

SECTORAL ACTIVITIES PROGRAMME

Working Paper

**Vocational education and training in the
chemical industry in India**

National Safety Council of India (NSCI)

Working papers are preliminary documents circulated
to stimulate discussion and obtain comments

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Preface

The chemical industry is a base of modern society. It is huge, one of the largest industries in the world. As societies and economies grow, so does the chemical industry. It is of strategic importance to the sustainable development of national economies. The world chemical industry employs an estimated 14 million workers and accounts for about 10 per cent of national GDP in developed countries. World trade in chemicals reached a record US\$700 billion, and the industry is still growing. The chemical industry in Western Europe shows steady growth, with annual averaged growth of over 4 per cent. The Asian chemical industry shows an increase reaching almost two-digit growth every year. The chemical industry keeps improving our standard of living and provides many of the essentials that our society needs. The chemical industry produces more than 70,000 products.

It is a highly capitalized industry. Much of the manual work has been replaced by automation, but significant parts of the operation still rely on human input. Workers' skills are therefore crucial to the stable production and growth of the industry. The aim of this study is to explore in depth some practices of vocational education and training (VET) in the chemical industry in India, which is one of the leading chemical producers in Asia.

The National Safety Council of India (NSCI) prepared this Working Paper. The study has been carried out under the guidance of Mr. K. C. Gupta, Director General, NSCI; Dr. M. Sriram, Expert Panel Member, NSCI; and Mr. V. B. Patil, Deputy Director, NSCI. They are to be congratulated for their work and contribution to the improvement of VET and social dialogue in the chemical industry in India. The ILO hopes that this paper will provide an opportunity to consider how VET can be improved in the interests of both decent work and greater productivity.

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Abbreviations and acronyms

AITT	All-India Trade Test
AOCP	attendant operator (chemical plant)
API	active pharmaceutical ingredient
ATI	advanced training institutes
ATS	Apprenticeship Training Scheme
BTC	basic training centre
cGMP	current good manufacturing practices
CTS	Craftsmen Training Scheme
DCS	distributed control system
DGE&T	Directorate General of Employment and Training
GDP	gross domestic product
HOCL	Hindustan Organic Chemicals Limited
HRD	human resources development
HRM	human resources management
ITC	industrial training centre
ITI	industrial training institute
MITI	model industrial training institute
NAC	National Apprenticeship Certificate
NSCI	National Safety Council of India
NCVT	National Council of Vocational Training
PLC	programmable logic controller
R&D	research and development
RCF	Rashtriya Chemicals and Fertilizers Limited
RIC	related instruction centre
RIL	Reliance Industries Limited
SCVT	State Council for Vocational Training
SHE	safety, health and environment
SOP	standard operating procedures
SSI	small-scale industry
UPL	United Phosphorus Limited
US FDA	United States Food and Drug Administration
VET	vocational education and training

1. Introduction

The National Safety Council of India (NSCI) has prepared this Working Paper. The study has been carried out under the guidance of Mr. K. C. Gupta, Director General, NSCI, Dr. M. Sriram, Expert Panel Member, NSCI and Mr V. B. Patil, Deputy Director, NSCI.

This Working Paper is a part of follow-up activities to the Tripartite Meeting on Best Practices in Work Flexibility Schemes and their Impact on the Quality of Working Life in the Chemical Industries, Geneva, 2003 to meet a request of the conclusions of the Meeting which state, inter alia, that: “[t]he ILO should carry out comparative studies on vocational training in developing countries, intermediate countries and developed countries”.

There is no databank available from which one can draw information or data about VET in the fragmented chemical industry in India. The number of very small chemical entities do not make available to the public even the financial information filed by public limited companies. In this milieu of limited information, the methodology used in the study was to visit a few representative companies and garner information through personal interview.

A questionnaire concentrating on the key questions of the study had been devised to facilitate the interview. But it was found that the questionnaire mostly was not answered by the companies. So desk research was conducted to supplement to the field study to collect information from the chemical company’s handouts, web sites and publicly available information.

2. Overview of the chemical industry in India

The chemical industry is one of the oldest industries in India. It not only plays a crucial role in meeting people's daily needs but also significantly contributes to the industrial and economic growth of the country.

In 2004, the total sales of the Indian chemical industry were about US\$28 billion, or about 2 per cent of global chemical sales, which stand at about US\$1.7 trillion. It is the third largest in Asia and ranks at 12th in world chemical production. Some statistics on the contribution of the Indian chemical industry to the national economy are given in box 1.

Box 1	
The Indian chemical industry at a glance in 2005	
Total sales:	US\$32 billion
The chemical industry constitutes:	
-	7.5 per cent of India's total GDP;
-	10 per cent of India's total exports; and
-	12 per cent of industrial production in India.
Unionized chemical workers account for 17 per cent of the total unionized workforce (or about 1 million unionized workers in the chemical industry).	
20 per cent of excise and import duty collection	
Source: Indian Chemical Manufacturers Association, Sixty-Fifth Annual Report 2004-05.	

The Indian chemical industry is highly fragmented. The primary cause of the fragmentation is due to the Government's corporate licensing policies, allowing various sizes of chemical firms in order to address the supply and demand gap of chemical products.

The sectoral classification of the Indian chemical industry in 2004 is given in figure 1.

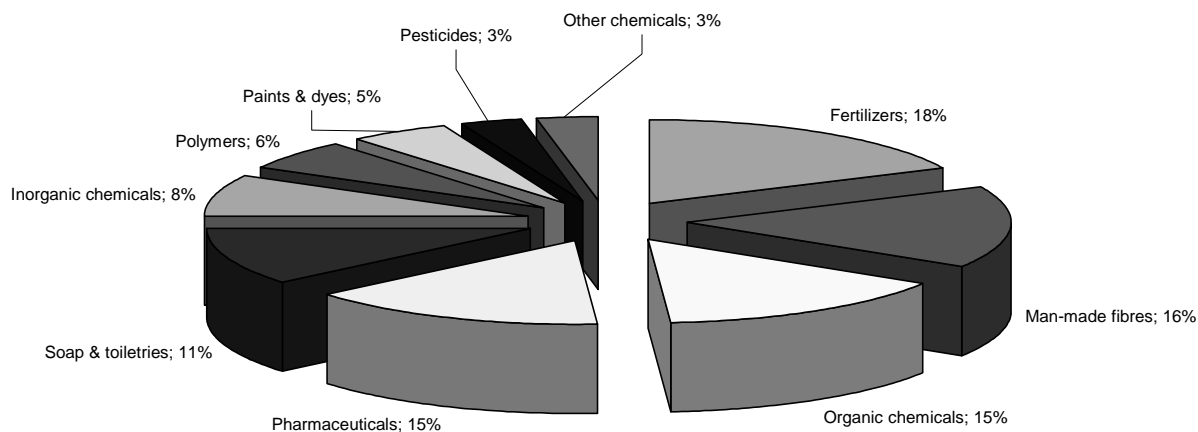
The dyestuff sector is one of the important segments in the chemical industry in India, which is closely related with other chemical sectors. The textile industry is the largest consumer of dyestuffs, nearly 80 per cent of total dyestuff production. While in the 1950s, India imported dyestuff, the country's dyestuff sector has grown into a very strong industry and has become a major foreign currency earner. India has emerged as a global supplier of dyestuff and dye intermediates, in particular reactive, acid, vat and direct dyes.

Fertilizers and pesticides played an important role in the "Green Revolution" of the 1960s and 1970s. But the consumption of pesticides in India has been decreasing, and is now lower than any other developing country. India now turns to be an exporter of agrochemicals, showing an impressive growth in the last five years. In 2004, fertilizers accounted for about 18 per cent of India's total chemical production.

In 2004, the Indian pharmaceutical industry was worth about US\$5 billion and is growing at about 9 per cent each year. It ranks high among developing countries in terms of technology, quality and range of medicines manufactured. Like the chemical industry, the pharmaceutical industry is highly fragmented, consisting of nearly 20,000 drug production companies. Of these, the leading 250 companies control about 70 per cent of the market and several multinational companies have local operations. Some of the domestic-owned market leaders, including Dr. Reddy's and Ranbaxy Laboratories, have acquired an international presence and a reputation for producing high-quality, affordable

generic drugs and formulations. The Indian pharmaceutical industry is increasing mergers and acquisitions (M&A) in the overseas market. For example, the Hyderabad-based Dr. Reddy's Laboratories recently bought a Roche subsidiary in Mexico and Betapharm in Germany.

Figure 1. Indian chemical industry: Sectoral classification, 2005



Source: Deepak Mehta, Chemical Weekly, 7th Annual Business Outlook Conference, April 2006.

Over the years, the pharmaceutical industry has benefited from a substantial amount of government support. The Government has a Department of Biotechnology and has provided infrastructure support and seed money to diversify the sector and create a biotechnology research and development (R&D) segment. It has also permitted 100 per cent foreign equity investment in biotechnology, which has allowed existing multinational companies to expand their scope of operations.

The growth of the pharmaceutical industry depends more on progress in developing its R&D segment than on drug manufacturing and export. In 2004, India opened the Wockhardt Biotech Park in Aurangabad. This is the India's largest biopharmaceutical complex. It has the capacity to serve 10-15 per cent of global demand for biopharmaceuticals.

In the past two decades, Indian pharmaceutical companies have benefited from the intellectual strength of the country's workers in science and technology and have focused their efforts on biotechnology research. This has given the industry the potential to become a leading player in the drug discovery market.

Drug exports to the United States have been increasing in recent years. The Indian industry has the largest number of pharmaceutical manufacturing plants approved by the United States Food and Drug Administration (US FDA) outside the United States. Given the United States' large trade deficit, the big United States-based pharmaceutical companies may find India a much safer place to invest and to market their pharmaceutical products. Among the developing countries, India has a well-established private market mechanism and a legal framework for safeguarding the interests of foreign companies.

Box 2 gives some information about the state of the Indian pharmaceutical industry, as of 2004.

Box 2

Indian pharmaceutical industry at a glance in 2004

- (1) Created more than US\$5 billion in value.
- (2) Exported about 60-65 per cent of output to countries around the globe.
- (3) Ranked at 13th in the global value of the pharmaceutical market, accounting for 1.4 per cent of global value of the pharmaceutical market. In volume terms, the industry ranked at fourth in the world, accounting for 8 per cent of global volume.
- (4) Manufactured over 400 APIs and more than 60,000 formulations in 60 therapeutic categories;
- (5) About 20,000 establishments including large, medium and small companies.
- (6) Top 50 firms accounted for bulk of exports, almost all R&D investments and for most of the introduction of new drugs.
- (7) More than 70 US FDA-approved plants, which is the largest figure outside the United States.
- (8) 200 units certified for international good manufacturing practices (GMP).
- (9) Compounded annual growth rate (CAGR) in sales is around 10 per cent in the last decade;
- (10) A McKinsey Report estimates that the Indian pharmaceutical market will grow to US\$25 billion by 2010 and to US\$100 billion by 2025.

Source: Chemical Industry Digest Data Bank, Jan. 2005.

3. National framework of vocational education and training (VET)

3.1. Introduction

In 1947 India was independent. In the early 1950s, India launched a five-year plan with massive industrializing drives to stimulate workers to acquire high skills. To meet this end, the Directorate General of Employment and Training (DGE&T) in the Union Ministry of Labour initiated the Craftsmen Training Scheme (CTS) by establishing about 50 ITIs for imparting skills in various vocational trades to meet the increasing skilled workforce requirements for the advancement of technologies and the industrial growth of the country.

VET is a concurrent subject of both central and state Governments in India. VET-related matters, such as the development of training schemes, training policies, training standards, training procedures, organization of trade tests and issuance of certifications, are the responsibility of the central Government, whereas the implementation of training schemes largely rests with state Governments. The central Government created the National Council of Vocational Training (NCVT), a tripartite body representing central Government, employers and trade unions. Similarly, the State Council for Vocational Training (SCVT) was established at the state level, with the same purposes as the NCVT. At the national level, at present there are two main vocational training initiatives, which are the CTS and the ATS.¹ The Government and chemical companies have dual responsibility for providing workers with training under the Apprentices Act, 1961.

3.2. Craftsmen Training Scheme (CTS)

3.2.1. Objectives

The objectives of the CTS are:

- to ensure steady flow of skilled workers in all industrial/service sectors;
- to raise the quality and quantity of industrial production by systematic training of workers; and
- to reduce unemployment among the youth by equipping them with suitable skills for industrial workers.

3.2.2. Salient features of the CTS

Training is imparted in 50 engineering and 48 non-engineering trades through the industrial training institutes (ITIs) and the industrial training centres (ITCs) located throughout the country. The period of training varies from one to three years. The entry qualification varies from 8th to 12th class completed students, depending on the requirements of trade.

¹ www.dget.nic.in.

The training institutes have necessary infrastructural facilities. These institutes are required to conduct training courses as per the training curriculum decided by the NCVT.

All-India Trade Tests (AITTs) are conducted in January and July every year by the DGE&T. After the completion of the training at the ITIs and ITCs, trainees must appear in the All India Trade Tests. National Trade Certificates will be awarded to those who pass the tests. The Certificates are recognized by the central Government for the purpose of recruitment at the central Government and the state-owned corporations.

About 70 per cent of the training period is allotted to practical training and the rest to theoretical training relating to trade theory, calculation and science, engineering, social studies including environmental science and family welfare.

Broad-based modular training is offered in four central model industrial training institutes (MITIs). This training offers an advantage of re-orienting the training modules as per the changing skill requirements in the industry.

3.2.3. Trades related to the chemical plant operators

The trades related to chemical plant operators, the period of training and their entry qualifications under the CTS are summarized in table 1.

Table 1. Trade, period of training and entry qualifications for chemical plant operators under the CTS

Trade	Period of training	Entry qualifications
Maintenance mechanic(chemical plant)	2 years	Passed 10th class examination with physics, chemistry and mathematics under 10+2 system of education or its equivalent.
Instrument mechanic (chemical plant)	(a) 2 years	Passed 10th class examination under 10+2 system of education with physics, chemistry and mathematics as one of the subjects or its equivalent. Passed B.Sc. with physics and chemistry.
	(b) 6 months	
Attendant operator (chemical plant)	(a) 2 years	Passed 10th class examination, under 10+2 system of education with physics, chemistry and mathematics as one of the subjects or its equivalent. Passed B.Sc. with physics and chemistry.
	(b) 6 months	
Laboratory assistant (chemical plant)	(a) 2 years	Passed 10th class examination under 10+2 system of education with physics, chemistry and mathematics as one of the subjects or its equivalent. Passed B.Sc. with physics and chemistry.
	(b) 6 months	

3.3. Apprenticeship Training Scheme (ATS)

The ATS is operated under the Apprentices Act, 1961. The law requires all companies to provide apprentice training to entry-level workers. Firstly, we will briefly discuss the aims and the background of the Act, followed by the discussion concerning the ATS.

3.3.1. Objectives of the Apprentices Act, 1961

The Apprentices Act, 1961, was enacted in order to:

- regulate the programme of training of apprentices in the industry so as to conform to conditions of training such as the syllabi, period of training as laid down by the Central Apprenticeship Council; and
- operate the facilities available in industry for imparting practical training with a view to meeting the requirements of the industry.

3.3.2. Evolution of the Apprentices Act, 1961

The National Apprenticeship Scheme started in 1959 on a voluntary basis. The Apprentices Act was enacted in 1961 and promulgated on 1 March 1962. Initially, the Act envisaged training of trade apprentices. The Act was amended in 1973 to include training of graduates and diploma engineers as “graduate” and “technician” apprentices, respectively. The Act was further amended in 1986 to bring it within its purview the training of the 10 + 2 vocational training system as “technician (vocational)” apprentices.

3.3.3. Administration of the Apprentices Act, 1961

The responsibility of administering the Apprentices Act, 1961, lies in the DGE&T. The DGE&T is also responsible for implementation of the Act with respect to trade apprentices in the central Government through the undertakings and departments. This is done through six regional directorates of apprenticeship training located at Kolkata, Mumbai, Chennai, Hyderabad, Kanpur and Faridabad. State apprenticeship advisers are responsible for the implementation of the Act at the state level.

In addition, the Department of Education in the Union Ministry of Human Resources Development (HRD) is responsible for the implementation of the Act with respect to graduate, technician and technician (vocational) apprentices. This is done through four boards of apprenticeship training located at Kanpur, Kolkata, Mumbai and Chennai. Under the Act, the chemical industry is included in the categories of manufacture of basic chemicals and chemical products and manufacture of rubber, plastic, petroleum and coal products.

3.4. Apprenticeship Training Scheme (ATS)

The Central Apprenticeship Council is a responsible organ to the ATS. The Council advises the central Government on designing the policies and prescribing the standards and principles in respect of the ATS. It is a tripartite organ. The Union Minister of Labour is the Chairperson of the Council and the Minister of State for Education is the Vice-Chairperson.

3.4.1. Coverage

The apprenticeship training is obligatory on the part of employers in public and private establishments; they must have the requisite training infrastructures, as laid down in the Act. In 2005 nearly 18,000 establishments engaged in the apprentice training, of which 254 companies or groups of companies in the chemical industry were covered by the Apprentices Act. For the attendant operators in the chemical plant, chemical companies must hire one apprentice trainee for every ten workers, excluding non-skilled workers.

3.4.2. Training of trade apprentices

Some important features of the training of trade apprentices under the ATS are:

- 140 trades in 31 trade groups are designated for apprentice training;
- qualifications for apprentice training vary from 8th grade graduates (class pass) to 12th grade graduates (10 + 2) system;
- minimum age required for apprentice training is 14 years;
- the period of apprentice training varies from six months to four years;
- apprenticeship training is linked with craftsmen training, conducted in 92 trades; and
- training comprises basic training, shop-floor training and related instruction as per prescribed syllabus for each trade.

Basic training and related instructions are conducted in basic training centres (BTCs) and related instruction centres (RICs) set up within the establishments or in a BTC and a RIC set up by the Government.

The number of trainees entering into trade apprenticeships is decided by the Apprenticeship Adviser based on the quota of apprentices and the accommodation capacity of training facilities. Admission to trade apprentices is made twice a year in February/March and August/September every year. Every apprentice and employer must enter into a contract of apprenticeship training, which must register with the Apprenticeship Advisers. Employers and apprentices must fulfil their duties and obligations under the Act.

3.4.3. Testing and certification of trade apprentices

AITTs for trade apprentices are conducted by the National Council of Vocational Training (NCVT) twice a year (October/November and April/May) every year.

The National Apprenticeship Certificate (NAC) is awarded to those who successfully pass the AITTs. The NAC is recognized for employment under government/semi-government entities.

3.5. The role of the chemical industry in the national VET framework

Chemical companies take the following roles and initiatives as their commitments to the national vocational education system:

- to deliver basic and practical training for apprentices in the industry by the enterprise, with the whole cost borne by the enterprise;
- to appoint the experts from these training centres as members of the curriculum committee at the national level to draft the curricula for the Craftsmen and Apprenticeship Training Programme;
- to appoint the experts from these training centres as examiners and paper setters for the Craftsmen, Apprenticeship and Instructor Training Programmes; and

-
- to appoint the experts from the training centres as members of advisory committees, such as the Central Apprenticeship Council, the NCVT, the State Apprenticeship Council and the SCVT, as well as advisory committees of ITIs and ATIs. The companies on their own fund their in-house and external training programmes for their employees.²

3.6. Liberalization of the Indian chemical market and VET

When liberalization hit the Indian chemical industry in the early 1990s, most of the chemical companies – regardless of the number of employees – were affected by a massive drive of cost reduction due to increased competition stemming from globalization.

Before liberalization arrived in the chemical industry, the Government of India devised protective schemes to protect its industry and domestic market. In fact, the chemical industry was one of the major forces urging the Government to take protective measures. The rationale was that if the industry were not protected, it would have been wiped out, causing a loss to India's exchequer.

Under the protected market, chemical companies produced only enough to make minimum profits. The Government restricted the production capacity through corporate licensing. Hence, there was no incentive for chemical companies to improve the quality of product, reduce production cost or replace outdated machines and equipment with state-of-the-art high-tech production systems. Improving workers' skills in order to increase productivity had been barely considered. Once workers were employed by chemical companies, they received initial training but nothing further.

Liberalization and the substantial reduction of customs tariffs in 1991 due to globalization shocked the manufacturing sector, in particular the chemical industry. Globalization resulted in the closing down of many small and medium-sized chemical firms in India. To cope with emerging globalization, chemical companies needed to change their business manners and business practices. Cost-cutting was the only way for them to survive in a keenly competitive globalized market. Chemical companies also took drastic measures to reduce workers as an instant means of increasing profits.

In this milieu, chemical companies had not given any consideration to VET because of fear that executing VET would lead to increased cost. This was a prevailing business practice in the chemical industry in early 1990s when liberalization and globalization were rapidly hitting the Indian chemical market. The survival of a company was the absolute priority for its management.

Increased competition due to globalization challenged Indian chemical firms to compete with cheaper imported chemicals from overseas. Indian chemical firms were compelled to take measures to reduce per unit costs by improving production facilities and reducing raw material cost and utility consumption per unit of product. An introduction of advanced technology such as the programmable logic controller (PLC) and distributed control system (DCS) induced the chemical industry to increase the number of highly qualified production operators. These chemical companies had the ability to improve their financial condition, however. GDP figures demonstrate this point. Between 1974 and 1984, where the Indian chemical market was protected, average annual GDP growth rate was only 4.2 per cent. However, between 1994 and 2004 the figure increased to 5.1 per cent.

² ER. D.S. Dagaur, "India: Enterprise participation in training", ILO, 1997.

4. VET in the chemical industry

In the chemical industry, training is given for all workers in all trades. The extent and the type of training vary. In this paper, the emphasis is given to training imparted to production workers.

4.1. Traits of VET in the chemical industry

Training set-up throughout the manufacturing industry, including the chemical industry, shares some similarities. Training consists of induction and on-the-job training. However, the programmes differ by industry.

Another difference is that the chemical industry produces and deals with hazardous substances. Production vocation in the chemical industry focuses on safe handling of hazardous substances in the production system. In the manufacturing sector the use of safety equipment is not as sophisticated as those in chemical industry because chemical hazards differ a lot compared to physical hazards.

In the past, mostly ITI-trained production workers who passed the secondary school education were hired as apprentices. In recent years, however, preference in entry-level recruitment is given to diploma holders in engineering over ITI trainees. This trend is related to the introduction of modern production technologies in the chemical industry.

4.2. Initial training

As discussed in Chapter 3, the Apprentices Act, 1961, obligates public and private enterprises in India to provide apprentice training for all employees. A typical induction programme given in progressive medium- and large-scale chemical enterprises is described in this section.

All the chemical enterprises give induction training. The period of training varies from two to ten days. Trainees are normally attached to the Training Section of the Human Resources Department. The trainee's initial meeting takes place with the Personnel Department, which is responsible for the trainee's appointment and employment and all personnel-related matters.

At the training centres, trainees receive an induction schedule, which includes briefings on general information about the company, company structure, financial performance, layout of the production facilities, and other essential matters. Subsequent initial training programmes include an introduction to site facilities and briefings presented by various departments of the company.

Then, induction training reaches the next level. Knowledge of the production process, equipment and instruments is taught in the classroom, followed by an onsite exercise by production managers.

At the end of induction training, oral and written examinations are given to trainees as a means of evaluating their grasp of what has been taught. Once trainees achieve a passable minimum score, they are sent for on-the-job training.

4.3. On-the-job-training for acquiring basic skills

On-the-job training normally has two phases. The first phase is pure observation of work performed by experienced operators, with the goal of understanding the entire production process. Chemical production consists of many different processes. Accordingly, chemical production plants have various subsections, and trainees rotate from one subsection to another until they acquire full familiarity with all aspects of the job they will eventually perform independently. This on-the-job training takes more than one plant – trainees are exposed to as many different workplaces as possible so they can acquire deep knowledge of the production system as a whole. It is common for trainees to perform non-critical work, with full monitoring by their supervisors. This job observation lasts for three to six months, depending on trainees' educational background.

Once this first phase of on-the-job training is completed, trainees are examined to gauge their level of knowledge. Once they can pass the examination, they are given partial charge of the operation but still remain under the supervision of skilled senior operators. After three months, trainees are given written and oral examinations to examine their capacity for performing jobs independently. Unless trainees can pass the examinations, the companies will not give them an independent job to perform. Skill examinations are more difficult at the US FDA-approved pharmaceutical plants than at chemical plants because the US FDA quality control standards demand highly skilled workers for pharmaceutical plants.

Continuous training has become a norm in the chemical industry so as to increase competitiveness in the global market. Many chemical companies have expanded their production capacity, introducing the latest production technologies. When the latest production technologies have been introduced from overseas, production workers are trained for short spells in the technology supplier's plants in overseas. Alternatively, trainers from the technology suppliers visit India for 10-30 days to give training there.

The need for additional training arises whenever new process control systems are introduced. Lean production, also known as the "Just-In-Time" production system, has ushered into the chemical industry the new age of production systems. The advent of electronically controlled production systems has considerably changed production methods. Batch processes are mostly used by agrochemical, dye and pharmaceutical companies, and also small-volume, high-value specialty chemical manufacturers. PLCs for controlling batch processes were adopted by many of them, which led to a need to train production workers. Because the operation is conducted from a single location control room, production workers must learn how to read computer monitors, hear audio alarms, and take corrective action while sitting in front of a computer-controlled console. Trainers provide production workers with a demonstration of how to operate the system and then workers are trained on a simulator before commencing the actual operation of the machines. A similar training process is used for the DCS. In addition, the automation of production has resulted in workforce reduction and created a need for re-training of affected production workers.

4.4. Safety and health quality training

Based on experiences of the Bhopal disaster in 1984, chemical enterprises have started reviewing their operations from the perspectives of safety, health and environmental protection. In addition, environmental laws and environment-friendly regulations require chemical companies to enforce all measures to ensure the safe operation of chemical plants. This meant that process safety and operational safety became a vital add-on to production workers' training programmes. This also meant a review of all

operations, making them safe by providing employees with adequate safety training and equipment.

Many chemical companies have realized that globally recognized assurance systems such as ISO 9000 for quality control and ISO 14001 for environmental management and, more recently, OHSAS 18001, which assures the occupational safety and health. In other words, safety and health training has become one of the important elements of training for production workers in the chemical industry. These safety assurance systems expect every employee to be aware of the overall policy of the company and to be knowledgeable and skilful in their specific area of work – beyond the traditional boundaries of safety and health training. This was another milestone, which has moved chemical companies to revive training. Production workers today in the chemical industry are also trained about in the areas of occupational safety and health and environmental protection.

4.5. The role of trade unions in VET

In the past, trade unions were not particularly concerned about the type and the extent of VET given to workers. Their main concerns were wages, bonus and welfare schemes provided by the chemical companies to their members.

After the Bhopal disaster, the Factories Act was amended to require management and trade unions to work together in a bipartite safety committee within each company. In the safety committees, it was a norm that trade unions proposed to the management that with the provision of proper and better quality safety equipment, workers would be trained in all aspects of safety connected with their job. Production workers, who often withstand the worst of any ill effects of accidents due to improper safety measures, were in the forefront of the drive to improve safety.

4.6. In-house and external training

In medium and large-sized chemical companies, training for workers, including production workers, is normally conducted in-house since experienced supervisors and managers are available to facilitate the training programmes. They can be supplemented by external experts from outside institutions wherever necessary.

Whenever the new equipment and/or production control systems are installed, training is given by the vendor's experts. Training for certification-based quality, environment management, and occupational safety and health systems are conducted by external certified trainers. In chemical companies that have adopted modern human resource management concepts, training in such soft skills as attitude and stress management is offered by external psychologists and organizational behaviour experts.

4.7. Case studies of VET in the chemical industry

As stated in the introduction of this paper, a few representative chemical companies were visited by our field research teams to conduct personal interviews. A summary of the field studies is provided in the following sections.

4.7.1. A petrochemical company – Reliance Industries Limited (RIL)

The Indian petrochemical sector is a dominant contributor to the country's economy. It is growing at the rate of about 15 per cent per annum. At present, petrochemicals

production is highly skewed, with major production coming from a single company, Reliance Industries Limited (RIL).

RIL was founded in the 1970s and grew from a small textiles business into the country's largest petrochemicals manufacturer. Following economic liberalization in the 1990s, the company exploited new business opportunities in a number of sectors. The company is now a leader in energy exploration and has ambitious plans to develop the power sector, while it has also become a principal player in the telecom sector. RIL's estimated capital value is US\$20 billion and the revenues of its various branches equal to 3 per cent of India's total GDP. Globally, RIL is the largest producer of polyester fibre and yarn, third-largest producer of paraxylene, fifth-largest producer of mono ethylene glycol (MEG), sixth-largest producer of purified terephthalic acid (PTA), and seventh-largest producer of polypropylene (PP). It has the biggest integrated refinery petrochemical complex at Jamnagar, Gujarat and independent petrochemical complexes at Hazira, Gujarat and Patalganga, Maharashtra.

From the point of view of VET for production workers, the Patalganga unit is an interesting case, as it was set up before liberalization in the 1990s. The highly manual labour oriented polyester fibre yarn (PFY) and polyester staple fibre (PSF) were first set up along with polyester chips. Later it has developed to produce intermediates purified terephthalic acid (PTA) and para xylene (PX) as well as linear alkyl benzene (LAB).

In the early years, RIL hired ITI-trained workers. When they were hired, they received induction training, which gave an overview of the company and the operations in which they would be assigned to work. Training was organized in classroom lecturing, followed by on-the-job training. Once the trainees were recognized as having sufficient skills, they gained an independent responsibility. At this time, there was not much to learn in on-the-job training because production work was then quite routine – basically repeating the same activities day after day. However, after liberalization in the 1990s, many of the manual operations in the fibre yarn spinning plant were replaced by automatic and semi-automatic operations. In 1998, an Automatic Product Handling System was introduced in the PFY plant. This meant the production workers had to receive four-day on-the-job training in order to acquire the skills to operate the new system.

The automation led to a number of people becoming surplus workers at the PFY plant. No new or additional recruitment of production workers have taken place. Those who held high competency at the junior operator level were selected and given on-the-job training to transfer to the newly built petrochemical plants as production operators. These transferring workers received classroom training, followed by training as observing operators working in the control room. The significance of these workers' transfer is that they were initially recruited as production workers, worked in the fibre plant, then were trained to take up more difficult and complex work at the petrochemical plants.

Since the late 1980s, many modern production control systems have been introduced in the petrochemical plants. Each time, production operators were called on to participate in on-the-job training to increase their proficiency at operating new control systems. On-the-job training is periodically given to refresh their skills concerning the production operations and safety every two years. It is also common practice to review all SOPs every two years and revisions on training is made, to give adequate and latest training to production workers. RIL provides workers with training on a continuous basis while they are employed by the company to upgrade their skills to operate the latest processes and control systems. In short, in RIL, training is built into a career path. Those who can acquire the high competences through VET can be promoted to a higher grade or position with more authority and responsibility.

Another important trait in VET at RIL is that the company has used the outside VET institutes to fill the shortage of skilled workers. Since mid-1990s, RIL has collaborated with nearby VET institutes to design and execute skills training and knowledge up-grading programmes for RIL employees. At these training institutes, about 350 production workers received training for four months during their non-working time and weekends, depending on the requirements of their vocations. Vocational trainers at these VET institutes in cooperation with in-house managers of RIL provide production workers with basic knowledge of chemical engineering, including instrumentation and process control. These workers are examined on their competence and knowledge. Once they pass the examinations, they are given jobs at the petrochemical plants as operator/technicians with a promotion to a higher grade.

4.7.2. A fertilizer company – Rashtriya Chemical and Fertilizers Limited (RCF)

Rashtriya Chemical and Fertilizers Limited (RCF) is a public-sector chemical enterprise which started its operation in Trombay in the Mumbai area in 1978. The company has a fully dedicated training department. The company undertakes the responsibility of identifying training needs and ensuring adequate training is provided to workers to meet the requirements for their work. In addition, the company has developed training programmes to enable its workers to work in other industries in India as well as to dispatch its workers to chemical operations abroad – in such countries as Algeria, Bahrain, Bangladesh, Oman, and Saudi Arabia – for the production operations and maintenance. In India, the company's workers are deployed to operate at Shahjahanpur, Namrup, and other locations. The company not only trains its workers but also provides training programmes to workers in other companies, both in India and abroad.

The company has a training centre where all levels of workers are regularly trained in functional as well as cross-functional areas of their responsibilities. A yearly training calendar is prepared by the training centre in consultation with the operation managers of each plant.

Workers' yearly assessment by their supervisors is the basis for evaluating their skill level and for identifying the needed training programmes in the following years. Individual training records are maintained at the training centre. A feedback system on training programmes also exists to validate the effectiveness of the training programmes.

The company recruits graduates in chemistry as operator trainees. Trainees are given induction training. In addition, under the Apprentices Act, trainees undergo 18 months of training before they are given full responsibilities.

In the past five years, the company has not recruited new employees. The company has had many old surplus workers who took early retirement under the Voluntary Retirement Scheme (VRS), thereby reducing its surplus workers. As a public sector undertaking, the company must secure jobs. This policy has made the company keep a considerable number of surplus employees. However, a drive to increase productivity under the keen competition of globalization has changed this policy, forcing the company to reduce workers under VRS. The trade union negotiated with the company to give a generous retirement allowance to those who took voluntary retirement. The trade union has also negotiated to provide young workers with more training. The type of training was decided in consultation with the head of the production department. In addition, every two years, all the production workers undergo two to three days of refresher training.

Human resources development is a core part of VET programmes at RCF, which is summarized in box 3.

Box 3

Human resources development policies in terms of VET at the Rashtriya Chemical and Fertilizers Limited (RCF)

At RCF, human resources management (HRM) is actively linked to the company's visions and goals. This linkage has been implemented as an initiative called total employee development focus. While achieving high business targets and customer satisfaction, quality of management, innovativeness, employee talent dynamism and social responsibility are proving to be as important as effective operations, cost saving and product quality. Human resources management at RCF is very well established in terms of design, infrastructure and continuity.

Vision building and innovation

A powerful tool for taking an organization forward in leaps and bounds, vision building is considered to be a top priority for today's dynamic organization. RCF has been engaging its executives across all levels, from shop-floor and frontline executives to the senior strategy makers of the organization, in fruitful vision-building exercises and idea sharing for business growth.

System development and managing change

HRM has a very crucial role in the development and implementation of systems in an organization. It can be a powerful catalyst in managing change. RCF has entered into enterprise resource planning (ERP) by way of networking all its major functional areas and will be drastically reducing the manual administrative work.

Succession and career planning

Implementing a succession plan is important to the health of an organization as it ensures the availability of future leaders at key positions and effective co-ordination. It also allows for creative development of personnel to "fit" within the organization at the middle and upper management level. RCF does not leave its leadership to chance. A meticulous succession planning for the top two-four layers of the organization is worked out and reviewed at regular intervals for implementation.

Employee development

Organizations that support employee development are better able to attract and retain talented people, where employability has taken priority over the traditional concept of job-for-life. At RCF, the following HRM subsystems are established.

Training and development

A systematic top-down approach is being followed in training and development activities, which are aptly designed for all levels and are being carried out on a continuous basis. A modular training concept has been introduced at all levels, including managers and workers, designed to provide uniform inputs at different employee levels leading to positive change in organizational performance, overall quality of manpower and organizational culture.

Employee involvement and commitment

The company has introduced continuous efforts for encouraging employee involvement at different levels as the following means to achieving commitment of the workforce. Production process interventions such as quality circles, employees' suggestion scheme, total quality management, 5S, best employee awards, performance linked compensation, profit sharing schemes and counselling services for employees on their career development.

Source: www.rcfltd.com.

4.7.3. A basic organic chemical company – Hindustan Organic Chemicals Limited (HOCL)

In the early 1950s, the Government of India felt the need for indigenous manufacturers of certain vital organic chemicals and intermediates for dyestuff, drugs, and rubber. In 1955, such a project came to be. Because of difficulty with capital flow at that time, the Government set up a state-owned manufacturer of basic chemicals, leaving the more profitable downstream segments in the orbit of private-sector small and medium-sized chemical companies.

Accordingly HOCL was the first state company manufacturing basic chemicals under the control of the Ministry of Chemicals and Fertilisers. HOCL is located at Rasayani, about 70 km from then-Bombay (now Navi Mumbai), founded with a view to serve as an indigenous source of supply of basic organic chemicals by using indigenously available raw materials such as benzene, naphtha, chlorine, caustic soda.

During the 1970s the operation of the plant was carried out only by graduates in science (B.Sc.). Those who had years of experience were appointed as chemists/shift-in-charges whereas the fresh graduates were appointed as chemical operator trainees. They received induction training and specific training for taking independent charge for a specific operation under supervision.

The company continued with vigour throughout the 1970s and 1980s. In the process of growth in the 1990s, training programmes implemented by HOCL are described in box 4.

Box 4

**Training programmes developed and implemented at the
Hindustan Organic Chemicals Limited (HOCL)**

1. Trade Apprentices Scheme

Duration: three years

Areas: attendant operator (chemical plant)
maintenance mechanic (chemical plant)
instrument mechanic (chemical plant)
boiler attendant (chemical plant)

Entry criteria: minimum 10th grade pass and other conditions may apply

Selection: test and interview

2. Production Trainee

Duration: one to two years

Areas: production division

Entry criteria: B.Sc.

Selection: test and interview

3. Company Apprentice

Duration: one year

Areas: production division and quality control

Entry criteria: B.Sc.

Selection: test and interview

4. Diploma Apprentice

Duration: six months

Areas: production division

Entry criteria: Through the sponsoring institutions

Selection: interview

5. OJT (On-the-job training)

Duration: nine months

Areas: mechanical maintenance division-fitting, welding, others

Entry criteria: as for the Government of India Schemes for retired defence personnel

6. Management Trainee (Engineering)

Duration: one year

Areas: chemical, mechanical, electrical, civil, instrumentation

Entry criteria: professional qualification in respective area

Selection: test and interview

Source: Hindustan Organic Chemicals Limited (HOCL).

Production workers go through one of the following VET processes:

- (1) trade apprentices scheme;
- (2) production trainee; or
- (3) company apprentice.

The process of economic liberalization as well as structural reforms took place in the early 1990s. The impact of reducing product prices has taken a toll on the company's economic performance. Sinking capital into expansion projects at Rasayani and lower profit margins worsened the company's profits nearly to a deficit. The company has started special training programmes for all employers covering the following:

- activities to increase awareness of the changing nature of the business, the present status of the company, ongoing activities and future plans to meet the challenges posed by liberalization;
- organized training programmes relating to quality, safety and health and the environment;
- organized training programmes concerning self development and career development; and
- organized training programmes concerning the ways and means of productivity improvement.

Though some topics may be not directly related to an employee's job in the traditional sense, the company found that these training programmes brought about an attitude change that resulted in improving productivity and quality of the products.

In general, all the training courses are designed based on various factors such as the needs identified, the objectives to be achieved, skill level, education, work experience, and time available. Head of the employee's department plays a key role in identifying his or her training needs.

Training courses are mostly conducted by senior supervisors and managers of the company. External trainers are also invited depending on the topic. After each training programme, a discussion is organized to assess the capacity of the trainers, and the usefulness/effectiveness of the programme. Employees' suggestions and comments are taken into consideration for the formulation of future training programmes.

4.7.4. A pharmaceutical company – M/s Cipla Limited

The pharmaceutical sector is the highest growth area in the chemical industry in India. This growth is a reflection of highly skilled workers as a result of VET programmes.

M/s Cipla Limited was founded in 1939 by an entrepreneur, Dr. K. A. Hamied. The company is purely indigenous. The company has been supplementing its in-house research and development capacity in collaboration with the Council of Scientific and Industrial Research, which is an autonomous institute set up by the Government of India.

M/s Cipla Limited is the second largest pharmaceutical company in India. The company produces bulk drugs and animal care products. It has about 500 employees, out of which 214 are in production and 140 are considered as production workers and production operators. The company has state-of-art manufacturing facilities with its main

plant at Patlaganga and other plants in Goa, Khurkumbh and Bangalore. A new manufacturing unit has been constructed in 2005 at Baddi in Himachal Pradesh. In 2005, it marked the annual sales of about Rs.24 billion (US\$530 million), out of which about Rs.10.5 billion (US\$230 million) are generated by exports to over 150 countries around the world.

M/s Cipla Limited has a standard mode of training system which is followed uniformly in all business units. The purpose is to ensure that all its employees receive appropriate training to execute their duties and responsibilities under current good manufacturing practices (cGMPs).

Until 1996, M/s Cipla Limited recruited ITI holders and provide them with in-house training. But there is an increasing need to hire more engineers, so the company is now hiring diploma holders of chemical engineering at the production facilities – they have more than three years of engineering education after completing 10th grade and 12th grade at the engineering school.

As per the SOPs, new recruits receive an induction schedule organized by the personnel department. The induction programme covers the briefing on general information of the company, the principles of the company and the current status of the drug business and market trends. The period of the programme is ten days. The programme includes introduction to site facilities and briefings on the various departments at the site. At the end of the initial training, trainees must submit a detailed report discussing their achievements at the induction programme.

On-the-job training is then given to trainees for one to two months. This includes classroom lectures and training on the shop floor in the following topics:

- cGMPs;
- procedures related to occupational safety and health;
- SOPs relating to the equipment and instruments;
- unit operations; and
- use and operation of equipment and instruments.

Trainees undergoing on-the-job training are supervised by skilled experienced senior workers. Trainees are assessed on their understanding and competence of their work by a written examination. The company uses a quantitative assessment sheet, which is to be filled in by the head of department to which trainees belong. A score of 75 per cent and above is considered satisfactory. Any person scoring less than 75 per cent must undergo retraining. After successful completion of on-the-job training, the certificate is issued.

Once trainees earn the on-the-job training certificate they receive the actual responsibility of independently performing a job. After trainees successfully perform their duties for one year, they become technicians. Trainees receive a monthly assessment of their performance concerning:

- knowledge and understanding about the jobs they are performing;
- degree of familiarity with the production units;
- understanding of risk and ability to make risk assessments;
- communication skills;

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- time management;
 - responsiveness;
 - discipline;
 - comprehension of occupational safety and health and cGMP standards; and
 - the ability to keep records accurately.

The need for further training is determined by the head of department. An annual training schedule is decided in considering the each employee's conditions. Consideration in VET is given to new technologies, updating workers' knowledge and skills to understanding the principles of new equipment, new or modified production processes, new instruments, methods, new dosage forms, and new SOPs. Both in-house and outside trainers are used depending on the subject. Toward the end of training, the trainers conduct a question-answer session to evaluate the achievements of training. Training reports contain critical points covered during the course of training. Those who receive training from outside faculties, seminars, workshops have to submit a detailed report to their head of department.

The needs of retraining are considered under the following circumstances:

- if is there any change in company structure or work organization;
- if are there any deficiencies at work observed by self-inspections, audits or performance reviews; and
- if is there any deviation between the training given and skills needed for actual work.

Records of training given are maintained at unit level. In case workers are transferred to another unit, their training file is also sent to the transferring location and a copy is also kept in the original unit.

Trainers are mostly provided internally. However, external experts are called in on training concerning safety and health, First Aid, fire-fighting, risk management, process safety management and stress management.

4.7.5. An outsourcing manufacturing company – Hikal Limited

Hikal Limited has five manufacturing facilities. Hikal is a multi-product, multi-location chemical company. The company's business areas range from research and development, manufacturing in chemicals, formulation and packaging. The company's annual turnover in 2005 was about Rs.1.6 billion (US\$35 million).

In the pharmaceutical business, the company functions as an extended organization by manufacturing intermediates and active pharmaceutical ingredients at its US FDA-certified facilities. Hikal provides customised solutions, and customises the manufacturing of intermediates for candidate drugs or APIs for formulations. Its customers are located in the United States, Europe and Japan. The company leverages its intellectual capital in the quality deliverables provided to its customers using state-of-the-art manufacturing facilities.

Hikal started at its plant at Taloja, Maharashtra in 1988 to produce thiabendazole (TBZ), a post-harvest fungicide used on fruits and vegetables. It is the only producer of

this product in the world. The technology for producing this unique product had been transferred by Merck. It is produced solely under a conversion contract with Merck. There are about 200 employees at this site, of which about 40 are production workers.

In the early years of the company, Hikal hired ITI-trained production workers. But the company has not recruited any workers at the production level since 2000. The company's training policy requires that whoever joins the company first receive an introduction to colleagues in that department/section. Then there is induction training for one to two days. This is called "awareness training". The induction training includes lectures concerning the company background, its products, company's history, safety systems, the use of fire extinguishers and masks, effluent treatment systems for air, water and solid pollution, and quality assurance systems.

Next, trainees receive further training in the departments where they will be assigned. Each department has developed a training manual for the initial on-the-job training. The production training manual normally contains information concerning production procedures, safety precautions and how to operate valves and their locations. Newly recruited workers are placed under the supervision of their senior workers, who give them training based purely on observing the entire process of workflow. Trainees are expected to learn from seeing how their senior workers operate the machines. This training takes four to six months. After this, an oral examination takes place to assess employees' abilities to perform jobs independently. While in service, workers receive a biannual two-day refresher training, although safety training and fire-fighting drills are organized on a regular basis. Whenever the production plant is on its annual two-week shutdown, production workers can receive the training.

Special training is provided whenever necessary, e.g. when the control system was changed to a DCS system. The plants have been grouped into Phase I, Phase II and Phase III depending on the steps involved in the production process. When a worker is transferred from one phase to another, he/she must be certified that he/she holds the competency to take a new assignment at a different production unit. Therefore, training for transferring is provided by the senior plant operators concerned. A checklist is made of all operations and equipment and the transfer candidate is given an oral examination to evaluate his/her skills at operating the equipment. If the workers receive "good" evaluations for all the equipment and operations based on the recorded checklist, the head of the department gives his/her approval on the certificate. The certificate indicates the worker's eligibility for the phase where he/she can be transferred.

Records of training undergone and future training needs for each worker are identified on an annual basis in order to plan training programmes in the following years. Workers' annual assessments are a base of their promotion. When workers receive their annual assessments, they are considered for promotions based on improved competencies.

4.7.6. An agrochemical company – United Phosphorus Limited (UPL)

Agriculture is the lifeline of the Indian economy. Over 70 per cent of India's economically active population are engaged in agriculture. The agriculture sector contributes 25 per cent to India's GDP and 12 per cent of its export earnings.

India is the second-largest manufacturer of agrochemicals in Asia after Japan. There are over 186 pesticides registered in India. The industry is characterized by severe fragmentation with about 80 large manufacturers and more than 500 small firms.³

UPL is the largest producer in India of crop products including fumigants, fungicides, insecticides, rodenticides and herbicides. UPL has seven production units in India, most of which are located in Gujarat; three units at Ankleshwar, two units at Vapi and one each at Halol and Jhagadia. In the last five years the company has recruited ITI graduates as apprentices.

Induction training is weighted toward safety, health and environment (SHE). The company draws upon services provided by Disaster Prevention and Management Centre, NSCI, and the Gujarat Safety Council. The company feels that no production can be sustained without SHE integrated production from the worker level to its supervisors and managers. After induction training, newly recruited workers receive on-the-job training. The period of training is three months and the type of training depends upon specifics of the job. Workers are training at the plants where they will be assigned to work. They are assessed on their performance on a yearly basis. There is also an internal examination on company activities, knowledge acquired on production, safety and health and the environment and SOPs. Workers who have successfully completed the training, increasing their competence and becoming eligible for promotion, are considered for higher responsibilities with an increase in wages.

4.7.7. VET providers in the chemical industry

National vocational training institutes cater to small- and medium-sized all companies including chemical companies. At the state level, vocational training institutes emphasise training by trade.

Most chemical companies in India are not solely reliant on government-driven vocational training. Instead, chemical companies have developed their own training capacities to provide their workers with the latest skill training.

In recent years, some larger chemical companies have become skill-training providers, offering their training programmes to small and medium-sized chemical companies. One example is shown in box 5.

<p>Box 5</p> <p>Training programme provider service developed by Hindustan Organic Chemicals Limited</p> <p>HOCL is a government-owned chemical company with annual turnover of Rs.4,100 million (about US\$70 million). In the last three decades, HOCL has played a pioneering role in the chemical industry in India. The expertise and experience developed by HOCL are shared with small and medium-sized chemical companies. The company offers services for training in the following areas:</p> <ol style="list-style-type: none">1. training in plant operation;2. training in testing of various samples at the industrial health and hygiene laboratories;3. training of trade apprentices;4. training of diploma apprentices;5. training of junior college students in mechanical maintenance;6. productivity and cost reduction techniques;7. total quality management;8. supervisory skill development; and9. self-development. <p>Source: www.hoclindia.com.</p>
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³ *Chemical Industry Digest Annual 2005.*

4.7.8. Accommodation for shift workers in VET

Shift work is inevitable in the chemical industry. Chemical firms give as much importance in VET for shift workers as day workers. VET programmes are scheduled in such a way that early morning and late evening shift workers can attend. When shift workers receive VET programmes, they are given time off from their regular work so they can attend the VET programmes normally organized in regular day working time. Another alternative is to take advantage of idle time in the production facilities when chemical plants are shut down due to annual maintenance, for example. In that case, a few core workers are kept in the plants, and the rest of shift workers can participate in daytime VET programmes.

4.7.9. Safety training for contract workers

Many chemical companies employ contractors for canteen, security, housekeeping, gardening, maintenance, civil works and other major projects on the premises. Contract workers often work in hazardous and harsh work environments. Therefore, safety and health issues are important for them. It has become a business norm not to allow any contractors or contracting companies in plant areas without a work permit. In addition, contract workers must receive training on safety and health and fire-fighting drills before commencing work. Chemical companies, which produce and handle highly toxic chemicals, are statutorily required to have an emergency preparedness plan.

Painting of plant buildings and equipment is another job commonly performed by contractors in chemical plants. Every time contractors commence painting work, chemical companies give training concerning the proper use of personal protective equipment (PPE), such as safety scaffolding, safety belts, and gloves. Training for contractors in plants is also provided in the area of safety and health. Chemical companies, which respect social responsibilities, employ only trained and experienced contractors.

5. VET to meet future demands in the chemical industry

5.1. Consideration of skills needed for the future chemical industry

VET in the future is closely related to the nature and development of VET in the chemical industry. As stated in Chapter 1, the Indian chemical industry is fragmented. In the early stages of industrial development, the chemical industry needed a number of skilled workers who were difficult to find.

At the national level, in order to increase the number of skilled workers, the Directorate General of Employment and Training (DGE&T) in the Union Ministry of Labour initiated the CTS by establishing ITIs for imparting skills in various vocations. This initiative was followed by the ATS (see Chapter 3).

In the controlled economy, the chemical industry existed with restraints on its capacity to expand. Only a limited number of companies were permitted by the Government to incorporate. There was no need to improve quality of product. It was sufficient for the industry to produce whatever it could – even poor- quality products – as long as it was saleable in the controlled market. In addition, the Government's capacity restriction policy prevented the introduction of new technologies from overseas. Under such circumstances, newly recruited workers were trained by a simple method of learning directly from senior workers and there was no need for further retraining. The employers were concerned about the volume of production and sales. Their main emphasis was centred on fiscal concessions given by the Government and tax benefits to protect their profits.

Immediately after liberalization, chemical companies' primary concern turned towards pure survival. Employers and the chemical industry associations urged the Government to relieve them from tax duty and levies, but they were not successful. The chemical companies turned to drastic cost-cutting measures including closure of non-viable plants or sections. Since the laws do not allow retrenchment of regular workers, the axe fell on contract and atypical workers as well as non-unionized middle-level supervisors and managers. In addition to the restriction on new and additional recruitment, chemical companies restricted the expenditure for VET in order to minimize losses.

Some chemical firms, however, have chosen to confront the challenges of the globalization. Some companies moved towards increasing production facilities, using the latest production technologies. It followed that production workers must be trained to update their skills to meet the new production technologies. VET has come to play an important role in the development of the chemical companies. They had achieved better operating capability by increasing the production of better-quality products at lower costs. The introduction of new production systems had to be based on standardized operational procedures. This meant that production workers had to be retrained. The training of workers to ensure they can perform their work in with international quality assurance systems became an important part of VET in the chemical industry. Chemical companies could not supply a sufficient number of skilled workers from within the companies. So they needed to bring in more skilled workers from the outside. Unfortunately, the Government-funded training institutes could not meet these demands. Hence, private consultant companies with experts trained abroad were used for training Indian chemical workers.

Another phenomenon in VET in the chemical industry is that it has used human resources development and management as a career development tool. This has meant greater attention to grooming and retaining talent from floor level to senior manager level. Training has become equally important as other business strategies such as marketing, finance and production.

5.2. Lifelong learning

In increasing the flexibility of work, within the realm of the labour laws and with trade unions' support, some chemical companies have been able to take some progressive measures in VET. Lifelong learning is the key to sustaining the growth and success of chemical companies amid increasing global competition.

Ankur is an example of lifelong learning in the chemical industry. The Corporate University of Dr. Reddy's Laboratories Ltd "Ankur" Sanskrit has achieved growth by transforming the company into a learning organization. It is Dr. Reddy's virtual corporate university, with the vision to make Dr. Reddy's a learning organization by involving all stakeholders such as employees, their families, customers and others. Ankur's endeavour is to build and promote a culture of continuous learning and innovation leading to individual and organizational excellence.

Since its inception in 1998, Ankur has grown and evolved into a strategic business partner through its efforts at bridging competency gaps, leadership development, values deployment and culture building. It has expanded its wings to reach out to employees by establishing learning centres in Jubilee Hills, Kukatpally, Miryalguda and Pydibheemavaram in Andhra Pradesh. The Ankur team includes a corporate learning and development team, business unit representatives, technical training and sales training teams. Their learning system consists of the following framework.

Vision. In order to make Dr. Reddy's a "learning organization," all stakeholders are involved: employees, their families and customers.

Charter. In keeping with the above vision, the Charter of Ankur has been formulated as follows:

- people's learning and development;
- cultural transformation;
- preparing for tomorrow's needs;
- knowledge management; and
- engaging families and building networks.

Strategic goals. While the charter sets the direction for Ankur, strategic goals with a span of two to three years define specific courses of action. The goals may be reviewed and reframed based on business needs from time to time, but the Charter will not be altered unless there is a dramatic shift in the business context. Ankur aims to influence and perform on the following strategic goals:

- create a learning climate, wherein each employee takes responsibility for personal development, and enhances his/her knowledge and skills;
- strengthen leadership skill base across levels in Dr. Reddy's;

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- build strategic capabilities and scale up the talent pools in the area of ipm, pm, ra, etc.;
 - facilitate transition towards the desired culture, by creating a shared understanding on the core values and promoting value-based functioning; and
 - contribute to employee engagement by offering higher-education opportunities along with involving families in the development process.

Key initiatives. Toward realizing its vision and road map, Ankur manages the following initiatives:

- Leadership development programmes
 - basic leadership programme
 - advanced leadership programme
- Long-term education programmes
 - M.Sc (pharmaceutical chemistry)
 - MBA (executive-pharmaceutical management)
- Certification courses
 - intellectual property management
 - project management
- Training programmes
 - Know Your Business
 - managerial effectiveness programmes
 - technical and functional programmes
 - training on quality
- Organization development initiatives
 - values week (value deployment)
 - 360 degree feedback
 - organization climate survey
 - code of business conduct and ethics roll out
- Family programmes
 - art of living
 - stress management
 - fabric painting for housewives
 - drawing and painting classes for children
 - music classes for children

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- Learning resources
 - library
 - Knowledge-sharing platform
 - technical conclaves
 - forum in API
 - cutting edge.

It can be seen that the training for chemical workers is not restricted to technical skills but has been extended to so-called soft skills, which include traditional skill concepts and practical knowledge needed for performing a job. Another trend is that a continuous learning culture is being built in a learning organization. A greater emphasis is being put on workers' personal career development and the enhancement of their knowledge and skills. Previously, the organization was interested only in employee satisfaction. Now, the primary aim includes employee engagement by offering higher-education opportunities. The role of supervisors has changed, even the role of the functional superior who was formerly only concerned about increasing productivity and discipline. Now, they have the responsibility of being a mentor or coach to their workers. They are responsible for developing workers' skills. The focus is on performance improvement and aligning workers with organizational strategy and values.

These recent trends predict the future needs of VET in the chemical industry in India. There are numerous challenges. Some of them include the need to take measures to respond to ongoing changes in the chemical industry and to promote skill transfer from old experienced workers to young workers. Matters that must be considered in VET to sustain further growth in the chemical industry in India are as follows:

- the minimum qualification of an entrant in production must be a graduate in science with an additional diploma in engineering or computer skills;
- chemical production is controlled by the PLC and/or the DCS and the familiarity with computer and basic operations thereof is needed. In the future, more advanced control systems may demand better education and skills even for production workers;
- multitasking is required, as there is a need for job diversification; workers must be able to handle all jobs in order to work effectively;
- production workers must be equipped with adequate maintenance and technical skills;
- production workers should have expertise in one unit and the confidence to work in other units as team members;
- production workers should not only operate the equipment but also know the reliability of the equipment which he/she operates. Workers should be aware of their actions on process time cycle, unit consumptions, effluents, instrument calibration, cost of waste disposal, etc.;
- production workers must be able to work independently and accurately;
- production workers must have been trained on quality management and behavioural aspects towards life learning; and
- production workers must be capable of implementing preventive maintenance of equipment, minor repairs of instruments and carry out some quick process control analysis.

6. Social dialogue and VET

6.1. Tripartism in VET

Tripartism has contributed immensely to VET in India since shortly after the country's independence in 1947. VET is a concurrent subject matter for both central and state Governments. The development of training schemes at the national level, evolution of policy, development of training standards, procedures, trade tests, certification, etc. are the responsibility of the central Government, whereas the implementation of the training schemes largely rests in the state Governments.

As mentioned above, the central Government created the NCVT, which is a tripartite body. Similar organizations known as the SCVT were constituted for the same purpose at the state level.

In 2003, the NCVT was reformed to meet the reality of the industry. Present officials of the NCVT are as follows.

- Union Minister of Labour (MOL) serves as a Chairperson of the NCVT; and
- Secretary to the MOL serves as a Vice Chairperson of the NCVT;
- Members include:
 - Director General of Employment and Training, the Union Ministry of Labour;
 - Financial Advisor, the Union Ministry of Labour;
 - One representative each from:
 - The Ministry of Human Resource Development;
 - Department of Information Technology;
 - Ministry of Small Scale Industries/Agro Rural Industries; and
 - Department of Urban Development and Poverty Alleviation.
- One representative each from the state Governments and the union territorial administrations:
 - State Directors dealing with the Craftsmen Training Scheme – Andhra Pradesh, Assam, Gujarat, Haryana, Madhya Pradesh, Maharashtra, Karnataka, Kerala, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, Jammu & Kashmir, Orissa, NCT Delhi, Pondicherry, Arunachal Pradesh and Sikkim;
 - three representatives of employers' organizations are nominated by the Government of India;
 - three representatives of workers' organizations are nominated by the Government of India;
 - five representatives of professional organizations are nominated by the Government of India;
 - one representative of the All India Council for Technical Education is nominated by the said Council itself;

- four experts are nominated by the Government of India;
- one representative each of the Scheduled Castes and Scheduled Tribes are nominated by the National Commission for Scheduled Castes and Scheduled Tribes;
- one representative from the All India Women’s Organization to be nominated by the Government of India;
- Deputy Director-General (Apprenticeship Training), DGE&T, the Union Ministry of Labour; and
- Director of Training, DGE&T, MOL – Member Secretary, the Union Ministry of Labour.⁴

The functions of the tripartite NCVT are delineated in box 6.

Box 6
The role of the National Council of Vocational Training (NCVT), India
<ol style="list-style-type: none"> (1) To establish and award National Trade Certificates in engineering, non-engineering, building, textile and leather trades and such other as may be included by the Government of India. (2) To prescribe standards in respect of syllabi, equipment, and scope of accommodation, duration of courses and methods of training. (3) To prepare trade tests in various courses and lay down standards of proficiency required for passing the examination for awards of the National Trade Certificate. (4) To conduct ad-hoc or periodic inspections of training institutions. (5) To monitor that VET standards prescribed by the Council are being followed. (6) To issue a license to the training institutions run by governments or by private companies for the purposes of granting them the National Trade Certificates and to decide the conditions for such licensing; (7) To co-opt, if necessary, any person(s) to advise the Council in connection with its work. (8) To prescribe the qualification for the trainers and facilitators of training institutions; (9) To prescribe the standards and conditions of eligibility for the award of the National Trade Certificates. (10) To monitor the qualifications and the conditions for awarding the National Trade Certificates. (11) To recommend the provision of additional training facilities, wherever necessary, and render such assistance in the setting up of additional training institutions or in the organization of additional training programmes as may be possible. (12) To advise the central Government concerning the distribution to state Governments of the contribution of the Government of India towards expenditure on the Craftsmen Training Scheme. (13) To perform functions as may be entrusted to it by the Government of India in the areas of VET. (14) To perform the functions as assigned by or under the Apprentices Act, 1961.
Source: <i>Gazette of India</i> .

Whatever training infrastructures have been created in India, the significant contribution for success of such infrastructure relies on tripartism – cooperation among government, employers and workers/trade unions. Historically, the Government of India made a significant contribution in developing tripartism in VET because the Government was the only possibility for providing resources to create such an infrastructure in the

⁴ *Gazette of India*.

country's early years. The Government has also contributed appreciably to shaping and improving the quality of training.

6.2. Social dialogue in VET in the chemical industry

State-owned chemical companies, more than private chemical entities, bore the brunt of globalization when the protection they received with respect to market share and price-fixing preferences vanished nearly overnight. Chemical companies could not withstand the situation of their consistently profitable position sliding into lower profits and eventually into enormous losses. Many socially conscious chemical companies have started a bipartite social dialogue with their trade union in order to improve labour productivity.

The Chairman and Managing Director along with the Finance and Technical Director started a dialogue with the two trade unions. They discussed with workers the idea of sharing the sort of information that had previously been thought to be the sole province of managers. Information sharing of unprecedented magnitude – such as the effect of globalization and reduced tariffs on the financial position of the company – were undertaken. The chief topic for dialogue was how the chemical companies can turn around; productivity improvements and cost-cutting schemes were also discussed. In addition to active bipartite dialogue within chemical firms, companies embarked on VET on a massive scale.

In the public chemical companies, all production workers were retrained. Details of the cost of production and areas for improving productivity and avoiding wastes were all a part of retraining in each vocation, including production operation. Intense dialogue between the production manager of the plant, plant supervisors and production workers took place during these retraining sessions. Many productivity and cost-cutting ideas were suggested by workers. Plant taskforces involving an equal number of representatives from both management and trade union were formed to make suggestions on productivity. Recommendations by this joint taskforce were discussed at the senior-management level. However, the power to implement these ideas was given to the taskforce. The trade unions organized enthusiasm individual workers to join the productivity activity, which was supported by task forces. These productivity activities have become a big awareness-boosting drive for the company's workers and trade unions. Process changes were made and VET for production workers was undertaken. Results flowed in, increasing productivity and reducing losses.

Similar experiences were also observed in some of the private chemical companies. One company exulted by saying that the role of trade unions is commendable on many new initiatives of Six Sigma relating to continuous-improvement work practices. Another company stated that trade unions' approach to training is very positive. Workers and trade unions appreciate the opportunities to improve skills and participate positively in training.

Overall, chemical firms have found that bipartite social dialogue leads to increased profits. Many chemical companies stressed the importance of implementing modern human resources management practices in connection with VET. Employee involvement and commitments have become one of the standards in many business practices. In cooperation with trade unions, chemical companies have introduced many productivity improvement initiatives such as quality circles, suggestion scheme, total quality management, 5S, and best employee awards. All these measures lead to greater productivity and enhanced workers' satisfaction as well.

7. Financing training

7.1. Funding at the national training systems

The central Government funds the national training system. In most cases, the central Government bears two-thirds of the total expenditure and the state Governments take one-third. Training in government ITIs is generally provided free of cost. There is a provision to grant stipends and workshop uniforms to all trainees of government ITIs. They are also provided with free access to library, sports and medical facilities. Some state Governments require that trainees pay a nominal fee.⁵

7.2. Company participation in training and funding

The Government and the companies have dual responsibility for imparting training under the Apprentices Act, 1961, as discussed in Chapter 3. The obligations and responsibilities of the three parties (government, employers and apprentices/workers) under the Apprentices Act are given in box 7.

<p>Box 7</p> <p>Obligations and responsibilities of government, employers and workers under the Apprentices Act, 1961</p>
<p>(a) Government:</p> <ol style="list-style-type: none">1. To bear the cost on related instruction to be imparted to apprentices.2. To provide basic training to apprentices engaged by companies employing less than 500 employees (other than unskilled workers).3. To inspect the progress of training of apprentices.4. To conduct a final examination and issue certificates on behalf of the NCVT.5. To register the contracts of apprenticeship executed between Apprentices/guardian and employer and to look into complaints, if any, between them.
<p>(b) Employer</p> <ol style="list-style-type: none">1. To engage apprentices as per prescribed ratio.2. To provide the apprentices with training in his/her trade.3. To submit periodic reports and returns to the Government.4. To pay the share of expenditure in imparting training, including payment of stipend to apprentices.5. To release apprentices for instruction classes either on day or block release basis.6. To look after the health, safety and welfare of apprentices.
<p>(c) Apprentices (workers)</p> <ol style="list-style-type: none">1. To learn trade conscientiously and diligently.2. To attend programmes without absence.3. To carry out obligations under the contract of apprenticeship, to be executed at time of admission.
<p>Source: www.dvet.gov.in.</p>

⁵ Annual Report DGE&T 2004-05.

7.3. Collective agreements in the chemical industry and cost sharing of VET

Trade unions in the Indian chemical industry do not include VET and VET-related matters in their collective agreements. Trade unions feel that because it is the employer who benefits from employees' labour, it is employers' responsibility to design and implement training programmes and to bear the cost. Trade unions are not motivated to put training at the forefront of their negotiations with employers, since promotions and wage increases are normally linked to workers' seniority and not directly connected to training. Hence, workers do not see the importance of taking training issues to their trade unions.

As seen from the above, there is some cost-sharing between the Government and companies related to training of apprentices. Nevertheless, in India there is no cost-sharing practice whatsoever between a company and trade union or any such sharing between a company and workers. This is based on Indian workers' opinion that it is the company that makes profits and so it is the company's responsibility not only to set up the plant, providing all necessary equipment, but also to recruit and train its manpower. In recent years, some workers and trade unions have been asking their companies for specific types of vocational training to allow employees to improve their work. However, they expect the company to fund all worker-related training.

8. Conclusion

In 2005, the gross sales of the Indian chemical industry were about US\$32 billion, which made up about 2 per cent of global chemical sales. The industry is the third largest in Asia and the 12th largest in the world. The industry accounted for 7.5 per cent of India's national GDP, 10 per cent of the country's total exports, 12 per cent of industrial production, and 20 per cent of excise and import duty. The chemical workforce accounted for about 17 per cent of the organized labour in India.

The Indian chemical industry comprises enterprises on all scales. Government policy resulted in a large number of small-scale industry (SSI) in the chemical industry. Currently, the Indian chemical industry is in the midst of major restructuring and consolidation. With the shift in emphasis to production innovation and environmental friendliness, the industry is increasingly moving towards greater customer orientation.

Immediately after the country's independence in 1947, India launched five-year plans aimed at massive industrialization, stimulating a demand for workers with industrial skills. The DGE&T in the Union Ministry of Labour initiated the CTS by establishing about 50 ITIs for imparting skills in various trades.

VET in the Indian chemical industry has various aspects. In the early years, under the Apprentices Act, 1961, preference was given to ITI-trained production workers who had passed their secondary-school education. Graduates in science were preferred when the operations demanded such recruits. In recent years, the preference is for diploma holders in engineering over ITI trainees, who only have secondary-school education.

Induction training is given by all chemical companies, but the induction period may vary from two days to ten days. This training includes general company orientation, knowledge about the production process, equipment and instrumentation. In recent years, subjects never before part of training have now acquired a primary place along with production, i.e. subjects such as quality, safety and health, and environmental issues. In the pharmaceutical sector, training in good manufacturing practices has become a core part of training in production.

In the next stage of VET for the entrants, on-the-job training is given. Under the Apprentice Act, entrants must receive on-the-job training for 12 to 18 months, before they are examined and found fit to take full charge. In recent years, with a higher educational level of entrants, on-the-job training has been shortened from one to three months. Without passing the examination at the end of this training, entrants are not allowed to perform work independently.

In the pharmaceutical industry, the competence of the production workers is taken very seriously especially by leading chemical companies, which cater to the global market. There, retraining is considered if there is any change of section or department, if any deficiencies are noticed in work during self-inspections, audits or performance reviews, in case of any change related to document, product, process or facility, and on assessment of classroom training, on-the-job training, deviation and complaints.

During this initial on-the-job training, periodic assessment of trainees takes place. After satisfactory on-the-job training, trainees are given a written examination and an oral interview. The successful trainee production workers become operators/technicians.

Training on the job as a periodic ongoing phenomenon was not needed before liberalization, as most of the chemical companies operated with globally mini-scale sized plants with outdated technology. They did not bother about training since experienced

production operators repeatedly doing the same routine operation became proficient enough to be trainers for fresh recruits.

Training of production workers while in service arises whenever new process control systems are introduced. In these cases the engineer, supervisor and production workers are normally given demonstrations of the system and trained by the control systems' vendor to operate it using a simulator.

Previously, trade unions were not concerned about VET. After the Bhopal gas leak disaster, many rules in the Factories Act changed, requiring both management and trade unions to participate in the safety committee. The trade unions then insisted on the provision of proper and better quality safety equipment and that workers be trained in all aspects of safety connected with their jobs.

Workers aspiring to a promotion know the value of training and have volunteered to take specific types of training which will help them take the coveted step up. In quite a few companies, production persons have requested training at outside institutions on safety and, after obtaining a diploma or certificate, were promoted as production/safety personnel.

In medium and large-sized chemical companies, VET for workers is normally conducted in-house since these firms have experienced supervisors and managers who can easily form the core-training group. Whenever a new vendor-based equipment or control system is to be installed, training is given by the vendor's experts. Some chemical companies who have adopted modern human resource management provide training on soft skills like attitude and stress management by external psychologists and organizational behaviour experts.

Many chemical companies engage contractors for canteen, security, housekeeping, gardening, maintenance activities, annual maintenance contracts, civil works and major projects. Training for those workers includes safety, health and environmental issues. Most responsible companies employ only trained and experienced contractors.

The practice before liberalization had been that the workers kept on doing almost the same chores day in and day out. When slight modifications in their area of responsibility were made, minimal training was imparted by the supervisor. The liberalization in 1991 triggered global competitiveness leading to reduced profitability and continued loss over a number of years. Many small chemical companies closed down. The surviving companies resorted to cost-cutting and enhanced productivity, especially in regard to human capital. This led to retrenching of older workers through Voluntary Retirement Schemes (VRS).

Lifelong learning is likely to become an industry standard for sustaining growth. In the Indian chemical industry, a few leaders have begun introducing the new mindset of lifelong learning, transforming their enterprises into learning organizations. The onus is now on workers, to be responsible for their own personal development and to enhance their knowledge and skills.

Tripartism has contributed immensely to VET in the chemical industry. Tripartism is built into the national training mechanism. The managing structure of the NCVT lies in the collaboration of government, employers and trade unions, although the role of the Government is predominant.

The central Government is the primary source of funding for the national training organs. Central and state Governments share their financial burden in a two-thirds to one-third ratio. Training in government ITIs is provided free of cost. In addition, chemical companies fund in-house and external training programmes for all their employees.

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Sectoral working papers ¹

	<i>Year</i>	<i>Reference</i>
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Employment and poverty in Sri Lanka: Long-term perspectives (Vali Jamal)	2000	WP.157
Recruitment of educational personnel (Wouter Brandt and Rita Rymenans)	2000	WP.158
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The changing conditions of higher education teaching personnel (Thierry Chevaillier)	2000	WP.161
Working time arrangements in the Australian mining industry: Trends and implications with particular reference to occupational health and safety (Kathryn Heiler, Richard Pickersgill, Chris Briggs)	2000	WP.162
Public participation in forestry in Europe and North America: Report of the Team of Specialists on Participation in Forestry	2000	WP.163
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¹ Working Papers Nos. 1-155 are not included on this list for reasons of space, but may be requested from the Sectoral Activities Branch (SECTOR), Social Dialogue, Labour Law, Labour Administration and Social Activities Department, Social Dialogue Sector, International Labour Office (ILO).

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The role of joint voluntary initiatives in the promotion and momentum of social dialogue in the textile, clothing and footwear industries (Stéphanie Faure)	2001	WP.170
La situation sociale des artistes-interprètes de la musique en Asie, en Afrique et en Amérique latine (Jean Vincent)	2001	WP.171
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	<i>Year</i>	<i>Reference</i>
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Employment trends in the tobacco sector: Selected provinces of Bulgaria and Turkey (Roska Ivanovna Petkova and Nurettin Yildirak)	2003	WP.194
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Violence and stress at work in the postal sector (Sabir I. Giga, Helge Hoel and Cary L. Cooper)	2003	WP.200
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Making ends meet: Bidi workers in India today. A study of four states	2003	WP.202
Civil aviation: The worst crisis ever? (Bert Essenberg)	2003	WP.203

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Violence and stress at work in the transport sector (Bert Essenberg)	2003	WP.205
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Academic employment structures in higher education: The Argentine case and the academic profession in Latin America (Garcia de Fanelli)	2004	WP.222

	<i>Year</i>	<i>Reference</i>
An introduction to labour statistics in tourism (Dirk Belau)	2004	WP.223
Labour implications of the textiles and clothing quota phase-out (Hildegunn Kyvik Nordas)	2005	WP.224
Baseline study of labour practices on large construction sites in Tanzania (coordinated by the National Construction Council, Dar es Salaam)	2005	WP.225
Informal construction workers in Dar es Salaam, Tanzania (Arthur Jason)	2005	WP.226
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