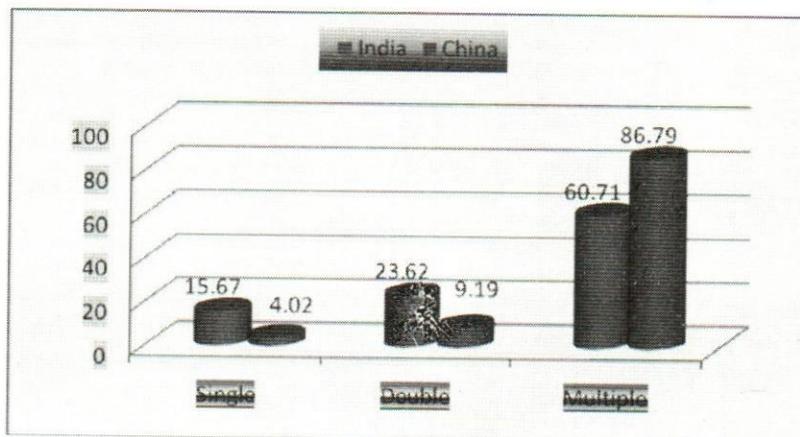
percent is in the form of articles in India and China with 82.68 percent; followed by 12.94 percent in India and 8.13 percent in China in the form of conference papers, while other forms perform a poor show with negligible numbers.

Table 4 and Figure 4 show multiple authorship with 60.71 percent of the total research literature output in India and 86.79 percent in China. This is followed by double authorship with 23.62 percent in India and 9.19 percent in China. Single authored publications record a score of 15.67 percent in India and 4.02 percent in China which is found to be less when compared to the other categories of authorship.

**Table 4: Authorship Pattern**

Sl.	Authorship	India		China	
		Count	%	Count	%
1	Single	207	15.67	42	4.02
2	Double	312	23.62	96	9.19
3	Multiple	802	60.71	907	86.79
	<b>Total</b>	<b>1,321</b>	<b>100</b>	<b>1,045</b>	<b>100</b>

Table 5 shows the degree of collaboration in (India) authorship trend, which works out to be 0.76 and above. It gives a picture of extent of collaborations among the authors. The degree of collaboration for different years has been calculated as per the formula proposed by



**Figure 2: Authorship Pattern in India and China**

**Table 5: Degree of Collaboration in India**

	Block Period	1 au	2 au	3 au	3+ au	DC	Total
1	1983–1987	18	32	11	13	0.76	74
2	1988–1992	8	25	14	33	0.90	80
3	1993–1997	16	28	19	17	0.80	80
4	1998–2002	30	51	35	79	0.85	195
5	2003–2007	52	112	118	157	0.88	439
6	2008–2012	57	120	132	144	0.87	453
	<b>Total</b>	<b>181</b>	<b>368</b>	<b>329</b>	<b>443</b>		<b>1,321</b>

**Table 6: Degree of Collaboration in China**

	Block Period	1 au	2 au	3 au	3+ au	DC	Total
1	1983–1987	0	2	2	1	1.00	5
2	1988–1992	2	1	2	3	0.75	8
3	1993–1997	4	5	5	28	0.90	42
4	1998–2002	5	12	19	47	0.94	83
5	2003–2007	10	28	64	246	0.97	348
6	2008–2012	20	49	72	418	0.95	559
	<b>Total</b>	<b>41</b>	<b>97</b>	<b>164</b>	<b>943</b>		<b>1,045</b>

**Table 7: Co-Authorship Index (CAI) in India**

	Block Period	Single Author	CAI	Two Authors	CAI	More than Two Authors	CAI	Total
1	1983–1987	18	177.53	32	155.23	24	55.50	74
2	1988–1992	8	72.98	25	112.18	47	100.53	80
3	1993–1997	16	145.97	28	125.64	36	77.00	80
4	1998–2002	30	112.28	51	93.88	114	100.04	195
5	2003–2007	52	86.45	112	91.58	275	107.19	439
6	2008–2012	57	91.83	120	95.09	276	104.25	453
	<b>Total</b>	<b>181</b>		<b>368</b>		<b>772</b>		<b>1,321</b>

Subramanian and is presented in Table 5. The degree of collaboration (China) over the years varies from 1.00 and the mean value is found to be 0.97 (Table 6).

For calculating the co-authorship index, the authors have been classified into three blocks, namely single, two,

and multiple authors and the period of the study has been divided into six blocks during the period 1983–2012. The results have presented for India and China in Tables 7 and 8, respectively.

Table 8: Co-Authorship Index (CAI) in China

	Block Period	Single Author	CAI	Two Authors	CAI	More Than Two Authors	CAI	Total
1	1983–1987	0	0.00	2	430.93	3	69.13	5
2	1988–1992	2	637.20	1	134.66	5	72.01	8
3	1993–1997	4	242.74	5	128.25	33	90.53	42
4	1998–2002	5	153.54	12	155.76	66	91.62	83
5	2003–2007	10	73.24	28	86.68	310	102.63	348
6	2008–2012	20	91.19	49	94.43	490	100.99	559
	<b>Total</b>	<b>41</b>		<b>97</b>		<b>907</b>		<b>1,045</b>

Table 9 displays the length of the papers in India and China. In India, 169 (12.79 percent) papers have the length of five pages, and in China 148 (14.16 percent) papers

Table 9: Distribution of Length of Papers in India and China

Sl. No	India			China	
	Page Length	Count	%	Count	%
1	1 page	53	4.01	18	1.72
2	2 pages	111	8.40	78	7.46
3	3 pages	153	11.58	98	9.38
4	4 pages	167	12.64	126	12.06
5	5 pages	169	12.79	148	14.16
6	6 pages	154	11.66	144	13.78
7	7 pages	108	8.18	118	11.29
8	8 pages	96	7.27	88	8.42
9	9 pages	84	6.36	70	6.70
10	10 pages	60	4.54	49	4.69
11	Between 10 and 20	128	9.69	91	8.71
12	Above 20 pages	38	2.88	17	1.63
	<b>Total</b>	<b>1,321</b>	<b>100</b>	<b>1,045</b>	<b>100</b>

have the length of five pages, followed by papers with four pages in India being at 167 (12.6 percent) and 126 (12.06 percent) in China. In India, 154 (11.66 percent) and in China 144 (13.78 percent) papers have the length of six pages.

Table 10 reveals the *Journal of Food Science and Technology* is ranked first (114 or 20.92 percent), followed by *Indian Pediatrics* with (60 or 11.01 percent). In China, *Asia Pacific Journal of Clinical Nutrition* ranks first (46 or 13.77 percent), followed by *Chinese Journal of Clinical Rehabilitation* at 38 (11.38 percent).

Table 11 displays the mostly cited journals in India and China. Out of the 1,321 articles in India, the first rank is secured by *Journal of Nutrition* 599 (10.48 percent), followed by *Journal of Medicinal Food* 495 (8.66 percent). Out of the 1,045 articles in China, the first rank is secured by *Nutrition* with 669, followed by *Journal of Nutrition* with 519 (9.96 percent) times.

Table 12 shows the top 10 research institutions in India and China. Further, it may be inferred that in India the National Institute of Nutrition India stands first with 110 research literature published, followed by the All India Institute of Medical Sciences with 57. In China, *China Agricultural University* stands first with 85 and Chinese Center for Disease Control and Prevention comes second with 82 publications in F&N research.

Table 10: Core Journals in India and China (Top 10)

INDIA		CHINA	
Name of the Journal	No. of Records	Name of the Journal	No. of Records
<i>Journal of Food Science and Technology</i>	114 (20.92%)	<i>Asia Pacific Journal of Clinical Nutrition</i>	46 (13.77%)
<i>Indian Pediatrics</i>	60 (11.01%)	<i>Chinese Journal of Clinical Rehabilitation</i>	38 (11.38%)
<i>Indian Journal of Pediatrics</i>	53 (9.72%)	<i>Poultry Science</i>	29 (8.68%)
<i>Indian Journal of Animal Sciences</i>	53 (9.72%)	<i>Journal of Nutrition</i>	29 (8.68%)
<i>Journal of Medicinal Food</i>	52 (9.54%)	<i>Journal of Medicinal Food</i>	27 (8.08%)
<i>Indian Journal of Medical Research</i>	38 (6.97%)	<i>American Journal of Clinical Nutrition</i>	26 (7.78%)
<i>Food and Nutrition Bulletin</i>	26 (4.7%)	<i>Archives of Animal Nutrition</i>	26 (7.78%)
<i>European Journal of Clinical Nutrition</i>	21 (3.85%)	<i>Public Health Nutrition</i>	17 (5.09%)
<i>British Journal of Nutrition</i>	20 (3.67%)	<i>Chinese Journal of Endemiology</i>	16 (4.9%)
<i>Indian Journal of Experimental Biology</i>	20 (3.67%)	<i>British Journal of Nutrition</i>	15 (4.49%)

Table 11: Ranking of the Journals Cited in India and China (Top 10)

Name of the Journal in India	No. of Citations	Rank	Name of the Journal in China	No. of Citations
<i>Journal of Nutrition</i>	599 (10.48%)	1	<i>Nutrition</i>	669 (12.83%)
<i>Journal of Medicinal Food</i>	495 (8.66%)	2	<i>Journal of Nutrition</i>	519 (9.96%)
<i>The Lancet</i>	471 (8.24%)	3	<i>Poultry Science</i>	427 (8.19%)
<i>Critical Reviews in Food Science and Nutrition</i>	389 (6.81%)	4	<i>American Journal of Clinical Nutrition</i>	383 (7.35%)
<i>Trends in Food Science and Technology</i>	366 (6.40%)	5	<i>Public Health Nutrition</i>	325 (6.23%)
<i>Indian Journal of Medical Research</i>	342 (5.98%)	6	<i>International Journal of Epidemiology</i>	283 (5.43%)
<i>Journal of Food Science and Technology</i>	325 (5.69%)	7	<i>Nature</i>	266 (5.10%)
<i>American Journal of Clinical Nutrition</i>	297 (5.20%)	8	<i>Journal of Chromatography A</i>	255 (5.9%)
<i>European Journal of Clinical Nutrition</i>	283 (4.95%)	9	<i>Asia Pacific Journal of Clinical Nutrition</i>	229 (4.39%)
<i>Bio resource Technology</i>	270 (4.2%)	10	<i>Journal of the American Medical Association</i>	212 (4.07%)

Table 12: Top Level Institutions in India and China

INDIA		CHINA	
Name of the Institution	No. of Records	Name of the Institution	No. of Records
National Institute of Nutrition India	110	China Agricultural University	85
All India Institute of Medical Sciences	57	Chinese Center for Disease Control and Prevention	82
CCS Haryana Agricultural University	51	Zhejiang University	62
Central Food Technological Research Institute India	47	Chinese Academy of Sciences	39
Punjab Agricultural University India	35	Chinese Academy of Agricultural Sciences	33
Annamalai University	26	The University of North Carolina at Chapel Hill	30
National Dairy Research Institute India	23	Peking University	25
University of Delhi	20	Ocean University of China	24
King Edward Memorial Hospital India	18	Sun Yat-Sen University	21
Indian Agricultural Research Institute	18	Nanjing Agricultural University	16

### Findings and Conclusion

One of the interesting features of bibliometrics/scientometrics/informetrics is the fact there are three related terms used to describe part or all of this discipline. Each of these terms has a particular historical origin which is generally well documented and these terms have a range of definitions that have been applied to them by the authors who are working in this field. Over time, the usage of the terms has been changed, with the older term "bibliometrics" fairly stable and the newer terms, "informetrics" and "scientometrics" gaining momentum in usage. The present study concluded that India is found to be the predominant country as it tops the rank in list of F&N Research literature compared to China and other countries. This study revealed that the multi-authored papers had increased in China when compared to India (86.79 percent vs. 60.71 percent). An active institution in India is the National Institute of Nutrition with 110 articles published out of a total 1,045 articles and in China it is the China Agricultural University with 85 items. For the most cited journals in both the countries, the first rank is secured by *Journal of Nutrition* 599 (10.48 percent) which is followed by the journals in *Journal of Medicinal Food* 495 (8.66 percent). This study covered 1,045 articles in China, where the first rank is secured by

*Journals in Nutrition* which has been cited 669 times (12.83 percent) and the second rank is secured by *Journal of Nutrition* which has been cited 519 times (9.96 percent). Scientometrics analysis used to measure in order to obtain a more balanced view of the scientific production of researchers and that minimizes some of the problems which were present.

### References

- Diodato, Virgil. (1994). *Dictionary of Bibliometrics*. New York: Haworth Press.
- Mahapatra, M. (1985). On the Validity of the Theory of Exponential Growth of Scientific Literature. *Proceedings of the 15<sup>th</sup> IASLIC Conference, Bangalore* (pp. 61–70). Bangalore.
- Nattar S. (2009). "Indian Journal of Physics: A Scientometric Analysis," *International Journal of Library and Information Science*, 1(4): 55–61.
- Onodera, Natsuo. (2001). A Bibliometric Study on Chemical Information and Computer Sciences Focusing on Literature of JCICS. *Journal of Chemical Information and Modelling*. 41(4): 878-888.
- Pritchard, A. (1969). "Statistical Bibliography of Bibliographies," *Journal of Documentation*, 25(4): 348–349.

---

**Rajendran, Jeyshankar and Elango.** (2011). "Scientometric Analysis of Contributions to Journal of Scientific and Industrial Research," *Journal of Scientific and Industrial Research*, 1(2): 78–88.

**Seeman, Sivaraman.** (2013). "Research Trends and Collaboration Pattern Among Environmental Science Researchers in Selected Universities in South India: A Scientometric Analysis," *International Journal of Library and Information Science Research and Development*, 2(1): 18–25.

**Subramanian, K.** (1983). "Bibliometric Studies of Research Collaboration: A Review," *Journal of Information Science*, 6: 33–38.

**Zabed Ahmed S. M. and Md. Anisur Rahman.** (2008). "Nutrition Literature of Bangladesh: A Bibliometric Study," *Malaysian Journal of Library & Information Science*. 13(1).

*A small body of determined spirits fired by an unquenchable faith in their mission can alter the course of history.*

—**Mahatma Gandhi**

# Global Retail Development Index: India's Ranking

RAJESH SUND

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## Introduction

A report by A.T. Kearney on Global Retail Expansion presents a comparative analysis for potential markets for retail and online retail and their respective challenges. It provides (G.R.D.I.) Global Retail Development Index highlighting how online retail is changing international retailers global expansion strategies and presents an ecommerce index about which of the developing markets hold the most potential for online growth. The annual A.T. Kearney Global Retail Development Index ranks 30 developing countries on a 0-to-100-point scale—the higher the ranking, the more urgency there is to enter a country. Countries are selected from 200 developing nations based on three criteria:

Country risk: lower than 110 in the Euromoney country-risk score.

Population size: two million or more

Wealth: GDP per capita of more than \$3,000 (Note: The GDP per capita threshold for countries with more than 35 million people is more flexible because of the market opportunity.)

GRDI scores are based on the following four variables:

- Market attractiveness (25 percent)
  - Retail sales per capita (40 percent). Based on total annual sales of retail enterprises (excluding taxes). A score of zero indicates an underdeveloped retail sector; a score of 100 indicates a mature retail market.
  - Population (20 percent). A score of zero indicates the country is relatively small with limited growth opportunities.
  - Urban population (20 percent). A score of zero indicates a mostly rural country; 100 indicates a mostly urban country.

- Business efficiency (20 percent). Parameters include government effectiveness, burden of law and regulations, ease of doing business and infrastructure quality. A score of zero indicates inefficiency; 100 indicates highly efficiency.
- Country and business risk (25 percent)
- Country risk (80 percent). Political risk, economic performance, debt indicators, debt in default or rescheduled, credit ratings and access to bank financing. The higher the rating, the lower the risk of failure.
  - Business risk (20 percent). Business cost of terrorism, crime, violence and corruption. The higher the rating, the lower the risk of doing business.
- Market saturation (25 percent)
- Share of modern retailing (30 percent). A score of zero indicates a large share of retail sales is from a modern format. Modern formats include hypermarkets, supermarkets, discounters, convenience stores, department stores, variety stores, warehouse clubs and supercentres.
  - Number of international retailers (30 percent). The total score is weighted by the size of retailers in the country—three points for tier 1 retailers (among the top 10 retailers worldwide), two points for tier 2 retailers (within the top 20 retailers worldwide) and one point for tier 3 retailers (all others). Countries with the maximum number of retailers have the lowest score.
  - Modern retail sales area per urban inhabitant (20 percent). A score of zero indicates the country ranks high in total modern retail area per urban inhabitant, close to the average Western European level of 200 square metres per 1,000 inhabitants.
  - Market share of leading retailers (20 percent). A score of zero indicates a highly concentrated market, with the top five competitors (local and international) holding more than 25 percent of the retail food market; 100 indicates a fragmented market.
- Time pressure (25 percent)
- The time factor is measured by the CAGR of modern retail sales (2010–2014) weighted by the

general economic development of the country (CAGR of GDP from 2012–2014 and forward-looking from 2015–2017) and the CAGR (2010 to 2014) of the retail sales area weighted by newly created modern retail sales areas. A score of 100 indicates a rapidly growing retail sector, thus representing greater time pressure to enter or expand in the market in order to capture the growth.

Data and analysis are based on the Population Reference Bureau, International Monetary Fund and Economist Intelligence Unit national statistics, Euromoney and World Bank reports, and Euromonitor and Planet Retail databases. Populations listed throughout the report are from the Population Reference Bureau; figures related to retail sales are from Planet Retail.

The GRDI defines retail as the sale of goods through physical and online channels. Categories considered grocery, beauty and personal care, apparel and Development Index for the year 2011 to 2015.

The findings of this report had put India on fourth position in its GRDI-2011 and second in Asia after China. In the GRDI-2014, India drops six spots to 20th place, its lowest-ever ranking. India remains an appealing long-term retail destination for several reasons, starting with its demographics—a population of 1.2 billion people, half of whom are younger than 30 and roughly one-third of whom live in cities. Indians' disposable incomes are increasing, allowing them to spend more and try new products, brands and categories while spending a lower proportion on food. Migration from traditional stores to modern retail continues, but modern formats account for only 8 percent of the total market. Concerns for the industry include an opaque real estate market with high prices and low availability, high borrowing costs, personnel shortages, expensive supply chains and unpredictable politics, both locally and regionally. More retailers today are focusing on improving operations and back-end processes to increase profitability.

India rises to 15th in GRDI-2015 behind solid growth in retail sales and strong prospects for future GDP growth. India's retail market is expected to grow to \$1.3 trillion by 2020, and GDP is expected to grow at 8 percent over the next three years, making India the world's fastest-growing major developing market. Consumer and investor sentiment have seen an uptick, as the pro-reform government under Prime Minister Narendra Modi sets out on an ambitious goal of improving its Ease of Doing Business ranking from 142nd to 50th in the next two years.

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India represents a good opportunity for international retailers in single-brand retail, cash-and-carry and e-commerce, as the country appears to be on the cusp of a strong growth phase over the next five years. The tipping point for brick-and-mortar retail continues to be the opening up of FDI norms in multi-brand retail, a move that is not expected in the near term.

India's e-commerce market is expected to grow more than 50 percent in the next five years, as its young population increases Internet access and speed. Cash-on-delivery options have been an important step to growth. Inventory management, logistics planning, and resource availability are important hurdles for online retail in India.

**A.T. Kearney Global Retail  
Development Index, various issues**

Table 1: Global Retail Development Index-2011

2011 Rank	Country	Market Attractiveness (25%)	Country Risk (25%)	Market Saturation (25%)	Time Pressure (25%)	GRDI Score	Change in Rank Compared to 2010
1	Brazil	100	79.4	42.9	63.9	71.5	4
2	Uruguay	85	73.8	63.6	39.6	65.5	6
3	Chile	84.3	100	30.3	44.3	64.7	3
4	India	28.9	59.9	63.1	100	63	-1
5	Kuwait	80.4	80.6	57.3	27.1	61.3	-3
6	China	49.5	76.5	31	87.7	61.2	-5
7	Saudi Arabia	70.9	80.7	50.6	35.7	59.5	-3
8	Peru	39.8	61.5	72	59.5	58.2	1
9	United Arab Emirates	87.6	88.9	12.6	42.9	58	-2
10	Turkey	83.8	65.5	45	37	57.8	8
11	Lebanon	56.3	43	57.5	53.8	52.6	N/A
12	Egypt	22.1	49.5	85.5	52.7	52.5	1
13	Albania	19.9	48.3	79.6	60.5	52.1	-1
14	Russia	76.2	49.1	30.9	51	51.8	-4
15	Kazakhstan	29.2	30.1	87.5	60.1	51.7	N/A
16	Indonesia	38.2	53	54.5	58.8	51.1	0
17	Morocco	22.6	72.9	52.8	54.8	50.8	-2
18	Philippines	26.2	54.3	66.1	51	49.4	4
19	Tunisia	37.5	75.2	63	21.3	49.3	-7
20	Sri Lanka	8.4	52.6	86.5	42.4	47.5	N/A

Source: Euromoney, Population Data Bureau, International Monetary Fund, World Bank, World Economic Forum, Economist Intelligence Unit, Planet Retail: A.T. Kearney Analysis.

**Table 2: Global Retail Development Index-2012**

2012 Rank	Country	Market Attractiveness (25%)	Country Risk (25%)	Market Saturation (25%)	Time Pressure (25%)	GRDI Score	Change in Rank Compared to 2011
1	Brazil	100.0	85.4	48.2	61.6	73.8	0
2	Chile	86.6	100.0	17.4	57.1	65.3	0
3	China	53.4	72.6	29.3	100.0	63.8	3
4	Uruguay	84.1	56.1	60.0	52.3	63.1	-1
5	India	31.0	66.7	57.6	87.9	60.8	-1
6	Georgia	27.0	68.7	92.6	54.0	60.6	N/A
7	United Arab Emirates	86.1	93.9	9.4	52.9	60.6	1
8	Oman	69.3	98.3	17.4	50.4	58.9	N/A
9	Mongolia	6.4	54.4	98.2	75.1	58.5	N/A
10	Peru	43.8	55.5	62.9	67.2	57.4	-3
11	Malaysia	56.7	98.1	18.9	54.8	57.1	8
12	Kuwait	81.1	88.7	36.4	20.3	56.6	-7
13	Turkey	78.8	69.3	32.3	33.1	53.4	-4
14	Saudi Arabia	63.1	81.8	35.4	33.0	53.3	-4
15	Sri Lanka	12.7	68.3	79.0	51.3	52.8	6
16	Indonesia	39.6	61.6	47.0	62.4	52.7	-1
17	Azerbaijan	19.2	41.5	93.6	53.2	51.9	N/A
18	Jordan	45.8	65.3	69.5	23.8	51.1	N/A
19	Kazakhstan	31.5	47.5	75.5	47.5	50.5	-5
20	Botswana	44.4	88.1	42.7	23.7	49.7	N/A

Source: Euromoney, Population Data Bureau, International Monetary Fund, World Bank, World Economic Forum, Economist Intelligence Unit, Planet Retail: A.T. Kearney Analysis.

Table 3: Global Retail Development Index-2013

2013 Rank	Country	Market Attractiveness (25%)	Country Risk (25%)	Market Saturation (25%)	Time Pressure (25%)	GRDI score	Change in Rank Compared to 2012
1	Brazil	100	86.2	43.3	48.3	69.5	-
2	Chile	95.6	100	18.7	54.3	67.1	-
3	Uruguay	92	73.9	63.5	36.5	66.5	1
4	China	62.1	67.9	34.3	100	66.1	-1
5	United Arab Emirates	95.8	94.6	3	60.8	63.5	2
6	Turkey	86.8	83.7	28.9	50.9	62.6	7
7	Magnolia	17.7	37	99	96.5	62.5	2
8	Georgia	36.6	63.8	83.4	61.9	61.4	-2
9	Kuwait	87.8	87.1	36.4	22.2	58.4	3
10	Armenia	32.3	63.6	93.5	43.6	58.2	N/A
11	Kazakhstan	44.1	51.9	76.2	57.8	57.5	8
12	Peru	52.9	60.4	63.4	49.3	56.5	-2
13	Malaysia	63.4	95.8	22	39.8	55.3	-2
<b>14</b>	<b>India</b>	<b>36.8</b>	<b>59.4</b>	<b>63.3</b>	<b>60.6</b>	<b>55.0</b>	<b>-9</b>
15	Sri Lanka	16.6	60.5	81.8	58.6	54.4	-
16	Saudi Arabia	71.4	79.2	35.6	30.7	54.2	-2
17	Oman	77.5	97.8	11.3	29.1	53.9	-9
18	Colombia	59.2	73.6	43	32.4	52.1	5
19	Indonesia	47.4	49.6	49.3	61.4	51.9	-3
20	Jordan	53.1	65	65.9	19.6	50.9	-2

Source: Euromoney, Population Data Bureau, International Monetary Fund, World Bank, World Economic Forum, Economist Intelligence Unit, Planet Retail: A.T. Kearney Analysis.

Table 4: Global Retail Development Index-2014

2014 Rank	Country	Market Attractiveness (25%)	Country Risk (25%)	Market Saturation (25%)	Time Pressure (25%)	GRDI Score	Change in Rank Compared to 2013
1	Chile	100	100	13.2	47.3	65.1	1
2	China	60.9	52.5	44.5	100	64.4	2
3	Uruguay	93.4	57.5	70.3	32.4	63.4	-
4	United Arab Emirates	98.5	82.3	17.5	43.8	60.5	1
5	Brazil	99.4	59.8	48.7	33.2	60.3	-4
6	Armenia	26.4	35.3	81.5	86.7	57.5	4
7	Georgia	32.4	32.8	79.6	78.8	55.9	1
8	Kuwait	78.8	72.6	32.9	31.7	54	1
9	Malaysia	66.7	68.7	32.2	43.5	52.8	4
10	Kazakhstan	45.4	38.5	72.7	54.3	52.7	1
11	Turkey	83.6	50.2	46.5	30.2	52.6	-5
12	Russia	94	38.4	30.7	46.4	52.4	11
13	Peru	46	43	61.9	51.3	50.6	-1
14	Panama	56.2	46.9	52.7	41.3	49.3	8
15	Indonesia	46.2	33.4	57.7	59.6	49.2	4
16	Saudi Arabia	72.3	67.3	29.5	27.4	49.1	-
17	Oman	75.1	79.1	27	11.1	48.1	-
18	Sri Lanka	6.3	36.7	78.8	67.3	47.3	-3
19	Nigeria	39.6	6.6	92.3	48	46.6	N/A
20	India	26.4	39	72.3	43.4	45.3	-6

Source: Euromoney, Population Data Bureau, International Monetary Fund, World Bank, World Economic Forum, Economist Intelligence Unit, Planet Retail: A.T. Kearney Analysis.

Table 5: Global Retail Development Index-2015

2015 Rank	Country	Market Attractiveness (25%)	Country Risk (25%)	Market Saturation (25%)	Time Pressure (25%)	GRDI Score	Change in Rank Compared to 2014
1	China	66.7	55.7	42.3	96.6	65.3	1
2	Uruguay	93.3	60.4	68.0	38.9	65.1	1
3	Chile	98.2	100.0	13.0	37.9	62.3	2
4	Qatar	100.0	89.4	34.3	12.8	59.1	N/A
5	Mongolia	22.4	19.9	93.1	100	58.8	N/A
6	Georgia	36.5	39.1	78.8	79.2	58.4	1
7	United Arab Emirates	97.6	84.0	16.5	33.9	58	3
8	Brazil	98.0	60.4	45.2	28	57.9	3
9	Malaysia	75.6	68.8	29.3	52.7	56.6	-
10	Armenia	35.4	37.1	82.1	66.3	55.2	4
11	Turkey	83.1	48.1	40.2	44.8	54.1	-
12	Indonesia	50.6	35.5	55.1	65.9	51.8	3
13	Kazakhstan	49.6	34.2	72.5	50.7	51.8	-3
14	Sri Lanka	15.8	34.4	77.8	78.8	51.7	4
15	India	30.5	39.8	75.7	58.5	51.1	5
16	Peru	48.9	43.9	58.6	51.8	50.8	-3
17	Saudi Arabia	78.6	64.4	30.4	27	50.1	-1
18	Botswana	49.2	62.5	33.3	54.2	49.8	8
19	Panama	62.3	46.8	49.7	37.6	49.1	-5
20	Colombia	55.6	49.3	52.0	39.1	49	1

Source: Economist Intelligence Unit, Euromoney, International Monetary Fund, Planet Retail, Population Reference Bureau, World Bank, World Economic Forum; A.T. Kearney Analysis.

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