Technological change and human resource development practices in Asia: a study of Singapore-based companies

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Technological change is a constant phenomenon in contemporary organizations. How to prepare employees for technological change has increasingly become an issue for human resource development theory and practice. This study investigated the human resource development practices of organizations in Singapore, where companies are continuously responding to rapid technological changes in order to remain competitive. The results show similar patterns of responses across business sectors; however, some differences were found in the transport and communications sectors. On-the-job training was reported as the most frequently used training method to address organizational change needs. The discussion and recommendations focus on the need for improved change management approaches.

Technology can be classified into three types: (1) product, (2) process, and (3) management (Osman-Gani, 1996). Briefly, product technologies are when ideas are incorporated into a concrete object. Process technologies are the sequential steps used to produce a product or deliver a service. Management technologies are the actions taken to optimize resources to achieve business goals (Osman-Gani, 1991). Regardless of the type of technology, its appearance in organizations has definitively changed the nature

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of work (O'Connor *et al.*, 1996; Haddad, 2002). Indeed, it has been suggested that the greatest impact of technology has been on the nature of work and the abilities of employees to meet the new requirements.

Responding to technological change ultimately places greater pressure on the strategic activities of organizations (Nankervis *et al.*, 1999). However, no empirical research has been found to determine the effects that technological change has had on human resource development practices, particularly when they occur in organizations located in Asia. For instance, Singaporean organizations generally have decided to invest heavily in developing their employees on a continuing basis for maintaining their competitive edge. But, in spite of this commitment, how these companies explicitly develop their employees in response to technological change has not been studied to any extent. This information would be important to HRD researchers to show the effects of organizational change on critical processes such as training and development. This information would also be important to HRD professionals to help them anticipate which responses will be necessary during planned change efforts.

In order to investigate the phenomena, the following research questions were formulated to guide this research:

1. What are the impacts of technological change on human resource development practices in Singapore companies?
2. What is the nature of the resistance to technological change experienced by Singapore companies?
3. What is the nature of differences among companies from various industrial sectors in using human resource development strategies to cope with technological change?

Methodology

The sampling frame of this study was from the 'Singapore 1000' database of best performing companies. It was used because technological changes are more likely to impact dynamic organizations. A sample of 908 companies was selected randomly for each stratum, according to their representation in the sampling frame. The sample was selected using a proportionate stratified random sampling method with the strata being the five primary business sectors, namely manufacturing, construction, financial and business, transport and communication, and commerce. Respondents were either HR managers or general managers.

Preliminary interviews were conducted on a sample of 30 HR managers drawn from various companies. Interview findings were incorporated into the questionnaire design, which encompassed specific technological changes and the possible impact faced by companies on the various HR issues. Research findings from existing literature were also integrated. The questions were carefully worded to avoid misinterpretation. Technical terms were also explained in simple language.

The questionnaire layout was formatted in a logical and aesthetically pleasing manner to ensure a higher response rate. The structured questionnaire was designed using a five-point Likert-type response scale and some categorical items were provided for choosing frequency of use. A cover letter was attached to the questionnaire describing the purpose of the study with anonymity and confidentiality emphasized to increase the response rate. In order to verify the reliability and validity of the questionnaire, test and retest method was used. A panel of experts comprising of senior managers of companies and professors of Nanyang Business School were consulted to check for adequacy and relevancy of the questionnaire items. The questionnaires were mailed to the HR managers and general managers of the sample organizations. Managers were requested to complete and return the questionnaires within two weeks either by mail or fax. Due to the initial low response rate, a second mailing was carried out, and follow-up calls were made. The collected data were verified and compiled in a database, which was subjected to appropriate statistical analyses (descriptive statistics, analysis of variance, etc.) for response to the research questions of the study.

Results

A total of 147 responses could be used for the analysis after screening the returned questionnaires for their completeness and consistency. The relevant profiles of respondents are presented below through the following demographic information:

- 51 per cent of the respondents were from local, and 49 per cent were from foreign companies (MNCs).
- 52 per cent were from the SMEs (small & medium enterprises), and 48 per cent were from large companies.
- Six per cent of the respondents were from the Financial and Business Services sectors.
- 21 per cent were from the Manufacturing sector.
- 14 per cent were from the Commerce sector.
- Seven per cent were from the Transport and Communication sectors.
- Six per cent were from the Construction sector.
- Seven per cent were from other sectors.

About 70 per cent of the respondents had business experience of more than ten years.

Changes in information technology were the most frequently experienced technological changes in Singapore organizations. Recruitment and selection were not found to play an important role in helping companies cope with technological changes. Singapore companies were using other means such as training and development to cope with technological change. Employee training and skills development helped companies to cope with technological change. However, tight training budgets constrained the type and frequency of training programs.

In general, employees were found to be motivated to accept changes through the use of annual increment, medical benefits, and training opportunities. Motivational strategies enabled employees to face technological changes more positively. The role of planning change rested mainly with top management. The following sections present the results by responding to each research question of the study:

1. What are the impacts of technological change on human resource development practices of Singapore companies?

The results showed that on-the-job training was the highest ranked training method used by Singapore companies to cope with technological change (Table 1). The results also showed that most companies during this time used external consultants and vendors to provide human resource development expertise. The average length of time for the training was found to vary from one to three days. Surveys and questionnaires were the most frequently used training evaluation method.

2. What is the nature of the resistance to technological change experienced by Singapore companies?

The results showed that psychological and emotional attitudes were the most frequent type of resistance encountered as a result of introducing new technology (Table 2). Different human resource development strategies are used to reduce the resistance to change. Communication and education, employee participation and involvement, and facilitation and support were the most frequently used human resource development strategies.

3. What is the nature of differences among companies from various industrial sectors in using the HRD strategies to cope with technological change?

Table 3 shows that significant differences were found among companies from the transport and communications sectors in terms of their use of overseas training ($p < 0.01$). No significant statistical differences were found across the business sectors in

Table 1: Training methods used to cope with technological changes

Frequency of use of training methods	N	Mean*	SD
On-the-job training	98	**4.14**	0.94
Seminars/workshops	97	**3.88**	0.99
Classroom/Lectures	98	3.44	1.31
Computer-based training	91	2.95	1.21
Small group discussions	93	2.94	1.17
Self-instructional materials	93	2.92	1.32
Overseas training	89	2.53	1.32
Audio and video tapes	90	2.50	1.33
Games and simulation	87	**2.06**	1.15
Written tutorials	87	**1.76**	0.86
Sensitivity training	79	**2.04**	1.08

* 1 = Least frequently used . . . 5 = Most frequently used.

Table 2: Strategies used for reducing the resistance to change

Strategies	N	Mean*	SD
Communication and education	95	**4.09**	0.93
Employee participation & involvement	95	**3.98**	0.85
Facilitation & support	93	**3.61**	0.89
Creating a common vision	90	3.50	1.03
Stress management	85	3.52	1.10
Team-building	94	3.49	1.02
Goal setting	84	3.25	1.12
Career planning	89	3.10	1.10
Negotiation and agreement	91	3.02	1.22
Job enrichment/analysis	83	2.75	1.17
Self-managed work teams	86	2.71	1.13
Restructuring/reengineering	84	2.70	1.12
Role negotiation/analysis	84	2.44	1.14
Coercion (explicit & implicit)	84	**2.24**	1.08
Sensitivity training	79	**2.04**	1.08

* 1 = Least frequently used . . . 5 = Most frequently used.

terms of the nature of training providers used by companies (Table 4). Table 5 shows that there were no significant differences in the training duration across companies from various business sectors. In terms of the use of training evaluation methods, significant statistical differences were found among business sectors in using trainer feedback (Table 6).

Discussions and conclusions

Employee training was found to have helped companies to cope with technological changes in Singapore. However, tight training budgets, work schedules, deadlines, and limited manpower have constrained the use of the required training programs. In such cases, companies can consider using contract workers on a temporary basis of about six months to relieve current workload. This is because those workers need not be trained since they can take over simple tasks and are relatively more cost-effective.

Table 3: Summary results of the analysis of variance on the use of training methods by business sector

Frequency of use of training methods	Business sectors																		F-Value	Sig.
	Manufacturing			Construction			Financial and Business Services			Transport & Communication			Commerce			Others#				
	N	Mean*	SD	N	Mean*	SD	N	Mean*	SD	N	Mean*	SD	N	Mean*	SD	N	Mean*	SD		
Classroom/Lectures	21	3.67	1.02	6	2.83	1.17	43	3.42	1.42	8	4.25	0.71	13	3.00	1.35	7	3.29	1.70	1.34	0.26
Seminars/workshops	18	3.89	1.08	6	3.50	0.84	44	3.89	1.13	8	4.00	0.53	14	3.71	0.83	7	4.29	0.76	0.50	0.78
Games and simulation	16	2.13	1.09	6	2.33	1.51	38	1.97	1.15	8	2.63	1.19	13	1.38	0.65	6	2.83	1.33	2.05	0.08
Small group discussions	18	2.89	1.02	6	2.50	1.38	41	2.95	1.20	8	3.00	1.20	13	2.92	1.12	7	3.29	1.50	0.29	0.92
Written tutorials	16	1.75	0.68	6	1.67	1.03	39	1.79	0.92	8	1.75	0.46	12	1.67	0.89	6	1.83	1.33	0.06	1.00
Audio and video tapes	18	2.61	1.04	6	2.50	1.38	38	2.26	1.35	8	3.25	1.28	13	2.15	1.28	7	3.29	1.70	1.49	0.20
Computer-based training	18	3.00	1.24	6	4.00	0.63	40	2.90	1.19	8	3.13	1.36	13	2.31	1.18	6	3.17	1.17	1.79	0.12
On-the-job training	20	3.95	0.94	6	4.17	0.98	43	4.14	1.08	8	4.38	0.52	13	4.38	0.77	8	4.00	0.76	0.46	0.80
Self-instructional materials	17	2.53	1.23	6	2.17	1.60	42	3.02	1.26	8	2.75	1.28	14	3.36	1.22	6	3.33	1.86	1.20	0.31
Overseas training	19	2.89	0.94	6	2.50	1.38	37	2.16	1.38	8	3.63	0.52	13	1.92	1.19	6	3.50	1.64	3.61†	0.01

* 1 = Least frequently used . . . 5 = Most frequently used.
# Includes companies from the healthcare, theatre and performing arts, IT and printing services.
† Significant at ≤ 0.05.

Table 4: Summary results of the analysis of variance on the use of training providers by business sector

Frequency of use of training providers	Business sectors																		F-Value	Sig.
	Manufacturing			Construction			Financial and Business Services			Transport & Communication			Commerce			Others#				
	N	Mean*	SD	N	Mean*	SD	N	Mean*	SD	N	Mean*	SD	N	Mean*	SD	N	Mean*	SD		
External consultants/vendors	20	3.35	1.14	6	4.00	0.63	42	3.69	1.20	8	3.63	1.41	11	3.64	1.29	7	4.14	0.69	0.64	0.67
Human resource professionals	18	2.56	1.20	6	2.33	0.82	41	2.07	1.19	8	2.00	1.07	13	2.77	1.30	7	3.29	1.11	1.92	0.10
Department/functional managers	19	2.79	0.85	6	3.67	1.03	43	3.30	1.30	8	3.38	0.74	14	3.57	1.22	7	3.29	1.38	0.99	0.43
Academic professionals	19	1.84	1.07	6	2.33	0.82	42	2.29	1.24	8	2.25	1.04	13	2.08	1.04	6	2.67	1.63	0.64	0.67

* 1 = Least frequently used . . . 5 = Most frequently used.
# Includes companies from the healthcare, theatre and performing arts, IT and printing services.

Table 5: Summary results of the analysis of variance on the use of training duration by business sector

| Frequency of use of training duration | Business sectors | | | | | | | | | | | | | | | | | F-Value | Sig. |
| | Manufacturing | | | Construction | | | Financial and Business Services | | | Transport & Communication | | | Commerce | | | Others# | | | | |
	N	Mean*	SD	N	Mean*	SD	N	Mean*	SD	N	Mean*	SD	N	Mean*	SD	N	Mean*	SD		
Less than 1 day	17	3.24	1.35	4	3.00	1.63	38	3.16	1.44	6	2.33	1.37	9	2.89	1.45	6	2.50	1.52	0.59	0.70
1 day to less than 3 days	18	3.78	1.00	6	3.83	1.17	37	4.05	1.08	7	4.14	0.90	12	3.75	1.22	7	4.14	0.69	0.36	0.87
3 days to less than 1 week	17	3.06	1.03	4	2.50	1.00	36	3.00	1.01	7	3.57	0.98	11	3.00	1.18	6	3.33	1.63	0.62	0.68
1 week to less than 2 weeks	17	2.24	1.30	4	2.50	1.29	36	1.92	1.13	6	2.67	0.82	10	2.10	1.20	5	2.60	1.52	0.73	0.60
2 weeks to less than 2 months	17	2.00	1.41	4	2.00	0.82	34	1.53	0.71	6	1.50	0.84	11	1.73	1.01	4	1.25	0.50	0.83	0.52
2 months to less than 6 months	17	1.76	1.09	4	1.50	1.00	34	1.41	0.82	6	1.33	0.52	10	1.30	0.48	4	1.25	0.50	0.62	0.68
6 months and above	16	1.69	0.95	4	1.50	1.00	31	1.29	0.53	6	1.00	0.00	9	1.11	0.33	4	1.00	0.00	1.85	0.11

* 1 = Least frequently used . . . 5 = Most frequently used.
# Includes companies from the healthcare, theatre and performing arts, IT and printing services.

Table 6: Summary results of the analysis of variance on the use of training evaluation methods by business sectors

Frequency of training evaluation methods	Business sectors																		F-Value	Sig.
	Manufacturing			Construction			Financial and Business services			Transport & Communication			Commerce			Others[#]				
	N	Mean*	SD	N	Mean*	SD	N	Mean*	SD	N	Mean*	SD	N	Mean*	SD	N	Mean*	SD		
Surveys/questionnaires	14	4.07	1.14	6	4.17	0.98	19	3.89	1.15	6	4.17	1.17	7	3.00	1.15	4	4.50	0.58	1.35	0.26
Supervisor feedback	13	3.38	1.19	6	3.83	0.75	18	3.61	1.09	5	3.60	0.55	7	4.00	0.58	4	4.50	0.58	1.01	0.42
Administration of tests	14	2.57	1.40	4	1.75	0.50	16	1.88	0.96	6	2.83	1.17	7	2.29	0.95	3	2.00	1.00	1.13	0.36
Trainer feedback	12	2.83	0.94	6	3.50	1.52	17	2.82	1.07	6	4.17	0.41	7	3.00	1.00	4	4.00	1.15	2.37	0.05

* 1 = Least frequently used ... 5 = Most frequently used.
# Includes companies from the healthcare, theatre and performing arts, IT and printing services.

This will allow employees to focus on critical job aspects that are technology dependent, and more specific and relevant training programs could be provided for them, leaving non-critical work to contract workers.

With the increasing use of the Internet and web-based technology by Singaporeans, the applicant pool will increase and thus companies should consider the use of e-recruitment. This can be achieved by setting up a company website or by using e-recruitment services such as RecruitAsia. Similar tools could also be used for training and development programs.

Training can be used as an effective tool for motivating and retaining the employees. For example, scheduling an employee to a one-year overseas training program can help to boost morale. Other financial incentives such as the use of stock options can be useful in companies that face many technological changes, which demands the full attention and energy of employees to innovate in order to survive. This increases the employee's commitment to the company and motivates him/her to work harder for mutual benefits. Non-monetary, innovative and valuable incentives could be used more frequently to enhance employee motivation. For example, a point-scheme based on work performance can be devised to replace overtime pay. Points accumulated can be redeemed for incentives such as free staff lunch and reduced working hours. Providing opportunities for continuous skills development through appropriate training programs will be a major motivating factor for updating the expertise needed due to technological changes.

It is recommended that companies increase their training budgets to accommodate more training programs for employees. However, it should be cautioned that training should be viewed as an investment and not an expense. Training programs are critical for upgrading employee skills when technological change occurs. Thus, there is a vital need for more resources to be allocated to training. Training programs should be structured to include technical training as well as management training. Of equal importance is the need for good change management and communication skills to ensure successful changes. Companies should continue using structured forms of on-the-job training (Jacobs, 2003) as emphasized by the Singapore government in their OJT21 initiative and seminars/workshops. Computer-based training should also be considered to enable employees to familiarize themselves with computer-related and Internet applications. However, the use of specific training methods would depend on individual company's needs.

Outsourcing of non-proprietary training could be a good strategy as the management can focus on more important strategic issues and redirect the training programs to people who have the expertise and knowledge about the change. This is especially so with the increase in information technology. Shorter training duration allows companies to adapt to new technological changes and this enables them to gain an edge over their competitors. Thus, duration of training sessions should be appropriate to allow employees sufficient time to absorb new knowledge. Companies should conduct some form of training evaluation. This is because it would be valuable to the HR personnel in shaping and improving the company's future training programs.

Implications for future research

Future researchers could use a larger sample of companies to improve on representation. The study covered only technological change and its impact on HRD strategies, hence researchers may want to consider studying other types of changes, such as organizational changes. Reasons driving technological changes and the frequency of changes can be investigated to determine an appropriate period for companies to retrain workers to cope with new changes. Techniques such as cascade training might be used to address institutionalization of such organizational change issues (Jacobs & Russ-Eft, 2001; Osman-Gani & Jacobs, 2003).

Other HRD issues such as career development, performance appraisal and industrial relations can be explored. Organization variables affected by technological changes such as organization structure, job design, authority, responsibility and

communication patterns could also be included. To obtain a more comprehensive and in-depth study, employees could also be included as respondents to show the impact of various HR strategies on different interest groups. The length of business experience can also be incorporated to see if there are significant differences among companies of different years of experience in their use of human resource strategies to cope with technological change.

Analysis between government-linked and private companies, as well as between listed and non-listed companies can be conducted. A comparison between technology firms such as Internet and software companies and non-technology firms could be examined for differences in HR strategies with regard to technological changes. Future research should focus on more detailed interviews and focus groups to obtain more comprehensive views of the current situation. Specific case studies could be conducted on representative companies to gain an in-depth knowledge of the impact of technological changes on HR within each company. The study may be replicated in other countries with an additional variable, national culture considered. It would be a valuable finding to prove that national culture varies from country to country hence enabling the development of an Asian model depicting the impact of technological changes on HR strategies.

Acknowledgements

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