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The Impact of ICT in Making Global Markets More Inclusive

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Abstract

Analysis based on models of (i) matching, (ii) network externalities, (iii) trade fragmentation, and (iv) resource supply on technological progress, shows that longer-term trends set in motion, from new technology enabled global sourcing, improve equity. Firms in emerging markets gain more access; labour markets become more inclusive. Global sourcing has the potential to raise the mobility and market access of virtual labour to match that of capital, despite continuing restrictions on migration. It makes a wider menu of jobs available to labour categories that were earlier excluded because of their higher transaction costs of reaching markets. It improves labour's exit options and therefore bargaining power. Trade fragmentation or splitting of the production chain across countries reverses earlier tendencies for trade to be confined to countries with similar industry structure. Further induced technological progress reduces wage inequalities within and across nations. Government policy initiatives and firms' strategies to boost and utilize these trends are examined.

Keywords: Global sourcing, Technology, Remote Work, Equity, Trade fragmentation, Production chains

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Introduction

Internet and communication technology (ICT) make global sourcing and distant work feasible for emerging market labour, which may be organized in firms. Emerging market economy (EME) firms can access new markets and opportunities from which they were hitherto excluded. Firms that can understand and act on these new trends can gain major comparative advantages. But since technology changes ways of doing jobs, makes some skills redundant, and requires re-training, workers themselves have an ambivalent relationship with technology. They have often resisted the introduction of new technology, although, over the long-run it has been responsible for the enormous rise in productivity and wages. ICT has met with a similar response from the world's workers. Unions worry about the loss of bargaining power that comes with mobile capital. Those in developed countries have focused on the transfer of jobs abroad; those in EMEs that wages are low and conditions exploitative.

Insiders always want to preserve the status quo. But global sourcing has the potential to raise the mobility and market access of virtual labour to match that of capital, despite continuing restrictions on migration. It makes a wider menu of jobs available to labour categories that were earlier excluded because of their higher transaction costs of reaching work. It lowers asymmetries in power between labour and capital, between EME firms and MNCs. We explore these issues using insights from analysis of (i) matching, (ii) network externalities, (iii) trade fragmentation, and (iv) the effect of resource supply on technological progress, developed in more detail in Goyal

(2005, 2006a, 2006b). So much is changing so fast because of ICT. Analysis helps to identify causal forces and future trends, and therefore fashion appropriate industry strategy, policy and social response.

One theme is analyzed in each section, brief strategic and policy implications are drawn from it, and these are then further elaborated in a final section.

Search and Matching

Search, matching and bargaining models offer useful insights on the labor market effects of new technology (Goyal 2005). ICT implies a reduction in frictions so that matching of labour to firms and of firms to other sourcing firms improve.

Workers differ from each other in these models so there is no uniform market determined wage giving their opportunity cost. Returns are not driven to outside options. Since a worker can be matched to a firm anywhere in the globe, firms do not have monopsony power, and workers are not limited to their marginal product[1]. A particular pairing will occur only if it yields a match-specific surplus. Relative bargaining power decides the distribution of the match surplus. Firm's profits will rise with the match surplus initially, but ICT implies easier firm entry, which will compete away profits.

ICT reduces transaction costs in finding and maintaining a match. It helps an EME to acquire information on potential partners, to leverage its Diaspora to find new matches, to gain knowledge of international standards and raise its output quality. Global sourcing requires harmonization of standards and relationship specific

investment to ensure good quality of work. It is not possible to specify all details fully in a contract, so the local firm or worker has to invest in equipment or training relevant for a particular job. This skill or asset specificity raises the cost of investment since cover is required for a possible future loss of bargaining power and consequent holdup. ICT facilitates the spread of common standards and improves monitoring, which can compensate to some extent for incompleteness of contracts. It creates more opportunities and makes markets thicker, reducing the specificity of investment or training, thus reducing matching costs.

Higher output, productivity, improved matching and scale economies due to ICT give equal benefits to firms and to workers. Reduction in the cost of entry for employers (technical innovation) and higher employee productivity (training and technology) raise employees' share of the match surplus. Entry of distant workers has permanent scale effects, raising the level of employment or the size of the market, which in turn improves matching thus benefiting both firms and workers. ICT makes firm entry easier, lowers costs and raises output thus attracting more firms and benefiting workers in the longer-run, since opportunities for workers rise compared to the searches they have to do. Thus although outsourcing is seen as benefiting firms while workers lose jobs or are offered low-wage jobs, the longer-term trends set in motion favor workers or EME firms that organize workers. Global markets become more equitable as well as inclusive. Given ICT's contribution in improving matching, policy should have a clear objective to encourage its development.

Technology, education choice, and separation

If the endogeneity of both technology and education decisions are considered, the results of the matching framework are reinforced. Outsourcing increases workers' own returns to training. Since it expands the set of relatively low-wage workers available to firms it encourages the further adoption of technology that makes it possible to utilize them. The higher scale of employment increases learning by doing and human capital formation, and stimulates further innovation.

Technical advances often depend on the number of people working, their previous mastery of simpler problems, and the depth of experience in related fields. New technologies and materials make it possible to generate more new technologies by recombination. Such factors explain the explosion of printing following printing of the German Gutenberg bible in A.D. 1455, and the absence of a similar explosion following the creation of the Phaistos disk for printing purposes, years before, in 1700 B.C., Crete (Diamond, 1997). High British unemployment in the nineteenth century meant fewer people were working. So learning by doing and productivity growth was lower compared to the US where labor was short (Acemoglu, 1997).

Since training and technology raise output and therefore the match surplus and wages, they have a self-reinforcing aspect. The more they are adopted, the higher the returns to adopting them. Stretches of increasing returns occur. Training rises with the probability of a successful search, since the expected benefits from education rise. This has two effects on the entry of firms. First, the rise in wages lowers firm entry. Second, the rise in the level of workers' training raises entry. Thus there could be a sharp jump in firm entry after training crosses a threshold, when the second effect

dominates the first. Multiple stable outcomes arise at low and at high probability of successful searches.

Separation after a match is likely in distant work. Accounting for this again leads to multiple outcomes. In the new random match following a separation, technology and training may not be found together. Since private parties may not recover the full returns to their investment, they may underinvest. If the proportion of the population investing and training approaches one, all will find it profitable to invest. But the private returns to investment fall as the proportion approaches zero. Returns can even be negative if the probability of separation is high (for example, close to 1). Then all agents investing are a possible outcome, but so is one with no one investing. After diffusion of investment crosses a critical level, cumulative improvement can occur. Because of the possibility of underinvestment, policy that coordinates to a full investment outcome can make a major contribution. Conditional on these policy initiatives, firms gain from investing fully in these technologies and in training their workers.

Network access and externality

The large networks established firms can leverage lead to exclusion of EME firms or labor or reduces their share in transactions. Developed country firms may use strategic forward-looking behavior to influence bargaining power and extract surplus. Since trade between any two parties depends also on their interactions with a third, future trades, including those between sellers and other buyers, matter when there are networks. For example, a dominant firm may force a new entrant to agree to an

unfavourable contract by threatening to discourage third parties from transacting with the new entrants if the latter does not agree to the contract.

As ICT makes labour markets more inclusive and market entry of new firms becomes easier, the dominance of any one firm falls. Rising density of interactions and access to multiple networks for the new entrants will give them more alternatives, better exit options and bargaining positions. Categories such as women, whose higher opportunity cost of travel has lowered their labour market participation, are able to participate more fully, reducing inequities and decay of human capital.

Externalities and lock-in in networks make it difficult to establish new networks. But ICT has made it easier to establish new networks and there are many examples of such networks being able to challenge existing networks. For example, the perceived neglect of issues important for developing and small countries has led to the rapid proliferation of regional trade networks that are more sensitive to local concerns.

Being able to draw on decentralized sources of information, allows new margins of adjustment to open up which make it possible to suit different preferences in innovative ways.

Another example comes from how a relatively new private network, the International Accounting Standards Board (IASB), has been able to influence evolution of global accounting standards. Even the US has become willing to accept foreign standards differing from their own Generally Accepted Accounting Standards (GAAP). Among the reasons the IASB has been successful is its drawing on technical expertise in

financial markets in pushing a shift from historical to fair or market value based standards and its use of a network of international organizations. Both of these would not have been possible without ICT. It has also been able to benefit from rivalries among heterogeneous countries and regulators, and the backing of the US Securities and Exchange Commission, which after Enron, is in favour of a shift to principles-based standards away from the detailed rules characteristic of GAAP (Nolke, 2005).

Firms and labour should therefore join networks, take the initiative to create new networks and make use of decentralized information. Policy-makers should encourage the process and bargain centrally to reduce entry barriers.

Information

Asymmetric information gives tremendous advantages to the side that is better informed. Pizzarro defeated the Aztec emperor although the latter had a much larger army and was on home ground. Their ability to write gave the Spanish the major advantage of superior information and communication (Diamond, 1997). ICT makes access to information easier for EMEs. It encourages openness and diffusion without which fewer technologies are acquired, and more existing technologies are lost. Historical examples of this are the Japanese abandoning guns after acquiring them because of the dominance of an isolated samurai culture; China losing its 1000 year technology lead over the west, since it was too unified and the Chinese emperor made centralized choices that killed innovation; their more advanced neighbors eliminating hunter gatherers such as the African pygmies; Eskimos replacing conservative Norse farmers in Iceland.

Openness, transparency, continuous learning and diffusion have to be conscious policy and strategic choices. But initiatives are also required for the organization and classification of information so as to be able to extract relevant knowledge from noise.

Trade Fragmentation

Populous EMEs should specialize in labor-intensive production according to classical trade theory. But much of the growth in modern trade was in intra-industry trade, or exchanges of goods within standard industrial classification, driven by scale economies due to specialization between developed countries with similar labor endowments. Wage dispersion rose within and across countries due to continuous productivity improvements in established clusters. New trade theories analyzed this process.

But such economies of scale were not the driving force for offshoring, or the growth in components trade, which boomed in the nineties. Rather, labor-intensive components were sourced from EMEs according to the Classical concept of comparative advantage from cheap labor. EME share in trade increased from 16 to 35, with rapid growth in Asia.

As new technologies magnified global sourcing and changed its character, outsourcing of services boosted this technology-enabled offshoring. As the scale of outsourcing expanded it was possible to spread the fixed costs of initial investment in technology and learning thus reducing unit costs. Improved coordination of far-flung global production units reduces transaction costs; so, as production rises, increasing returns can be expected to continue from the fall in the fixed cost of co-ordination.

This splitting or fragmentation of the production chain across countries will encourage sourcing of labor-intensive components from EMEs. It will create external economies, and raise productivity for all countries (Jones and Kierzkowski, 2005). Since labor at one location does not substitute for that at another, each firm's labor demand, at different lowest-cost production locations producing different components, becomes complementary. With this type of specialization there is more possibility of factor prices converging under free trade (Goyal 2006a).

The strategic implications are that firms must invest in the type of technologies and contacts that make splitting of production chains possible; they should leverage the spreading of fixed costs, increasing productivity to maintain the initial advantage from low wages; governments should remove trade and other barriers that restrain this process.

Resource availability and technical progress

Although technical change sometimes compensates for a scarce resource, abundance of a resource can also stimulate technology to utilize it. For example, deforestation provoked Britain but not China into developing coal resources early. River rich North Europe developed water mill technology, but rainier New Guinea did not (Diamond 1997).

The new global mobility of capital suggests that capital need not be such a constraint, so that analysis should focus on the availability of labor skills. Global sourcing provides jobs for labor with some basic skills, which we class as "medium". ICT increases the availability of "medium" skills. High skills come from a professional

degree or training, medium skill workers have an undergraduate or school degree, while low skill workers include barely literate categories, with a few years of schooling or informal training. When a developed country, with high and medium-skilled labor, interacts with an EME with medium and low skilled labor, medium-skill biased technical change could be induced, raising the demand for such labor. Acemoglu (2002) analyzes the effect of a change in resource availability on high- or low-skill biased technical progress within a country; we extend this to consider two countries and skill types (Goyal 2006b).

There is evidence that differential availability of skills induces skill biases in technical change. The early nineteenth century increase in supply of unskilled labor to English cities, due to enclosures and labor releasing technical change in rural areas, and a large migration from Ireland, led to the development of unskilled labor-biased or skill-replacing technologies, such as the factory system, that replaced skilled artisans. Adoption of the factory system in the US was delayed due to the absence of cheap labor supplies (Acemoglu 2002).

Since major technical inventions normally occur before they are really used, technology is exogenous in that sense. But its adoption and further adaptation responds to economic incentives. An example of the importance of demand-pull and the market size for the development of technology is the high rate of innovation in horseshoes that lasted only as long as horses were commonly used. Expanding supply of skilled labor induced skill-biased technical change explaining the sharp rise in wage inequality in the US from the 1980s (Acemoglu 2002). Apart from relative economic advantage compared to existing technology, social value and prestige

attached to the new technology, the ease with which its advantages can be observed, and its compatibility with vested interests all affect its acceptance (Diamond 1997). ICT has advantages on all these grounds, except for the last point where some short-term losers create resistance.

The two categories of skilled workers in a country can be taken to be imperfect substitutes in producing the output of the economy. Empirical estimates of the elasticity of substitution between the two types of workers suggest that the elasticity exceeds one so that the two worker types are gross substitutes. In this case technology favoring anyone type of worker will tend to replace the other skill type. Technology favouring any skill-type will tend to "complement" that skill type, increasing demand for workers with those skills. A low elasticity of substitution would imply that technology biased towards a particular skill type, can reduce employment of that type, creating excess supply of those skills.

In a developed country, if the elasticity of substitution exceeds unity, so that high and medium-skill goods are gross substitutes, a larger relative supply of medium-skilled workers through global sourcing, will lead to more medium-skill biased technologies being created. If the elasticity of substitution is even higher, exceeding two, the high-skill premium will fall in the developed economy, as the supply of medium-skilled labor rises, thus making the domestic wage distribution more equitable.

In a closed developing economy, if elasticity of substitution is high the medium-skill premium will tend to rise, but labour supply inflow from the informal sector moderates the rise. There may be a slack of medium-skilled labour absorbed in low-

skill jobs. As labor is slowly absorbed in the medium-skill sector, there is a larger market for technology relevant for this sector, although the influx of labour moderates the rise in the price of the skill intensive good. The market size effect dominates the price effect, so that induced technical change is biased towards medium-skills. Adding the demand for EME medium-skills from the developed country as the developing country opens out and becomes an EME, will tend to further raise the skill premium and medium-skill employment in the EME.

Thus global sourcing will tend to create a medium-skill bias in developed country technical progress. Outsourcing implies more sharing of technology so technical progress will be faster in the EME also. The average wage will rise, and the rise in demand for medium-skills will induce a faster catch-up in the EME. Such a shift in demand in response to a change in supply of a factor, explains why sometimes factor price do not change following a change in supply. The education premium did not fall, despite a large influx of skilled workers from the former Soviet Union into Israel in the early nineties since production was restructured to absorb them (Acemoglu, 2002).

Box 1: Case study of a small ITES medical transcription company

Table 1 shows the high share of graduates or medium-skills in the employees. That post-graduates are highest among the transcriptionists, or lowest employee category, supports a high elasticity of substitution among different labour categories due partly to the poor quality of degrees. Inherent ability and experience may dictate progress within a company rather than initial qualifications after the latter cross some minimum threshold.

Table 1: Case Study: a medical transcription company					
Employees	**Number**	**As percent of total**		**Rate of growth of wages**	
		Females	**Graduates**	**2005**	**2006**
Transcriptionists	414	71	82	20	25
Editors	102	43	89	12	9.5
Supervisors/Managers	22	32	68	3.7	17.9
Total	538	64	83	11.9	17.4

Table 2: Changing skill premiums			
Wages as a percent of transcriptionist wages	**2004**	**2005**	**2006**
Supervisors	225	194.5	183.3
Editors	137.5	128.5	112.5

Table 2 shows that medium-skill premiums were rising over the boom period of 2004-2006, when wages growth generally was in double digits. But the wages of the lowest category grew the highest. Initial training, induced technical change and improved processes may have raised the productivity of this medium-skill category the most.

The rapid changes in Indian labour markets, with the development of the Indian information technology and information technology enabled services sectors, support the above analysis. Underemployment of skills, or the size of L, fell as the total direct employment in this sector grew by over 50 percent per annum from1999-2000 to 2005-06. Indirect and induced employment created another 3 million jobs, compared to over a million directly employed. Thus distant work enabled a large rise in medium-skilled employment. Skill premiums rose with wage inflation averaging 10-15 per cent annually. Yet Indian offshore operations continued to provide cost savings of 40-50 per cent because of declines in telecom and other overhead costs, productivity gains and economies of scale (NASSCOM, 2006). Thus substantial induced technical advances improved the productivity of this labour. Companies

found that redesigning business processes to exploit automation in offshoring back-office functions released large additional revenues over the savings in labor cost alone—this is one type of induced technical change or reorganization. A case study of a small ITES medical transcription company, Box 1, based on confidential data and interviews, also supports the above general trends and the analysis.

The catch-up will slow down as the period of training required for labor in the low skilled sector to make the transition to medium-skill work lengthens. As more labor in the EME acquires high skills, it will begin to resemble the mature economy. When transition is complete, technology development will respond again to the rise in availability of high skills and a new developed economy dynamics will set in.

Thus greater labour availability may induce more labour-using technical change due to major cost savings from global sourcing. This will improve market access for workers, create more jobs, even as it raises labour productivity and makes labour markets more inclusive. Fuller employment, with fewer gaps in service, will lower the deterioration in human capital that used to occur in excluded labour categories. The larger scale of learning-by-doing, more margins and specialization possible will also raise productivity and choice for labour.

While market incentives induce the required developments in technology, policy in EMEs can aid the process by increasing the size of medium-skilled labour, through education, training and systematic skill upgrading using well-designed public-private collaborations.

Policy

The spread of ICT combined with the importance of induced technological progress has important implications for policy. These are detailed and discussed below:

1. *It is precisely when labour markets are flexible and maximum inducements exist for the development of technology that technological progress increases equality, in both developed countries and EMEs. Therefore policy should ensure these conditions in both sets of countries.* The traditional argument is that technological development increases inequality and in order to reduce the latter policy should build in various kinds of restraints on technology and restrictions on labour markets. But our analysis implies that special features of ICT tend to make labour markets more inclusive, and improve opportunities for EME firms.

2. *Encouraging the spread of ICT, access and bandwidth, should be a key policy objective.* As ICT reduces transaction costs, raises the efficiency of the matching process, and facilitates global sourcing, it benefits both firms and workers. The entry of new distant workers increases the scale, improves matching, and again benefits both. While ICT makes entry of new firms easier, the availability of distant workers induces entry of more firms and expands the level of activity.

3. *Special funds and training programs can be created to moderate short-term job-losses and adjustment costs for labour in some regions.* An insurance or welfare fund, to upskill and redeploy workers whose jobs migrate abroad, can be established through a low tax on the large transient profits outsourcing

firms make. Firms will factor in some of the losses to workers, but unlike with a ban, will still be able to outsource if cost savings are very high.

4. *Subsidizing education and training facilities will also reduce adverse effects on low-skill workers. Unions should focus more on demands for training, insurance and access.* Inequality has risen in America over the last decade partly because of the decline in the quality of primary education and the affordability of secondary education and high skill-biased technical change—not because of the more recent spread of outsourcing. The latter may even moderate the rise in inequality by stimulating a medium-skill bias in technical change.

5. *Policy that ensures competitive entry will tend to reduce inequality between wage and profit earners, within and across countries, over time.* A rise in the efficiency of the matching process, affects both search and opportunities equally, but a rise in per worker productivity, and fall in the cost of entry of new firms increase opportunities and reduce search by workers. Since they benefit workers relatively more than they benefit firms, the workers get a larger share of the match surplus. Free competitive entry of firms reduces excess profits to zero.

6. *In addition to direct intervention on the supply side, policy should induce more innovation and learning, making use of economic incentives for the purpose. Given these policy initiatives firms gain from investing fully in these technologies and in training their workers.* Since of externalities, private

investment may be less than socially optimal, requiring policy intervention. The enhanced matching model shows that training and technology have a self-reinforcing aspect. Training choice responds positively to a rise in the probability of a match, and to firms' adoption of better technology. Returns to the technology and learning by doing, in turn, improve with training. Since the level of private investment may be less than socially optimal under multiple outcomes, policy to stimulate investment further will raise social welfare. Well-designed public intervention can trigger large changes. A policy-induced boost to ICT adoption can lower the probability of being trapped at a low-level where private investment is less than socially optimal, and magnify the impact of ICT on labour markets.

7. *Quality standards will make employers more willing to expand education and training facilities to shift workers above the threshold.* There are strong incentives for training in conditions where opportunities are expanding. Strict quality standards can strengthen these incentives. The availability of labour skills, in turn, can induce firms to adopt new technology in a beneficial feedback cycle. Having to compete in export markets forces improvement in quality.

8. *International patent rights (IPRs) should be limited to facilitate interoperability between competing products and rights such as reverse engineering given.* Open standards enhance competition and innovation, and thus contribute to beneficial feedback cycles. But they are especially valuable when they apply to inputs, and where innovation occurs in small steps through

a series of contributors. Such interoperability turns competitors into complementors. There should be only limited copyright protection for a firm improving an interface. Conversion costs of common standards should be lowered. When conversion costs of standardization are small relative to network effects, all regions gain from accepting common standards. When there are network effects, consumers value compatibility and IPRs by turning the initial choices of a small user group into *de-facto* standards, may confer monopoly rights without any significant innovation.

9. *The enhancement of competition and innovation in the ICT industry itself from open standards gives valuable lessons, to apply to different kinds of networks.* To allow products of different manufacturers to work together in a computer system, reproduction and translation of copyright code are essential. The rapid development of the LINUX system, based on multiple decentralized inputs, even as a competitor for Microsoft, is an example of the power of open source.

10. *Industry bodies, governments, or international institutions can encourage new specialized networks and make use of decentralized information. Policy-makers should encourage the diffusion of information and bargain centrally to reduce entry barriers.* EME workers' bargaining power will improve with their exit options as ICT allows them to participate in distant markets. Better information and deeper networks available to established firms or individuals, is a source of their advantage, and explains the low share of EME firms and workers in the match surplus. ICT has the potential to improve developing region's access to networks but institutional support is required for access to

be established. ICT lowers the cost of acquiring information both about potential trading partners and about standards of acceptable products. This knowledge is vital for developing regions to access new markets.

11. *Openness and transparency have to be conscious policy and strategic choices; but also initiatives for the organization and classification of information so as to be able to extract relevant knowledge from noise.* More functional web portals could be developed, with ministries and industry bodies serving as repositories, graders and sorters of information.

12. *Far-seeing policies should lock-in the large new populations into the networks, even at the cost of some minor current concessions on openness and market access.* Open standards also contribute to better information and to expanding networks. If network effects dominate it pays to expand the market.

13. *Greater collaboration with suppliers helps to adopt the advanced sourcing techniques required for competitive advantage.* These are the processes that lead to technology spillovers and uniform standards. Companies need more understanding of new markets in China, India and Eastern Europe from which sourcing activity is slated to increase.

14. *Small new entrants need to think strategically and combine with those who gain.* Network externality destroys small local networks unless compatibility is built in. The latter must be willing to learn the language before contributing

to it, be willing to engage in a range of activities and move slowly up to higher value added products.

15. *It is necessary to enhance the development of public and quasi-public standards development organizations and their speed and conflict resolution capabilities.* Although standards help specialists who want to compete globally, incompatibility provides local protection. For inefficient firms with large installed bases, incompatibility maybe a strategic choice, in order to deter rivals. Thus markets maybe locked into inefficient standards.

16. *Regulation is required, but under network externalities competition policy has to consider dynamic aspects. It should ensure competitive entry and access*. Firms may have to give concessions initially in order to make a market; the concessions may not be aimed at destroying competition. Policies that improve one's product need to be distinguished from those that block a competitor. Open standards can help prevent the latter. Competition policy should give rivals rights such as reverse engineering that allow them to insist on compatibility, notwithstanding patent rights. A high rate of new firm entry is essential for the beneficial effects on equality to occur. ICT can reduce barriers to the expansion in size of a firm, and therefore lead to giant firms and reduced entry; but it can also reduce the viable size of a firm thus encouraging entry. Regulation influences the direction of change.

17. *Governments should remove trade and other barriers that restrain trade fragmentation; firms must invest in the type of technologies and contacts that*

make splitting of production chains possible. Since trade fragmentation reverses the tendency for trade to be restricted between countries with similar industry structure, it is beneficial for equality as well as development. Firms can leverage the spreading of fixed costs to increase productivity and maintain the initial advantage from low wages. International experience and systematic development of contacts will help in the discovery of synergies.

18. *Removing labour markets rigidities can encourage technological change that favours labour.* Policy supported rigidities in EMEs often lower the elasticity of substitution between different labour-skill types, and we have seen that appropriate technology is more likely to develop, and the rise in inequality will be less, when substitution is high.

19. *Policy in EMEs can aid induced technological change by increasing the available size of labour with some skill, improving its quality and matching it better to industry requirements.* Market incentives induce the developments in technology that raise the productivity of medium-skilled labour, but policy can help the process. Expanding education and improving the healthcare systems obvious strategy, but it is also necessary to improve the quality of education and give it more flexibility to adapt to changing requirements.

20. *Industry has a major role to play in conceiving, designing and executing specially designed training programs.* Such training programs can sometimes aid the shift of large numbers from labour from low to medium-skill categories. Box 2 gives an example of such an effort.

21. *Widespread collaborations are required of industries and industry associations with universities and institutes.* This has two aspects. One to train the young who constitute the future labour force, second design special vocational training programs to better equip today's workers. Creating a diversity of jobs to suit the range of skills available can also help in this aspect[2]. Box 2 gives an example of a special university course.

22. *Planned applications of technology can make it possible to reach excluded categories of labour*. In India, software is being developed to make it possible for outsourcing to go to the villages and draw upon rural labour. Distance work that allows women to work from home reaches another large and, as many companies are discovering, more loyal and committed workforce. The medical transcription company (Table 1) had a high and more stable proportion of women workers because it allowed work from home.

23. *More special women only technical training institutes ranging from engineering colleges to computer training institutes to more basic training centres for ITES type jobs should be set up.* Participation of girls in IT education lags that of boys. Active collaboration from local communities, business and governments, and special initiatives for backward areas and communities would be fruitful to remedy this.

Box 2: Special Training Programs

An example of potential contributions of industry associations comes from recent efforts of the Indian national association of software and service companies (NASSCOM). It estimates that only 25% of technical graduates and 10-15% of general college graduates are suitable for employment in the offshore IT and BPO industries. But special training programs and certification programs, some of which they are designing, can quickly upgrade them helping the shift of labour from low to medium-skilled (NASSCOM, 2006).

An example of a special university training program is De Montford University, UK's, special course called "Women's Access to Information Technology" (WAIT). The one-year free course gives women, between the ages of 19 and 65 who may have no qualifications, the technology skills they need to go on to do a degree or get a job[3]. It develops their potential making it possible for them to get back onto the career ladder. Graduates have gone on to a range of jobs. The course is actively canvassed in the communities in creative ways to convince potential participants that computers need not be dull. Women can make unique contributions as they adapt technology to their needs. For example a woman Teri Pall invented the cordless telephone in 1965 since she wanted to be able to talk as she did other things around the house.

Firms that understand the new trends and base strategies on them can gain major advantages; government policy initiatives that support these trends will further boost a virtuous cycle of development.

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[1] Although we use the term worker in this analysis, it can also be taken as referring to an EME firm that organizes workers and matches them to distant work, or supplies services to a distant firm.

[2] To indicate the challenges and magnitudes involved, India's labour force in 2005 is estimated to be 460 million, with 39 million unemployed, and 10 million expected to be added every year upto 2011. But 60 percent of the workforce is in agriculture, only 61 percent literate, and only 3 to 4 percent has any vocational training (Indian Liberal Group, 2006).

[3] Reported in BBC NEWS, as "Giving Women Tech Know-how," http://news.bbc.co.uk/go/pr/fr/-/2/hi/technology/6103512.stm, published on 03/11/2006, and accessed on November 22, 2006.