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</tr>
</tbody>
</table>
ARTICLES

Islamic versus conventional stock market Indices synchronization 270
Imed Medhioub and Mustapha Chaffai

The socio-economic potential of under-utilized species to small holder farmers: The case of Khat (Catha edulis) in Ethiopia 279
Amos Gyau and Catherine Muthuri

Women and access to ICT: A case study of India 288
Ranjana Agarwal and Gunjan Malhotra
Few works are considered to the empirical literature on the performance of shariah stock market indices compared to those of conventional markets. This work deals with the analysis of business cycle synchronization of five Islamic and their corresponding conventional markets over the period 2000 and 2014. In this research, three different measures of synchronization were proposed: The pair wise correlation coefficients of the cyclical components, the pair wise correlations of stock market returns and the concordance index. Results suggest a high degree of synchronization between Islamic and Conventional stock markets to each pair of country, except the case of Indonesia. These results confirm the point of view of some Muslim scholars considering that the mechanisms and products adopted in Islamic finance are similar to the Conventional system under the label of Shariah.

Key words: Synchronization, Islamic/conventional stock indices, concordance index.

INTRODUCTION

With the phenomenon of globalization and liberalization international stock market indices are becoming more and more interdependent and integrated. Masih and Masih (2001) suggested that when stock markets are integrated, we have a similar risk degree in different markets leading to a similar degree of return. Moreover, the pair wise correlations between the returns of these stock market indices are important. Therefore there is a high degree of synchronization between these markets. In effect, as the main objective of investors is to maximize profits, Islamic finance must be efficient and competitive to the conventional sector. In a country where the two systems are simultaneously adopted, is there coordination between the two systems in such away that markets are synchronized and then integrated. Since 1970s, a great interest is accorded to the performance of Islamic stock market compared to their corresponding conventional markets. Modern Islamic finance, although it is considered as a small market, has experienced a high growth rate lying between 15 and 20% annually. In this investigation, we study the connection between Islamic and Conventional stock markets via a synchronization analysis. In fact, many researchers, especially those who defend the Islamic point of view, consider the modern Islamic finance as an imitation of its traditional counterpart. They consider that the mechanisms and the products of modern Islamic finance are similar to the conventional finance including the label of Shariah.
In many products, like Sukuk, we consider these products free of interest; gharar and maysir and any Muslims can invest it. Thus, we tend to determine synchronization between Islamic and Conventional stock market indices in order to verify whether shocks affecting both markets are common or not. We verify whether good (bad) news lead to increase (decrease) in the performance of Islamic and Conventional stock market indices.

Although Islamic finance still represents only one percent of the global financial industry, it has known an important fast pace growth lying between 10 and 15% per year and has been playing a major role in some markets. The industry has experienced a rapid geographic expansion, from the Middle East to South East Asia and Europe, with the emergence of different potential regional and global centers of Islamic finance (Bahrain, Dubai, Kuala Lumpur and London). With the efforts provided especially by Malaysian authorities in the recent years, the range of Islamic financial services has been diversified and given a great interest to all segments of the financial assets. This growth is also accompanied by the development of Islamic financial infrastructure support. Islamic finance is then not considered as an opposed system to the conventional financial system, but it is considered as an integral part, with its particularities, of the global financial infrastructure.

The affirmation of Islamic finance is inserted in some emerging countries, in a more general development policy of the country system. Among these we can cite the Malaysian case where the central bank plays a leading role in promoting the development of the regulation, the consolidation of the system, and the formation of professional experts in Shariah. At the beginning Islamic finance was created to respond to the specific needs of a particular social group “the Muslims”, but after that, Islamic finance became attractive to other segments of the population. In fact, and in order to attract Muslim investors and to diversify the portfolio in order to reduce losses, non-Muslim countries, including Germany, Netherlands, Switzerland, France and Belgium, started to apply Islamic finance in their countries by developing Islamic windows. Also, London is now considered as a financial hub for Islamic finance and this reflects the sensitivity shown by the British authorities to the opportunities in London market that accord a growing importance to the Islamic finance: The evolution of the phenomenon was well accompanied by the removal of regulatory and tax obstacles, and then, the authorities themselves have played the role of a catalyst for this change.

The aims of this investigation are to answer to the following questions:

1. Is there synchronization between the Islamic stock market indices?
2. Is there synchronization between the Conventional stock market indices?
3. Is there synchronization between the Islamic and their corresponding stock market indices in the country or in the region?

### Islamic financial system overview

Similarly to the real economic activity, the financial sector plays an important role in the economic growth. Because of the frequently problems that knows conventional financial system, like the crisis 2007 to 2009 and the subprime mortgage market crisis, investors became worried and more attentive. Crises that largely hit the conventional financial system were less severe for the Islamic financial system. That is why a great attention is accorded to the Islamic finance in the recent decades. Now, many countries adopt both conventional system and Islamic financial system and investors can choose the way of investing their money either in conventional or in Islamic financial system where all transactions comply with the Shariah principles.

In its concept, the Islamic financial system is different from the conventional system. It is derived from the Shariah principles which are essentially based on halal and transactions must be free of interest, gharar, gambling…. The main objective of Islamic finance is to adopt only the procedures that totally comply with Shariah and financial transactions must be accompanied by real investment activity. On the other hand, as the main objective of investors is to maximize profits, Islamic finance must be efficient and competitive to the conventional sector. In a country where the two systems are simultaneously adopted, is there a difference between them in terms of profitability and is there coordination between the two systems in such a way that markets are synchronized and then integrated.

Islamic finance back to the middle epochs (the beginning of Islam area from the 1st to the 6th century). While modern Islamic finance industry is considered as a new industry and we talk about it only a few decades ago. In fact, in the 1970s after the dominance of the traditional system, Islamic governments accord a great attention to the Islamic system and it becomes since that date an important industry interesting nations all over the world. A second factor played an important role in developing Islamic finance industry is the discovery of petroleum in the Gulf area since the 1970s. The first efforts of modern Islamic financial system came back to the 1960s with the Egyptian and Malaysian experiences. In the middle of the 1970s and after the discovery of petroleum resources in the Gulf region followed by the highly economic and financial growth, Gulf countries give importance to the Islamic finance industry with the establishment of Islamic Development Bank in Saudi Arabia and the Dubai Islamic Bank in United Arab Emirates. The first attempt in a non-Muslim country was established in Luxembourg in 1978. In the 1980s some
Muslim governments, like Pakistan, Iran and Sudan transformed all its financial system to Islamic system. After that, especially in the 1990s, and in order to attract Muslim investors, many non-Muslim countries like UK, USA and France established Islamic institutions and Islamic windows offering new financial products and mechanisms compliant with Shariah. Islamic financial system is given more attention due to the very significant growth registered by this industry compared to the conventional financial system. In fact, since the 1990s the Islamic financial assets has grown at a rate lying between 15 and 20% per annum and achieved $ 1.3 trillion in 2013\(^1\). Recently, after the global financial crisis (2007 to 2009) several studies had focused a great attention to the Islamic finance system as it has knowing stability during the crisis compared to the conventional market (Charles et al., 2011).

Islamic financial markets are based on a fundamental characteristic "Shariah Compliant". Investors investing in these markets are sure that they use their money in transactions free of interest, gharar, gambling, ... All transactions, rules and regulations in Islamic markets are considered halal not contradictory to the Shariah principles. In Islamic finance, like in conventional market, commercial transactions should be made according to the ethical and moral values. But, as equity market is a market where investors buy and sell financial tools in order to release benefits, Islamic equities must be efficient and concurrent to the conventional ones.

In order to comply with Shariah rules many Muslim countries established International Islamic Organizations, such as the Islamic Financial Services Board IFBS and the Accounting and the Auditing Organization for Islamic Financial Institutions AAOIFI, to formulate standards, regulate, supervise and monitor the activities of the market in order to serve the needs of Muslims, even non-Muslims, investors.

Some authors argued that the gaps between practices in Islamic and conventional financial systems have diminished and shrunk over time as Islamic market became more competitive (El-Gamal, 2006). Even though there are fundamental differences between the two systems, they perform similarly in the market. They highlighted that differences existing between the two systems are caused essentially by the different business models adopted by each one and not by the principles of Shariah.

**METHODOLOGY: FINANCIAL CYCLE'S SYNCHRONIZATION**

Generally, economic and financial integration among a group of countries lead to common shocks that contributes to a deeper synchronization of business cycles between countries that belong to this group. Many authors are interested in the study of financial cycle synchronization, especially during financial crises, as it has an important and heavy impact on real world activity. The recent global financial crises highlighted the importance of the Islamic financial system as this crisis had largely hit the conventional system compared to the Islamic system which is considered as a regulating sector. The severity of this crisis motivated the researchers to study the comparison between Islamic and conventional financial systems. Some authors are interested in the analysis of the main differences between both systems by the analysis of the performance and others by the analysis of financial cycles and synchronization between the two systems. The main goal of this study is to analyze the synchronization between Islamic and Conventional stock market indices and the interaction between Islamic stock indices.

In finance, it is proved that disruptions are relatively larger than booms. In effect, financial cycles are characterized by longer and deeper episodes of downturns and synchronization of financial series are in many cases high. For example, Claessens et al. (2012) are interested in the analysis of financial cycles across industrial countries. They found that the degree of synchronization between credit and housing price is larger than that of credit and stock prices. Calderon and Serven (2011) found evidence of high degree of synchronization of financial cycles in Latin America. They concluded that financial cycles are long and deep and that they are highly synchronized across countries. According to the study of Schuler et al. (2015) which is applied to 13 European Union countries, they indicated that for most countries the degree of synchronization in financial cycles is higher than that of business cycles. Meller and Metiu (2015) found in their analysis among 12 European countries that countries with more highly correlated business cycles tend to have more synchronized credit cycles.

Business cycles are representative of periods of relative growths and periods of relative stagnation or decline. In this work we consider the growth and the decline between conventional and Islamic financial markets and we measure the synchronization among market returns. Many methods are considered in empirical literature to measure synchronization; some methods are based on the correlation coefficients of growth rates, others considered the correlation coefficients of the cycles. To extract cycles from series many techniques have been developed in literature. One of the data filtration techniques that can be cited is the Hodrick Prescott filter (1982). When correlations are high, synchronization is high between series. Sebastian et al. (2003) consider two main approaches for locating the expansionary/contractionary phases of the cycles in a financial variable. The first one advocates a parametric specification of the data generating process, where two different regimes are allowed. The second approach takes a nonparametric perspective and, instead of fitting a fully specified statistical data generating process, looks at the original data series for the specific features of the cycle. That is, this procedure looks for periods of generalized upward trend, which will be identified with the expansions, and periods of a generalized downward trend which will be identified with the contractions.

As the correlation coefficients only measure linear relationships between two variables and therefore the results are not accurate for nonlinear cases, other measures of synchronization have been considered in the literature. Harding and Pagan (2002, 2006) and others proposed indicators to assess business cycles synchronization. We will focus in this analysis on the measure of concordance index as suggested by Harding and Pagan (2006). They proposed to calculate a concordance index based on the proportion of time where two series are in the same state. A binary variable for each series is constructed, \(S_i\) and \(S_j\) for countries i and j to indicate the state of the economy (it takes one when the state is in an expansion and zero when it is in a recession). The concordance index is written as follows:

\[
I_{ij} = \frac{1}{T} \left[ \sum_{t=1}^{T} [S_{it}S_{jt} + (1 - S_{it})(1 - S_{jt})] \right]
\]

\(^1\)Compared to the conventional assets it represents a small amount but very significant.
For this index we measure the percentage of time where two series share the same phase (recession or expansion). This index lies between 0 and 1, where a score close to 1 indicates a highly symmetric between series and then there is a high significant synchronization, a score close to zero implies a highly asymmetry whereas a score approaching 0.5 indicates no concordance between series and then no synchronization. To apply this method of concordance, firstly we have to determine the state of each series in the date t (recession or expansion). Parametric and non-parametric methods are developed in the empirical literature to construct a binary variable, named S, which represents the state of the economy. In this paper we employ the Markov switching method to construct this variable. Markov switching models are nonlinear models known by their success in explaining business cycles. These models are succeeded in capturing recession and expansion phases which are controlled by a latent state variable, called S, that follows a first order Markov chain. For the case of two state model, the unobservable variable S is binary and it is determined from the filtered and the smoothed probabilities where S = 1 if the probability of staying in state one is greater than 0.5.

According to the concordance index, we obtain a score lying between 0 and 1 but we cannot say whether synchronization is significant or not. To overcome this limit, Harding and Pagan (2002) proposed the following equation:

\[ S_{it} = \beta_0 + \beta_1 S_{jt} \epsilon_t \]

We can consider \( S_{it} \) or \( S_{jt} \) to be the dependent variable and we estimate this equation by the Generalized Moment Method taking into account heteroscedasticity and serial correlation. After estimating this equation, we use the following test:

\[
\begin{align*}
H_0: \beta_1 &= 0 \\
H_1: \beta_1 &\neq 0
\end{align*}
\]

**EMPIRICAL RESULTS AND DATA ANALYSIS**

**Data**

As we are interested on the measure of conventional and Islamic synchronization of the stock market indices, we consider a monthly data base of five Islamic and five conventional stocks that belong to the same financial group covering the period January 2000 to October, 2014. Stock indices selected in this study are collected from the Thomson Reuters database. Table 1 presents the selected series.

**Empirical findings**

In this part, we are interested in the analysis of stock market indices synchronization among Islamic and Conventional systems. To measure the channels of stock market linkages, different methods can be employed. In this work two different methods are considered: The first is based on the correlation coefficients while the second is based on the concordance indexes and the estimations of synchronization.

**Correlation coefficients**

Concerning this method, two different filtering methods are considered to measure correlation. In the first we consider correlations between stock market indices returns (the first difference of the natural logarithm of stock market index multiplied by 100). In the second method we employ the Hodrick Prescott filter in order to decompose the series of logarithmic stock market index and calculate the correlation coefficients between cycles obtained by this filter. Tables 2 and 3 give the descriptive statistics of correlation coefficients.

Table 2 and 3 show that, in general, there are strong and significant correlations among Islamic and conventional stock markets with stronger coefficients obtained from cycles compared to returns series. We can then conclude that the common shocks affecting the global financial sector added to the similarity in the behavior of Muslims and non-Muslims investors (maximization of profits) amplify a high degree of synchronization among Islamic and conventional stock market indices. As simple correlation coefficients have some disadvantages, such as, it only measure linear between two variables, we use in the next section the concordance index largely applied in business cycles synchronization analysis.

**Concordance index**

Here, we calculate the concordance index for each pair of

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Table 1. Data.

<table>
<thead>
<tr>
<th>Islamic stock market index (coverage period)</th>
<th>Conventional stock market index(coverage period)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FTSE Bursa Hijra Index Malaysia (January 2000 - October 2014)</td>
<td>KLCI Malaysia (January 2000 - October 2014)</td>
</tr>
<tr>
<td>Jakarta Islamic Index (July 2000 - October 2014)</td>
<td>Jakarta SE Composite Index (January 2000 - October 2014)</td>
</tr>
<tr>
<td>Dow Jones Islamic Market International Titans 100 (January 2000 - October 2014)</td>
<td>Dow Jones Composite Index (January 2000 - October 2014)</td>
</tr>
<tr>
<td>FTSE Shariah Developed Index (July 2007 - October 2014)</td>
<td>FTSE Asia Pacific Index (December 2001 - October 2014)</td>
</tr>
<tr>
<td>MSCI Islamic Hong Kong (July 2007 - October 2014)</td>
<td>Shanghai SE Composite Index (July 2007 - October 2014)</td>
</tr>
</tbody>
</table>

Source: Bloomberg database.

Note that the upper (lower) triangular tables represent the correlation coefficients between Islamic (conventional) stock market indices, while the diagonal is devoted to the correlation coefficients between Islamic and conventional stock market indices.
markets as shown previously. First of all, we determine the latent variable, $S_t$, from which we calculate the concordance index. The variable $S_t$ is constructed via smoothed probabilities obtained from estimated Markov switching models. In this paper we consider the two state Markov switching processes to estimate our series assuming that there are two phases: expansion and recession. The Markov switching model is written as follows:

$$\Delta r_t = m_{S_t} + \sum_{i=1}^{p} \beta_i \Delta r_{t-i} + \varepsilon_t$$

$$\varepsilon_t \sim N\left(0, \sigma_{S_t}^2\right),$$

where $S_t = \{0,1\}$ is an unobservable variable which is governed by a first order Markov chain. The switch from one state into the other is given by the following probability transition equation:

$$p_{ij} = P[S_t = i | S_{t-1} = j] \text{ for } (i,j) = 0,1.$$

Where,

$m_{S_t} = m_0 \text{ and } \sigma_{S_t}^2 = \sigma_0^2 \text{ "if the economy is in a recession"}$

and

$m_{S_t} = m_1 \text{ and } \sigma_{S_t}^2 = \sigma_1^2 \text{ "if the economy is in an expansion"}.$

Table 4 presents the results of estimated Markov switching models. From this table we can remark first of all that the results for all estimated models are qualitatively similar but quantitatively there are some differences. The likelihood ratio test rejects the null hypothesis of absence of regime change for all estimated models. The estimates presented in Table 4 shows that, during the sample period corresponding to each series, the model detect recession and expansion phases with the only exception of the Islamic and conventional Malaysian stock indices where the growth rate is positive for both regimes but not significant for the first regime. In this case, we consider the first regime as a low growth phase whereas the second regime as a normal phase. For all cases, the total duration of remaining in regime 1 (recession or low phase) is shorter than remaining in regime 2 (expansion) which means that contractions have low persistence than expansions. But durations vary from one stock market index to another. For example, the conventional index of Jakarta stay 87.2% of time in an expansion phase with a duration of 154.5 months out of 177 observations, while it stays only 61.4% of time for the case of the Hong Kong conventional index. Contractions are shorter and more severe than normal phases of growth rates. In effect, for all series the volatility of remaining in a contraction phase is larger than the volatility of staying in an expansion phase implying that declines in recession phases are deeper than expansions. Figure 1 presents the smoothed probabilities obtained from Markov switching model for all stock market indices. The first panel (a) shows the probability of staying in the expansion regime of the Islamic and conventional

<table>
<thead>
<tr>
<th>Conv/Islm</th>
<th>Malaysia</th>
<th>Jakarta</th>
<th>Dow Jones</th>
<th>FTSE</th>
<th>Hong Kong</th>
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Conv/Islm, Conventional/Islamic.

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<td>Hong Kong</td>
<td>0.879</td>
<td>0.877</td>
<td>0.771</td>
<td>0.940</td>
<td>0.960</td>
</tr>
</tbody>
</table>

Conv/Islm, Conventional/Islamic.
stock indices for all pairs of countries: The blue solid line refers to $P(s_t = 1 \mid y_{t-1})$ in our estimated model for the Islamic stock index, while the red dashed line corresponds to the probability of staying in the same regime for the conventional stock index. It is clear from these graphs that the expansion regime tends to appear persistent than the recession phase for the two series. We remark a very high correspondence between Islamic and conventional Malaysian stock market. Moreover, a comparison of the series shows that the synchronization between the series seems to be very high. In Panel (b) we present the smoothed probabilities of staying in expansion phase for Islamic stock indices while Panel (c) correspond to the case of conventional stock indices. Contrary to the previous Panel, we remark that the smoothed probabilities of Jakarta stock index (Islamic and conventional) are different to the other markets indicating then a low synchronization between Jakarta stock market index and the others.

For a better analysis of the synchronization between series, the concordance index measure is considered. After the estimations of Markov switching models, we compute the concordance index from the latent variable $S_t$ obtained from smoothed probabilities. Results are presented in Table 5. The table shows the concordance indexes are similar and higher between Islamic and conventional returns. It center on 0.8 indicating a similar business cycles characteristics between Islamic and conventional markets in each country. The results of concordance indexes between conventional and also between Islamic indexes are different from those obtained from the correlation coefficients. The most important results are those obtained for the case of Malaysia and Jakarta. For Malaysia, which is considered as the leader country of the Islamic finance practitioner, we found that concordance index is low with all other Islamic stock indices. In fact, Malaysia is considered as the gateway of the Islamic finance and it has the largest Islamic financial system in the world known by its considerable efforts in developing new Islamic products and procedures. Compared to other Islamic stock markets, Malaysia has comprehensive regulations, supervisions and clears Shariah guidance that gives safety to investors. Therefore, these factors and the growing popularity of Shariah compliant stocks in Malaysia have led to the differences with the other Islamic stocks and then to the non-synchronization. However, the concordance index is close to one and is very significant between Islamic and conventional stock market in Malaysia. On the other hand, we obtained a highly synchronization between conventional stock markets except Jakarta stock market with an average of concordance index of 0.79 meaning that conventional stocks are in the same phase for 79% of time. Conventional Jakarta’s stock market is not synchronized with other conventional markets with a concordance index score that does not exceed 40% for all cases.

For the other markets, Islamic or conventional, there is a high degree of synchronization between markets showing that there are common shocks affecting stock markets. This stronger synchronization between Islamic and conventional stock market indices in each country/region can support the suggestions of some scholars and authors who consider that Islamic and conventional finance share the same objectives with some differences in practices. In fact, we found on average that there is a
Panel (a)

- Malaysia Islamic vs. Malaysia conventional
- Jakarta Islamic vs. Jakarta conventional
- Hong Kong Islamic vs. Hong Kong conventional
- FTSE Islamic vs. FTSE conventional
- DJ Islamic vs. DJ conventional
Figure 1. Smoothed probabilities of expansion phases. Panel (a) Islamic and conventional smoothed probabilities for each pairs of countries; Panel (b) Islamic smoothed probabilities Panel; (c) Conventional smoothed probabilities.

Table 5. Concordance index.

<table>
<thead>
<tr>
<th>Conv/Islm</th>
<th>Malaysia</th>
<th>Jakarta</th>
<th>Dow Jones</th>
<th>FTSE</th>
<th>Hong Kong</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaysia</td>
<td>0.937</td>
<td>0.286</td>
<td>0.299</td>
<td>0.178</td>
<td>0.275</td>
</tr>
<tr>
<td>Jakarta</td>
<td>0.157</td>
<td>0.824</td>
<td>0.836</td>
<td>0.750</td>
<td>0.827</td>
</tr>
<tr>
<td>Dow Jones</td>
<td>0.796</td>
<td>0.204</td>
<td>0.762</td>
<td>0.773</td>
<td>0.873</td>
</tr>
<tr>
<td>FTSE</td>
<td>0.761</td>
<td>0.357</td>
<td>0.751</td>
<td>0.904</td>
<td>0.821</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>0.735</td>
<td>0.379</td>
<td>0.724</td>
<td>0.988</td>
<td>0.793</td>
</tr>
</tbody>
</table>

Conv/Islm, Conventional/Islamic.

A high and significant degree of synchronization between Islamic and conventional stock market indices that belongs to the same country or region. We obtain that, in average, Islamic and conventional stock market indices occupied the same phase 84% of the time.

When estimating the equation proposed by Harding Pagan (2002) equation in order to test business cycles synchronization, we obtain a significant coefficient $\beta_1$ among all the above combinations between all the market indices, except those of Islamic/Conventional Jakarta indices and between Islamic Malaysian index and the other Islamic indices. These results confirm those obtained from the concordance index.

Finally, we could argue that among the studied markets and the different measures of synchronization, Islamic and conventional stock market indices are highly synchronized meaning that both types of markets have many resemblances and there is a strong similarity between them. This results confirm the fact that the two types of markets are similar and investors can have investment in the conventional or Islamic markets and the crises can have the same effect on their portfolio and if the investors choose the international diversification of their portfolios they can have the same results due to the synchronization of the two types of markets and the Islamic markets cannot have less risk than conventional markets. We also ask the question if these markets can be very well be integrated; other studies can give the best.
answer to this question.

Conclusion
Following the major problems experienced by conventional stock markets in the period of financial crises 2008, 2009 and 2011 several authors have considered the Islamic market more efficient than the conventional market and they can better resist during the crisis. Also, other authors considered the Islamic stock market as a regulator to the global financial market. The essential objective of this investigation is to look into the differences between Islamic and conventional stock markets via a synchronization analysis. We examine empirically whether Islamic and conventional stock market indices are synchronized or not. Our main result suggests that for the different cross sectional stock market indices correlations, there is a similarity between both markets. While when we consider the concordance index scores, we found some differences with correlation coefficients indicating the non-synchronization between some stock market indices. The most important result concerns the weaker concordance index between Malaysian Islamic stock market and the other Islamic markets.

However, this synchronization analysis suggests the evidence of high interdependencies between Islamic and conventional stock market indices implying then that Islamic ones can offer a good tool for investors by giving them the possibility of greater diversification in their portfolios and making mixture with the conventional stock indices. Although, there are fundamental differences between the two types of stocks, each one affects the other. They are integrated and diversification is possible between them and can lead to an optimal portfolio. In this paper we have presented some preliminary results concerning the synchronization among Islamic and conventional stock markets; richer methods for higher frequency data (weekly or daily) can be employed to improve our findings and to determine if there is a delay effect between Islamic and conventional stock markets in the shock's transmission from one market to another. Important questions that can be explored is the following: Does hybrid financial system composed of conventional and Islamic system in the same country contribute to the slowdown of the economic activity or does it makes the financial system more competitive and then contributes to its growth?

Conflict of Interests
The authors have not declared any conflict of interests.

REFERENCES
The socio-economic potential of under-utilized species to small holder farmers: The case of Khat (Catha edulis) in Ethiopia

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"Agriculture is an important part of Ethiopia’s economy constituting a significant proportion of it’s Gross Domestic Product (GDP) and total export earnings. The method of agricultural production in Ethiopia has led to increased deforestation and degradation. In order to reverse the trend, government of Ethiopia together with its development partners are in search of strategies to address the situation. Among others, Agroforestry has been considered as a potential strategy that can reduce the increasing deforestation and degradation; whilst at the same time can enhance food production and increased the income of small holder farmers. Khat (Catha edulis), an indigenous shrub species offers the potential to be intercropped with other food crops in an Despite its potential, limited attention has been given to it in terms of assessing its potential and profitability. The aim of this article is to assess the competitiveness of khat production and commercialization as a complementary source of income for farmers in the West Shewa and East Wollega zones in Ethiopia. Three focus group discussions (FGD) with khat producers were conducted in 3 villages to obtain data for the analysis. This was supplemented with key informant interviews with traders in order to obtain further information about its production and marketing. Porters’ five forces was adopted as the conceptual framework for analysis. The results indicate that demand for khat exceeds its current supply and farmers have power to determine the price. However, there is high level of competition among traders in sourcing from the farmers leading to price competition among traders. The agro ecological suitability for khat production in the area indicates that more farmers can produce it if the awareness of its market potential is created. The study concludes that khat can be promoted as a profitable crop for agroforestry practices in Ethiopia.

Key words: Agroforestry, market analysis, competitiveness, Porter’s five forces, neglected species, market analysis.

INTRODUCTION

Agriculture is an important part of Ethiopia’s economy constituting more than 40% of its Gross domestic product.
Ethiopia has resulted in increasing deforestation and degradation of forest, land and other natural resource (GDP) and more than 90% of total export (Franzel and Houton, 1992).

The method of agricultural production in Agroforestry may be considered as a potential alternative to some land-use practices such as slash and burn and intensive mono-cropping which characterize many farming systems in Africa including Ethiopia. Agroforestry is defined as a dynamic, ecologically based, natural resources management system that, through the integration of trees on farms and in the agricultural landscape, diversifies and sustains production for increased social, economic and environmental benefits for land users at all levels (World Agroforestry Centre (ICRAF), 2003). These practices enable producers to enjoy the dual benefits of generating income from the production of a wide range of products while protecting and conserving soil, water and other natural resource at the same time (Gold et al., 2004).

In the West Shewa zone of Ethiopia, many different tree species have been identified as ecologically suitable for agroforestry practices and farmers have expressed the willingness to plant these in an agroforestry system (Field research, 2012/2013). One of the priority species according to focus group discussions and key informant surveys carried out by ICRAF scientists in 2013 is Catha edulis commonly called khat in Ethiopia. It is a slow growing shrub which can reach a height of 1.4 to 3.1 m, depending on region and rainfall. It’s 5 to 10 cm long leaves are used as a tea and often masticated. It grows at an altitude of 1600 to 2600 metres and adapts to a range of soil and climatic conditions. It is often cultivated on terraces built on hillsides where the trees grow in rows and can be combined sometimes with other crops (Peters, 1952; Brooke, 1960; Getahun and Krikorian, 1973). The khat tree is not often affected by diseases and can live up to 75 to 100 years if taken care of properly (Peters, 1952; Brooke, 1960; Kennedy, 1987). One important reason for the expansion of khat production is that when intercropped with other food crops, productivity and earning per unit land area is improved. For instance, the khat–maize intercropping system has been found to be 2.7 times more profitable per hectare than maize mono-cropping.

In addition, khat is also less risky to grow compared to other crops like cereals and coffee because it’s production is less vulnerable to drought (Feyisa and Aune, 2003).

According to the Survey of Ethiopian Economy-II carried in 2005, khat is planted and chewed for various purposes: it is a stimulant that is said to cause excitement, loss of appetite and euphoria. It occupies the second place among export commodities after coffee. In Ethiopia, 85 to 90% of the khat produced is exported (Lemessa, 2001) and thus makes a very significant contribution to the country’s foreign exchange earnings.

Belwal and Teshome (2010) argued that despite socio-economic importance of khat, existing studies have often concentrated on its history, botany and its narcotic, pharmacological and medicinal properties. Up to now, not much has been done on assessing the market potential of khat and its competitiveness in general.

Belwal and Teshome (2010) contributed to the literature on khat in Ethiopia by assessing the opportunities and dilemmas associated with its production and marketing. Despite these efforts, some knowledge gaps still remain. In particular, to the best of our knowledge, there is no study that addresses the industry-wide competitiveness of Khat production as a potential income source for farmers.

This study aims to fill this knowledge gap by assessing the competitiveness of Khat production and marketing as a complementary industry for farmers in the West Shewa and East Wollega zones in Ethiopia. Porters’ five forces model (Porter 2008) is used as a framework for analysis since it offers a robust approach to examine the efficiency of under-developed markets like that of khat. The model can assist smallholders who want to participate in markets by helping them to understand market characteristics and strategies for the product they want to produce (Gold et al., 2004). This is particularly important as some producers may be reluctant to produce khat in the absence of readily available market information, which is important for the production of a niche product like khat (Gold et al., 2006).

The remaining sections of the article are organized as follows: First, the study provide a brief overview of khat production and supply chain. Next, the conceptual framework, which is the Porter’s five forces model, is presented and is followed with data collection and analysis. Results are then presented. The article is concluded with recommendations for the promotion of khat in agroforestry systems in the study area.

METHODOLOGY

Description of the supply chain

The main actors involved in the khat supply chain are the seed and seedling suppliers, producers, local collectors, traders from outside and exporters. Farmers obtain germ plasm from either their own source or buy from the market. Farmers either sell the khat leaves directly to the traders from the nearby towns or sell through local collectors who subsequently sell to the traders. Traders may sell directly to consumers and in some cases also to exporters who are either individuals or cooperatives (Belwal and Tesome, 2011). Most of the producers of khat are men although women were observed as traders in some places. The main markets are domestic markets and export to countries like Djibouti, Yemen, Australia, China, England, USA and Canada. However, England, USA and China have banned the importation of Khat (Figure 1).

Conceptual framework- Porter’s five forces model

The competitiveness of khat production is assessed using the Porter’s five forces model in combination with the analysis of the
external environment which affects its production and marketing. According to the Porter’s five forces model (Porter, 2008), before investment, any business or firm should first of all evaluate its internal attractiveness and market potential. Michael Porter’s five forces model is a model used to explore the environment in which a product or company could operate to generate competitive advantage. This model suggests that the expected profitability of any industry can be identified by examining how rivalry among existing competitors, threat of entry, power of suppliers, power of buyers, and the threat of substitutes affect it. The core concept of this model is that the profitability in the industry will be greater the weaker these five forces are. Bechdol et al. (2010) suggested to use Porter’s five forces model to assess the potential profitability of any given crop for farmers. Porter’s five forces of competitive market forces provide a structure for examining competition applicable to all industries and business sectors (Perdana et al., 2012). The five forces are:

- rivalry among existing competitors, threat of entry, power of suppliers, power of buyers and threat of substitutes.

The degree of rivalry determines the extent to which the value created by an industry is dissipated through head-to-head competition (Taviyamana et al., 2011). According to Porter (2008), high rivalry limits the profitability of an industry and the degree to which rivalry drives down an industry’s profit potential depends on the intensity with which companies compete, and on the basis of which they compete. Competition increases as rivals’ competitive goals increasingly congregate or intersect. This happens when rivals coincide in using similar competitive strategies as competitive advantage, envisioning similar target markets, or an increase of similarity occurs in business plans.

The threat of entry influences the profitability of the industry and when the threat is high, existing firms must hold down their price or boost investment to discourage new competitors (Porter, 2008). There also are some entry barriers whenever it is difficult or not economically feasible for an outsider to replicate the existing firms’ position. Apart from some intrinsic physical or legal obstacles, the common forms of entry barriers are the scale and the investment required to enter an industry as an efficient competitor (Karagiannopoulos et al., 2005).

According to Porter (2008), power of suppliers is another factor which influences the competitiveness of industry. Suppliers, if powerful can exert an influence on the producing industry, such as selling raw materials at a high price, limiting quality or services, or shifting costs to industry participants in order to capture some of the industry’s profits. A supplier becomes powerful if it is more concentrated than the industry it sells to; it does not heavily depend on the industry for its revenue, industry participants face switching costs in changing suppliers, suppliers offer products that are differentiated, there is no substitute for what the supplier group provides and the supplier group can credibly threaten to integrate forward into the industry (Porter, 2008).

The power of buyers is the impact that customers have on a producing industry. Buyers with bargaining power can extract excess profit from an industry by putting downward pressure on prices, demanding better quality products or services, and play industry participants off against one another (Porter, 2008). According to Karagiannopoulos et al. (2005), the determinants of buyer power are the size and the concentration of customers, the extent to which the buyers are informed and the concentration or differentiation of the competitors.

Finally, substitutes perform the same or similar functions as an industry’s product by a different means. The threat that substitute products pose to an industry’s profitability depends on the relative price-to-performance ratios of the different types of products or services to which customers can turn to satisfy the same basic need. The threat of substitution is also affected by switching costs; these are costs in areas such as retraining, retooling and redesigning that are incurred when a customer switches to a different type of product or service (Karagiannopoulos et al., 2005) (Figure 2).

Description of the study area

West Shewa is a zone in the Oromia Region of Ethiopia and takes its name from the kingdom of Shewa. It is bordered on the southwest by Jimma, on the west by Misraq Welega, on the northwest by HoroGudru Welega, on the north by the Amhara Region, on the northeast by Semien Shewa, and on the east by Oromia Special Zone Surrounding Finfinne. It has a rugged landscape consisting of mountains, hills and valleys. Depending on the topography, agro-ecologies vary, but many of the administrative zones are dominantly sub-humid: kola-warm lowland (orange in legend) and waynadega – tepid mid highlands (greenish yellow in legend) (Figure 3). Some areas with river gorges have more warm moist lowland climates, while toward higher altitudes tepid

![Map of the supply chain of khat.](image)
humid/moist climates are prevalent (ICRAF field observation, 2012/2013). According to the Central Statistical Agency of Ethiopia (CSA), this Zone had a total population of 2,058,676, in the year 2007.

Data collection
A qualitative research method involving focus group discussions (FGD) and key informant interviews was used for collecting the data. In view of the limitations of traditional quantitative bases for knowledge (Goulding, 1998; Somogyi et al., 2009), the qualitative research approach, which is adopted for this study is quite relevant. A FGD was conducted in each village. Fourteen farmers each from Arjo and Ukee and 16 farmers from Bako (in the West Shewa region and East Wollega) were involved in the interviews which were carried out in January 2013. Participants were both males and females who resided in the area and who are knowledgeable about khat and other agricultural activities. In addition, five khat traders in the villages and the nearby market centers in Nekemte were also interviewed using an interview guide with set of questions of interest. Questions asked include how prices are determined between producers and traders, their relative power in the business, level of competition among producers and traders, threat of substitutes and other external environmental factors, such as regulations and policies, that influence the...
production and marketing. In addition, social demographic characteristics of the respondents and information about their farming practices were sought. The interviews were conducted in Aramaic language and the responses were translated into English.

RESULTS AND DISCUSSIONS

Most khat producers involved in the focus group discussions were male and over 40 years of age. All the farmers had food crop production (particularly cereals like maize, teff and sorghum) as their main source of income. Farming was the primary occupation of all the participants, although all of them had a secondary source of income from off-farm activities like local brewery, casual labour, cereal trading, and livestock trading, local trading and pottery. Average reported land holding is between 1.5 to 5.500 ha. khat was planted as a cash crop on marginal lands occupying less than 10% of total land holding and was ranked by all the groups as one of the priority species for agroforestry because of its high market potential (Table 1).

External environment for the production and marketing of khat

Khat also called Arabian tea or qat is a shrub that contains cathinone, an amphetamine-like stimulant, which is said to cause excitement and loss of appetite, hence can be consumed to control hunger. In Ethiopia, there seems to be no specific government policy that promotes or hinders the production of khat, a situation, which differs from other tree crops such as coffee where the market is regulated and production inputs are sometimes supplied. khat as a cash crop experiences some form of double taxation from regional and federal Governments and these taxes are not collected from other cash crops (Belwal, 2003). This situation is corroborated by a trader who said that:

“Khat is taxed more compared to other cash crops. We don’t understand why it is like that but we have to live with it”

Despite the fact that some countries like Germany, Canada and the United states have considered khat as a drug, no ban has been placed on it by the Ethiopian Government and it obtained the status of a cash crop in 2003. The chewing of khat is widely practiced in East Africa and parts of the Middle East, such as Yemen where it performs a deep-rooted social and cultural function (Drake, 1988). Its production, sale and consumption are legal in other nations, including Djibouti, Somalia and Yemen. Gebissa (2004) mentions that there has been an increase in the trade and export of khat as a result of the construction of rail and road transport between Ethiopia and Djibouti after the Second World War.

Gebissa observed that in decades after the Second World War, a large amount of land in Ethiopia was dedicated and converted to khat production. Khatchewing, which used to be mostly in the Harar region is now common in other parts of Ethiopia. Al-Hebshi and Skaug (2005) estimated the prevalence rate of khat chewing to be 30, 50 and 31.7% respectively for the years 1996, 1999 and 2000. Data from a survey conducted in 1996 in Addis Ababa and 24 towns across Ethiopia showed that khat usage has been increasing

<table>
<thead>
<tr>
<th>Table 1. Khat farm and farmers’ characteristics in Ethiopia.</th>
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<tbody>
<tr>
<td><strong>Total participants (% male)</strong></td>
</tr>
<tr>
<td>---------------------------------</td>
</tr>
<tr>
<td>Average age respondents (in years)</td>
</tr>
<tr>
<td>Education</td>
</tr>
<tr>
<td>None</td>
</tr>
<tr>
<td>Primary</td>
</tr>
<tr>
<td>Secondary</td>
</tr>
<tr>
<td>Post-secondary</td>
</tr>
<tr>
<td>Average land size (acres)</td>
</tr>
<tr>
<td>Income sources (house hold (hh))</td>
</tr>
<tr>
<td>Crop (%hh)</td>
</tr>
<tr>
<td>Livestock (%hh)</td>
</tr>
<tr>
<td>Off-farm (%hh)</td>
</tr>
<tr>
<td>Tree products (%hh)</td>
</tr>
</tbody>
</table>
and that it has become popular among all segments of the population (Selassie and Gebre, 1996) indicating that the market for khat is expanding. Furthermore, there is sense of land tenure insecurity which may affect the planting of long term shrubs/trees such as khat. A khat farmer mentions that:

"Khat production is easy but sometimes we are disrupted by legal plurality between the state and tradition. We feel insecure"  

In many areas, successive attempts by Ethiopian authorities to demonstrate and exercise control over tenure relations has disrupted the role of customary institutions in land administration and allocation. Given Ethiopia’s history, there is continuing lack of clarity or assurance regarding the rights of farmers and others to manage, access, or use land, forest, water, and mineral resources upon which they depend for their livelihoods (USAID, 2011).

**Competitive analysis of Khat production**

**Rivalry and threat of new entrants among farmers**

This variable in the Porter's model describes the degree of competition among existing businesses in the same market especially when there is little opportunity for growth in the market (Gold et al., 2004). In the khat industry, there is no rivalry among producers, as each producer produces its own khat and there is enough demand. Most sales are done on spot market and producers do not see themselves as competing with each another. A focus group discussant in Arjo opined that:

"We don’t see ourselves as competing with one another since there are enough traders to buy our Khat. We rather try to link each other to a trader if we cannot have enough to supply to them”

A trader of khat from Nekemte who was probed about the possibility of rivalry among his suppliers had this to say:

“I don’t think they (farmers) see each other as business rivals. They rather see themselves as families and they sometimes lead me to buy from another farmer if I don’t get enough from them”

The agro ecological suitability of the study area for the production of khat indicates that farmers can easily convert part of their land to its production. However, the quantity can be constrained by the size of land available since farmers have to divide the land among the various agricultural enterprises they are involved in. Despite the low entry costs, farmers generally do not see new entrants as a threat. This is against the background that farmers think there is still adequate demand from traders. Besides, khat has regional and international market, which can be exploited if production exceeds local demand.

Moreover, there is no large capital requirement which will serve as a constraint for its production implying that there is little barrier to entry by prospective producers. However, in view of the fact that demand hugely exceeds supply of the khat coupled with large export market implies that industry wide profit will not be eroded with new entrants. This may explain why there is no rivalry among the producers. Gold et al. (2006) have argued that rivalry within an industry depends on many factors including the number of competitors, the size and distribution of the competitors, the homogeneity of the products, the level of fixed investments and the volatility of market demand. Since there is no direct competition and rivalry, khat producers will be expected to work together to pursue common interest. This is in line with observation by Gold et al. (2006) who observed that in the face of less competition like hazelnuts (Corylusavelana) or non-native chestnut (Castanea spp.) in the Pacific Northwest, rivalry among producers was not a factor and market participants worked together to further the demand for their products and increase profitability for all participants.

**Power of buyers**

There is limited buyer power as producers are the price makers especially during periods of shortage. Demand for khat exceeds the current level of supply and buyers are often forced to accept the terms and conditions offered by the producers. Although the general mode of trading is spot market, some producers mentioned that traders sometimes provide advance payment when the product is not yet harvested to ensure supply. Producers generally sell to the highest bidder and they argue that there are often price wars among traders in an effort to secure the supply of khat.

"I give my khat to the person who gives the highest price unless it has been paid in advance before harvesting is done” a comment from a Khat producer.

A khat trader commented that:

"we have to walk between 3-10 kilometres to look for Khat and you often go and meet many other traders especially on Saturdays when the producers bring the products to the roadside."

"it is difficult to find supply especially during the dry season and we have to pay high price to secure whatever is available”

Since producers are price makers in the market, there is the potential for them to improve or sustain their earnings from the sale of khat.
Power of suppliers

According to Porter (2008), suppliers’ bargaining power will be high if there are fewer large suppliers selling to large number of producers, when there are no alternative source of supply and when switching cost to a new supplier is high. All these conditions seem not to prevail in connection with the supply of input for khat production. The main input used in the production of khat is the seed and seedlings. Most producers use their own source with limited purchase from the market, so seedlings are affordable and readily available. Unlike other tree crops like coffee and to some extent mango, there is no supply farmers. Supply of germplasm from the market is available although farmers contend that there could be improved planting materials if the government were to show interest in the production of khat. There is no supplier power that can influence the production of khat in the study area. A producer mentioned that:

“planting materials are from our own sources and sometimes we can buy it very cheap from the market” another mentioned that “there is no supply of germplasm from the ministry or the research institutes… the research institutes could provide better planting material…”

Threat of substitutes

Substitute products can replace other products with little or no lost value to the consumer. This means consumers might buy more of the commodity in question if the price of a close substitute increases. As a result, close substitutes can have an effect on market prices by providing an option to consumers when prices fluctuate. A threat of substitutes exists when there are products which provide similar benefits or use as khat in the market. In lieu of this, farmers and traders were asked if there are known substitutes for khat.

According to Belwal et al. (2011), khat is chewed in occasional events such as social meetings, prayers, wedding and funeral ceremonies, and during wake keeping for the dead (Gebissa, 2004). It is also served in welcoming and entertaining guests, mourning, weddings, circumcision ceremonies, and in collective labour works (Lemessa, 2001).

According to farmers although there may be other products which can be used as substitutes at some of these social events, these may not be seen as a direct substitute to khat since it has its own peculiar properties when it is chewed. This was supported by a statement by a trader who sells Khat:

“I don’t think we have a direct substitute in the market for khat. … khat is khat and cannot be replaced … the feelings cannot be obtained from using other leaves, may be not that I am aware of”

Producer of khat argued that “… well, khat has its own uniqueness and as such I don’t think there are substitutes. There are many different types of khat and sometimes a particular type can be substituted for another but not substituting another product for khat”

Since there are no known substitutes for khat in terms of its mastication properties, it has the potential to remain competitive as a source of income for farmers.

CONCLUSIONS AND IMPLICATIONS

An analysis of the khat industry in Ethiopia using the Porter’s Five Forces model indicates that increased productivity and scale efficiency will continue be critical for the profitability of the khat industry. This is against the background that increasing demand and high returns are likely to be responded by producers by increasing their production. However, given that land is limited due to competition from the production of food and other cash crops, producers of khat will have to improve the productivity of the land they manage. This will require the use of new production methods and technologies that will increase the output per land area. Furthermore, although seedlings suppliers power and competition among producers are not important factors that may influence the profitability of the khat industry, the relative ease of entry into production of khat may have long-term effect on the profitability and competitiveness of production. This notwithstanding, there is constraint on the size of land available to farmers and hence may continue to regulate the quantity of khat that can be supplied to the market. The findings have some major implications for the promotion of khat in particular and development of neglected species in general.

Implications for the development of the khat industry in Ethiopia

First, it is recommended that for the producers to continue to have control over the price of khat, some form of collective action and cooperative will be needed. This will ensure that producers are able to market their khat as collectively even in the face of increasing production and new entrants. Farmers working together as a group will enable them to secure the necessary recognition by government and national authorities, and can then agitate to have some form of assistance such as planting materials which is offered to other tree based products like coffee and mango in the study area.

Secondly, there is also the need for stakeholders along the value chain to devise strategies to prolong the shelf life of khat after it is harvested. The active substance in khat is effective during the first 48 hours after it is harvested and therefore loses its effectiveness thereafter. This is a major limitation for the marketing of khat. This is
even more challenging in the context of export market which rely on rail and air transport which are often not reliable in Ethiopia. Against this background, there is the need to explore strategies on post-harvest handling of khat thereby improving its shelf life.

In addition, most rural producers of khat do not have adequate market information especially upstream the supply chain and the export market. Consequently, many farmers are of the perception that middle men reap a greater part of the industry wide margin serving as a disincentive for growing although price is relatively high compared to other crops. In view of this, promoting effective market information and market intelligence for khat can help to improve producers’ understanding of the market which will enable them to make right marketing decision on if and when to harvest and market.

Government must also play a role in enhancing the competitiveness of khat as an income source for farmers. For instance there is currently no government incentive to promote the cultivation of khat although statistics show that it is one of the important export crops in Ethiopia. Government’s interventions may include provision of improved germplasm for khat, improving extension education for the production and marketing, promoting technologies to increase productivity per land area as well as regulating the industry as is the case for coffee.

Furthermore, land and tree tenure systems in Ethiopia which prevent the cultivation of trees can be addressed. Despite recent measures to encourage Ethiopia’s farmers to plant trees on their land, the country’s complex feudal past still discourages tree as farmers’ still have some sense of insecurity. In view of this, it will be important for the Government to further develop and harmonize the legal framework at federal and regional levels in order to strengthen property rights in land and natural resources and continue to support the formulation and implementation of appropriate land policies and legislation by removing restrictions on transfer of land use rights.

**Implication for the development of neglected species**

The analysis of the competitiveness of khat indicates that some neglected species may have important potential for income and poverty alleviation in many developing countries. In spite of this, experience from khat indicates that a holistic approach to the analysis will provide a good basis for its promotion. Whereas the agro-ecological suitability of the species is important for its development, consideration must be given to other factors such as the social acceptability, existing services and infrastructure support, as well as the competitive forces and government policies that shape and guide the development of the industry.

For instance, although the study have demonstrated the broader social-economic potential of khat, there are legal and ethical issues concerning its consumption in certain jurisdictions such as the European Union and the US which have recently put a ban on its importation and consider it as a narcotic limiting its market potential. Furthermore, some studies have reported on the health hazards associated with khat consumptions.

Finally, although many well-known species such as khat continuous to be grown on marginal lands, many are still considered as under-utilized because they are locally abundant in developing countries but rare globally. In addition, they have limited scientific information and knowledge, and their current use is limited relative to their economic potential (Gruère et al., 2009). In view of this, enhancing research and development for these products will be an important step towards their commercialization.

**Disclaimer:** Views expressed in the article are solely that of the author and not the World Agroforestry Centre or the financiers of the field work.

**Conflict of Interests**

The author has not declared any conflict of interests.

**REFERENCES**


Women and access to ICT: A case study of India

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Women account for a sizeable number of Information and Communication Technologies (ICT) workforce in India. This paper makes an attempt to find out women's status in emerging areas of IT in India. This paper firstly tries to find out factors affecting women's access to ICT education in India. It also tries to find out factors affecting participation in ICT employment. The paper addresses issues regarding IT education availability for all women. Policy recommendations are given regarding women participation in IT sector.

Key words: Women, information and communication technologies (ICT), access to ICT, IT workforce.

INTRODUCTION

The Information and Communication Technologies (ICT and IT can be used interchangeably). ICT includes all aspects of Information Technology and Business Process Management (IT-BPM) firms. Since 2013, Information Technology and Business Process Outsourcing (IT-BPO) has been renamed as IT-BPM drives growth in the present era. These technologies have created new opportunities for scientific progress, economic development, education and social change. The ICTs are a significant factor in performance and growth of economies and also help advance sustainable human development. In 2014, world-wide IT-BPM spending was 2.3 trillion US$, a growth of 4.6% over 2013. The largest market in BPM services is America with 5.1% growth (NASSCOM STR, 2015).

In India, the ICT sector has come to occupy a prominent position. The contribution of ICT is significant in terms of income and earnings. The Indian IT-BPM industry has generated overall revenue (exports as well as domestic) of USD 146 billion in 2015, with a growth of 13% from the previous year. This contributes 9.5% to India's Gross Domestic product (GDP) and more than 38% in total services exports. In terms of global sourcing, India has a leadership position with 55% of total market share. India's share in global offshoring market has increased from 45% in 2009 to 55% in 2014 (NASSCOM-BCG Report, 2015).

The ICT sector is the largest and most diverse employer in the private sector in India. It was estimated to provide direct employment to more than 3.5 million people and indirectly created jobs around 10 million. This includes 170000 foreign national employees and greater share of employees from non-Tier 1 (Tier 1 cities are classified on basis of (a) population, (b) infrastructure and government spending. Details are given in a note at the end) Indian cities. Women employees constitute around 34% of the total employees (NASSCOM, 2015). An abundant pool of skilled manpower has facilitated the rapid growth of ICT industry in India. Hence, the ICT workforce has come to occupy an important role in the economy.

In the ICT sector emphasis is on intellectual rather than...
physical resources. As emphasis is on knowledge, the ICT industry is considered to be non-discriminating. It is considered to be an equal opportunity employer for men and women, minorities and handicapped alike (Gupta, 2015; Bhattacharya and Ghosh, 2012; Upadhyay, 2006; Shanker, 2008).

Women constitute half of the resources of the nation and a significant portion of IT workforce. What are the factors affecting participation of women in newly emerging areas of information technology? What is the position of women in newly emerging areas of IT in India? What problems are faced by women regarding education in ICT? Is ICT education available to all sections of Indian women or is it available to few sections of population? Is there a digital divide prevailing in Indian IT sector? Are there any problems or discrimination involved regarding women? This paper makes an attempt to find answers to these questions. Therefore, the objective of the paper is as follows: (1) to find out factors affecting women’s access to ICT education in India, (2) to find out factors affecting women’s participation in ICT employment in India.

Section 1 gives introduction and objectives of the study. Section 2 states the methodology formulated for the study. Section 3 discusses ICT industry in India. Section 4 deals with factors affecting women’s access to ICT education. This section also discusses women’s participation in ICT employment in India. Section 5 concludes the paper.

METHODOLOGY

This paper is based on secondary data. Data were mostly collected from The National Association of Software and Services Companies (NASSCOM) and The National Service Scheme (NSS), Indian government-sponsored schemes. Also, the data was compiled from various sources as World Bank, Dataquest, Human Development Index (HDI), United Nations Department of Economic and Social Affairs (UNDESA). The available data for the most recent year was compiled for the factors that affect women and their access to ICT education and job opportunities in India.

The key indicators of gender and employment (NSO, 2011; Barro and Lee, 2013; UNESCO Institute for Statistics, 2013; ILO, 2013, NSSO, 2013) included in the study are as follows:

(a) Human Development Index (HDI): A composite index measuring average achievement in three basic dimensions of human development, a long and healthy life, knowledge and a decent standard of living.

(b) Gender Development Index (GDI) (female to male ratio of HDI): A composite measure reflecting disparity in human development achievements between women and men in three dimensions, health, education and living standards.

(c) Gender Inequality Index (GII): A composite measure reflecting inequality in achievements between women and men in three dimensions: reproductive health, empowerment and the labour market.

THE ICT INDUSTRY IN INDIA

The revenues of Indian ICT industry comes both from exports as well as domestic market, exports constituting more than 60% of revenues, around 98 US billion $ in 2015. India has fundamental advantages in abundant talented human resource and cost factors which are sustainable over the long term. The industry is continuously growing.

It is expected that Indian IT-BPM sector will generate revenues of USD 300 billion by 2020. BPM sector is expected to grow at a rate of 15%. There will be significant drive creation in rural and metro areas. There will be global opportunities. A major challenge faced by the industry is availability of a pool of skilled labour force.

The growth of IT-BPM sector in India can be assessed through 4 pillars of growth (NASSCOM, 2015):

1. India is the world’s most attractive market in terms of (a) improving economic growth; (b) connected economy, digital ready market; (c) growing spending power of 1.2 billion people; (d) positive investment climate; and (e) unmet needs.

2. India’s excellence in business delivery includes (a) optimum cost; (b) highest volume of diverse, employable talent; (c) strong network of ODCs, multi-shore presence; (d) quality infrastructure; (e) mature ecosystem; and (f) effective collaboration and partnerships.

3. India is a hub of digital skills which comprises of (a) more than 7000 firms in India focusing on digital solutions; (b) 1.5 lakh digitally skilled employees; (c) more than 2000 digitally focused start-ups; (d) 30% start-ups working on innovative solutions; and (e) enabling environment for skill-set development, focused trainings.

4. India is a leading innovator in global IT-BPM industry. This consists of (a) large firms fostering innovation, collaboration, building scale, co-creating best solutions; (b) strengthening entrepreneurial environment, rise in investments; (c) rise in technology and digital start-up, making innovation and IP available across the world.

IT-BPM sector was initially located in 7 main locations. They are Bangalore, Poona, Chennai, Delhi, Hyderabad, Bombay and Kolkata. This sector has rapidly to other locations. It is expected that 43 new locations, Tier 2 and Tier 3 cities will emerge as BPM locations and expected to contribute more than 50% of total employment by 2018 (NASSCOM, 2015).

Education requirements

As ICT is a knowledge based work, the entry to labour market is affected by many factors. The human capital variables (Becker, 1964) as education and training are critical factors in determining access to it labour market. Acquisition of human capital is in form of education, continuity of experience and on- the- job training, health and migration (Becker, 1975; Shultz, 1961; Mincer, 1974).

The knowledge or skills required in the ICT sector vary
Table 1. Supply of technically qualified talent for ICT-BPM sector in India (NASSCOM, 2012).

<table>
<thead>
<tr>
<th>Numbers</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total engineering graduate output</td>
<td>392,400</td>
<td>451,700</td>
<td>498,082</td>
<td>622,603</td>
<td>812,679</td>
</tr>
<tr>
<td>Degree (four year course)</td>
<td>258,800</td>
<td>312,200</td>
<td>344,258</td>
<td>430,323</td>
<td>572,329</td>
</tr>
<tr>
<td>Diploma (three year course)</td>
<td>133,600</td>
<td>139,500</td>
<td>153,824</td>
<td>192,280</td>
<td>240,350</td>
</tr>
<tr>
<td>Total engineering postgraduate output</td>
<td>61,800</td>
<td>62,400</td>
<td>72,777</td>
<td>87,332</td>
<td>104,799</td>
</tr>
<tr>
<td>MCA</td>
<td>47,000</td>
<td>46,700</td>
<td>54,466</td>
<td>65,359</td>
<td>78,431</td>
</tr>
<tr>
<td>Engineering Post Graduate</td>
<td>14,800</td>
<td>15,700</td>
<td>18,311</td>
<td>21,973</td>
<td>26,368</td>
</tr>
<tr>
<td>Technology graduate and post graduate (Computer Science, Electronics, Telecom, etc.) output</td>
<td>233,100</td>
<td>268,622</td>
<td>295,846</td>
<td>368,168</td>
<td>481,129</td>
</tr>
<tr>
<td>Engineering IT graduates (degree)</td>
<td>153,500</td>
<td>185,515</td>
<td>203,642</td>
<td>253,608</td>
<td>337,934</td>
</tr>
<tr>
<td>Engineering IT graduates (diploma)</td>
<td>79,600</td>
<td>83,107</td>
<td>92,204</td>
<td>114,561</td>
<td>143,195</td>
</tr>
</tbody>
</table>

2012 is a forecast.

according to the nature of job. Five tier hierarchy of ICT skills have been identified in the ICT sector (Chandra, 1993). They range from simple user skills to advanced user skills. Other higher level skills are system implementation, management and facilitation skills, development skills and research and innovation skills.

In India, the supply of trained manpower comes from a large number of educational institutions, formal as well as non-formal, both in the government as well as the private sector. In the formal sector, the type of courses provided range from diploma to computer programming at the polytechnics to graduation and above at the universities/institutes. Table 1 shows that many institutes provide a Master’s degree in computer application. Engineering institutes provide a degree in Computer Science, Electronics and Communication.

India has a diverse employable talent in the world. It is expected that in 2015, nearly 5.8 million graduates and post graduates people will be there and out of which 1.5 million suitable people will be hired for this industry. This is due to the growth of IT-BPM industry in size, scale, maturity, domain expertise, and focus in addressing customer business’ demand (NASSCOM, 2015).

As the IT sector is growing, there is demand for specialized skills. In the IT services sector, technical graduates consist of more than 60% of employees. Business intelligence and data analytics are the most wanted skills. There is demand for cloud and mobile technology, SAP, IT developers, programmers, infrastructure managers and IT security consultants. Demand for banking and financial experts is expected to pick up. In the BPM sector, a quarter of employees are domain and technical specialists. In this sector, the top skills are domain knowledge, technical skills and soft skills.

Status of women in ICT in India

It is seen that women are now occupying a prominent position in the IT labour force in India. The number of software professionals increased from 6800 in 1985 to 650,000 in 2003 to 2004 and further to 2.23 million in 2008 (NASSCOM, 2009). In 1993, women comprised only 10% of ICT workforce which increased to 21% in 2003. Women employees now constitute around 34% of the total employees (NASSCOM, 2015). It is expected that 50% of workforce will be women by 2020.

Women are employed in IT companies located mainly in cities as Bangalore, Poona, Chennai, Delhi, Hyderabad, Bombay, and Kolkata. More women are employed in Southern regions of the country. They belong to the younger age group (COD, 2004, Dube et al., 2012; Shanker, 2008; Agarwal, 2000).

Although women are expected to contribute around one third of the labour force, they represent only one section of the Indian society. The new knowledge based ICT are considered to be non-discriminating. However, access to ICT is not even and there persists a divide in society. It is seen that the IT workforce is largely urban and
FACTORS AFFECTING WOMEN ACCESS TO ICT

Access to education

Access to education is one of the key factors affecting women’s participation in IT employment. In India, IT professionals are a small group of educated urban elite, where women constitute almost one third of professionals. On a macro level, when analyzed in detail it is seen that access to IT employment is denied to a majority of population, especially women. Women IT professionals are a very tiny portion of India’s large population. Lack of access to basic education and literacy are the prime reasons affecting women’s access to IT.

In India, literacy levels are relatively low. As per 2011 census, literacy levels in India are currently 74.4%, male literacy levels being 82 % while female literacy levels are just 65%. Basic literacy is low for women. Hence, less women have access to IT. The level of human resources are shown in Table 2 based on the KAM report.

On gender parameters, India ranks very low. It ranks poorly on Gender Development Index (GDI), female to male ratio of Human Development Index (HDI, 2013), scoring 0.828, a rank of 135 in the world. With respect to Gender Inequality Index, India has a score of 0.563 and a score of 0.519 for HDI, female, which has a same rank of 135 in the world (HDI, 2013). These scores lie in the medium human development category as defined by HDI.

Education is a basic human right in India. India has still a long way to go before it achieves this status. Average years of schooling are an aggregate measure of educational stock of a country. India’s average year of schooling in 2013 for adults was just 4.4 years. In 2013, gross secondary enrollment rate was 71%, while gross tertiary enrollment rate was only 25%. For women, the figure was even lower. At secondary levels, enrolment ratio for women is 60.4% in 2010, while enrolment at

<table>
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<tr>
<th>Table 2. India, Education and human resources (2012).</th>
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<tbody>
<tr>
<td><strong>Education</strong></td>
</tr>
<tr>
<td>Adult literacy rate (% age 15 and above), 2011</td>
</tr>
<tr>
<td>Adult literacy rate (% age 15 and above), Male, 2011</td>
</tr>
<tr>
<td>Adult Literacy Rate (% age 15 and above), Female, 2011</td>
</tr>
<tr>
<td>Mean years of schooling (of adults) (years), 2013</td>
</tr>
<tr>
<td>Gross secondary enrollment rate, (% of relevant age group), 2013</td>
</tr>
<tr>
<td>Gross tertiary enrollment rate, (% of relevant age group), 2013</td>
</tr>
<tr>
<td>Public spending on education (total % of GDP), 2012</td>
</tr>
<tr>
<td>Quality of science and math education (1= Poor; 7=Excellent) (weighted average), 2011-12</td>
</tr>
<tr>
<td>Quality of management schools (1= Poor; 7=Excellent) (weighted average), 2011-12</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gender</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender development index, female to male ratio of HDI, 2013</td>
<td>0.828</td>
</tr>
<tr>
<td>Females labor force (% of total labor force), (ages 15 and older), 2014</td>
<td>24</td>
</tr>
<tr>
<td>Women in parliaments (% of total seats), 2015</td>
<td>12</td>
</tr>
<tr>
<td>School enrollment; secondary; female (% gross), 2010</td>
<td>60.4</td>
</tr>
<tr>
<td>School enrollment; tertiary; female (% gross), 2010</td>
<td>14.9</td>
</tr>
</tbody>
</table>

Source: Education stats – KAM report.
Data refer to the most recent year available.
http://wdi.worldbank.org/table/2.11
http://wdi.worldbank.org/en/content/mean-years-schooling-adults-years
http://wdi.worldbank.org/table/2.2
http://wdi.worldbank.org/table/1.5

middle and high class and hail from educated families (Upadhay, 2006; Agarwal, 2000; Krishna and Brihamdeshan, 2006; Fuller and Narasimhan, 2006) Various factors affect women’s participation in IT. The work participation rate in any country also affects their employment patterns in IT industry. Other basic questions facing women are access to IT education, employment opportunities, location of employment, work structure of IT and skill up gradation. Women have double responsibility of market based work as well as home responsibilities.
tertiary level is just 14.9%. As less women are enrolled in higher education, their access to ICT employment is limited.

Although the proportion of women in higher education has not reached the desirable level, the absolute number of women in higher education has been increasing over the years. The expansion of education for women has been phenomenal over the years. The number of girls enrolled in primary stages increase rapidly from 10,944 thousand in 1961 to 47,453 thousand in 1998...and increased to 62769 thousand in 2014. At senior secondary level, enrolment rates increased from 700 thousand in 1961 to 2129 thousand in 1998 and further increased to 104,00 thousand in 2014. In professional/ technical/vocational education, the number of degree holders increased from 33,000 in 1961 to 285,000 in 1998. In higher education, the number of women increased from 200 thousand in 1961 to 13300 thousand in 2013 (MHRD 2014).

The number of women engineers in India has been growing over the years. Women engineers were only around 1% of the total in the eighties. Their numbers gradually increased to 15 to 20% of total engineers in 2005 (Parikh and Sukhatme, 2004). In IIT Bombay, the number of women engineers increased from 1.5% in 1972 to 8% in 2005 (Sukhatme and Parikh, 2006). In 2014 to 2015, the enrolment of women in engineering/ technology institutions was 1232006 which was 9.8% of enrolment in higher education. A significant number of women engineers are specializing in computer related fields. A study by Parikh and Sukhatme (2004) showed that more than 50% engineers were specializing in Computer/Electronics field. This has been due to changing economic policies in India post 1991. Liberalization policies led to growth of IT led economy and creation of jobs in IT sector. Privatization of engineering colleges and access to engineering colleges increased women participation in engineering education (Gupta, 2015). A job in IT sector was considered a sign of status symbol, termed as symbolic capital which increased women’s status in society (Shanker, 2008; Gupta, 2015). This led to parents investigating more in daughter’s education.

Access to employment opportunities

Both demand and supply factors affect women’s labour force participation. This is majorly affected by women’s status in society. On the demand side, economic, social and cultural factors, employers’ attitude and discriminatory policies all affect female work participation. The supply of female labour depends on various factors as socioeconomic status of family, life cycle commitment of marriage and fertility and education levels.

The labour force participation rate (LFPR) was 40% in 2009 to 2010, 41.4% in rural areas and 36.2% in urban areas. The International Labour Force (ILF) reported that the rate of female participation in the total labour force in India has fallen from 37% in 2004 to 2005 to 29% in 2009 and 2010. The female labor force participation (FLFP) rates are the lowest for India. FLFP is measured as a share of women that are employed or seeking work as the working age female population among emerging markets and developing countries. At around 33% rate of FLFP, around 125 million of the roughly 380 million working-age Indian females are either seeking work or are currently employed (Census of India, 2011).

Due to this, India is ranked at the lowest 11th position among 131 countries (International Labour Force, 2013). In 2011 and 2012, women comprised 24.8% of all rural workers, down from 31.8% in 1972-73. In 2011-2012, women comprised 14.7% of all urban workers, a small increase from 13.4% in 1972-73 (www.catalyst.org).

As less women are enrolled in higher education, their access to IT employment is limited. Apart from education levels, the background of an individual plays an important role on determining entry in labour market. The IT sector is elitist in nature.

Education is the key to getting entry in a knowledge based sector. As less women are enrolled in higher education, their access to IT employment is limited. Apart from education levels, the background of an individual plays an important role on determining entry in labour market. The IT sector is elitist in nature.

Various studies have shown that the people working in IT sector are mainly from urban background, especially for women. It is seen access to education and training is highly skewed towards English speaking masses and varies according to different classes (COD, 2004; Agarwal, 2000; Upadhay, 2006). Thus, it is seen that majority of the respondents entering the IT industry belong to the upper caste and urban areas who had access to higher education related to newer technologies. The average is around 28 years. The respondents have a high socioeconomic status as measured in terms of parents’ education and occupation attainments. It is also noted that women have a higher SES as compared to men. Only women from well-off families have access to IT. Similar results have been reported by Rothboeck (2001), Ramesh (2008), and Hussain (2008). Good communication skills are a necessity for entry in the IT sector (Fuller and Narasimhan, 2006). Persons from rural background and lower caste groups have an immediate disadvantage as English speaking skills are required and access to them is limited.

The results are same when analyzed on a macro level data by NSS as shown in Table 3. The NSS data shows that majority of people, more than 90% working in IT sector belong to urban areas. The figure is higher in case of women.

The majority of professionals belong to upper castes. In India, 27.8% of population live in urban areas. The socioeconomic status shows that 28% of population in
India lives below poverty. They are not represented in the IT workforce.

**Employment status of women**

There is a wide gap between computer education and absorption in the labour market. India has the largest number of computer educated, but unemployed women in the world. A NASSCOM-Mckinsey report states that there is a huge gap between number of women trained in IT and actual no. of women entering the labour market (1999). As per NASSCOM-Mckinsey Survey (1999), there were 50,000 women trained in IT in India. However, the number of women actually employed in IT was only 5000.

Study by Parikh and Sukhatme (2004) reports that the number of women engineers has increased rapidly. However, unemployment rates are also very high among women engineers, 20% in 1990 which increased to 35% in 1998. The figure was as high as 50% in Andhra Pradesh. Women were forced to take jobs as teachers or work in small scale industries and 50% of employed women were either underpaid or unemployed. Both social and economic reasons were stated for higher unemployment rates among women (WISE, 2010). Family background, personal commitments and priority to family were some reasons for not getting a job. Some were unwilling to relocate or travel. In some cases employers were reluctant to give jobs, and sometimes women were getting lesser salary as compared to men. Women also stated that they were getting lesser promotions as compared to men (WISE, 2010).

**Women have restricted employment opportunity**

Lack of mobility is cited as one of the major constraints to participate in IT workforce in India. Currently, there are very few IT job opportunities in many of the northern states, especially outside New Delhi. The IT companies are in select locations. Relocation from families is not the norm for young women. Due to cultural traditions, women with sufficient IT education are not able to participate in the labour force. As mentioned earlier, a substantial portion of potential workers belong to Tier 2 and Tier 3 cities and rest of India.

In higher strata of society, women’s participation in employment is increasing and they have more of locational mobility. Increasing economic pressure on urban middle class families and a gradual ideological change in social values increased the tendency among urban educated women to take up paid employment. However, studies show that women’s careers are determined more by familial and domestic factors rather than choices available to them. 45% women are not clear about career goals as compared to 25% men. 24% women stated that they changed jobs for personal choices as compared to 5% men (Rothboeck, 2001).

**Place of women in IT**

The position of women is uneven in the IT sector, there is concentration of women at lower levels of jobs. Even among women who are employed, it is seen that more women are working in particular category of occupations. It is seen that more women are working in the IT enabled services sector. Unni (2008) highlights issues of gendering of ICT labour market. A Strong gender bias exists with respect to access to different jobs. 40% of men are in high end jobs while 7.3% are in IT enabled services as compared to 21% of women in high-end jobs and 21% in IT enabled services (Rothboeck, 2001).

The same results are illustrated when analyzed on a macro scale as shown in Table 4. The data shows that women are concentrated in certain occupations. A large chunk of women are employed as software professionals. Almost 20% of women are in database activities, while a negligible portion are employed in hardware.

Not only are women concentrated in particular level of occupations, they are located at lower levels of organizations. There is a glass ceiling where few women are able to reach the top only (Rothboeck, 2001). Results

### Table 3. Rural/Urban and social group-wise Composition of Workers in IT industrial Categories (%).

<table>
<thead>
<tr>
<th>Variable</th>
<th>1999-2000</th>
<th></th>
<th>2004-05</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>Total</td>
<td>Male</td>
</tr>
<tr>
<td>Rural</td>
<td>7.9</td>
<td>0.2</td>
<td>6.8</td>
<td>8.1</td>
</tr>
<tr>
<td>Urban</td>
<td>92.1</td>
<td>99.8</td>
<td>93.2</td>
<td>91.9</td>
</tr>
<tr>
<td>ST</td>
<td>0.7</td>
<td>0.6</td>
<td>0.7</td>
<td>0.2</td>
</tr>
<tr>
<td>SC</td>
<td>2.1</td>
<td>13.0</td>
<td>3.6</td>
<td>3.3</td>
</tr>
<tr>
<td>OBC</td>
<td>16.6</td>
<td>5.4</td>
<td>14.9</td>
<td>24.9</td>
</tr>
<tr>
<td>Others</td>
<td>80.7</td>
<td>81.1</td>
<td>80.8</td>
<td>71.7</td>
</tr>
</tbody>
</table>

Source: NSSO 51st and 61st rounds (Figures are male – female share to total).
of Dataquest-Jobs Ahead (2003) study conducted among 1.5 lakh Indian IT professionals found that women constitute over 19% of the total workforce at lower levels, up to three years of experience. The number dropped to 6% at senior levels of workforce with more than 10 years of experience. NASSCOM reported that although 25% of IT workforces are women, only 3% are in senior management positions (NASSCOM, 2008). Study by NASSCOM–IIMA (2008), Agarwal (2003) and Bhattacharyya and Ghosh (2012) highlight prevalence of glass ceiling.

Work structure of IT and women

Majority of women are affected by lifecycle factors as marriage, childbirth and gender division of labour within the household. In the IT industry, career development takes place through hard work, training, application and continuity in learning. There is an aspect of learning which involves doing rather than using (Rosenberg 1993). Career development in IT takes place at a young age. IT careers are fast track careers. The work structure in IT requires long hours and is extremely demanding and stressful. Daily work hours range from 14 to 16 h in low and medium end firms doing short duration export projects (Rothboeck, 2001).

Women’s careers are affected by affected by social, gender and lifecycle factors. Family factors as marriage and children significantly affect careers of women (Johnson and Stafford, 1974; Long et al., 1993; Jones and Makepeace, 1996). Their mobility options are restricted by their husband’s career location (Bielby and Bielby, 1992). Thus, married women are much less likely than married men to change jobs for improved job opportunities (Felmerie, 1982). As the family structure is virilocal (residence determined by males), there is greater pressure on the wife to follow her husband rather than vice versa (Fox and Biber, 1984). Men change jobs for better career prospects while it is not so for women.

Women's allocation of time is also different when compared to men. Married women's time is distributed between market work, nonmarket work and leisure. For men, time is divided between market work and leisure. The division of labour within the household is based on the premise of comparative advantage in household production (Becker, 1981). Due to gender division of labour within the household, women have primary responsibility of activities as child-care and other household responsibilities (Becker, 1985). Women are similar to men regarding careers in terms of achievement and earnings. However women in general are have comparative advantage in household production (Becker, 1981). This leads to double responsibility for women.

Childbirth may lead to temporary withdrawal from the labour force for women. Children are considered as time intensive commodities especially when they are small (Becker, 1965). There is a lowering of work activity during the years of childbirth and childrearing. However for men, children were not connected with restrictions on professional activity (Elggqvist-Saltzman, 1992). The prevalence of double effort intensive responsibilities as child-care and household work may lead to married women spending less effort than married men on each hour of work on the job (Becker, 1985). This may have a direct bearing on women’s performance in the workplace.

Women’s productivity at work is considerably influenced by the prevalence of suitable

<table>
<thead>
<tr>
<th>Occupational category</th>
<th>1999-2000</th>
<th>2004-05</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>Hardware consultancy</td>
<td>5.1 (70.6)</td>
<td>12.7 (29.4)</td>
</tr>
<tr>
<td>Software consultancy</td>
<td>43.6 (88.3)</td>
<td>34.2 (11.7)</td>
</tr>
<tr>
<td>Data processing</td>
<td>19.2 (82.8)</td>
<td>23.6 (17.2)</td>
</tr>
<tr>
<td>Data base activities</td>
<td>10.8 (92.6)</td>
<td>5.1 (7.4)</td>
</tr>
<tr>
<td>Maintenance and repair of computers and computer based systems</td>
<td>6.3 (88.2)</td>
<td>5.0 (11.8)</td>
</tr>
<tr>
<td>Other computer related activities</td>
<td>4.5 (68.7)</td>
<td>9.7 (31.3)</td>
</tr>
<tr>
<td>Provision of value-added telecom services: paging, email, etc.</td>
<td>5.3 (86.5)</td>
<td>4.8 (13.5)</td>
</tr>
<tr>
<td>Total</td>
<td>100.0 (85.5)</td>
<td>100.0 (14.5)</td>
</tr>
</tbody>
</table>

Source: NSSO 51st and 61st rounds (Figures are male – female share to total).
support system at home and division of labour between members of the family (Fogarty et al., 1972). In less developed countries, cheap surrogate care and household help provide suitable support systems which enable women to work efficiently outside home. There is an assumption that IT workers has no family and is working 24 × 7 on the job (Uma Devi, 2000). A study by COD (2004) reported that 'sixty hours a week is common. Dedicated young programmers do not hesitate at the idea of working until 2 am in the morning, surviving on sandwiches and pizza and sleeping on the floors of their offices'. It is taken for granted that employees will stay in the office at least till 7 or 8 in the evening although often they come in only at 9.30 or 10 am (Upadhyay, 2006).

However, the nature of work in IT clashes with women’s lifecycle factors and household responsibilities. The discrimination lies in the male biased structure of the workplace (Agarwal, 2000). Women tend to work less longer hours as compared to men (Rothboeck, 2001; Agarwal, 2000).

A study was conducted by NASSCOM–IIMA (2008) in 85 companies to provide recommendations to organizations and women. It was found that majority of organizations had no formal mechanism to collect the views of women while framing any policy or retaining women. There was Low availability of “support” policies related to part time work, work from home post maternity, and paternity, sabbatical across all levels; worse for junior level. Men find it easier to progress due to informal networks.

Many companies have taken steps to promote women which affect their work participation rates. IBM India Pvt. Ltd. sends recruitment teams to suburban residential complexes for a woman-only hiring programme that seeks to bring experienced women back into the workforce. Services firm Infosys Technologies Ltd, which set up a Women’s Inclusivity Network in 2003, offers connectivity at home and part-time working options to retain women at work. Vaahini, a networking forum at Accenture India Pvt. Ltd, offers mentoring and counselling options for women employees across all levels of the company. Creche for children is a facility offered by many firms. Companies as TCS, Wipro and Infosys have more than 25% women employees.

**Skill uprating**

In the IT industry, Career development takes place through hard work, training, application and continuity in learning. It may also require a visit to the client side. In software engineering, there is a related aspect of learning that involves doing rather than using (Rosenberg, 1993). IT is an industry which thrives on newer and innovative ideas. This industry equates one year of progress equal to that of seven normal years, which means the last three years have actually seen changes that may have been ordinarily witnessed in 21 years. The negative side of this is the high rate of obsolescence of skills. A break in service may cause discontinuity in learning experience (Khadria, 1984). In the software industry, output or productivity on the job is measured in terms of software development. The success of software effort depends upon the ability to meet the time schedules. Other crucial aspects are working within budgeted costs, user friendliness, flexibility of operations, quantity maintainability and efficiency of operations (Benjwal, 1998).

Women who have been out of the labour force for some time find their skills obsolete. Employees are required to constantly reconstitute their skills to keep themselves employable to be successful in IT industry, one has to be update on technology (NASSCOM, 2015). Most people update their skills through informal networks. It was seen that in Information Technology enabled Services (ITES) sector, women have less exposure to new technology (Ramesh, 2008). It was seen that less women have had training in latest technology (Shanker, 2008). In some cases, women stated that they training opportunities were not provided to them (COD, 2004). Women may have less of informal networks which may lead them to lag behind men.

**SWOT analysis of women’s access to ICT employment**

**Strength:** Comfortable environment for women, large number of urban women employed, women have requisite skill sets to enter this sector.

**Weakness:** Occupational segregation - women employed more is ITES (low levels of skills), elitist in nature – only urban oriented, gender digital divide, women employment affected by social and cultural factors.

**Opportunity:** Shortage of skilled labour so all groups of labor employed, Women employed in ITES sector in large nos, high growth of ITES sector so potential for women, spread to 43 tier 2 and tier 3 cities, Nasscom predicts that 40% of employment will be in these cities in 2018.

**Threat:** Marginalisation of women in less skilled jobs, low education levels of women.

**CONCLUSION AND RECOMMENDATIONS**

This paper has provided a holistic view of factors which affected participation of women in ICT employment through secondary data and a comprehensive review of literature available on women and ICT. It is seen that women constitute a sizeable no. of workforce in IT. However, they are not representative of all women in the society. Access to ICT is restricted to a select group of women. They are a select group of women who belong to urban background with high socioeconomic status. Access to ICT employment is restricted to certain class of women as education is
restricted to only a small group of women. Even among women who are employed in ICT jobs, women are located in specific occupations. Access to ICT employment is restricted to less skilled jobs. It is also seen that proportion of women declines as one goes up the career ladder. Women have less access to top jobs in IT sector.

It is seen that women’ employment are affected by factors which are gender specific. Women have prime responsibilities of household work and childcare. They are affected by patriarchic norms prevailing in society. Job choices are affected by personal factors. Social and cultural norms limit mobility of women. The localized location of IT companies also affects women’s mobility. The issues which affect access to IT employment need to be addressed to tap the existing pool of workers.

POLICY RECOMMENDATIONS

India is the second fastest growing economy in the world. It faces a shortage of manpower in IT. Women constitute a sizeable number of potential workers. Their potential can be tapped. A study by Global McKinsey stated that India could increase its GDP by 16 to 60% simply by enabling women to participate in the economy as the same footing as men (Hindustan Times, 2015). The introduction of policies as digital India campaign post 2014 has increased the demand for IT professionals.

Policies need to be taken at different levels of stakeholders. Policies needed to framed from the viewpoint of (a) individuals (women employees), (b) organizations, (c) governments (enforcement agencies), (d) society (remedial actions).

The collaborative effort of all stakeholders can solve the problems faced by women in IT. No group can singlehandedly solve the problem. The government can make policies conducive to women and ensure implementation. Companies should gender friendly policies so as to get the best out of their workforce.

On a macro level, efforts should be made to spread education. The process should start from primary education. There should be more schemes and incentives for promoting higher education among women also. Education skillsets among women should be developed. Companies should stress on hiring from rural areas. Adequate training may be given to new recruits in terms of English speaking skills. All companies employing women should provide facilities as transport, canteens and crèches for working mothers. They should have separate mentoring teams.

Policies should be framed to make it mandatory that women constitute one third of resources in all companies, large or small. More hostels should be constructed for working women in Tier 2 and Tier 3 cities by the government. Non-governmental agencies can also be instrumental in these activities. Creating awareness about women’s safety and their rights can also be done on by societal groups. Implementation of gender inclusivity policies will go a long way in tapping more women workers and reduce attrition rates.

Conflict of interests

The author have not declared any conflict of interests.

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