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Source: *The China Quarterly* , Mar., 1999, No. 157 (Mar., 1999), pp. 72-114

Published by: Cambridge University Press on behalf of the School of Oriental and African Studies

Stable URL: http://www.jstor.com/stable/655866

Research Note

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Jin Xiao and Mun C. Tsang

Introduction

Human capital refers to the skills, knowledge and values that individuals acquire in formal schooling, in the workplace and in other settings that raise their productive capacity.[1] In an increasingly global economy, investment in human capital is seen as one of the major strategies for enhancing the economic competitiveness of firms and nations[2] and a major factor in determining the extent of economic polarization among social groups and nations.[3]

Meeting the demand for human capital in a changing and growing economy in a cost-effective and responsive way is a major challenge to education and training systems across the world. In many countries, formal schooling has consistently been the focus of human-capital investment, and substantial resources have been spent in this area.[4] Although formal schooling has long been a key component, adult education and training in the workplace have also increased in importance over time, although relatively little is known about their role. There is little information on how different forms of human-capital development, including formal schooling, adult education and workplace training, combine to meet the skill-demand of a fast-growing economy.

In the OECD (Organization for Economic Co-operation and Development) countries, adult education has undergone significant development, both in terms of the variety of programmes and the level of participation. It has moved from a marginal position relative to formal educational systems to an increasingly important place in a society's overall educational provision.[5] A recent study on new patterns of adult learning in six OECD countries manifested the increased demand and provision of large

* This study is part of a research project entitled "Evaluation of the external efficiency of vocational/technical education in Shenzhen." It is funded by the Chinese University of Hong Kong's Direct Grant (SSEP AC No. 2020287). The authors would like to acknowledge the collaborative effort of the Shenzhen Institute of Educational Research, especially the assistance of Ms Zhao Peifeng in data collection. We would also like to express our thanks for technical assistance from Mr Lau Hei Yin in drawing the figures for data presentation.

1. T. Schultz, *Investment in Human Capital* (New York: The Free Press, 1971).
2. L. Thurow, *The Future of Capitalism* (New York: Penguin, 1996).
3. R. Reich, *The Work of Nations* (New York: Vintage, 1992).
4. J. Eicher, "International educational expenditures," in M. Carnoy (ed.), *International Encyclopaedia of Economics of Education*, 2nd edition (Oxford: Pergamon, 1995), pp. 443–450.
5. Organization for Economic Co-operation and Development (OECD), *Learning Opportunities for Adults*, Vol. 1 (Paris: OECD, 1977).

numbers of adult learning opportunities as a trend of the "silent explosion." This trend has been building for a long time to meet the needs of skill development across all occupational strata as jobs disappear or emerge.[6] In the United States, workers across occupations pursue a large variety of training paths to acquire job-related skills, and informal "picking up the trade on the job" training is found among the most important sources of job-related skill development.[7] A clear trend in adult education development in recent decades is the strengthening of vocational training, especially on-the-job training sponsored in industry by employers.[8] Analysts point out that on-the-job training is of crucial importance not only for economic growth but also for the sustained viability of an economy in the modern world, and formal schooling and job-related training after formal schooling can complement each other.[9] In the United States and several other developed countries, investment in adult education and vocational training in the workplace is quite substantial, both in terms of absolute amount and as a proportion of spending on formal schooling.[10]

In many developing countries, the development of primary and secondary education is a high priority in the overall development of the formal-schooling system. Pre-employment training institutions, such as government vocational secondary schools and training centres, tend to be the focus of government training policy. Workplace training and lifelong education through adult programmes are generally not well-developed, and little information on such training and programmes exists. Studies have, nevertheless, found that in some developing countries, a mix of education and training programmes is available for skill acquisition and that there are multiple paths to skill development for a given occupation.[11] There is a need to better understand the skill market and the range of education and training modes in developing countries, particularly adult education and employer-sponsored on-the-job training. Such understanding can contribute to more efficient investment of scarce resources in

6. P. Belanger and A. Tuijnman, "The 'silent explosion' of adult learning," in P. Belanger and A. Tuijnman (eds.), *New Patterns of Adult Learning: A Six-country Comparative Study* (Oxford: Pergamon, 1997) pp. 1–16.

7. U.S. Department of Labor, *Learning the Tool and Die Maker Trade*, Manpower Research and Development Monograph No. 17 (Washington, DC: U.S. Printing Office, 1970); C. Brown, "Empirical evidence on private training," in Commission on Workforce Quality and Labor Market Efficiency (eds.), *Investing in People* (Washington, DC: U.S. Department of Labor, 1989).

8. A. C. Tuijnman, "Providers of adult education: an overview," in A. C. Tuijnman (ed.), *International Encyclopaedia of Adult Education and Training* (Oxford: Pergamon, 1996), p. 617.

9. M. J. Bowman, "Training on the job," in Tuijnman (ed.), *International Encyclopaedia of Adult Education and Training*, pp. 69–75; J. M. Hunter, M. E. Borus and A. Mannan, *Economics and Non-formal Education* (Michigan State University: Institute for International Studies in Education, 1974).

10. M. C. Tsang, "The costs of adult education and training," in A. C. Tuijnman (ed.), *International Encyclopaedia of Adult Education and Training*.

11. J. Middleton, A. Ziderman and A. V. Adams, *Skills for Productivity: Vocational Education and Training in Developing Countries* (New York: Oxford University Press, 1993); A. Ziderman and R. Horn, "Many paths to skilled employment: a reverse tracer study of seven occupations in Colombia," *Education Economics*, Vol. 3, No. 1 (1995), pp. 61–79.

education and training in these countries and in targeting human-capital development programmes for the economically disadvantaged as part of an overall strategy for poverty reduction.

This research note is a case study of how human capital is developed to support the fast economic growth of Shenzhen, China. The study highlights the substantial and integrated nature of three forms of human-capital development – formal schooling, on-the-job training in the workplace, and adult education outside the workplace.

Shenzhen has been singled out by the Chinese government as an important model of rapid economic development in the transition from a centrally-planned to market-oriented economy. How Shenzhen manages to meet the demand for human capital of a rapidly growing economy in transition is of great interest to policy-makers and practitioners in other parts of China and in other countries contemplating a similar economic transformation. A reverse-tracer study is used in an attempt to find out where employed workers in Shenzhen obtain their education and training, particularly exploring the extent and type of workplace training and adult education, given that pre-existing information on such training and education is lacking.

The argument is organized as follows: opening with a brief description of the Chinese context and the key research questions, it goes on to explain research methods and data. Following the presentation of the findings the key features of Shenzhen's human-capital development model are summarized, relating the findings on the national debates on vocational/technical education, and comparing these with those in other countries. Finally, there is a discussion of the implications of the findings for education and training policy.

The Chinese Context and Research Questions

Since the implementation of China's modernization programmes in 1978, the focus of state education policy has been on developing the education and training system. In addition to the expansion of basic schooling and regular higher education, the Chinese government has advocated adult education as a means of renewing and upgrading the skills of the workforce; it has also restructured education by expanding secondary vocational/technical education.[12]

Currently, the education structure consists of nine-year compulsory

12. China Central Committee and the State Council, *Decisions on Strengthening Employee Training*, Central Committee Document No. 8 (Beijing: The State Council, 20 February 1981); China Education Yearbook (eds.), "Report on restructuring secondary education by China the State Education Ministry and Labor Ministry and endorsed by the State Council," in *China Education Yearbook 1949–1981* (Beijing: China Encyclopaedic Press, 1984), pp. 708–709; People's Press, *Documents on the Reform of the Educational System* (Beijing: People's Press, 1985) pp. 1–18; M. C. Tsang, "The structural reform of secondary education," *Journal of Educational Administration*, Vol. 29, No. 4 (1991), pp. 65–83; and J. Xiao, "Higher adult education in China: redefining its roles," in M. Agelasto and B. Adamson (eds.), *Higher Education in Post-Mao China* (Hong Kong: Hong Kong University, 1998).

education (five/six years of primary education and three/four years of lower-secondary education), a three-year upper secondary education with academic and vocational/technical tracks, two/three-year junior colleges, four-year universities, and adult-education at various levels. Upper-secondary vocational/technical education is provided in three types of schools: secondary vocational schools run by education bureaucracies, skilled-workers' schools run by the Ministry of Labour, and secondary specialized schools run by various line ministries. Since the mid-1980s, government policy has restructured upper-secondary education from predominately academic education to a mix of academic and vocational/technical education (VTE). In 1995, out of 16.5 million students in upper-secondary education in China, 57 per cent were in vocational/technical education.[13] Adult education can take place in the workplace or in institutions outside the workplace. Adult education outside the workplace has developed rather rapidly in the past decade and a half. In 1995, for example, there were 2.57 million participants in adult education at the higher-education level, 56.94 million at the secondary level and 7.78 million at the primary level.[14] Information is lacking on the amount of training in the workplace sponsored by employers.

Prior to economic reform, Shenzhen was a small, rural town in Baoan county on the border of Hong Kong. Before 1979, the county's 0.3 million inhabitants were engaged in farming and fishing. In 1980, the State Council, China's executive decision-making body, announced the inauguration of the Shenzhen Special Economic Zone,[15] which was designed as a prototype of economic development, to be built at the maximum speed possible. The twin policies of reform (*gaige*) and opening to the outside world (*kaifang*) were implemented to help boost the Chinese economy. At the same time, Hong Kong experienced an economic transition from industrialization towards a diversified economy with an increased emphasis on services. Labour-intensive industries, particularly processing/assembling, were rapidly phased out and moved to mainland China, first to Shenzhen and then to other regions in Guangdong.[16] Shenzhen aided Hong Kong's economic transition by providing cheap domestic labour and low-cost land. Correspondingly, the economic integration of Shenzhen with Hong Kong stimulated profound changes in Shenzhen's economy and created millions of new jobs. Over the last decade or so, the Shenzhen Special Economic Zone and two rural

13. China State Education Commission, "The Ninth Five-Year Plan of the national education and development plan for 2010," in *Policy Report of State Education Commission*, Vol. 6 (Beijing: China State Education Commission, 1996), pp. 219–227.

14. *Ibid.*

15. Shenzhen Municipality, formerly named Baoan county, is about 2,020 square kilometres. Shenzhen includes three districts – Shenzhen Special Economic Zone, and two rural districts, Baoan and Longgang. As economic development in the special zone has strong impacts on the two rural districts, "Shenzhen" in this study refers to all three districts.

16. Sung Yun-wing, *The Economic Integration of Hong Kong with China in the 1990s: The Impact on Hong Kong*, Canada and Hong Kong Project, Research Paper No. 1 (Toronto: University of Toronto–York University Joint Centre of Asia Pacific Studies, 1992), pp. 1–5; Organization for Economic Co-operation and Development (OECD), *China's Special Economic Zones* (Paris: OECD, 1986).

districts, Baoan and Longgang, have developed into a large industrialized area. Since 1980, internal immigrants across China have moved to Shenzhen and settled down to aid the economic reform and development projects. The population in Shenzhen rose from 0.3 million in 1979 (with a workforce of 0.15 million) to 3.4 million in 1996 (with a workforce of 2.45 million). Per capita real GDP (in 1978 terms) has also grown rapidly over time. For example, in 1980, Shenzhen's per capita real GDP was 719.8 *yuan*, about one-third of that of Shanghai (2,360.3 *yuan*) and slightly over half of that of Beijing (1,370.7 *yuan*). In 1994, Shenzhen's per capita real GDP reached 4,032 *yuan*, which exceeded that of Shanghai by 1,410 *yuan*, Beijing by 2,185 *yuan* and China's average by 3,001 *yuan*.[17] Between 1980 and 1994, per capita real GDP increased at an annual rate of 13.1 per cent. Shenzhen has been recognized by the Chinese government as a successful model of economic growth within the larger context of the transition from a centrally-planned to a market-oriented economy.

In the process of economic growth, development projects required new jobs in management, clerking, sales, business services, financing and international trade; these emerged when the market-oriented economy gradually took shape in Shenzhen as well as in other parts of China later on. New production technology introduced as part of investment from Hong Kong and other countries continues to pour into Shenzhen.[18] For example, the electronics industry changed its production equipment from hand-installing and hand-welding prior to the mid-1980s to machine-welding in the late 1980s, and then went to machine-installing in the mid-1990s. Digital numerically-controlled machines have been adopted in industry extensively since the early 1990s. Offices are equipped with computers with Internet access. The changing technology and economic structure have increased the demand for a skilled workforce in Shenzhen.

In the early 1980s, the government of Shenzhen placed a high priority on school expansion.[19] During the period 1979–95, the number of primary schools increased from 226 to 274, and their enrolment increased from 47,022 to 157,210 students. The number of secondary schools increased from 24 to 62, with enrolment increasing from 13,686 to 71,540 pupils. Similarly, the number of secondary vocational schools increased from one to 28, and enrolment increased from 80 to 13,393. Two higher education institutions were set up, enrolling 5,291 university students in 1995. This rapid expansion ensures that the formal education system can provide the children of all new immigrants with basic schooling (defined in China as upper-secondary education).

At the same time, the government recognized that formal schooling

17. J. Xiao, "Education expansion in Shenzhen, China: its interface with economic development," *International Journal of Educational Development*, Vol. 18, No. 1 (1998), pp. 3–19.

18. Q. S. Li, "Foreign investment on a large scale," in *Shenzhen Special Economic Zone Yearbook 1995* (Shenzhen: Shenzhen Special Economic Zone Publishing House, 1995), pp. 88–91.

19. J. Xiao, "Education expansion in Shenzhen, China."

was only part of an overall strategy to develop local human resources: the expansion and further development of adult education and training had to be an important component of this overall plan.[20] Because of the weak training capacity of enterprises, the government initially took an active role in financing and providing adult education and training. But over time, enterprises have become more active in financing and providing adult education and training as the role of the government has correspondingly diminished.[21] Between 1980 and 1995, job-related training was provided up to 2.1 million person-times to the workforce of 2.5 million.[22]

In Shenzhen, two types of institutions provide education and training to working adults: employee-oriented adult education/training centres and community-oriented adult education/training centres.[23] In the first type, larger firms provide training to their own employees; training is directly job-related and financially supported by these firms. The second type is run by other educational institutions which provide training services to working adults in the local community. This training may or may not be job-related, and participants usually pay for their courses, although some receive subsidies from their employers.

This study distinguishes the education and training experiences of working adults in Shenzhen in three ways: the level and type of formal schooling acquired before the first job; job-related training provided by employers in employee-oriented centres; and adult education in community-oriented centres. Two sets of analysis are undertaken by this study. The first deals with the education and training experiences of a representative sample of employees in Shenzhen. The key research questions are: what education do firms seek in employees? To what extent do firms provide training to their employees to improve their performance? And to what extent do individual employees seek adult education and training outside their firms to improve their productive capacity? The second set deals with alternative training paths for selected occupations in Shenzhen. It addresses questions such as: what are the alternative paths by which employees in a given occupation obtain their education and training? What is the mix of formal schooling, adult education and job-related training provided by employers for selected occupations? Based on these two sets of analyses, the key features of the human-capital development system in Shenzhen can be identified, with the major purpose of providing a better understanding of how Shenzhen meets the demand for human capital in growing economy.

20. Shenzhen Municipal Policy Research Office (SMPRO), *Ten Years in Shenzhen* (Shenzhen: Haitian Press, 1990).

21. J. Xiao and M. Tsang, "Costs and financing of adult education in Shenzhen, China," *International Journal of Educational Development*, Vol. 14, No. 1 (1994), pp. 51–64.

22. J. Xiao, "Education expansion in Shenzhen, China."

23. J. Xiao and M. Tsang, "Costs and financing of adult education in Shenzhen, China."

Methodology and Data

This study employs the reverse-tracer study technique (RTST) to survey the workforce in Shenzhen. RTST focuses on the analysis of persons who are currently employed in particular occupations and traces their education and training histories. It begins with current employment and seeks to identify each major alternative education and training route pursued to reach that position. This technique thus permits the analysis of an array of education and training options utilized by both organizations and individual employees for human-development purposes in the production sector. As pointed out by Ziderman and Horn,[24] RTST is most suited to addressing questions such as: where do skilled workers obtain their training? And, what is the most cost-effective means of preparing workers for skilled employment? This technique distinguishes from the type of trace or follow-up technique which traces the employment experiences of graduates of a given education or training programme: that is more suitable for addressing questions concerning the effectiveness and economic profitability of a single given programme.

Our studies of job-related training and vocational education since 1990[25] indicate that many employers and employees have used on-the-job training and adult education to develop job skills. Based on employment records, interviews with educators and training managers, observations, a survey of trainees and the findings of previous studies, the current research questions were devised and it was decided to conduct a reverse-tracer study to uncover the extent that mixed approaches of formal education, on-the-job training and adult education outside firms were utilized to develop human capital in Shenzhen.

The survey questionnaire consisted of three groups of the questions covering: (a) an employee's formal education history and its relevance to the current job; (b) on-the-job training provided by firms to employees and its relevance to the current job; and (c) adult education courses that employees attended at their own expense, separate from their firms and any relevance to their current job. The survey was conducted in 1996, and information on training and adult education was obtained for the five-year period from 1991 to 1996.

Stratified random sampling was used to select the participating firms and employees. The stratified sample included (a) different service and production firms in both the manufacturing and service sector; (b) firms with eight types of ownership; (c) firms of different sizes, and (d) one or two major production lines in the firms, including all personnel, from managers, clerks and technicians to machine operators. For each economic sector, three large firms (defined as firms with over 800 employees),

24. Ziderman and Horn, "Many paths to skilled employment."

25. M. C. Tsang, "The costs of adult education and training"; M. C. Tsang, "The costs of vocational training," *International Journal of Manpower*, Vol. 18, Nos. 1/2 (1997), pp. 63–89; J. Xiao, "A study of the relationship between organizational factors and the transfer of training in the electronics industry in Shenzhen, China," *Human Resource Development Quarterly*, Vol. 7, No. 1 (1996), pp. 55–73; J. Xiao and M. Tsang, "Costs and financing of adult education in Shenzhen, China," pp. 51–64; J. Xiao, "Education expansion in Shenzhen, China."

two medium-size firms (with between 301 and 800 employees) and one small firm (fewer than 300 employees) were sampled in each of the eight types of firm ownership,[26] providing a total of 96 firms. It should be noted that the entire production-line sampling strategy has the advantage of showing the actual personnel structure in these firms. The information on the education and training of these personnel reflects the firms' decisions regarding the formal education qualification of the workers that they hire and their investment in worker training.

To select firms and production lines, the *Yearbook of Registered Firms* covering these classifications was obtained from the Association for Shenzhen Enterprises. Representatives from industrial and service firms were randomly selected. Managing directors and personnel officers were contacted and data confirmed about ownership, size and their acceptance of the study being conducted in their firms. If any of the conditions was not met, the firm was replaced with another – also randomly selected. After deleting some types of firm which did not exist (such as large private service and manufacturing organizations), 76 firms – all of which had agreed to participate in the study with one or two of their production lines/groups – were finally selected. A total of 6,200 employees in these firms were surveyed, slightly less than 1 per cent of the registered workforce in Shenzhen.[27] Of the 76 firms, 42 were in manufacturing and 34 in the service sector. The manufacturing firms included 19 firms in electronics, eight in construction and construction materials, eight in household products such as clothes, shoes, bicycles, jewellery, etc., four in food and medicine, two in machinery and one in electricity supply. The 34 service firms included eight firms in tourism (hotel and entertainment), six in trading, two in finance and stocking, eight in wholesale

26. The eight types of ownership refer to state-owned; collectively owned; joint-ventures with firms from Hong Kong, Macau and Taiwan; joint-ventures with firms from other countries; sole-investment firms from Hong Kong, Macau and Taiwan; sole-investment firms from other countries; local private firms; and corporate firms. The first two are considered typical in the planned economy and the latter six are new forms of ownership that have occurred in the transferred economy after 1980. Due to space constraints, this paper does not present results on training and education in enterprises of different ownership, which fall into another focus of analysis.

27. Shenzhen has a population of 3.4 million with a workforce of 2.45 million. Among this workforce, there are 0.46 million town inhabitants, 1.1 million village dwellers, 0.89 million registered employees and 0.05 million others. The first group consists mostly of original local populations who now own village-run enterprises and rent premises for a living. The second and the third groups consist mostly of the immigrating population from other parts of China. They held temporary residence permission status when they first came. Those in the second group usually find a temporary job in village-run enterprises, usually in the two rural districts, Baoan and Longgang. Those in the third group are hired by firms and organizations in the formal sectors that register their employees with the municipal government labour department or personnel department. These registered firms are located in all three districts in Shenzhen, but are mostly in the urban areas. Employers of the second and third groups could apply to the government to convert the temporary residence permission of their employees into a permanent one when they have completed more than one contract term or worked over three years, but on the conditions that the employees' skills are important to the production or service of the organization and development projects in Shenzhen. Otherwise, employees could stay with the employers on renewable contracts and temporary residence permissions. Currently, Shenzhen has kept its permanent resident rate at 29%. For our study, we only sampled the third group, the registered workforce.

and retail, three in transportation, two in telecommunications, and five in real estate.

In conducting the survey, questionnaires were sent by our research staff to one main production line or work group (if it had 50 employees or so) or two (it they had fewer than 25 employees in each) in a firm. Questionnaires were then distributed to each employee. It was required that the questionnaires be completed and returned in a couple of days and the same research staff collected the completed questionnaires. Out of 6,200 surveyed employees, 4,002 returned questionnaires, providing a 65 per cent response rate. The non-returns were those who did not bring the questionnaire to the firm on collection day.

Among the returned questionnaires, state-owned firms were under-represented while corporate firms were over-sampled because their production lines or work groups were large. Weights were then applied to the sample in order to arrive at a representative sample of the overall workforce. Data on where employees obtained their education and training are presented in the next section. These findings are disaggregated by gender, age, occupation, industry and firm-size groups. Findings on the education and training paths for selected industries/occupations are given in the following section. Due to space constraints, findings by ownership of firms and products are not presented in this article.

Education and Training Experiences of Employees

This section provides analyses of employee experience of formal education, firm-provided training, and adult education in Shenzhen. The results are based on the entire sample of 4,002 surveyed employees, further confirmed by interviews and calls with the managers in 20 firms during data analysis.

Educational qualifications sought by employers. Table 1 shows the distribution of formal educational attainment of employees at the time they were first employed. It presents the percentage of employees who had acquired lower-secondary general education (LSGE), upper-secondary general education (USGE), upper-secondary vocational/technical education (VTE), and post-secondary education (two/three-year junior college or at least four years of university). The information is presented for male and female employees in various economic sectors, occupations and age groups.

Among the 4,002 sampled employees, 19.1 per cent had LSGE, 34 per cent had USGE, 20.4 per cent had VTE, 8.5 per cent had junior college, and 15.2 per cent had at least four years' university education. The proportion for post-secondary education is very high, given the proportion of the population group with access to higher education. For example, in China in 1993, only 4 per cent of the higher-education age

Table 1: **Education Attainment in Distribution**

	OVERALL SAMPLE							*MALE*							*FEMALE*						
	Lower (%)	*Secondary Upper (%)*	*VTE (%)*	*Junior college (%)*	*4-year university (%)*	*Missing (%)*	*Total (%)*	*Lower (%)*	*Secondary Upper (%)*	*VTE (%)*	*Junior college (%)*	*4-year university (%)*	*Missing (%)*	*Sub-total (%)*	*Lower (%)*	*Secondary Upper (%)*	*VTE (%)*	*Junior college (%)*	*4-year university (%)*	*Missing (%)*	*Sub-total (%)*
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*
Total (person)	765	1358	816	340	611	112	4002	238	550	392	183	417	37	1817	517	793	418	148	182	63	2121
	19.1	34.0	20.4	8.5	15.2	2.8	100	13.1	30.3	21.6	10.0	23.0	2.0	100	24.4	37.4	19.7	7.0	8.6	3.0	100
Sector																					
Industry	25.5	32.4	19.7	6.6	13.2	2.6	57.8	13.8	30.4	24.6	8.7	20.9	1.7	59.2	36.3	34.5	15.7	4.5	5.9	3.1	56.5
Service	10.4	36.0	21.3	11.1	18.2	3.1	42.2	12.1	30.1	17.3	11.9	26.0	2.6	40.8	8.8	41.2	24.9	10.2	12.0	2.8	43.5
Size																					
Large	11.5	39.3	20.6	8.8	16.3	3.5	44.1	7.3	33.0	23.7	10.5	22.8	2.7	45.1	15.0	45.6	18.1	7.2	10.2	3.8	42.8
Medium	17.7	31.3	23.7	8.4	16.2	2.6	26.1	8.1	26.7	26.2	9.1	27.6	2.3	24.3	25.0	35.1	22.5	7.3	7.7	2.2	27.4
Small	31.5	28.4	17.2	8.1	12.9	1.9	29.9	25.6	29.1	14.8	10.1	19.5	0.8	30.5	37.1	27.8	19.4	6.3	7.0	2.4	29.8
Occupation																					
Managerial	9.1	33.0	18.7	10.3	27.1	1.8	9.9	11.6	23.1	18.1	13.0	33.2	0.9	13.3	4.8	50.3	19.7	6.2	15.8	3.2	7.0
Professional	6.0	19.7	19.7	13.5	41.4	2.0	21.5	3.5	17.0	17.2	12.7	48.1	1.5	28.1	9.6	24.4	18.4	14.5	31.6	1.5	15.7
Salesperson	9.7	48.4	14.2	13.7	8.3	5.8	7.2	10.3	30.0	13.3	22.4	18.9	5.2	5.9	9.2	60.7	15.6	8.7	0.6	5.2	8.2
Clerk	6.1	37.2	27.2	15.4	12.4	1.8	14.8	4.9	29.9	18.0	23.9	23.6	0.0	7.9	6.5	39.3	30.3	12.6	8.8	2.5	20.9
Skilled worker	23.5	38.3	31.1	2.6	3.4	1.2	12.2	13.8	40.7	35.3	3.5	4.8	1.9	17.2	39.9	33.5	24.2	1.2	1.2	0.0	8.2
Non-skilled worker	47.8	32.5	15.8	0.9	0.3	2.6	20.8	33.2	39.0	22.8	2.5	1.0	1.4	14.7	55.1	29.3	12.5	0.2	0.0	2.9	26.2
Others	21.0	46.3	20.3	6.4	4.9	1.0	7.9	20.4	47.3	18.5	5.6	6.9	1.3	8.1	22.1	46.5	22.5	5.1	3.0	0.8	7.6
Age																					
16–25	26.4	28.8	26.9	7.4	7.7	2.8	50.4	16.2	27.7	31.0	9.6	13.7	1.8	42.6	33.4	29.6	24.9	5.7	3.8	2.5	56.7
26–35	9.5	38.6	14.7	10.2	24.9	2.2	35.9	7.8	29.3	16.2	11.2	33.4	2.1	39.2	11.3	48.2	13.3	9.0	15.9	2.4	33.3
36 and above	17.0	41.1	11.4	8.1	18.1	4.3	13.7	17.0	38.5	11.2	8.7	22.1	2.4	18.1	16.6	46.0	11.8	7.3	11.0	7.5	10.0

cohort were enrolled in higher education.[28] According to the most recent population census in 1990, only 2.3 per cent of the working-age population had post-secondary education (computed from the *China Statistical Yearbook 1995*[29]). In hiring employees, especially managerial and professional staff, employers in Shenzhen preferred those who were relatively young, with higher education.[30] Thus, by inference, in order to sustain their high level of economic growth and per capita output, firms in Shenzhen employ a very high concentration of highly skilled workers.

There are clear differences in the distribution of formal educational qualifications of employees across economic sectors and occupational categories.[31] For example, 11.1 per cent and 18.2 per cent of employees in the service sector had junior college and at least four years' university education respectively, compared to 6.6 per cent and 13.2 per cent (around 20 per cent) in the manufacturing sector. These two sectors had similar proportions of employees with upper-secondary VTE. About 27 per cent of managers and 41.4 per cent of professional employers had at least four years' university education while only 3.4 per cent of skilled workers and 0.3 per cent of non-skilled workers had university education. Most LSGE graduates were employed in manufacturing sector and non-skilled jobs. The educational backgrounds of employees in large firms and in medium-size firms were quite similar. In comparison, small firms had relatively more employees with LSGE and USGE and correspondingly fewer employees with VTE.

Table 1 also shows that most of the employees were in the 16–25 age group. This is a relatively young workforce because 90 per cent of the

28. World Bank, *World Development Report 1997* (New York: Oxford University Press, 1997), p. 200.

29. China State Statistics Bureau, *China Statistical Yearbook 1995* (Beijing: China Statistical Publishing House, 1995), p. 61.

30. When hiring, employers usually prefer upper-secondary graduates around 20 years old, but under 25 years of age. For managerial and professional staff, they look for individuals under 35 years and holding a university degree. In this newly-emerging Shenzhen, employers expect hard-working employees in developing new projects. What's more, younger employees have more years ahead of them to contribute to projects. Also see Shenzhen Special Economic Zone Yearbook Personnel, *Shenzhen Special Economic Zone Yearbook 1995* (Shenzhen, 1995), pp. 147–49.

31. Occupational classification is defined in very general terms in China. Managerial staff include those for business administration and production management, which are new positions in the Shenzhen economy. Professionals include personnel engaged in research and technical aspects of project design, engineers, financial personnel and factory-floor technicians. Sales is also a new job category to emerge in the market-oriented economy. As for clerks, this traditional support occupation in the Chinese context re-emerged as a new occupation. Besides traditional clerical support, clerks often have to perform some semi-professional and technical tasks (such as computing). "Skilled workers" refer to those who have obtained intermediate or above skill proficiency and/or have technical responsibility for quality control and mentoring unskilled workers in the work group. Non-skilled workers refer to those unskilled or semi-skilled employees who are at the entry level on the production line or in a firm. Others include non-skilled jobs such as cleaning, building custodian, gate-keepers and security personnel. The conventional skill proficiency scale for workers consists of eight levels. Levels 1 to 3 are referred to as entry level, levels 4 to 6 are intermediate, and 7 to 8 are senior workers who can be considered technicians. In Shenzhen a simplified scale of entry, intermediate and senior levels is in use.

residents are immigrants from other cities.[32] Among the three age groups, the age group 26–35 had received most higher education; obviously, many employees in the 16–25 age group in the sample have not gone to college, or have not yet finished their university education.

Table 1 also shows clear differences in occupation by gender. For example, more males than females are found in managerial, professional and skilled occupations. In contrast, more females work in clerical and non-skilled jobs. For all the occupational groups, male employees have more university education than females. In managerial, professional, sales and clerical occupations, female employees have more VTE than their male counterparts. This seems to suggest that overall, males have an education advantage over their female counterparts. As pointed out in subsequent analyses, these differences can be partly explained by disadvantages faced by females in formal schooling and in on-the-job training.

Job-related training provided by employers. Before 1980, most of today's jobs did not exist in the planned economy or were not known in Shenzhen, as discussed earlier. Development projects created millions of new jobs and new production technology introduced as part of investment brought changes to existing jobs. On average, 68.4 per cent of the sampled employees experienced workplace changes at least once in five years. Thus, human resource development – particularly in terms of the acquisition of new skills and the upgrading of existing skills – has become a major challenge for firms operating in Shenzhen. On-the-job training provided by employers became an important strategy for developing job-specific skills because the curriculum in formal schooling could not be revised quickly enough to meet the demand for specific skills.

Table 2 shows the different types and amounts of training received by employees. In column (1) to column (6), the types of training are listed in more or less a chronological order. Job-entry training usually takes about two weeks. After one or two days of initial orientation to the firm, new employees are assigned to a job position. For employees in a big work group, nine- or ten-day job-specific training is then provided to prepare them for their new position. Remedial training consists of training in literacy, numeracy and some basic job skills, which employees with low basic skills are required to undertake. Skill upgrading is provided most extensively to improve employees' job-specific skills and performance in a more demanding production environment. New-skill training is usually provided when firms change production technology or products: employees in the affected positions receive this type of training. Management training is provided to supervisors and managers and to those who are to be promoted. Other training is more concerned with broad production issues, such as seminars on new products, new technology, marketing and on quality control. These last two forms of training are concerned with staff development.

32. See above, notes 27 and 30.

Table 2: **On-the-job Training Received by Employees in Distribution**

	Entry-job (%) 1	*Remedial (%) 2*	*Skill Upgrading (%) 3*	*New skill (%) 4*	*Manage-ment (%) 5*	*Other (%) 6*	*At least once (%) 7*	*No training (%) 8*	*Sample size (person) 9*
TOTAL (person)	1193	138	1722	317	653	316	2363	1639	4002
	29.8	3.4	43.0	7.9	16.3	7.9	59.0	41.0	
Sector									
Industry	28.1	3.1	42.6	10.3	19.2	7.9	57.3	42.7	2312
Service	32.2	3.9	43.6	4.6	12.3	8.0	61.5	38.5	1690
Size									
Large	34.8	5.0	47.6	8.1	21.0	9.0	63.5	36.5	1763
Medium	33.8	3.1	46.5	11.7	15.9	7.8	66.1	33.9	1043
Small	19.0	1.5	33.4	4.4	9.7	6.4	46.3	53.7	1195
Occupation									
Managerial	26.7	4.3	46.8	8.4	43.7	13.2	69.6	30.4	395
Professional	28.0	2.4	39.6	7.8	16.4	8.2	57.6	42.4	862
Salesperson	31.8	6.8	45.2	2.7	8.2	6.9	57.7	42.3	288
Clerk	27.6	1.6	37.8	4.5	20.0	10.9	59.3	40.7	593
Skilled worker	28.2	2.4	48.1	9.1	12.4	4.9	57.2	42.8	488
Non-skilled worker	31.7	4.6	48.1	14.2	8.7	3.8	57.5	42.5	833
Others	40.1	3.2	40.6	1.9	9.5	11.9	66.7	33.3	315
Age									
16–25	34.9	3.3	42.9	9.1	11.6	7.3	59.1	40.9	2017
26–35	29.4	3.6	44.5	7.8	19.7	8.4	60.4	39.6	1433
36 and above	12.3	3.7	39.6	4.1	24.8	8.6	55.7	44.3	548
Gender									
male	30.1	4.1	43.8	9.1	17.8	9.0	59.5	40.5	1817
female	29.7	2.8	42.4	6.9	15.2	6.9	58.9	41.1	2121

When first hired in their current job, 29.8 per cent of the employees received job-entry training. Those who were then identified as being below workplace literacy qualification received remedial training. Given the relatively high educational attainment of workers in Shenzhen, only a small portion (3.4 per cent) of employees needed this type of training. To improve employees' job-specific skills, employers provided two types of training, one that helped improve current job skills, and one to teach new skills when new production technology and products were introduced. Overall, 43 per cent of employees received skill-upgrading training and about 8 per cent received new-skill training. Where management is concerned, 16.3 per cent of the sampled employees received management training. Finally, 7.9 per cent received other kinds of training, which covered a variety of general topics. Column (7) indicates that, overall, 59 per cent of employees received training of one kind or another at least once; 41 per cent received no training provided by employers.

Training received varied across different economic sectors. Overall, a higher percentage of employees in the service sector received some type of training than those in the industrial sector (61.5 per cent as opposed to 57.3 per cent). The types of training also differed between the two sectors. Service-related firms provided more entry-related training while industrial firms provided more new-skill and management training to their employees. In terms of firm size, small firms provided much less on-the-job training than their medium and large counterparts. While 63.5 per cent of the employees in large firms and 66.1 per cent of the employees in medium firms received some on-the-job training, only 46.3 per cent of employees had similar opportunities. Due to their size and limited capacity, many small firms could not provide training internally.

For most of the occupational groups, about 57–59 per cent of employees received at least some training in their firms. About 70 per cent of managers had at least one type of training – not surprisingly, given the additional training (especially specific managerial training) received by employees who were promoted to be managers. The percentage distributions of the type of training for occupational groups were quite similar to one another, with some exceptions. For example, unskilled workers had comparatively more "new-skill" training than the other groups, and managers had significantly more management training than the other groups. The overall pattern of training received by occupational groups suggests that training has been provided broadly to all groups to improve their job-related skills.

From the three age groups, the youngest received the most job-entry training (34.9 per cent) in firms in which they currently worked while the most senior group received the least (12.3 per cent). This suggests that young people tended to receive more job orientation when they started a job but that older workers already had some experience from their previous jobs. For skill-upgrading training and new-skill training, the senior group tended to be less involved, again. In contrast, they were more likely to receive management training. This suggests that as employees get older, they are likely to find more opportunity for staff-

development training. Table 2 also shows that male and female employees had somewhat similar training experiences in their firms. However, male employees had more new-skill training and staff development training than female employees.

Figure 1 shows graphically the paths of on-the-job training at the moment when this study was conducted. The different types of training are indicated on the left side of the figure. The bold oblong blocks in the figure indicate the occurrence of on-the-job training. The number at the upper right corner of each block indicates the number of different types of on-the-job training that employees had received, while the number in the middle of the block indicates the percentage of employees receiving that variety of training or not (totalling 100 per cent). The bold vertical lines joining the blocks indicate the provision of a given type of on-the-job training shown on the left side, and the adjacent dotted lines indicate that the given type of training is not received.

The bottom part of Figure 1 shows that 29.8 per cent of the sampled employees received job-entry training while 70.2 per cent did not. A total of 3.4 per cent of the sample received remedial training, consisting of 2.9 per cent of the sample who had job-entry training, and 0.6 per cent of the sample who did not. Similarly, 43 per cent of the sample had job-upgrading skill training – 2.5 per cent of those had received two types of training already (that is, job-entry training and remedial training), 16.9 per cent had had one type of training already (job-entry training *or* remedial training), and 23.6 per cent had had no prior training. The top of the figure indicates that 41 per cent of the sample had no training of any kind, 28 per cent had one type of training, 18.4 per cent had two types, 8.3 per cent had three types, 3.2 per cent had four types, 0.7 per cent had five types, and 0.4 per cent had six types of training.

Table 3 summarizes the same types of training received by employees with different formal educational qualifications. The notable result from this table is that substantial training was received by employees of all educational backgrounds. Compare general education and VTE graduates: when first entering a job, 22 per cent of LSGE graduates received job-entry training – most of them were assigned to non-skilled job positions. Some 33.1 per cent of USGE graduates received job-entry training, but an even higher proportion of VTE graduates received job-entry training (39.7 per cent). For skill upgrading, substantial proportions of USGE graduates (52.2 per cent) and VTE graduates (47.5 per cent) received training. For new-skill training, 8.8 per cent USGE graduates and 10.2 per cent VTE graduates received training. Overall, 65.4 per cent of VTE graduates received at least some training while the corresponding percentage was 65.8 per cent for USGE graduates.

It is usually assumed by policy-makers that VTE would provide students with specific occupation skills for future jobs. Thus, such VTE graduates may require less training in the workplace than general education graduates – at least initially. The above results indicate that this is *not* the case. Either many VTE graduates do not work in the fields for which they were prepared, or occupational skills learned at school may

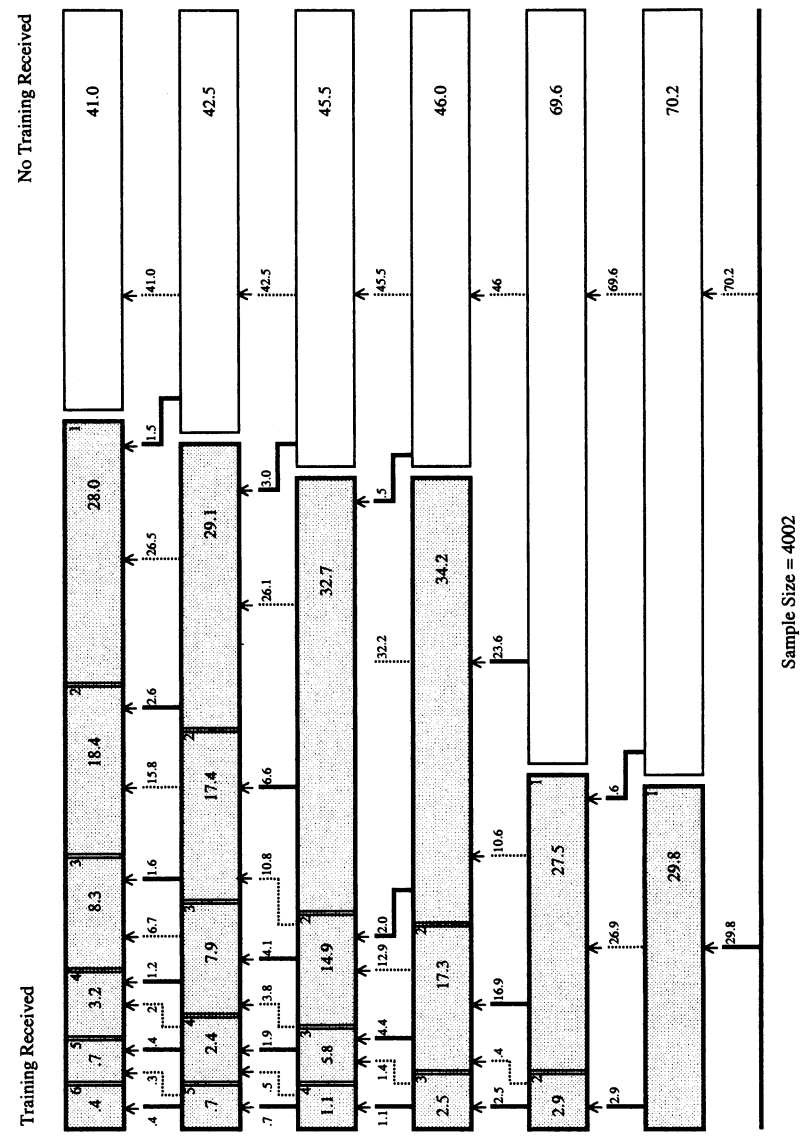


Figure 1: **Paths of On-the job Training**

Table 3: **On-the-Job Training Received in Distribution by Formal Education**

	Entry-job (%) 1	*Remedial (%) 2*	*Skill Upgrading (%) 3*	*New skill (%) 4*	*Manage-ment (%) 5*	*Other (%) 6*	*At least one (%) 7*	*No training (%) 8*	*Sample size 9*
Total (person)	1193	138	1722	317	653	316	2363	1639	4002
	29.8	3.4	43.0	7.9	16.3	7.9	59.0	41.0	
Lower general	22.0	1.8	37.4	6.0	11.2	3.7	49.3	50.7	765
Upper general	33.1	4.4	52.2	8.8	19.1	9.8	65.8	34.2	1358
VTE	39.7	4.9	47.5	10.2	16.0	7.2	65.4	34.6	816
Junior college	18.5	3.7	33.0	5.2	16.1	8.5	49.7	50.3	340
4 year university	28.2	1.7	31.3	6.9	18.8	10.1	55.9	44.1	611
Male (person)	547	74	795	165	323	164	1080	736	1817
	30.1	4.1	43.8	9.1	17.8	9.0	59.5	40.5	
Lower general	19	1.3	39.9	5.9	8.8	2.5	52.1	47.9	238
Upper general	32.7	4.7	56.4	10.7	22.0	12.2	68.4	31.6	550
VTE	43.7	6.5	50.6	12.3	17.8	7.7	66.4	33.6	392
Junior college	17.9	4.9	34.3	6.5	17.8	9.6	48.1	51.9	182
4 year university	26.7	2.4	28.5	7.2	18.4	9.8	52.4	47.6	417
Female (person)	630	59	900	145	321	146	1250	871	2121
	29.7	2.8	42.4	6.9	15.2	6.9	58.9	41.1	
Lower general	23.6	2.1	35.8	5.6	12.4	4.3	47.8	52.2	517
Upper general	32.7	4.0	48.9	7.4	17.0	7.8	63.9	36.1	793
VTE	35.8	3.2	44.3	8.3	14.1	6.8	64.5	35.5	418
Junior college	19.9	1.4	33.0	3.2	14.5	7.1	54.4	45.6	148
4 year university	32.4	0.1	39.7	6.7	20.2	11.4	65.4	34.6	182

not match the workplace-specific job requirements.[33] Consequently, specific job skills training is needed for VTE graduates despite their occupational training in formal secondary schools. Studies in China and a wide range of other countries indicate that secondary vocational/technical education is much more expensive than secondary general education.[34] Table 3 suggests that training provided to VTE graduates in the workplace is probably more expensive than that of general education graduates. Thus, unless VTE graduates are much more productive than general graduates in the workplace, VTE is a less efficient form of educational investment at the upper-secondary level in China.

Table 3 also shows that 49.7 per cent of employees with junior-college education and 55.9 per cent of employees with university education received some type of on-the-job training. Employers find it necessary to provide a substantial amount of on-the-job training to employees with higher education, despite their superior educational qualifications. These employees usually hold more senior positions in firms and their competence affects the competitiveness of the firm. Interviewed employers felt that in the fast-growing economy, adequate training for their manager and supervisors was critical so that they in turn could lead other employees. This suggests that rapid changes in the workplace require continuing learning for all formal-schooling groups, including employees with higher education.

That educational qualifications make a difference in the amount of training received by males and females is also indicated by Table 3. For employees with a secondary education (LSGE, USGE and VTE), males had relatively more on-the-job training than females (52.1 per cent, 68.4 per cent and 66.4 per cent compared to 47.8 per cent, 63.9 per cent and 64.5 per cent respectively). But for employees with higher education (junior college and university education), females had relatively more on-the-job training than males (54.5 per cent and 65.4 per cent versus 48.1 per cent and 52.4 per cent, respectively).

Table 4 further examines the amount of on-the-job training that each employee received. Column (1) in Table 4 shows that in all the five education groups, about 28 per cent received at least one type of training. As the total amount of training received by each employees increases, the proportion of employees tends to decrease. Just over 22 per cent of LSGE graduates received two to four types (the sum of Columns (2) to (4) inclusive) of training; the corresponding figure is 34.8 per cent for USGE graduates, 36.2 per cent for VTE graduates, 23.7 per cent for junior-college graduates, and 26.0 per cent for university graduates. This suggests that providing more than one type of training to employees is a common practice in the workplace in Shenzhen, and employees have opportunities to receive different types of training to improve their job skills. Table 4 also shows that, overall, 29.6 per cent of female employees

33. J. Xiao, "Education expansion in Shenzhen, China."
34. M. C. Tsang, "The costs of vocational training."

Table 4: **Amount of On-the-Job Training Received in Distribution by Formal Education**

	1 type (%)	*2 types (%)*	*3 types (%)*	*4 types (%)*	*5 types (%)*	*6 types (%)*	*At least once (%)*	*No training (%)*	*Sample size*
Total (person)	1122	737	331	130	27	16	2363	1639	4002
	28.0	18.4	8.3	3.2	0.7	0.4	59.0	41.0	
Lower general	26.2	15.7	5.5	1.4	0.3	0.0	49.3	50.7	765
Upper general	29.2	20.0	10.9	3.9	1.0	0.8	65.8	34.2	1358
VTE	28.0	21.8	10.1	4.3	1.0	0.2	65.4	34.6	816
Junior college	25.6	17.4	3.7	2.6	0.0	0.5	49.7	50.3	340
4 year university	29.4	15.9	6.8	3.3	0.3	0.1	55.9	44.1	611
Male (person)	486	346	155	73	13	12	1080	736	1817
	26.5	19.0	8.5	4.0	0.7	0.7	59.5	40.5	
Lower general	33.1	14.0	3.4	1.3	0.0	0.0	52.1	47.9	238
Upper general	28.2	20.7	12.2	4.9	0.9	1.5	68.4	31.6	550
VTE	23.3	24.6	10.6	5.7	1.7	0.5	66.4	33.6	392
Junior college	19.4	19.3	5.5	3.5	0.0	0.5	48.1	51.9	182
4 year university	26.5	15.6	6.5	3.1	0.4	0.2	52.4	47.6	417
Female (person)	627	381	175	51	14	3	1250	871	2121
	29.6	17.9	8.2	2.4	0.6	0.1	58.9	41.1	
Lower general	22.7	16.5	6.6	1.6	0.4	0.0	47.8	52.2	517
Upper general	30.3	19.3	10.0	2.7	1.1	0.4	63.9	36.1	793
VTE	32.5	19.2	9.7	2.8	0.3	0.0	64.5	35.5	418
Junior college	34.9	16.1	1.7	1.8	0.0	0.0	54.4	45.6	148
4 year university	36.2	17.5	7.8	4.0	0.0	0.0	65.4	34.6	182

received one type of training compared to 26.5 per cent for male employees. However, 32.9 per cent of the male employees received more than one type of training, compared to 29.2 per cent for female employees. To the extent that managerial positions generally require more than one type of on-the-job training, male employees have an advantage over their female counterparts in terms of on-the-job training for promotion.

Adult education outside the firm. Respondents for this study identified two dozen different skill development programmes[35] that they had attended in community-oriented adult education centres outside their firms. Such programmes were not made compulsory by their firms; employees made their own decision to improve their skills. These programmes could be short-term (defined as less than 30 days), medium-term (between 30 and 100 days), or long-term (over 100 days) programmes.[36] Short-term courses usually focused on a specific topic or skill that was not necessarily work-related. For example, they related to using computer software, understanding different schools of music, or how to invest in stocks. Medium-term programmes often prepared trainees with specific occupational skills, for example, in interior design or storehouse bookkeeping. Finishing a programme earned an employee a certificate of skill proficiency. Long-term programmes usually included a series of courses, completion of which led to an adult education degree such as a degree in adult secondary general education, or an adult higher education degree in accounting or management. Table 5 indicates the amount of adult education attended by employees. "Any type" in the table refers to any of the three types of programmes, not specified by the respondents.

Column (5) of Table 5 shows that, overall, almost one-third of employees attended adult education programmes of one kind or another. The rate of attendance was somewhat higher for the service sector (33 per cent) than for industry (30 per cent). However, the overall rate of attendance for employees in small firms (22.4 per cent) was much lower than in large and medium firms (36.4 per cent and 33.5 per cent). Among occupational groups, clerks had a much higher enrolment rate (48.3 per cent) than other groups. This may be because changes in the workplace

35. These programmes include economics and finance, electronics and electrical engineering, humanities subjects, construction engineering, accounting and clerkship, business administration, management in industry, public relations and sales, adult secondary specialized certificate study, adult secondary upper-general certificate study, business law, transportation and road engineering, art and design, journalism, continuing studies in medicine, cuisine, biology and food processing, security guard training, sports training, quality control in industry, and so on. Another study (see J. Xiao, "Education expansion in Shenzhen, China") found that adult education centres offer almost all the vocational and technical programmes that VTE schools or specialized secondary schools offer, except three specialized occupations – policing, kindergarten teachers and nursing. See J. Xiao, "Education expansion in Shenzhen, China," Table 8.

36. A three-hour course is counted as a half-day, six-hour courses are counted as a whole day.

Table 5: **Adult Education Received in Distribution**

	OVERALL SAMPLE						*MALE*						*FEMALE*					
	Short term (%) 1	*Medium term* (%) 2	*Long term* (%) 3	*Any type* (%) 4	*Total attendance* (%) 5	*Size* 6	*Short term* (%) 7	*Medium term* (%) 8	*Long term* (%) 9	*Any type* (%) 10	*Total attendance* (%) 11	*Size* 12	*Short term* (%) 13	*Medium term* (%) 14	*Long term* (%) 15	*Any type* (%) 16	*Total attendance* (%) 17	*Size* 18
Total (person)	164	212	343	532	1251	4002	55	82	138	237	512	1817	100	132	179	302	713	2121
	4.1	5.3	8.6	13.3	31.3		3.0	4.5	7.6	13.0	28.1		5.0	6.1	9.4	13.6	34.1	
Sector																		
Industry	4.2	5.6	8.4	11.8	30.0	2312	3.1	5.0	8.1	12.6	28.8	1075	5.1	6.3	8.8	11.1	31.3	1199
Service	4.0	4.9	8.8	15.3	33.0	1690	2.9	3.8	6.9	13.7	27.3	741	5.0	5.8	10.2	16.8	37.8	922
Size																		
Large	4.3	7.4	11.8	12.9	36.4	1763	3.7	6.8	10.2	13.2	33.9	820	4.7	8.2	13.3	12.9	39.1	907
Medium	4.6	4.8	9.1	15.0	33.5	1043	3.9	4.1	8.6	14.2	30.8	442	5.4	5.5	9.5	14.0	34.4	581
Small	3.4	2.7	3.3	13.0	22.4	1195	1.3	1.5	3.0	11.8	17.6	554	5.2	3.7	3.7	14.2	26.8	633
Occupation																		
Managerial	2.1	6.6	13.3	11.0	33.0	395	0.8	5.0	13.9	11.6	31.3	242	4.0	9.5	12.1	10.4	36.0	148
Professional	2.8	4.5	8.7	15.6	31.6	862	2.6	4.3	6.4	12.0	25.3	511	2.9	5.0	12.3	21.7	41.9	333
Salesperson	5.7	4.7	8.3	15.0	33.7	288	4.5	3.4	6.0	11.6	25.5	107	6.6	5.8	9.1	17.7	39.2	173
Clerk	8.4	7.6	15.1	17.2	48.3	593	8.6	8.1	13.2	18.5	48.4	144	8.2	7.5	15.8	16.5	48.0	444
Skilled worker	2.0	4.2	7.4	16.7	30.3	488	2.0	3.4	6.6	16.7	28.7	312	2.0	5.8	8.4	17.0	33.2	173
Non-skilled worker	4.3	4.2	4.5	9.6	22.6	833	4.4	3.9	5.3	10.7	24.3	268	4.3	4.5	4.2	8.6	21.6	555
Others	3.8	5.8	6.8	10.0	26.4	315	2.1	5.7	5.9	15.2	28.9	148	5.4	6.1	7.7	5.3	24.5	161
Age																		
16–25	5.1	5.6	7.9	13.2	31.8	2017	3.5	5.6	6.3	12.2	27.6	774	6.0	5.7	8.7	13.9	34.3	1202
26–35	3.3	5.3	9.7	15.0	33.3	1437	2.9	3.8	8.6	15.4	30.7	713	3.7	7.0	10.9	14.5	36.1	707
36 and above	2.5	4.2	8.1	9.3	24.1	548	2.0	3.6	8.4	9.7	23.7	329	3.4	5.2	8.0	8.8	25.4	212

caused by office automation require more learning. In contrast, the participation rate of non-skilled workers was only 23 per cent. Among the three age groups, the two younger groups attended more adult education programmes than the oldest group. The participation rates also varies with the length of the programme. A higher proportion of employees attended longer-term programmes which would award a certificate or a degree. For example, the clerical and managerial groups had the highest proportion of participation in long-term programmes. These credentials could be valuable at promotion time.

Regarding gender, female employees consistently showed higher attendance rates than their male counterparts across economic sectors, age groups and occupational groups, as well as by size of firm. Considering that female employees received less on-the-job training than male employees (which is largely the decision of employers) and that they were disadvantaged in formal schooling, female employees appear to attend more adult education to make up for the training gap inside the firm. Since 28 per cent of male employees and 34 per cent of female employees attended some kind of adult education programmes, adult education outside the firm is a significant source of learning for both gender groups.

Figure 2 shows how employees achieved their current level of educational qualifications through a combination of formal schooling prior to employment and adult education after employment. The oblong blocks represent various educational programmes. The vertical lines trace the paths of education programmes attended by employees. The bottom part of the figure delineates the formal education histories of employees. The bold blocks in the middle indicate education qualifications that employees acquired through formal schooling before their first job. The top part of the figure shows changes in educational qualifications due to attending successive long-term adult education programmes while working.

Starting from the bottom, one can see that almost all employees finished nine-year compulsory education. When lower-secondary education was completed, 19 per cent started to work. The rest were streamed into two tracks; 56.1 per cent were admitted into upper-secondary general education while 19.6 took various vocational/technical courses. A small portion, who might be left out of the formal track due to age or other reasons, took adult education to acquire a secondary education certificate. It is quite clear that only the general track leads to post-secondary education; 23.6 per cent of those graduating from this general track received more education. No one in other tracks was admitted into post-secondary education. This figure indicates that, for the first job in Shenzhen, formal education was the primary path for acquiring the needed educational qualifications that employers required. In our interviews, employers definitely indicated that solid basic education (defined as upper-secondary education in China) provides employees with a good foundation to learn job-specific skills at entry- to intermediate-skill level. Enterprise recruiting policy and the government policy on internal immi-

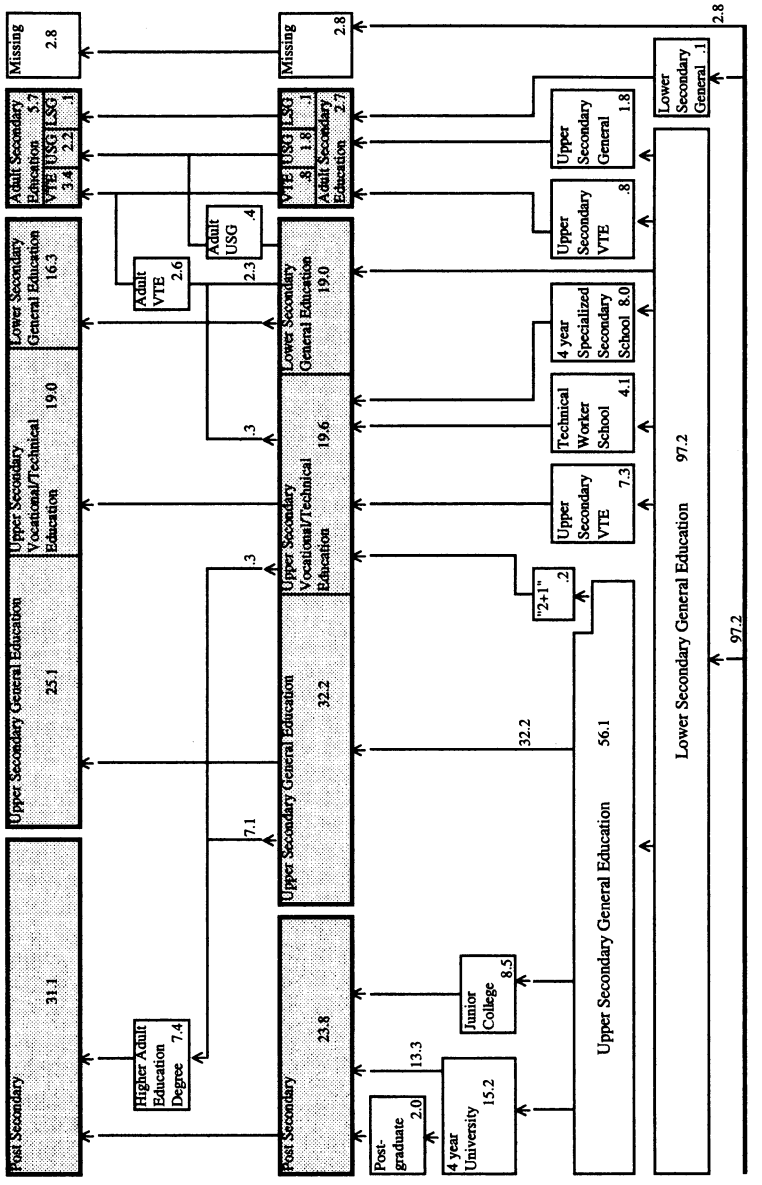


Figure 2: **Educational Attainment Through Pre-job Formal Education and Adult Education**

gration[37] also require a 12-year education qualification for new recruits for entry into skilled jobs. On the other hand, the government effort to expand education provision since the early 1980s has ensured that 95 per cent of the LSGE graduates are admitted into upper-secondary schools.[38] As a result, completion of formal education – at least at the secondary level – is quite common before the first job. A lower-secondary education is the minimal educational qualification. Adult education served as an alternative for making up the qualification gap.

In the top part of the figure, a total of 10.4 per cent of the employees attended long-term adult education programmes to acquire additional educational qualifications. Some 7.4 per cent of all employees obtained a post-secondary degree. It should be noted here that almost all of this group was from the general track. On the other hand, the other 2.7 per cent attending secondary adult education were from LSGE. Employees in the vocational/technical track were much less likely to pursue additional education.[39]

Figure 3 shows graphically the mix of on-the-job training and adult education outside the firm. The number inside each block indicates the percentage of the sampled employees receiving or not receiving some kind of training or adult education. The figure shows that among the 59 per cent who received on-the-job training, 39 per cent of them (or 23 per cent of all sampled employees) also had adult education. In contrast, among the 41 per cent of sampled employees who did not have on-the-job training, only 20 per cent (or 8 per cent of all sampled) had adult education. In other words, increased participation in on-the-job training was associated with increased participation in adult education. Overall, 67 per cent of all employees had on-the-job training and/or adult education. Among employees who participated in adult education, 57.9 per cent indicated that adult education courses were "relevant" to their jobs, 17.7 per cent indicated they were "somewhat relevant," and 24.4 per cent said they were "not relevant."

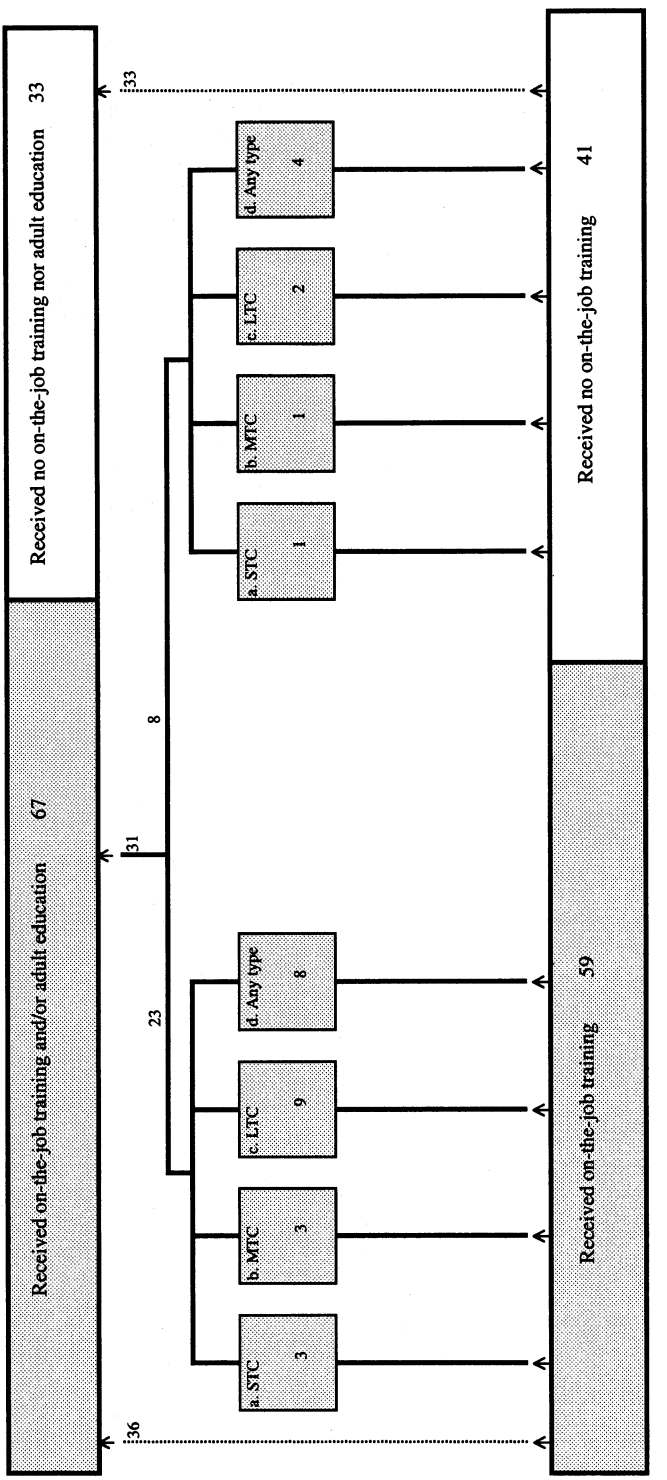
Education and Training Paths for Selected Occupations and Industries

The previous section began with a representative sample of employees in Shenzhen and examined their experiences in formal schooling, on-the-job training and adult education. In this section, selected occupations/industries are presented, and the education, on-the-job training and adult education paths which employees in these occupations/industries have used to achieve their current skills are examined. Because of space limitations, only four examples are given: these are male and female electronics workers, and male and female service clerks.

37. New recruits from other parts of China have to apply for residence permission from the Shenzhen government. Attainment of basic education is a requirement.

38. Shenzhen Yearbook Commission, *Shenzhen Yearbook* (Shenzhen: Shenzhen Yearbook Commission, 1997), p. 529; J. Xiao, "Education expansion in Shenzhen, China."

39. This pattern is observed in both gender groups and in both the service and industrial sectors.



Notes:
a. Short term course (30 days and less)
b. Medium term course (31-100 days)
c. Long term course (101 days and more)
d. Any type of training noted above.

Figure 3: **Employees Attending Self-paid Adult Education**

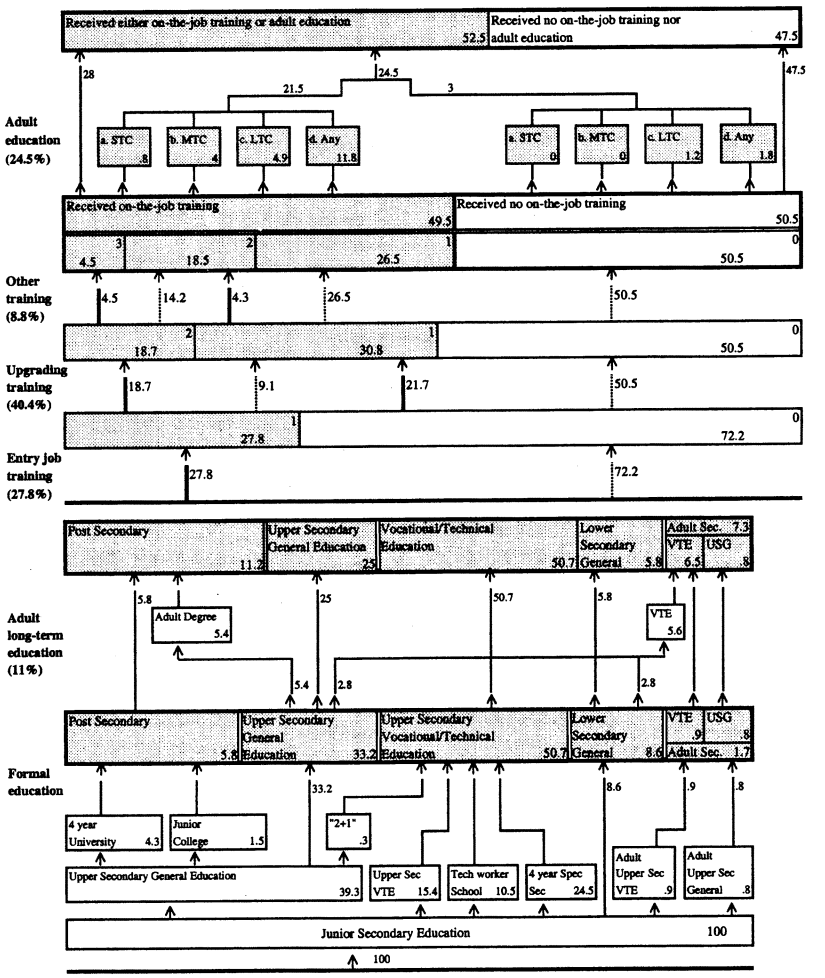
Education and training paths for male and female skilled workers in the electronics industry. The electronics industry is a major one in Shenzhen. In 1992, it accounted for 31 per cent of the total industrial product, and 42 per cent of the total export.[40] Figure 4 maps the education and training paths for sampled male employees in skilled occupations in the electronics industry. The lower half of the figure indicates how male skilled workers achieved their current level of educational qualifications through a combination of formal schooling prior to employment and adult education after employment. The upper half of the figure shows the mix of on-the-job training and adult education outside the firm. Blocks represent various educational and training programmes. The number in the middle of each block indicates the percentage of skilled workers receiving or not receiving training or adult education. The bold oblong blocks indicate education qualifications and training status achieved. Lines trace the paths of education and training experience.

According to the bottom part of Figure 4, all male skilled workers finished nine-year compulsory education. Upon completion, 8.6 per cent started to work. The rest were streamed into two tracks: 39.3 per cent into USGE and 50.7 per cent in various VTE programmes. A small portion of USGE graduates (5.8 per cent) was admitted into post-secondary education. Half of the male skilled workers received secondary VTE before taking up their first job. While working, 11 per cent of the skilled workers acquired additional qualifications through long-term adult education programmes. Among them, 5.4 per cent obtained a post-secondary degree and 5.6 per cent undertook secondary vocational adult education. All of them were from the general track, either USGE or LSGE. Male skilled workers who graduated from the VTE track did not seek additional education qualifications.

As shown by the upper middle of the figure, 27.8 per cent of the sampled skilled workers in the electronics industry received job-entry training while 72.2 per cent did not. A total of 40.4 per cent received upgrading skills training and a further 8.8 per cent received other training, which usually consists of staff development programmes. The shaded oblong blocks indicate that 26.5 per cent of the skilled workers in the electronics industry had one type of training, 18.5 per cent two types and 4.5 per cent three types, while 50.5 per cent had none. In the top part, the figure shows that among the 49.5 per cent male skilled workers who received on-the-job training, 43.4 per cent chose to attend adult education programmes outside their firms (as 21.5 per cent of this sample). In contrast, only 5.9 per cent of those who had no on-the-job training sought

40. In the 1990s industrial products were more diversified. Thus the proportion of the electronics industry's contributions to the total industrial output decreased somewhat but still remains the single most important product category among more than two dozen major industries. From all other product categories, none accounts for more than 8% of total industrial output. See Industry Section, *Shenzhen Statistical Yearbooks 1985, 1990* and *1993* (Shenzhen: Shenzhen Yearbook Commission, various years). Data on exports after 1992 are not available.

Figure 4: **Training and Education Paths – Skilled Male Workers in the Electronics Industry**



Sample Size = 96

Notes:
a. Short term course (30 days and less)
b. Medium term course (31-100 days)
c. Long term course (101 days and more)
d. Any type of training noted above.

adult education (as 3 per cent of this sample). Overall, 52.5 per cent of skilled employees had on-the-job training and/or adult education.[41]

For comparison, Figure 5 maps the education and training paths of

41. For the sake of clarity, Figure 4 omits information on the distribution of on-the-job training and adult education by education qualifications. The analysis showed that among those with vocational/technical education qualifications, 52% had on-the-job training, and 22% had adult education. Among those with general education qualifications, 48% had on-the-job training and 20% had adult education. For those having obtained post-secondary education, 52% received on-the-job training while 48% had adult education. This on-the-job training was provided equally to all groups with different education qualities. Skilled workers with post-secondary education qualifications also attended more adult education than other groups.

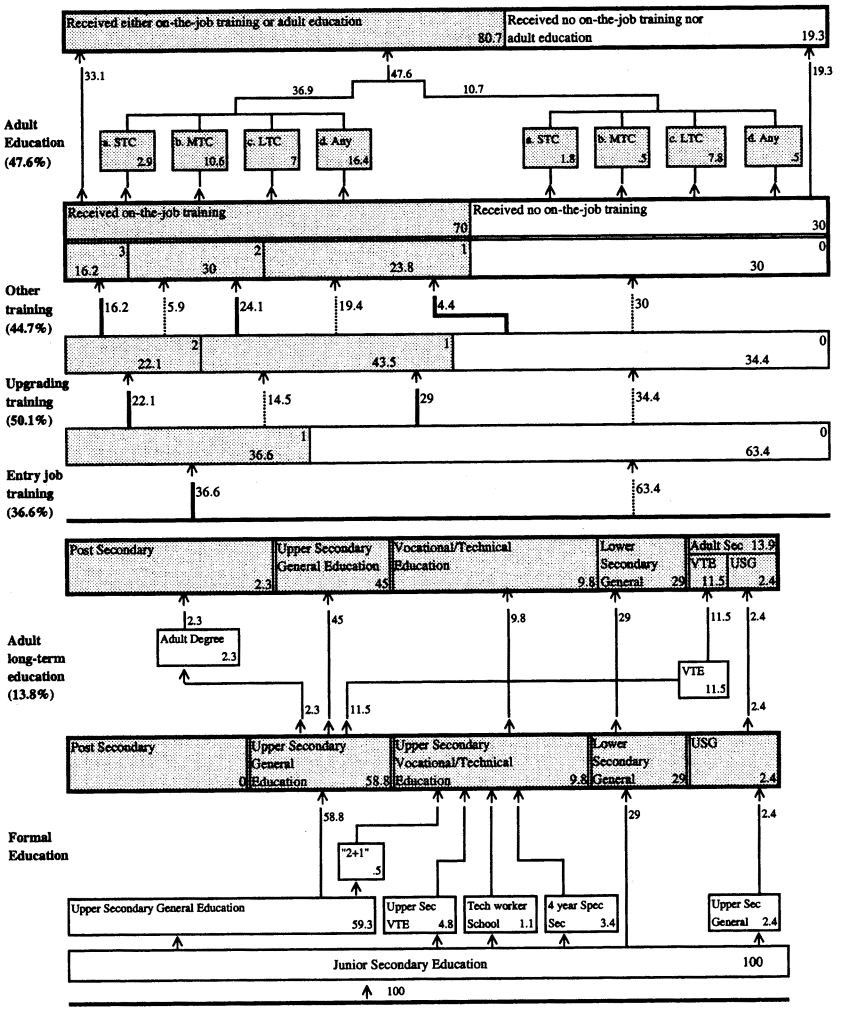
sampled female skilled workers in the electronics industry. Like the male skilled workers, all the females had nine years compulsory education. On graduation, 29 per cent of female skilled workers started to work (as compared to 8.6 per cent of males). Thus, about 20 per cent of females had three fewer years of education than their male counterparts on their entry to the job. Some 2.4 per cent of the female sample dropped out of the formal track and attended adult secondary education (0.7 per cent more than males). For the rest, 59.3 per cent were streamed into USGE and 9.3 per cent into the VTE track. In the VTE track, 24.5 per cent of the male skilled workers (see Figure 4) were admitted into four-year specialized education courses, which would confer a technical-cadre rank on graduation (a higher rank than those from other VTE institutions). In contrast, only 3.4 per cent of the sampled females were admitted into four-year specialized education. Moreover, no female skilled workers attended post-secondary education, while 5.8 per cent of male skilled workers did. All these differences indicate that female employees are disadvantaged in formal schooling before they get their first job. While working, 13.8 per cent of females attended long-term adult education programmes and obtained additional education qualifications, compared to 11 per cent of males.

Almost 37 per cent of the sampled female skilled workers received job-entry training. Slightly over 50 per cent of females received upgrading skill training. In addition, 44.7 per cent of female skilled workers received other training. The bold block in the middle of Figure 5 indicates that 20.5 per cent more female skilled workers received on-the-job training than male counterparts. This suggests that employers may use on-the-job training to compensate for the formal education disadvantage of female employees. The top part of the figure indicates that 47.6 per cent of female skilled employees attended self-chosen adult education programmes (36.9 per cent of them had on-the-job training and 10.7 per cent did not). This suggests that quite a large portion of female skilled workers also used adult education to learn more. Increased on-the-job training is associated with increased participation in adult education.

Altogether, 80.7 per cent of sampled females received on-the-job training and/or adult education while 52.5 per cent of male counterparts received on-the-job training and/or adult education. The histories of the male and female skilled employees reveal an important factor in skill development: although female skilled workers were disadvantaged in formal education, both on-the-job training and adult education can provide more learning opportunities to help them develop their skills.

Education and training paths for male and female clerks in the service sector. In the market-oriented economy in Shenzhen, clerical workers have assumed many new roles, which differ from the conventional clerical support for government cadres. Since the state no longer allocates resources or controls the demand and supply of goods and services, managers are responsible for the survival of the firms. New firms often have a flat organization structure and maintain minimal administration

Figure 5: **Training and Education Paths – Skilled Female Workers in the Electronics Industry**

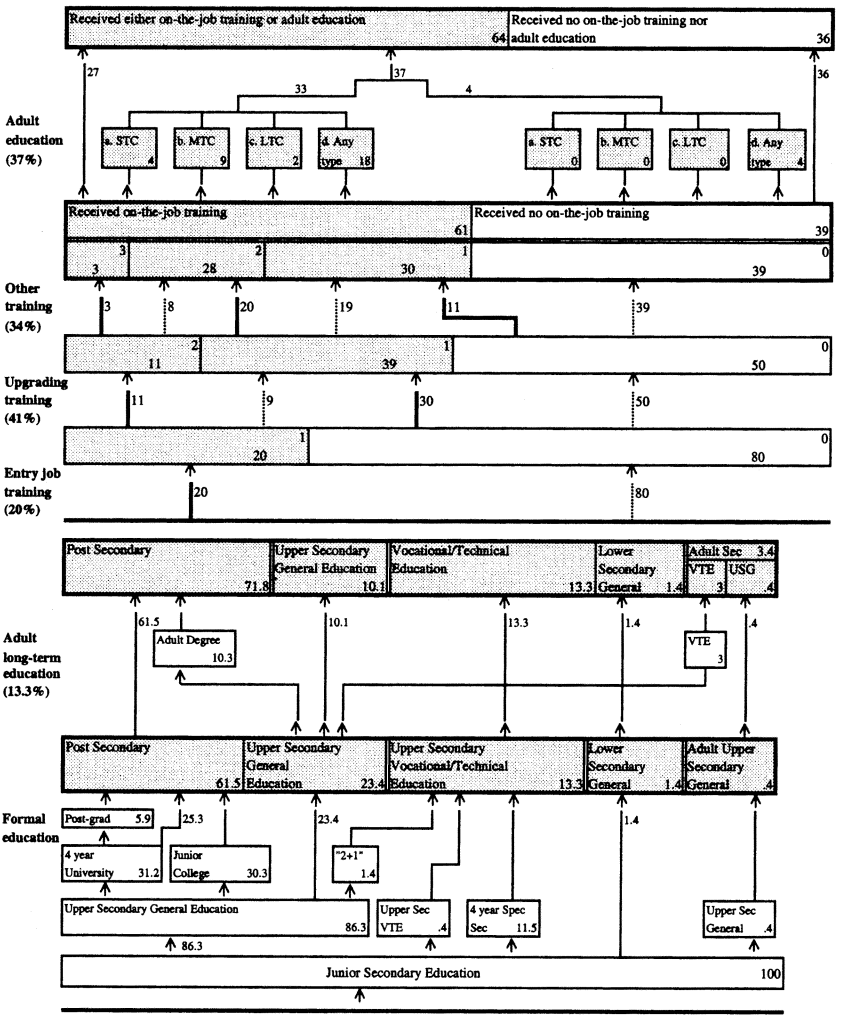


Sample Size = 47

Notes:
a. Short term course (30 days and less)
b. Medium term course (31-100 days)
c. Long term course (101 days and more)
d. Any type of training noted above.

and management staff. Consequently, clerical workers have taken on some technical, semi-professional roles in addition to providing traditional clerical support. They had many tasks to perform, including searching for market information, contacting clients, drafting business letters and translating documents and contracts for international transactions. Recruitment requirements are relatively high: proficiency in English, and good written and communication skills are fundamental requirements.

Figure 6: **Training and Education Paths – Male Clerks in the Service Sector**



Notes:

a. Short term course (30 days and less)
b. Medium term course (31-100 days)
c. Long term course (101 days and more)
d. Any type of training noted above.

Sample Size = 62

Figure 6 represents the education and training paths of male clerks in the service sector. All male clerks completed lower-secondary education. Upon graduation, only 1.4 per cent started to work. Of the rest, 86.3 per cent were admitted into USGE while only 11.9 per cent were streamed into the VTE track. After finishing upper-secondary general education, 23.4 per cent of the cohort started to work. Over 61 per cent continued to pursue post-secondary education, with half admitted into four-year university courses and half admitted into junior colleges. On

their employment, 13.3 per cent pursued long-term adult education for additional educational qualifications; they were all from the general secondary track. Among them, 10.3 per cent achieved post-secondary degrees. Thus, overall, 71.8 per cent of male clerks in the service sector had post-secondary education.

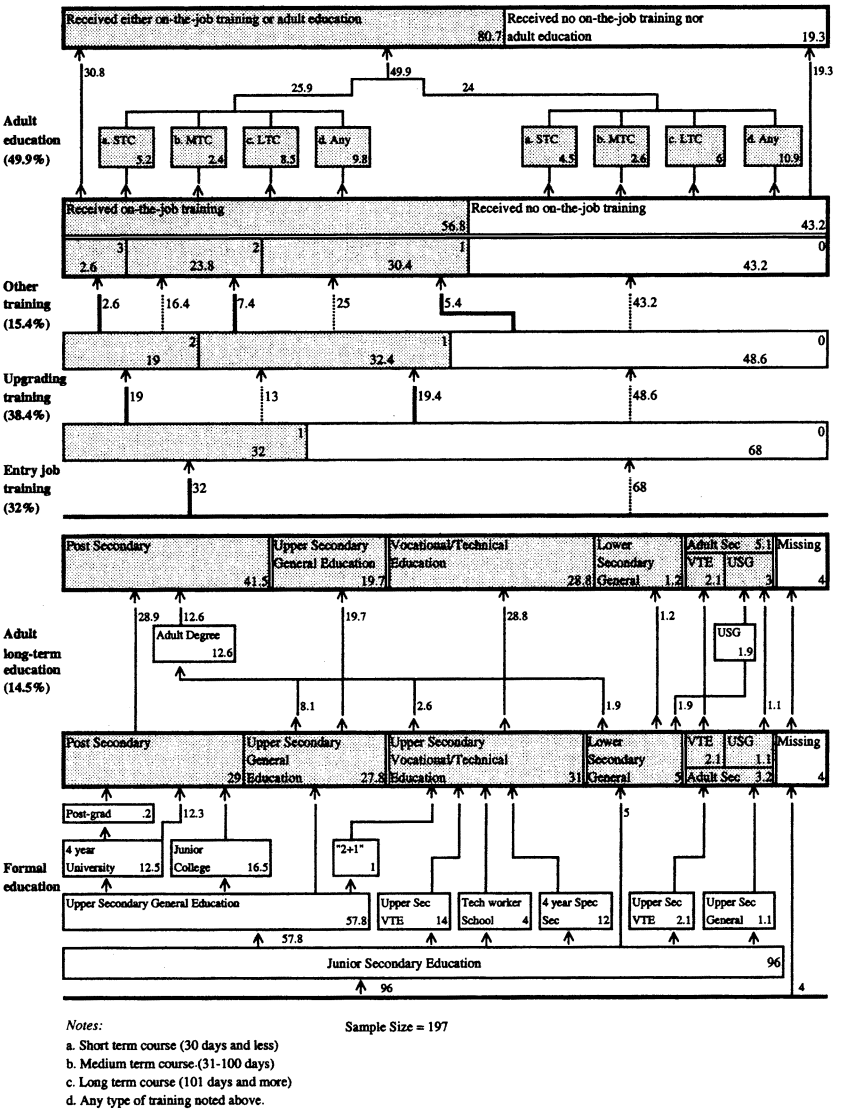
About 20 per cent of the new male clerks received job-entry training. Later, a large proportion of male clerks (41 per cent) received skill-upgrading training, and 34 per cent received other on-the-job training. In total, 61 per cent received on-the-job training. In addition, 37 per cent of male clerks also attended various adult education programmes outside their firms. One-third of them were from the group which received on-the-job training, and 4 per cent were from the group without training. The pattern that more recipients of on-the-job training tend to pursue more adult training is again demonstrated by this group. This suggests that on-the-job training may increase employees' awareness of alternatives to formal education and of the benefits of continuous learning while working. Although 61.5 per cent of this male clerk group had formal post-secondary education, they continued to acquire skills through on-the-job training and adult education.

Figure 7 illustrates the education and training paths of female clerks in the service sector. All members of this group completed lower-secondary education. Then 5 per cent started to work. The rest were streamed into general and VTE tracks. Compared to their male counterparts, a smaller proportion of females (58 per cent) was admitted to USGE and a larger proportion (30 per cent) was streamed into the VTE track. Among the VTE female group, only 40 per cent were admitted into the most prestigious VTE programmes, namely four-year specialized secondary education courses. The pattern that a larger proportion of male counterparts were admitted into the most prestigious four-year VTE also occurred in other occupational groups. Some 3.2 per cent dropped out of formal secondary education, and pursued secondary adult education to obtain a qualification. Some 29 per cent of female clerks had tertiary education (32.5 per cent less than their male counterparts). Among those female clerks who went on to post-secondary education, 57 per cent went to junior colleges and 43 per cent to four-year universities. This pattern is also observed in the male group and indicates that junior college provided an alternative for specialized post-secondary education.

While working, 14.5 per cent of female clerks pursued additional educational qualifications through long-term adult education. Almost 2 per cent lower-secondary graduates obtained an upper-secondary general diploma, and 12.6 per cent obtained post-secondary degrees. For both the female and male groups, the pattern of attending long-term adult degree courses was very similar: 13.3 per cent for male clerks and 14.5 per cent for female clerks.

While at work, 32 per cent of female clerks received employer-provided job-entry training; 38.4 per cent received upgrading skills training; and 15.4 per cent received other training which often included management and staff development training. In total, 56.8 per cent

Figure 7: **Training and Education Paths: Female Clerks in the Service Sector**



Notes:

a. Short term course (30 days and less)
b. Medium term course (31-100 days)
c. Long term course (101 days and more)
d. Any type of training noted above.

Sample Size = 197

received on-the-job training. Outside firms, a large proportion of female clerks (49.9 per cent) also attended various adult education programmes. Almost 26 per cent had on-the-job training and 24 per cent had no on-the-job training. All together, 80.7 per cent of sample female clerks in service undertook on-the-job training and/or adult education programmes outside their firms, which served as a major job-skills improvement strategy. Again, this indicates that on-the-job training and adult education can reduce the disadvantage of a lack of formal education.

Discussion

Shenzhen has one of the most developed education and training systems within China, in which three forms of education and training – namely formal education, on-the-job training and adult education – are employed to develop its human capital. In this section, key features of human capital development in Shenzhen are first discussed, followed by the way these findings from Shenzhen inform national debates on vocational education policy and the government's restrictive policy on the expansion of regular higher education. Finally, the Shenzhen findings are compared with those in other countries, and the implications for education and training policy are discussed.

Key features of human-capital development in Shenzhen. Human-capital development in Shenzhen is most distinctively characterized by its integrated tripartite system of formal schooling, employer-provided training and adult education outside the workplace. In the first place, all the employees in our sample had received nine years' compulsory education before employment. In fact, four out of every five employees had already achieved basic education before they began to work. This level of educational attainment provided a good foundation for additional and continuous training and education during the working life of an employee. And such an educational foundation is achieved primarily through the formal schooling system. Very little remedial training is needed on the job; in fact employers provide such training to only 3.4 per cent of their employees.

Developing formal basic schooling has been a key component of overall human-resource development strategy since the inception of the Shenzhen Special Economic Zone.[42] The expansion of education was achieved through both school enlargement and the construction of new schools. For example, by 1995, 274 primary schools – 48 of which were built after 1980 – increased the average enrolment from 208 to 547 students. By 1995, 62 secondary schools, 38 of which were built after 1980, had doubled the average enrolment from 570 to 1,153 students. In 1979, 80 students were enrolled in only one vocational school, whereas in 1995, there were 28 vocational schools with an average enrolment of 478 students. By 1989, 99.9 per cent of all school-aged children were enrolled at primary level and by 1994, 100 per cent of primary school graduates advanced to junior secondary schools. By 1995, the completion rate of nine years' compulsory education had increased to 99.7 per cent among 15-year-olds. In 1996, 95 per cent of the LSGE graduates were admitted into upper-secondary schools.[43]

The government has maintained a strong financial commitment to educational development. In 1994, 14 per cent of the Shenzhen government's total public expenditure was devoted to education, while for the

42. J. Xiao, "Education expansion in Shenzhen, China."
43. Shenzhen Yearbook Commission, *Shenzhen Yearbook*, p. 529.

country as a whole, public education accounted for an average 11.3 per cent of total public expenditure during the 1988–91 period.[44] In Shenzhen, public recurrent expenditure per pupil (in 1995 terms) increased in the period of 1991 and 1996, from 1,072 *yuan* to 2,525 *yuan* for primary schools, from 1,269 *yuan* to 5,309 *yuan* for secondary general schools, from 1,954 *yuan* to 7,618 *yuan* for secondary vocational schools, and from 4,183 *yuan* to 16,577 *yuan* for secondary specialized schools.[45] Since the mid-1990s, schools have started to focus on improving student learning through new educational technology and other means.

Rapid industrialization also creates a strong demand for highly skilled workers. Shenzhen tries to meet this demand through a combination of three strategies: development of regular three- and four-year higher education programmes, development of adult higher education, and attracting high-skilled workers from other parts of the country. This has produced a stratified and diversified higher-education system.

Prior to 1983, there was no higher education institution in Shenzhen. Shenzhen University was established as a comprehensive university in that year, offering both four-year bachelor's programmes (*benke*) and two/three-year specialized junior college programmes (*zhuanke*). As basic education expanded and the economic sector demanded more skilled personnel in various trades, Shenzhen Polytech (*Shenzhen zhiye jiaoyu xueyuan*) was set up in 1993. For the first time local rural students were enrolled in higher education in large numbers. Together these two institutions enrolled 5,291 students in 1995. At the same time, higher adult education has kept abreast of the expansion of formal sector, enrolling 4,100 students in 1994 and 3,700 in 1995.

When economic growth accelerated in the 1980s, the local workforce was unable to meet the human-capital demands of the Shenzhen economy, either in terms of job skills or the absolute size of the required workforce. To attract highly skilled employees, firms recruited from the top universities across China. For managerial and professional personnel, firms looked for recruits with a university degree or above who were under the age of 35. Other employees had at least an upper-secondary school diploma, were about 20 years old and many were from rural areas of Guangdong and other provinces. These employment practices attracted young adults who would either already have school-aged children or would bear children in the near future. The provision of quality education to their children was critical to retain capable employees. Therefore, high salaries and good benefits (at least equal to those for middle-level managers) have been offered to recruit first-rate teachers across China to teach in Shenzhen schools.

In addition to its sustained development in formal schooling, Shenzhen has cultivated and nurtured the development of workplace training and

44. M. C. Tsang, "Costs of education in China: issues of resource mobilization, equality, equity and efficiency," *Education Economics*, Vol. 2, No. 3 (1994), pp. 287–312, esp. p. 291.
45. J. Xiao, "Education expansion in Shenzhen, China."

adult education over time.[46] In the early 1980s, because of a weakness in institutional capacity, most firms were unable to provide and finance training for working adults. Thus, the government initiated and financed many of the adult training programmes. Over time, with the growth of the productive sector, the provision and financing of adult training was shifted to the employers and employees, with the government playing a co-ordination and monitoring role.

This study shows that a large proportion (59 per cent) of employees have received some on-the-job training. Employers provided a variety of training to their employees, from job-entry training to skill-upgrading training and management training.[47] In the period from 1991 to 1996, 28 per cent of employees received one type of training, and 30 per cent of employees received between two and four types of training on the job. On-the-job training was very broadly based; it was widely provided to employees from all personal (age and gender) and educational backgrounds, in all occupations, and for firms of different sizes and in different economic sectors. Employers had to provide training to employees to meet the skill needs of production; and employees were required by employers to take such training to adapt to changes in the workplace. Employers were also required by the government to spend up to 3 per cent of their wage cost on worker training.

Seeking additional educational qualifications while working is quite common among Shenzhen employees. In 1996, almost a third of all employees took part in some adult-education programmes outside their firm. Not only did such programmes provide the opportunity for skill acquisition, they were also a significant alternative to formal schooling for obtaining additional educational qualifications, especially a post-secondary degree. Among the employees participating in adult education, about one-third attended long-term programmes to acquire an educational qualification (10.4 per cent of all employees). And among those attending long-term programmes, 71 per cent were studying for a post-secondary degree (7.4 per cent of all employees). For working adults, adult education provided a convenient and relatively inexpensive way for obtaining the desired educational qualifications. Even though employees had to pay for the costs of adult education, they were willing to do so because they believed that additional education could increase their career opportunities, particularly in an area where jobs were plentiful and employers were willing to pay good wages for skilled workers.[48]

The education and training experiences of employees in Shenzhen suggest a number of relationships between formal schooling, workplace training and adult education. First, on-the-job training provision and adult education attendance are largely due to the rapid and constant changes in the workplace. Both employers and employees found upgrading work-

46. J. Xiao and M. Tsang, "Costs and financing of adult education in Shenzhen, China."

47. Training provided by employers was also perceived by employees as trust in them and served as a binding force, which encouraged employees to stay with the firm. Turnover was not seen as a problem in firms.

48. J. Xiao and M. Tsang, "Costs and financing of adult education in Shenzhen, China."

related skills necessary as the economic system underwent transition and innovative technology was introduced into production. Secondly, there appears to be some complementarity between workplace training and adult education outside the workplace. Participation in on-the-job training is associated with a higher rate of participation in adult education programmes outside the firm.

Thirdly, for all employees, more opportunity for on-the-job training was available to employees with upper-secondary education qualifications, holding skilled-entry positions. For example, about 66 per cent of USGE and VTE graduates had on-the-job training while 50–56 per cent of post-secondary graduates (with two and four years' higher education) had on-the-job training. Most LSGE held non-skilled positions and had about 50 per cent of the on-the-job training. Compared to post-secondary graduates, secondary graduates had significantly more job-entry training, skill-upgrading and new-skill training. The additional training for secondary graduates may have been necessary because of their lower skills and levels experience. There is no difference in demand of on-the-job training between USGE and VTE graduates.

Fourthly, for female employees, additional adult education provided the opportunity to lessen the disadvantages they faced in formal schooling. According to our study, compared to males, a higher percentage of females entered the world of work after just nine years of compulsory education; and within VTE a smaller percentage of females were enrolled in the more prestigious four-year specialized programmes. But a larger percentage of female employees enrolled in adult educational programmes to seek additional qualifications. In some occupations, such as clerical jobs in the service sector, female employees also had proportionally more on-the-job training than their male counterparts to compensate for their formal-schooling disadvantages. Nevertheless, females still occupy fewer managerial positions than males because of their prior educational experience and current training practices in the firm, among other reasons.

The Shenzhen experience and national education policies in China. Several observations can be made regarding general education versus VTE at the upper-secondary level in Shenzhen. These observations are relevant to the debate on the controversial national education policies regarding the vocationalization of upper-secondary education and restrictive access to higher education in China. First, a significant proportion of general-education graduates continued to acquire post-secondary education while hardly any VTE graduates do so. In Shenzhen, USGE schools continue to enrol higher achieving students (those who graduate from LSGE schools with scores above the median) and VTE schools enrol lower-achieving students. Only graduates from USGE have a legitimate chance of entering tertiary education; graduates from VTE have to seek employment after their secondary education. Thus the dual tracks in upper-secondary education serve to reduce the social demand for post-secondary education.

Secondly, in Shenzhen, VTE graduates actually required no less on-the-job training in the workplace than general-education graduates, although they were supposedly exposed to more specific-skill training while in school. This could be due to either a mismatch of skills, or a weaker foundation of basic knowledge. The growing economy offers many new job opportunities. For workers in Shenzhen, changing jobs and working in jobs they have not previously trained for are quite common. Employers do not seek a good match between potential employees' jobs and their specific skills; they preferred employees with potential to continue to learn and to adapt to changes. Thus, VTE graduates and general-education graduates alike had to pick up new skills on the job; and VTE graduates may need more training because of their weaker foundation in formal schooling.

Thirdly, employees with VTE were more costly to train than those with general education. In terms of per-student public recurrent expenditure, VTE programmes in secondary vocational schools were 40 per cent more expensive than general education programmes; and VTE programmes in specialized institutions were 210 per cent more expensive than general education programmes.[49] Since VTE graduates were less flexible and less adaptable to changes in the workplace, many managers had observed them to under-perform relative to general-education graduates over time. Thus, it is very likely that VTE is a less efficient form of social investment in education than general education. General education may turn out to be more effectively "vocational" than VTE in the Shenzhen context.

Fourthly, secondary vocational schools have faced more pressure to change their operations. Since the 1980s, rapid changes in production technology and in the range of goods and services produced have been quite common in Shenzhen. Secondary vocational schools have had to adapt to new economic realities. Upgrading VTE equipment in these schools can be very costly; and revising the school curricula to match future job opportunities has been a recurring and frustrating experience for many vocational-school principals. To avoid a mismatch, some VTE schools actually changed their curriculum to a "general" VTE curriculum (that is, a VTE curriculum with a substantial general-education content).[50]

Fifthly, as the educational attainment of the workforce in Shenzhen has increased over time, employers in Shenzhen have also increased the number of junior-college graduates they hire for higher skilled positions. Table 1 (above) shows that 8.5 per cent of employees had junior-college education and they were found mostly in the more skilled occupations. With the establishment of the Shenzhen Polytech in 1993, vocational-technical education in Shenzhen has expanded into the post-secondary level. Shenzhen Polytech provides vocational training above the intermediate-skill level. In providing an opportunity for tertiary education to graduates from upper-secondary VTE, Shenzhen Polytech may raise the

49. J. Xiao, "Education expansion in Shenzhen, China."
50. *Ibid.*

educational motivation of some students in the VTE track of upper-secondary education and increase their aspirations for post-secondary education. The establishment of this new VTE institution is an implicit admission by education decision-makers in Shenzhen that with the widespread access to secondary education, the social demand for post-secondary education has become stronger and the educational ambitions of upper-secondary VTE graduates have to be addressed.

Since Shenzhen has universalized secondary education and has a fast-growing and fast-changing economy, the above findings suggest that basic education in Shenzhen should focus on the teaching and learning of general, not specific skills. In Shenzhen, social stratification through streaming at the upper-secondary level should be moved to the post-secondary level.

The Shenzhen experience raises fundamental questions about the soundness of the vocationalization policy advocated by the central government since 1985. The focus of this policy is at the upper-secondary education level and requires that upper-secondary education would be restructured from a primarily general curriculum to a dual-track system of general education and VTE such that, over time, at least half of upper-secondary students would be enrolled in the vocational/technical track.[51] This policy was rooted in both economic and social considerations. From an economic efficiency perspective, the policy assumed that VTE graduates would perform better than general-education graduates and that vocationalization would meet the increased demand for middle-level technical personnel and skilled workers. From a social perspective, given a low-transition rate (around 4 per cent) between secondary education and higher education, the VTE track would siphon off the majority of upper-secondary students and reduce the pressure for expansion of higher education.[52] While the central government has been very firm in pursuing this approach, there are divergent views about the policy among educators in China.

The findings from Shenzhen and other Chinese studies show that the economic assumptions of this policy are flawed. VTE turns to be substantially more expensive than general-education at the upper-secondary level.[53] Empirical studies have found that VTE graduates have demonstrated only modest[54] or no productivity advantages[55] over general-education graduates. In fact, studies have found that employers favour general-education graduates over VTE graduates because of their train-

51. Initially, the policy called for an equal distribution between the two tracks. In the 1990s, the government asked for an even higher percentage of enrolment in the vocational/technical track (60–70%), especially in urban areas.

52. M. C. Tsang, "The structural reform of secondary education."

53. M. C. Tsang, "The costs of vocational training"; J. Xiao, "Education expansion in Shenzhen, China."

54. W. F. Min and M. C. Tsang, "Vocational education and productivity: a case study of the Beijing General Auto Industry Company," *Economics of Education Review*, Vol. 9, No. 4 (1990), pp. 351–364.

55. J. Yang, *The Interaction Between the Socialist Market Economy and Technical and Vocational Education and Training in the People's Republic of China* (University of Manchester and Bolton Institute: PhD dissertation, 1997).

ability and adaptability to production changes;[56] and employers in Shenzhen actually found general-education graduates to outperform VTE graduates in middle-level skilled jobs.[57] Thus, general education is an economically more efficient investment than VTE. In a fast-changing area like Shenzhen, the economic argument for general education at the upper-secondary level is even stronger.

In Shenzhen, as in other parts of China, the vocationalization of upper-secondary education since the mid-1980s has been a form of social stratification.[58] However, as an instrument of social stratification, vocationalization has substantial negative economic and educational consequences. Not only is VTE a less efficient use of scarce educational resources, VTE students also have little motivation to learn. Parents of VTE students have low educational expectations of the schools, regarding them as a place for supervising their children.[59] Given these negative effects, alternatives to vocationalization for increasing access to higher education should be explored.

One alternative that has attracted much attention and debate in China is the expansion of access to higher education. Actually, between 1985 and 1995, enrolment in regular higher education institutions in China increased from 1.70 million to 2.91 million,[60] at an average rate of 5.5 per cent per year. So far, Chinese education leaders want to maintain the expansion rate at this historic level in the near future. A much higher expansion rate will raise questions including how to mobilize additional resources for higher education, whether government investment in basic education will be adversely affected, whether the economy will be able to absorb the additional number of university graduates without adverse political and social consequences, and others. Other education observers in China argue that higher education needs to expand at a faster rate in order to meet the economic and social demand for higher education in the 21st century. According to these observers, the government should invest more in education (including higher education) and that the expanding economy will be able to absorb the additional university graduates. This debate is not yet settled and a detailed analysis is outside the scope of this article. But the Shenzhen experience indicates that adult higher education is a way to diversify access to higher education in China, with individuals being a major source of finance. Our study shows that in Shenzhen, 70 per cent of employees enrolled in long-term adult education programmes

56. See, for example, data produced by this study, and L. N. K. Lo and C. H. Lee, "In rural China: which road to relevant education?" *Educational Leadership*, Vol. 35, No. 8 (1996), pp. 60–63.

57. J. Xiao, "Education expansion in Shenzhen, China."

58. M. C. Tsang, "The structural reform of secondary education"; M. H. Lai and L. Lo, "Vocational education in China's rural towns: a comparative study on the developmental experience of two rural towns in the province of Guangdong," *Education Journal*, Vol. 24, No. 1 (1996), pp. 24–42; L. N. K. Lo and C. H. Lee, "In rural China: which road to relevant education?"

59. M. H. Lai and L. Lo, "Vocational education in China's rural towns."

60. State Education Commission, *Achievement of Education in China: Statistics, 1980–1985* (Beijing: People's Education Press, 1986); State Education Commission, *Educational Statistics Yearbook of China 1995* (Beijing: People's Education Press, 1996).

were studying for a higher-education degree. With the expansion of nine-year formal education across China, enrolment in adult literacy and primary education has decreased while enrolment in both adult secondary and higher education has increased since the early 1990s.[61] Adult higher education has actually developed into part of the dual system of higher-education, together with regular higher-education institutions in terms of both the number of institutions and enrolment. Thus, adult higher education substantially increases participation in higher education. Obviously, observed issues in adult higher education raise questions on its quality and more information is needed to assess the learning of participants. In addition to adult higher education programmes, it may be pointed out in passing that private higher education has also developed quite rapidly in China in recent years. With proper accreditation to ensure quality, private institutions can also meet the economic and social demand for higher education, with significant reliance on private financing sources. In short, as the economy continues to grow and the income of households rises, diversified institutions of higher education with more reliance on private financing can be developed to meet the increased economic and social demand for higher education.

In the near future, however, the supply of higher-education places will be limited relative to demand. So far, educational leaders in China have been intent on using a dual-track upper-secondary system to allocate access to higher education. And the economic wastage and educational problems of vocationalization persist. As China moves into the 21st century, the need for general and flexible learning in basic education will become stronger and the shortcomings of secondary VTE should become more apparent. It is not too early to rethink the vocationalization policy and to explore other alternatives for allocating and managing access to higher education.

Comparison with other countries. An examination of published studies on workplace training and adult education in a number of countries follows in order to provide a cross-national perspective for viewing the findings on the education and training system in Shenzhen. This article does not compare the characteristics of the adult education and training system of Shenzhen with those of other areas or countries since the authors are not aware of the availability of data sets similar to the one used in this study. Information on these two forms of human-capital investment world-wide is generally not widely available and accessible.

Using a similar reverse tracer study, Ziderman and Horn[62] documented how workers in seven occupations in Colombia obtained their vocational education and training. With data collected by SENA (Colombia's national training system) during 1979–81, they distinguished five categories of vocational education and training: job-related secondary vocational education, institutional training prior to SENA courses, SENA training,

61. J. Xiao, "Higher adult education in China: redefining its roles."
62. Ziderman and Horn, "Many paths to skilled employment."

institutional training following SENA courses, and employer-based on-the-job training (they did not examine formal schooling such as general secondary education and post-secondary education). Their analysis of training paths shows that workers choose a variety of training paths. Thus, the notion of any uniquely appropriate training path for a given occupation – a key assumption of manpower requirement forecasting models – is false. Since workers try to select a training path appropriate to their backgrounds and needs, government policy that limits the availability of training options (and thus the choice of training paths) would be misguided. In the different occupations in Shenzhen, employees also follow a variety of education and training paths. Many of these make use of all three forms of human-capital development – formal schooling, on-the-job training and adult education. Since the early development of the special economic zone, the Shenzhen government has encouraged the development of the three forms of human-capital formation, without limiting the education for and training options of any given occupation. The findings from Shenzhen and Colombia can provide valuable input for policy-makers of education and training systems.

Since 1991, about 60 per cent of employees in Shenzhen have participated in on-the-job training and/or adult education that was occupationally oriented. The Centre for Educational Research and Innovation at the OECD keeps track of the participation in job-related continuing education and training as a percentage of the employed population aged 25 to 64 in a number of countries over a 12-month period. The OECD found that the participation rate in 1993 was 38 per cent for Australia in 1993, 28 per cent for Canada, 41 per cent for Finland and 38 per cent for Switzerland, and, in 1994, 40 per cent for France, 33 per cent for Germany and 34 per cent for the United States.[63] Thus, Shenzhen's 60 per cent participation rate is very favourable when compared with those OECD countries. Shenzhen started at a lower level of economic development and the average amount of human capital per person was likely to be smaller than those of these advanced countries. Shenzhen needed to invest more in human capital in order to meet the skills demand of the fast-growing economy. In addition, product changes and the adoption of new technology in production have been rapid in Shenzhen since 1985. Formal education cannot give a graduate occupational skills for their whole life. It is critical that other forms of human-capital development, such as workplace training and adult education, are widely available to upgrade the skills of the workforce on a continuous basis. The OECD study also found that, in Australia, Canada, Finland, France and the United States, the participation rate was higher for females than males by 3–6 percentage points. Female employees in Shenzhen also generally participated more in adult education than males, and, in some occupations, females took up more on-the-job training than males. However, in

63. Organization for Economic Co-operation and Development (OECD), *Education at a Glance: OECD Indicators* (Paris: Centre for Educational Research and Innovation, OECD, 1996), table P8, p. 133.

Germany and Switzerland, the participation rate was higher for males than females by 4 and 8 percentage points, respectively. More research is needed to better understand why the rates of male and female participation rates in adult education and workplace training vary across countries.

Size is a definite factor in the provision of training by firms. In Shenzhen, firms with less than 300 employees had significantly less on-the-job training than firms with over 300 employees. In industrialized countries, larger firms generally provided more training to employees than smaller firms.[64] In some developing countries such as Indonesia and Hong Kong, smaller firms were also found to have a lower propensity to provide formal training to employees than larger firms.[65] In Taiwan, the large monopolistic utility companies were found to provide more training to employees than the smaller construction companies.[66] However, in the United States, Bishop[67] found that the smallest firms (less than ten employees) did not provide the least amount of training per employee. The relationship between amount of training and firm size is a U-shape curve.

Variation in the amount of workplace training by occupation is to be expected; but the pattern of variation may change over time and across countries. In Shenzhen, 69.6 per cent of managers had on-the-job training, compared to only 57.6 per cent of professionals, 57.7 per cent of salespersons and 57.2 per cent of skilled workers over a five-year period. In an annual survey of 1,803 companies in the United States, salespersons in 1995 were found to have the most training (in terms of the number of training hours per person), followed by professionals, managers and then production workers.[68] The survey in 1996 found professionals and production workers to have the most training.[69] The amount of training per employee depends on a variety of factors, including the nature of job, the background of employees, and the characteristics of firms.[70] Thus, it may be difficult to find generalizable patterns over time and across countries.

The amount of adult education sought by Shenzhen employees outside the workplace is consistent with the increased emphasis on self-directed continuing education for working adults in other countries. An earlier study by the OECD found that self-directed continuing education

64. Organization for Economic Co-operation and Development (OECD), *Employment Outlook* (Paris: OECD, 1991), ch. 5.

65. Middleton, Ziderman and Adams, *Skills for Productivity: Vocational Education and Training in Developing Countries*, ch. 6

66. G. San, "Enterprise training in Taiwan: results from the vocational training needs survey," *Economics of Education Review*, Vol. 9, No. 4 (1990), pp. 411–18.

67. J. Bishop, *The Social Payoff for Occupationally Specific Training: The Employers' Point of View* (Columbus, Ohio: National Center for Research on Vocational Education, 1982).

68. American Society for Training and Development, *1995 Industry Report* (Alexandria, VA: American Society for Training and Development, October 1995).

69. American Society for Training and Development, *1996 Industry Report* (Alexandria, VA: American Society for Training and Development, October 1996).

70. M. C. Tsang, "The costs of adult education and training."

accounted for about two-thirds of the total learning effort of adults.[71] A survey in the U.S. found that 23 million adults participated in adult education, responding to myriad individual needs and interests.[72] A number of studies have also found that, in developed countries, working adults arranged the learning activities themselves.[73] Thus, adult education programmes should be an integral part of a system of human-capital development. And a solid foundation in basic education provides the basis for lifelong learning through adult education and other avenues.

Formal education in Shenzhen places a relatively heavy emphasis on pre-employment vocational education at the upper-secondary level. In the context of a fast-growing and fast-changing economy, however, workers need to have a solid foundation in basic general education so that they are more flexible and more adaptable in the workplace. In many countries today, there is an increasing emphasis on general education at the secondary level while a substantial amount of vocationalization begins at the post-secondary level. Thus, this aspect of the Shenzhen system goes against the trend in other countries. China's policy-makers are preoccupied with ensuring social streaming after compulsory education and limiting access to higher education. Given this limited access, secondary vocational education siphons off students from the higher education track. As part of China, Shenzhen adheres to this national policy, but Shenzhen (along with other economically advanced cities in the coastal region), is quite dissimilar from the rest of China. Since it has already developed a substantial system of workplace training and adult education, specific skills can be more quickly and more cost effectively learned on the job to raise the productivity of Shenzhen's workers.[74] Basic schooling rather than technical training is better suited to the teaching and learning of general skills. Thus, there is a need to re-evaluate the policy of secondary vocational education in an economically advanced and fast-changing area such as Shenzhen.

71. Organization for Economic Co-operation and Development (OECD), *Learning Opportunities for Adults.*

72. S. T. Hill, *Trends in Adult Education 1969–1984* (Washington, DC: Centre for Education Statistics, 1985).

73. S. D. Brookfield, *Understanding and Facilitating Adult Learning: A Comprehensive Analysis of Principles and Effective Practices* (San Francisco: Jossey-Bass, 1986), pp. 148–150.

74. J. Xiao, "A study of the relationship between organizational factors and the transfer of training in the electronics industry in Shenzhen, China."