2015/101

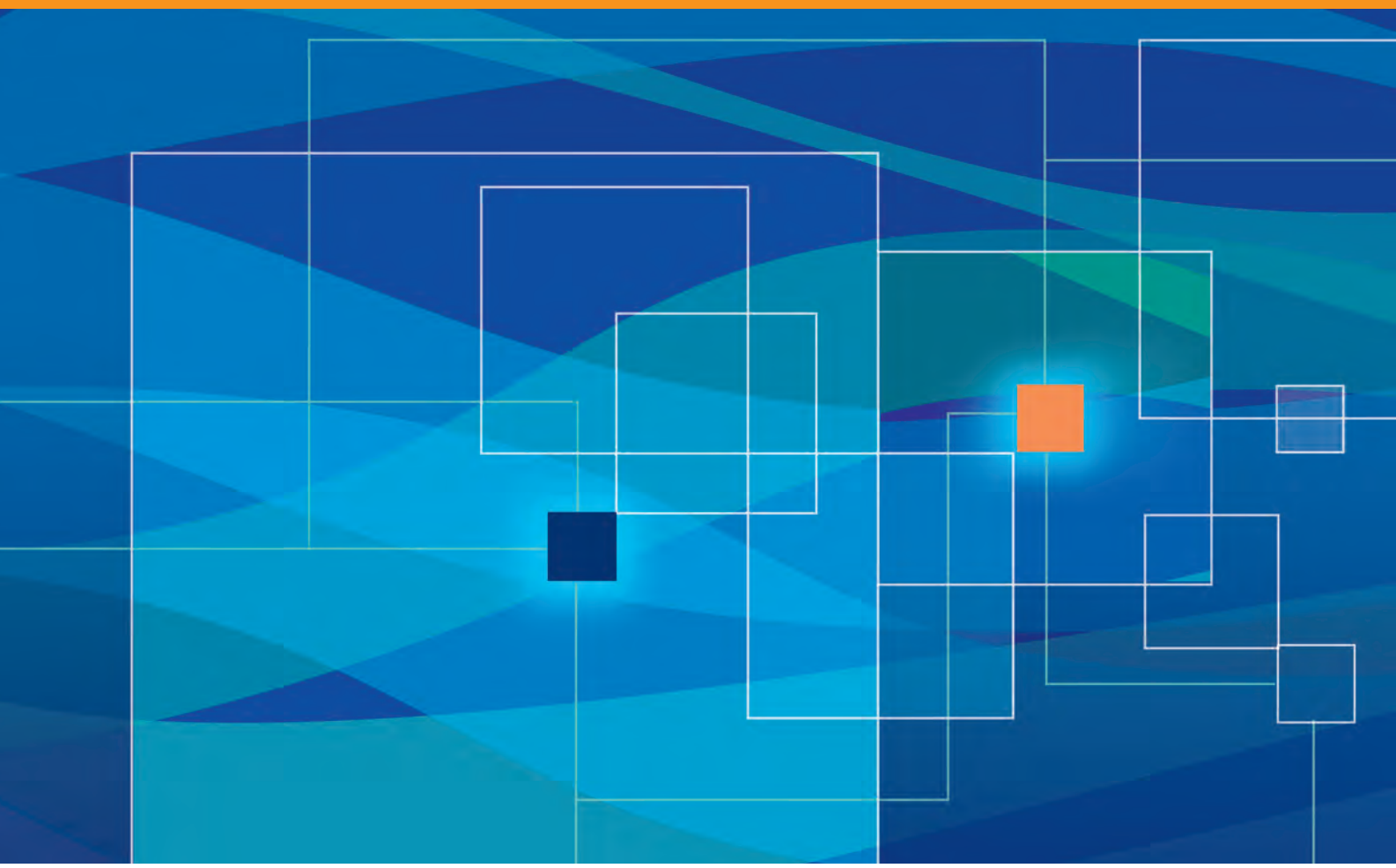
Fraunhofer IAO

FRAUNHOFER-INSTITUTE FOR INDUSTRIAL ENGINEERING IAO

Thomas Burger, Jürgen Lau, Peter Maurer

MODERNIZING VOCATIONAL EDUCATION AND TRAINING IN WATER MANAGEMENT

ADAPTING GERMAN EXPERIENCES TO INDIA



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BIBS Exporting Vocational Training in Urban Water Management to India

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Thomas Burger, Jürgen Lau, Peter Maurer (Editors)

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Adapting German experiences to India

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The research project on which this publication is based – Exporting Vocational Training in Urban Water Management to India – has been funded by the German Federal Ministry of Education and Research (BMBF) under the project numbers 01BEX03A13, 01BEX03B13, 01BEX03C13.

Project homepage:
www.bibspro.com

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Importance of Vocational Education and Training (VET) and water management in Germany and India

1.1
Partnerships for German VET success

Christine von Lonski
Managing Director
German Water Partnership e.V.

Germany has at its disposal a vast reservoir of knowledge and expertise in the water sector, spanning business, politics, administration, expert associations and the world of science. Access to clean water and the treatment of waste water form the basis for the struggle against hunger and poverty throughout the world. Clean water improves the chances of staying healthy and prevents the spread of disease. One of the UN's targets is to halve the number of people who have no permanent access to clean water by 2015. Since 2008, German companies, institutions and organisations have been building up a successful network of proven expertise in the water sector. This network is known as the German Water Partnership.

In many of the partner countries where we have been distributing our products and knowledge since 2008, the necessity and value of vocational training have been widely underestimated in terms of its significance for business success and the long-term impact of investments. Targeted HR management, public recognition and tangible support via remuneration schemes are not generally standard practice for companies and organisations. Reliable standards and qualifications for training and education are lacking, as are monetary or fiscal incentives to invest in employees' qualifications.

In order to fulfil the major requirements of a sustainable water management system, which in turn will amplify positive effects in terms of the climate, demographic change and urbanisation, we welcome the strategic partnership with BIBS, which secures the necessary experts for our facilities in the long run by virtue of needs-based vocational training. As a result, it will become more and more important to German companies offering products and services all over the world to not only sell their goods and services, but also to show how they are used in practice. It is therefore just as important to share knowledge about the processes that are operable with these products.

The "Berufsbildungsexport nach Indien im Bereich der Siedlungswasserwirtschaft" [Exporting vocational training in urban water management to India] project, supported by the German Federal Ministry of Education and Research [BMBF], makes a major contribution to closing this gap. Based on the actual needs of local companies, a training programme is developed in line with German standards in order to systematically qualify either untrained or semi-skilled workers in their field.

I would like to congratulate the members of the BIBS project and those supporting the programme from the worlds of politics and business for their dedication to vocational training, and wish them every success for their work in the future.

1.2 Water management challenges in India

Shri Malojiraje Chhatrapati
Ex-Member of Legislative Assembly, Maharashtra State
Honorary Secretary, All India Shri Shivaji Memorial Society, Pune, India

Rapid globalisation, industrialisation and urbanisation are changing Indian lifestyles and resulting in the problems of energy, environment and water management. India is home to cultural, social and climatic diversity. The country receives major rainfall from the south-east monsoon and minor rainfall from the north-east monsoon. Some parts of India receive heavy rain and other parts are desert. Some rivers flow throughout the year and some are dry for nine months. Rapid urbanisation is increasing the load on local municipal corporations to provide potable drinking water to exponentially increasing masses and to treat wastewater. About 38,254 MLD (million litres per day) of urban wastewater is generated, whereas treatment capacity developed so far is about 31% of the requirement. It is forecasted that urban and rural wastewater generation may exceed 170,000 MLD by 2051. There are about 270 major sewage treatment plants (STPs) in India.

In order to tackle this problem, there is a need to focus on equitable distribution of potable water, enhancement of wastewater treatment capacity and its reuse, reduction on the potable water load, development of eco-friendly, low-cost technology and development of skilled and trained manpower to handle these activities. Germany is a pioneer in water management. Unlimited potential in collaborative activities between Germany and India can play a major part in dealing with the problem and can serve as a role model for others to follow. It is a very welcome step initiated by the German government to implement the 'train-the-trainers' programme on water management and provide necessary infrastructure for it. It is noteworthy that various organisations with wide expertise in various related areas are coming together for the cause. The consortium of VESBE, University of Stuttgart, Fraunhofer IAO from Germany and All India Shri Shivaji Memorial Society (AISSMS) from India have joined forces to work towards this goal.

1.3 Bringing German expertise in water management to India

Dr Sanjay P. Danao (Principal), Dr. Vitthal L. Gole (Associate Professor)
All India Shri Shivaji Memorial Society's College of Engineering, Pune, India

Urban water management in India is facing basic issues like the availability of safe potable water, its equitable distribution to the masses, scientific management of wastewater and its reuse possibilities to reduce the increasing demand for potable water. About 80% of water is used for "non-drinking" purposes, which results in wastewater generation. Little wastewater is recycled and reused. However, recycling and reuse has not received much attention because of the lack of viable models, technological support and sufficiently trained and skilled manpower.

The availability of fresh water is about 1.5% of total water available in the world. Less than 1% is readily accessible and replenished by rainfall and other precipitation, of which 70% is locked in ice caps in Greenland and Antarctica. The total geographical area of India is 2.45% of the total global land area and the country is home to about 16% of the world's population. Of the total rainfall in India, about 25% is utilisable. Some of the major challenges in fresh water supply are technological aspects to remove various impurities in

raw water (physical, microbial, inorganic and organic), equitable distribution, transportation losses and inappropriate utilisation of fresh water.

In India, conventional methods for wastewater treatment are practised that consist of a combination of physical, chemical and biological processes. Typical municipal sewage treatment plants are divided into primary, secondary and tertiary stages. In primary treatment, coarse solids and other large materials are removed in order to reduce the load on the operation and maintain the plant. Major operations involved in primary treatment are coarse screening, grit removal and comminution of large objects. Secondary treatment involves the removal of biodegradables, dissolved and colloidal organic matter and the reduction of BOD load using aerobic biological treatment processes. Commonly used secondary treatment processes are activated sludge processes and trickling filters. Tertiary wastewater treatment is employed to disinfect the water. Sludge disposal is one of the major challenges in municipal sewage treatment plants. Very few plants are generating biogas from anaerobic sludge treatment. India needs minimum sludge producing technology for the treatment of sewage water. The Indian government passed the Water (Prevention and Control of Pollution) Act 1974. Pollution control bodies are developing the standards as per the site-specific requirements commensurate with the Act. They are also developing need-based standards for zero discharge for grossly polluting industrial units. The concept of delinking municipal sewers from rivers is gaining momentum in river conservation plans and may bring about a visible improvement in the water quality of recipient water bodies.

In view of these issues, water management has become a pressing need. Developed human resources in terms of skilled and trained manpower are going to play a vital role in this respect. A survey of various institutions involved in the field emphasised the fact that there is a very high potential in terms of developing the relevant human resources to deal with India's requirements. Skilled and trained staff are expected to understand the technological, operational and organisational aspects of the entire systems involved in potable and wastewater management. German technologies for water management are proven worldwide. Many German companies working in the field are operational in India and provide technological and other know-how to Indian organisations. There is plenty of scope for the two countries joining forces to work in the area of water management and create a win-win situation.

By keeping in mind these objectives, All India Shri Shivaji Memorial Society (AISSMS), Pune, India, and a German consortium of the Association for European Social Work, Education and Training (VESBE); the Institute for Sanitary Engineering, Water Quality and Solid Waste Management (ISWA, University of Stuttgart); the Institute of Human Factors and Technology Management (IAT, University of Stuttgart) and Fraunhofer IAO entered into an agreement to design and conduct a 'train-the-trainers' programme emphasising the development of vocational training courses for semi-skilled and skilled personnel in India. In order to understand the human resources requirements, German and Indian experts surveyed and analysed the various water management systems including municipal potable and sewage treatment plants and industrial sewage treatment plants in and around the city of Pune, plants that cover a population approaching 8 million. They also interacted with people working in the field. To raise awareness of the issue, two Indo-German symposia were organised, in which experts from industry, academia, research, policymaking and municipal bodies deliberated on the challenges in urban water management. Based upon the outcome of these activities, a syllabus has been framed for the relevant human resources development. Syllabus modules are broadly divided into basic courses on water management and specialised courses on water purification and wastewater management. These modules will cover safety, environmental aspects, organisational behaviour, technical fundamentals, water extraction and conditioning, storage and supply, analysis and control techniques, maintenance, handling of

wastewater, wastewater treatment, recycling and reuse. This step is going to make a remarkable footprint in the collaborative efforts towards achieving the objectives.

2
Introduction

Thomas Burger, Jürgen Lau, Peter Maurer

Water is a valuable commodity. It is the basis for all life and an essential factor in terms of the appeal of a location. As a result of climate change and the growing global population, this valuable resource is becoming scarce in many places. Clean drinking water and basic sanitation are human rights, as determined by the UN General Assembly four years ago. However, over 768 million people around the world still have insufficient access to clean water, and around 2.5 billion people live without access to sanitation facilities, as shown in the UN's 2014 World Water Development Report (Niesing, 2014; WWAP, 2014).

Water is, however, also an important factor in business: today, agriculture and industry are already using around four fifths of all water available, with requirements set to increase further in the decades to come. UN experts forecast that global water consumption will increase by more than half by the year 2050 – primarily due to increasing demand from industrial manufacturing (+400%) and thermal power generation (+140%). After all, more and more people will have to be supplied with drinking water, food, goods and energy (Niesing, 2014).

In many industrialised countries, we waste vast quantities of drinking water. In Germany, for example, water usage is at about 120 litres per day per person, only 3 litres of which are drunk. One third is used for flushing the toilet. But production and manufacturing also require water and can result in heavily polluted wastewater. In addition, pesticides and fertiliser residues from agriculture also leach into the water supply. New technologies enable us to effectively purify wastewater with the aim of recycling it and using it again. In order to master these challenges, we require innovative, high-performance technologies and techniques for purifying and treating water and wastewater – both in industrialised countries as well as in emerging and developing countries. Germany is a pioneer when it comes to innovative technologies and system solutions for sustainable water management. The global science and business communities are working on new solutions in water purification. The increasing demand for water, the drop in water availability in many regions caused by climate change, as well as enormous decreases in water quality, make new and improved water technologies absolutely essential. Although Germany has major expertise in the field and water technology is a major pillar of its exports, a significantly lower number of patents have been registered here recently and fewer publications printed. Other countries are catching up. The market is very promising and continues to grow with estimates expecting future investments of over EUR 500 billion every year (Niesing, 2014).

Demand for water will continue to increase in the decades to come. After all, more and more people will have to be fed. The economy and its demand for water will also continue to grow. These challenges can be mastered with the use of innovative technologies. What is required is the bundling of skills in the research and development of the entire water cycle. The aim is to transfer sustainable system solutions for water usage, water treatment and water management over to practical applications and to develop innovative urban water infrastructure concepts. In addition, the technologies, techniques and concepts also have to be understood, implemented and adopted by users. Alongside innovation, the training of experts in the use of water purification technologies is just as big a factor for success in mastering these challenges (Niesing, 2014).

In India, water is of the utmost importance for peoples' lives, the environment and prosperity. More than 70 per cent of India's population is engaged in agriculture and 10 to 15 per cent work in sectors highly dependent on water, such as textiles and leather companies as well as in the food industry. The growing population, urbanisation and increasingly western-oriented consumer behaviour could lead to serious social crises if the increased demand for water exceeds its availability. This, in the long term, will lead to a deterioration of water quality. Climate change impacts rainfall patterns and glacier melt while simultaneously increasing water demand by sector and affecting water quality. This is because climate change causes a change in water cycles and thus rainfall and evaporation. This has very different effects in different regions of the world. Therefore, climate change also plays a role in the increase in the frequency of floods and droughts. Water shortage will be felt particularly in southern China, in the southern United States, the Middle East and the Mediterranean. In contrast, in parts of East Africa, western China and southern India, more water will be available than at present. Glaciers in the Himalayan mountains feed into year-round water-bearing rivers such as the Indus, Ganges and Brahmaputra, which supply more than 60 per cent of India's population with water. In addition, it is estimated that 40 million hectares could be threatened by floods and 51 million hectares by drought – this is an equivalent of 12 per cent, or 16 per cent of the total area of India. India's progress from a developing country to a developed one could very well depend on the water supply. Thus, water shortages could hamper the overall development and growth of the country if appropriate countermeasures are not taken.

Many parts of Jammu and Kashmir, a state in northern India, were severely flooded due to heavy rains. Obstacles in natural water flows resulted in this. Many people died. Even ministers were trapped. Although the water has receded and the Indian military has done tremendous work, the aftermath will be more serious.

The objectives of this publication are to give a summary about our first year working on the project of exporting VET in the field of water management to India and, in particular, to highlight some of the results of the requirements collection and analysis phase for VET in this area. We will not only present the results of project work so far but also direct interest and awareness towards further project potentials, long-term solutions and the necessity of clean water for the health of the local population.

The publication is largely aimed at an interested expert audience in the field of water management, including company representatives, politicians and association representatives, as well as those involved in research, education and development.

Interested persons from the fields of vocational education, training and research will receive information about the project with practical insights into the development of an education service and an initial overview of challenges we face in establishing the vocational training programme in India.

Decision makers from companies (including manufacturers and distributors of water purification systems with requirements in terms of vocational training, but also distributors of repair and maintenance services, operators of industrial zones and water purification plants) can receive insights and suggestions on optimising their business, and proof of the necessity and requirement for VET in the field of water management in India. In addition, readers also obtain advice on covering their educational requirements for long-term export success and the positioning of their products.

For public institutions, the results confirm the significance of education and training in solving environmental problems in water management.

The publication is structured into five parts and chapters. Chapter 3 introduces the Exporting Vocational Training in Urban Water Management to India project. Jürgen Lau, Annika Meinecke and Sylvia Wohlfarth-Bottermann give a short overview of the publicly funded project. In particular, the objectives, project activities and expected results are presented.

In Chapter 4, some of the first experiences of the project work in India are presented and reflected upon, focussing on intercultural aspects as well as business model expectations. The experiences of all project members are described and shared.

Chapter 5 introduces the specific results of one part of the requirements analysis, the interviews with operators of water treatment and sewage plants. Thomas Burger and Thomas Meiren present the study objectives, the study design and the structure of the data pool, and highlight the study results as well as implications, limitations and lessons learned.

Chapter 6 gives an overview of the VET system in Germany and the possibilities of adapting its benefits for the development of a VET system in water management for India. Peter Maurer and Zaheer Sharif outline in detail the necessity of transferring the VET logic to India and describe a first draft of the BIBS-specific VET course in water management.

We hope our publication makes for interesting reading, and we look forward to further discussions with you.

3
Adapting German vocational education and training in water management

Jürgen Lau, Annika Meinecke, Sylvia Wohlfarth-Bottermann

According to forecasts, India is expected to exceed its demand for drinking water in the near future. Although India possesses large supplies of fresh water, population growth of about 1.6% combined with an already high population of over 1.2 billion people will create problems in the water supply. The groundwater table is already sinking and several rivers are overloaded. The situation is exacerbated by serious pollution of ground and surface water due to inadequate sewage piping systems and wastewater treatment. Despite the modern technology in place, improper maintenance and lack of preventive maintenance systems of existing wastewater and water treatment plants have led to massive damage to the equipment. Due to, among others, poor maintenance, frequent electricity break downs and lack of technically qualified man power, the facilities constructed to treat wastewater do not function properly and remain closed most of the time (CPCB 2007, Kaur et al 2012). Thus, many of the systems in operation are underperforming and there is a high rate of downtime. The problems in the operating systems are often caused by untrained staff working at times under very poor conditions. The rate of training in this area is low.

Recognising the need for qualified training of staff in water treatment plants, the BIBS consortium has as its project goal to develop a train-the-trainer and vocational training course in the field of wastewater and water treatment, and to create a sustainable Indo-German partnership aimed at exporting vocational education to India, modelled on the German system. The training will be based on the formal and thematic features of the German dual training system, and modified to Indian conditions. The training content has been developed from the input of the project consortium and should enable Indian VET institutions to qualify and further train students as well as staff of wastewater and water treatment plants.

The training is aimed at people with the educational levels of semi-skilled and unskilled workers and first-year students with a basic knowledge of craftsmanship skills who will be qualified and trained in training centres or on-site in the following areas:

- The transport, treatment and distribution of drinking water
- The transport and purification of wastewater

Our local cooperation partner is the All India Shri Shivaji Memorial Society (AISSMS ITI), a technical college with its training facilities in the district of Pune, and the only training centre in Maharashtra which is ISO 9001: 2000 certified. Another local cooperation partner is REMONDIS Aqua (India) Pvt. Ltd, part of the German global company REMONDIS, based in Pune and a worldwide leading specialist in water management, water supply and distribution systems, wastewater treatment processes incl. building and operating of water management facilities. Not only is REMONDIS Aqua a critical partner and source of information exchange but has also agreed to provide work experience opportunities for our trainees.

The curriculum developed in this project has been designed as follows: Basic technical courses taken from the AISSMS-ITI curriculum in India (National Skill Development Corporation (NSDC) courses) have been either partially or completely adapted into the BIBS curriculum to make up the individual modules. These modules are complemented

with completely new sections, mostly in the field of water treatment, which have been developed by ISWA on already existing models in Germany. These combined modules correlate with each other to present a partial or total process.

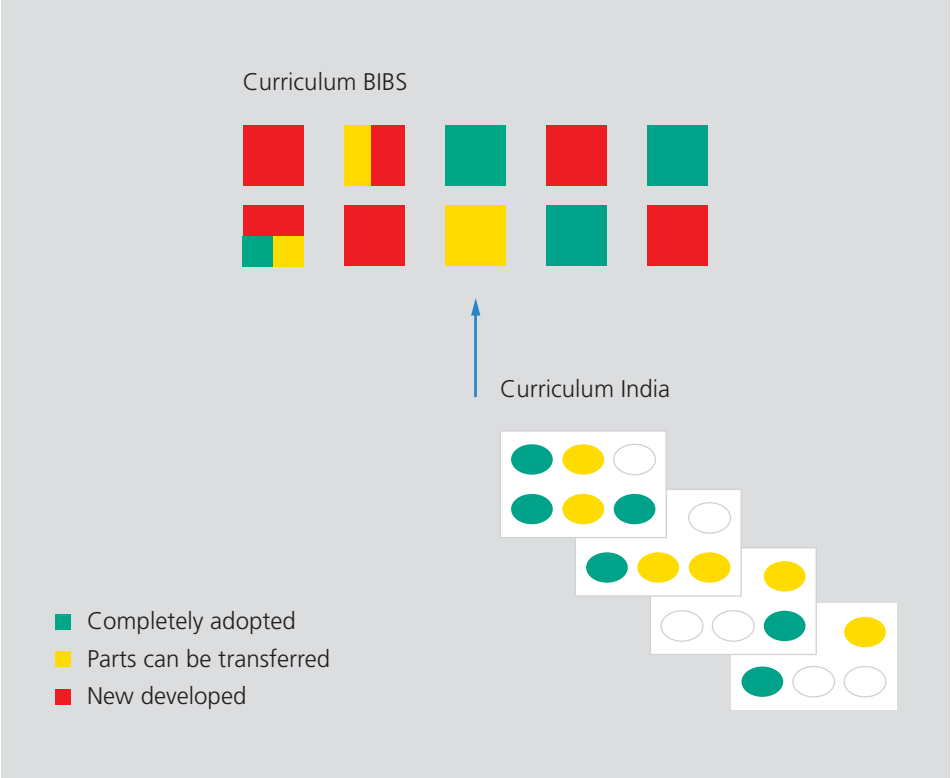


Figure 1: Curriculum development in the BIBS project

The initial training needs analysis showed that a qualification is required at different levels.

A lower level of automation at the plants leads to a greater need for process understanding and knowledge of maintenance and repair. In accordance with this demand, a basic course will be offered that should convey process understanding, especially of circulation in the field of urban water management. Built on this basic course, more detailed areas of specific work will be divided into advanced courses in water purification and wastewater treatment.

Indian instructors from the AISSMS ITI will be sent to Germany to be trained as trainers in the three courses. The aim of the training will be to deepen their specialist knowledge and equip them with modern teaching methods so that a recipient-specific implementation of the curriculum can take place on-site. The instructors will then, in a further step and with support from German trainers, introduce the individual modules at their training centre in Pune, check their applicability and modify them as needed.

The creation of diversified learning arrangements of this nature requires a high degree of responsiveness regarding the training requirements as well as the cultural characteristics of the target groups. Great consideration must also be given to the specific business and work cultures both in the plants and at the Indian cooperation partners in order to include the special linguistic challenges involved with the training. Therefore, as part of the project, the education opportunities that are being developed will, by means of innovative and pictorial learning environments, be visually enriched with real physical models and

virtual models (e.g. 3D simulations in ServLab and Physical model by Festo Didactics) in order to qualify the target group in terms of action-oriented training methods.

In order to meet these challenges in creating educational services, a systematic approach is required along with the accompanying development of a viable business model. The service engineering approach selected by the partners will contribute to this.

India, due to the enormous economic growth in its cities, is one of the most attractive emerging countries worldwide. For Germany, India is the most important partner in the field of scientific and technical cooperation in South Asia. In contrast, however, India has a shortage of qualified specialists due to the deficiency in the education and training system. The Indian government, being aware of this problem, has set the goal to vocationally train 500 million people by 2022. In the reform of the Indian VET system, Germany is considered to be the 'desired partner'. However, the reform efforts in state-run vocational training are proceeding at a very slow rate. In recent times, nonetheless, private enterprises are becoming significantly strong on the vocational training market, as businesses can access the offers of private providers of training and further qualifications, and even offer these trainings themselves.

Furthermore, up-to-date knowledge of service research flows into the project. This is an important part of the selected project approach and the upcoming methods which will be implemented to ensure that needs-oriented educational opportunities and a viable business model will be developed with the close involvement of future users.
Based on the specific problems and needs in Pune, the project will develop innovative solutions for the sustainable implementation of new education and training opportunities in the vocational education and training landscape, and not only in the field of urban water management. Thus, in a scientific discussion with specific success factors, barriers and design options, BIBS should serve as a blueprint for other fields of training. Another focus lies in the exploitation of the project results, as the development of the BIBS training programme means that a qualification course for trainers can be transferred to other regions and countries. This is all the more conceivable, as the issue of environmental pollution caused by wastewater and water scarcity is particularly relevant in many countries.

4
Challenges in terms of 'exporting' vocational education and training to India

Thomas Burger, Jürgen Lau, Peter Maurer, Annika Meinecke, Thomas Meiren, Zaheer Ahmed Shariff, Sylvia Wohlfarth-Bottermann

'Made in Germany' is a symbol of the highest quality standards in the world and is generally used in connection with products and high technology, German engineering and inventiveness. According to the former Minister of Education and Research, Annette Schavan, " 'Training made in Germany' is the trademark for the quality of German vocational and educational training and is increasingly becoming an export hit"(Bonn 2009).

Germany as a country with around 80 million inhabitants is the third largest exporting nation worldwide, leading in the sectors of construction and electronics, chemistry, precision instruments and industrial machine parts and, of course, cars. In line with countries like China and Saudi Arabia, Germany is the country with the greatest trade surplus. In order, however, to consolidate and even increase export turnover, Germany has to focus more on upskilling manpower in the countries where machines and technical know-how are being exported to. As Sabine Gummersbach-Majoroh, the former director of iMove, stated "Globalisation is for our national economy what gravity is for physics" (Köln 2010).

Companies and national economies which have highly skilled staff boast a strong competitive advantage and success factor. In most of the emerging markets, there is a lack of qualified employees in many occupations, while at the same time the unemployment rate is increasing.

Looking at the analyses of the German economic success story, one reason given is the combination of its engineering strength and the German vocational and educational training system. In the past and current economic crises in Europe and all over the world, Germany is one of the few countries that still managed to maintain a low unemployment rate and had little political and social unrest. Hence, there are many countries in the world that would like to "import" the VET system as a means of strengthening their economy.

Bridging the gap between the interests of the German economy, which wants to export its commodities, and those of the emerging markets which want to become more competitive and import the German VET system, would imply that this automatically leads to "a state of seventh heaven" for German VET providers.

This, unfortunately, is simply not the case!

So what are the challenges faced by German VET exporters, especially in the Indian market?

4.1 Finding the right strategy and business model

Against the backdrop of the growing world population, high unemployment rate, increasing urbanisation and climate change, sustainable and secure water supplies will become one of the central challenges of the future. At the same time, the Indian economy, as well as that of many other countries, is confronted with a growing lack of skilled manpower. The reason here can be found in the theoretically and academically-orientated and less practice-oriented VET system. This increasing shortage is all the more serious as it impedes further economic development. A reform of the Indian VET system, which has already been initiated by the Indian government, is urgently needed in order to impart the modern abilities a country needs to successfully participate in mid- and long-term global competition and to secure internal stability in the country.

What then could be the right strategy for entering the Indian market?

The criteria for determining the attractiveness of the Indian market is the volume of the need for education, the potential growth of different occupations, the significance of local and international competitors, the price level and the obstacles to market access. To date, we have gathered information and data regarding the above-mentioned criteria and designed an initial business model that will be continually adapted during the course of the project.

According to our current knowledge we can state that:

- There is a huge need for training.
- The price level for training is so low that there is little chance for direct export.
- The potential customer structure is strictly diversified and not unambiguous enough to be identified.

Based again on the results of the needs analysis and our experiences, we regard the business models of consulting (service contracts), strategic alliances, franchising, licensing and joint ventures as the most practicable solutions.

We will, for example, closely examine the possibilities of joint ventures and licensing and have therefore listed the pros and cons for both business models as follows:

Advantages of joint ventures:	Disadvantages of joint ventures:
Available expertise of the local partner, low requirements in terms of capital, cost-sharing with the partner, risk-sharing, knowledge transfer, reducing the impediments to market access.	A high risk of conflicts because of the different cultures, a high need for coordination and management, brain drain, a high dependency on the partner, the problem of acceptance of the contributed values (contributed assets/know-how).

Table 1: Pros and cons of a joint venture business model

Advantages of licensing:	Disadvantages of licensing:
Regular income based on the success of the licensee, low need for investing capital (money) and HR; low risk, generally profitable as there are no high costs for sales and marketing.	Limited possibility to control the process, creating a competitor; difficult contractual arrangements; low influence on sales and marketing; individual/personal access to the market remains closed.

Table 2: Pros and cons of a licensing business model

Halfway through the project, we are now at the point of finding the right strategy for our product.

4.2
Social and intercultural learning, teaching and working

On the other side of our project we have the learners, the potential workers.
The fact is that workers in wastewater plants mostly come from the lower social sectors of society and stand little chance of earning a good income. Most of our unskilled and semi-skilled learners normally face more difficulties in learning processes and therefore generally experience less success than their peer groups in other countries of the world. They do not, however, handle in isolation. They interact every day with their social, cultural and physical surroundings. Therefore, their environment has to be considered, too, if we want to understand and support them. Thus, a holistic approach necessitates the integration of their social background and environment.

There is certainly a correlation between social integration and employment, which implies that social integration can be achieved by employment, the precondition for which, in most cases, means training people.

The chances, generally, for the characterised group to upgrade themselves in the working world and society are very small. Years of technical development have led to continuously changing and increasing qualification requirements for employees.

The question we should be answering is: Considering the group and their learning environment, how can the qualifications required be imparted sustainably in their training and how will this be rewarded on the part of the employer?

Very often SMEs lack the insight into employees' valuable resources in order to utilise and promote them, and at the same time, vocational and pedagogic competence to successfully train and qualify disadvantaged and low-skilled people is lacking in the training staff.

The principal problem thus, is not only the question of integration through training as such, but also the issue of sound pedagogical concepts, methodology and didactics for the trainers.

After an analysis of the various attempts to find a pedagogical solution, we believe that action-based learning strongly suits the demands of the target group. The most essential point is that the concept of action-based learning, which includes a solution-orientated approach, is based on a comprehensive perception of action and handling at the work place. Thus, in addition to learning and expanding competences and abilities, as well as practising skills, this would include developing learners' soft skills.

Consequently, the focus of action-based learning is on the learner with his/her individual learning requirements, learning and working 'styles' and which is characterised by the following features:

- A comprehensive concept of action that includes creative and design aspects
- It opens up learning opportunities that enable individual initiative, personal responsibility and independent action to solve tasks and problems
- It places learners and their individual learning requirements at the centre (and not the subject matter or the curriculum, etc.)
- It involves learners actively in the planning and design of the learning process

- It supports the identification of learners with the learning subject matter, learners feel responsible for the success of the learning process
- It includes learners in the planning to support the linguistic and substantive handling of the learning subject

Therefore, in respect to the modular training courses, a didactic-methodological approach will be developed and implemented within the planned train the trainer course.

Up to this point in time, we believed that social integration can occur simply through providing a more work-based-focused VET aimed at upskilling people and raising their employability. We have however, discovered that attempts in the past to put action-based learning into practice have resulted in little impact and success. Frontal instruction is the most practised teaching system and its rigidity makes it difficult to introduce a sustainable work-based learning system. Our findings on analysing these attempts show that there is a huge gap between the demands and the reality. It is essential that, regardless of the cultural distinctions, there has to be a change in the mind set, and a step towards this would be to develop a new role model for the trainers. For this aspect, we developed a training concept to facilitate a change in their learning attitudes and styles.

This includes:

- Holistic thinking and action
- Active, self-directed learning and action
- Self-directed individual work and group-directed team work
- Interactive learning in social learning processes
- Independent planning of work
- Self-control/evaluation
- Participating and co-designing
- Working on complex, problem-oriented content or tasks
- Methodological competence and problem-solving skills
- Working in different learning and teaching teams
- Thinking and acting in terms of systems or complex correlations

Due to the needs for this appropriate approach, it is vital to focus on the role of 'the trainer as a learning role model' and provide a chance to gain new and improved access to the different learning groups in order to implement social integration through vocational and educational training.

On a final note, through sharing experiences in education and comparing systems, the focus should be on supporting partner countries to raise the attractiveness of their work- and action-based vocational education and training systems, making them more innovative and adapted to the needs of the job market and promoting learners' participation in society. Taking as an example the successful German Dual system of VET in which the costs for providing VET are shared with the employers, strategies should be developed in order to convince industry that spending on education is an investment and not a cost.

4.3 Time to market with or versus a systematic engineering approach

Furthermore, from our point of view – maybe influenced by a German engineering way of thinking – it seems important to develop this public-funded project in a systematic and

professional way. Therefore, the competencies of the partners came together and created a systematic project execution process in line with the Fraunhofer IAO reference process model of Service Engineering. Put simply, this approach consists of four overall phases:

Challenges in terms of 'exporting' vocational education and training to India

Phase 1: Requirements collection and analysis
Phase 2: Concept development
Phase 3: Testing and training
Phase 4: Implementation and market introduction

This overall process is intended to be completed within a three-year period, in which a lot of investment and time is spent using specific methods and tools to develop a market-ready, failure-proofed and customer-accepted final VET product.

Based again on the experiences of almost halfway through the project, we are now at the point of admitting that this sequential approach does not meet the requirements and situation that we are confronted with in the Indian market. Although it is important to keep the sequences and milestones in mind, we face the challenge of demonstrating and proving our offering at what is still an early development phase, especially in situations dealing with business models and cooperation perspectives as described in the previous chapters. That is why the project partners have strengthened the efforts to develop the prototype of the curriculum and test it at an earlier stage of the project than initially intended, further optimising and adapting it in discussions and applications with Indian partners in the following project phases and time period.

5
Vocational education and training needs analysis in urban water management: interviews with operators of sewage plants

Thomas Burger, Thomas Meiren

The requirements analysis for the BIBS project included many measures, from traditional desktop research and interviews at events, conferences and trade fairs through to interviews with operators of sewage plants (see figure 2).

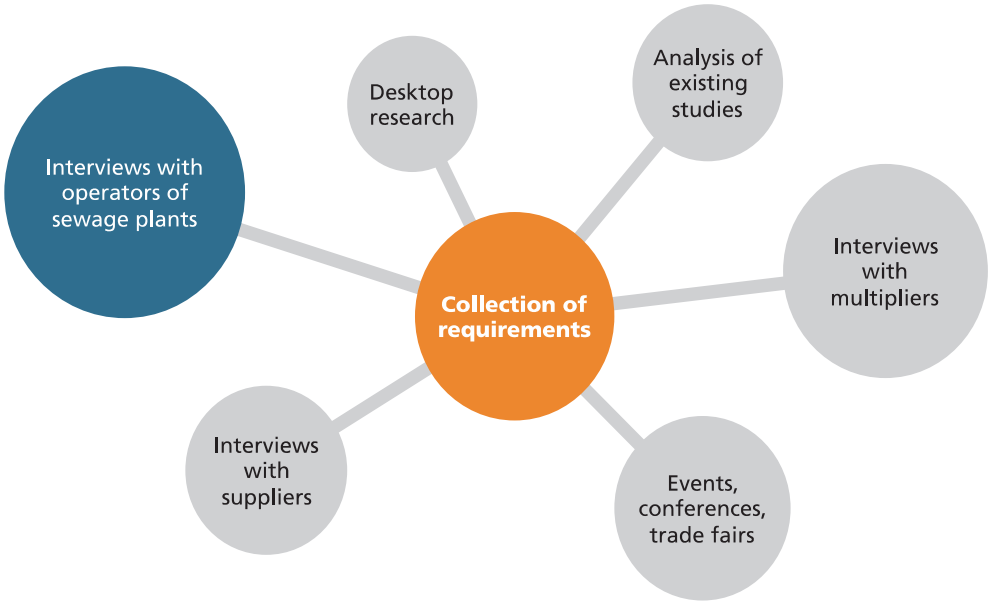


Figure 2: Requirements collection in the BIBS project

This chapter introduces the objectives, study design, methodology as well the overall results of the interview analysis with operators of sewage plants in the region of Pune.

5.1 Objectives

The objectives of the interviews were:

- To explore vocational training and education needs in urban water management in the region of Pune
- To identify current and future training needs
- To identify general requirements for vocational education and training in the region of Pune
- To identify qualification needs of employees of sewage plants
- To identify external support needs for qualification at sewage plants

Furthermore, the objective was to include municipal as well industrial sewage plants as well as German companies who operate a sewage plant in their Indian subsidiaries.

5.2 Study design

This chapter describes the methodology, the research design as well as the execution of the interviews. The necessary activities are structured into five steps, which are illustrated in the following sections:

- Preparation activities
- Design and pretesting of interview guidelines
- Selection and acquisition of the data sample
- Data collection
- Analysis and preparation of results

Preparation activities

The preparation activities included the collection of initial questions for the interview guidelines based on literature analysis, talks at trade fairs (e.g. IFAT Mumbai 2013) and existing interviews conducted in similar projects by the project partners. They were put together in a first draft of interview guidelines.

Design and pre-test

These interview guidelines were then pretested with five operators of sewage plants and their comments and suggestions were added to the final design of the interview guidelines. The experiences gained during the pretests eventually led to the following four sections within the interview guidelines:

- Questions on technical data
- Questions on training data
- Questions on external support data
- Concluding questions and comments

Data sample

The data sample consists of operators of sewage plants in the industrial and municipal area. They were selected and approached with the support of the All India Shri Shivaji Memorial Society (AISSMS) College of Engineering (CoE) and Industrial Training Institute (ITI) as well as the Indo-German Chamber of Commerce (Außenhandelskammer (AHK)) in Pune.

Data collection

In total, from October 2013 to April 2014, 58 interviews were conducted.

Vocational education and training needs analysis in urban water management: interviews with operators of sewage plants

Figure 3: Interview situation in Pune

Data analysis

The interviews were collected and the data was prepared and analysed using IBM SPSS™ predictive analytics software. For the documentation within this publication, only those results are included which have a high degree of significance from a statistical point of view.

5.3 Data pool

In order to be able to estimate and interpret the substance of these results for their own company, it is important to know what types of company have taken part in the trial. In particular, the following items of company information are of major importance:

- What is the plant or company's origin and background?
- What is the interviewee's position and background?
- How many employees do they have?
- What is their sector of operation?
- Which functions do the plants have?

Data pool

The data pool of interviewed operators of sewage plants consisted, as described in chapter 5.2, of 58 interviews in total.

Origin of plant operators

To get a better impression about which kinds of operators of sewage plants participated in the interviews, we started by analysing the origin of the plant operators' companies.

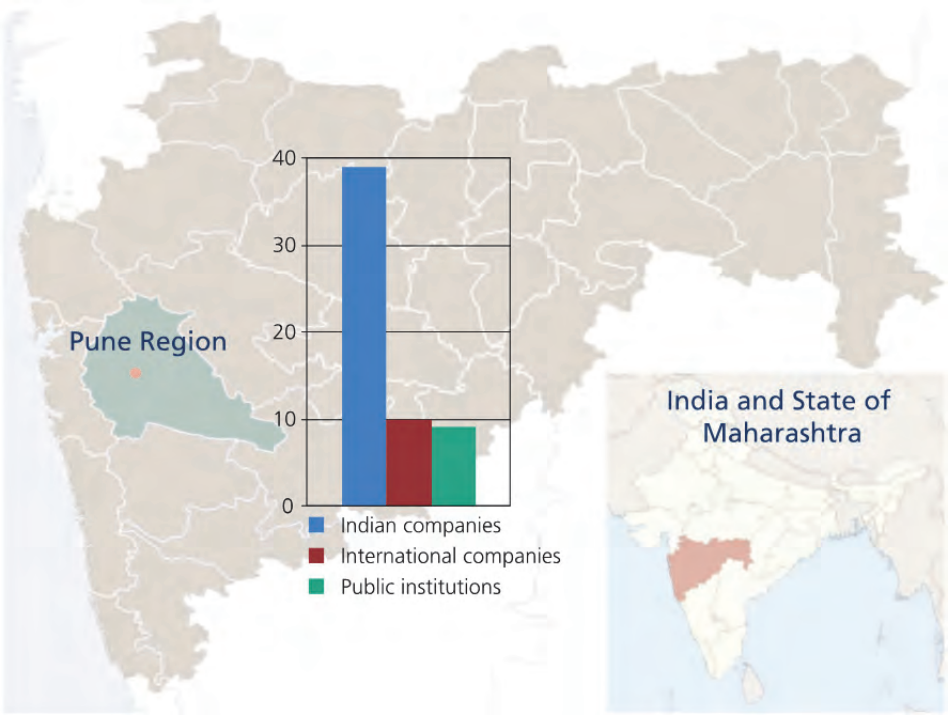


Figure 4: Distribution by country of origin of plant operators

48 of the plants are operated by Indian companies or Indian public organisations. 10 of the plants are operated by non-Indian companies. Their headquarters are located in Germany (6 companies), Belgium (1 company), the United Kingdom (1 company) and Italy (1 company).

5.3.1
Profile of participating interview partners, plants and companies

The interviewed persons were all in senior positions, either at executive level (e.g. Director, Vice President, Managing Director and Chief Executive Officer), management level (e.g. Human Resources Manager, Maintenance Manager, Project Manager, Head of Water Supply Systems) or operational engineering level (e.g. Project Engineer, Production Engineer, Mechanical Engineer). This indicates a high level of expertise amongst the interviewed persons and strengthens the validity of the interviews. Figure 5 gives an overview.

Position and background of interviewed experts

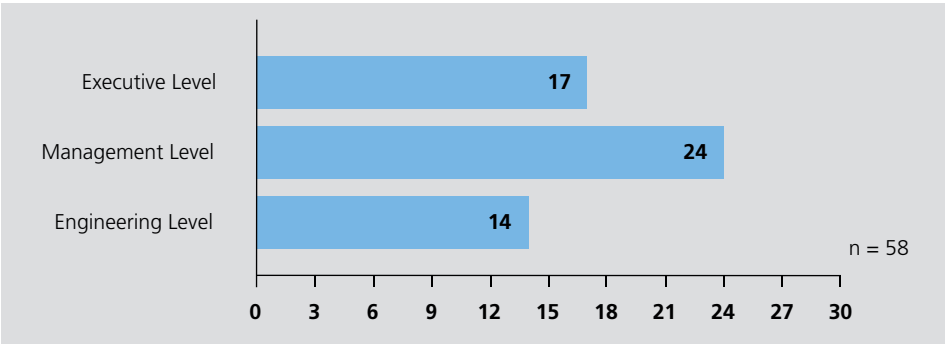


Figure 5: Position and background of interviewed experts

A typical approach is to analyse the size of the companies or plants that the interviewees work for. According to the definition of the European Union, enterprises are classified as small- and medium-sized if they have less than 250 employees. According to this definition, small companies have less than 50 employees, while big companies have more than 250 employees. Figure 6 shows the distribution of the interviewed plants and companies according to their number of employees.

Numbers of employees

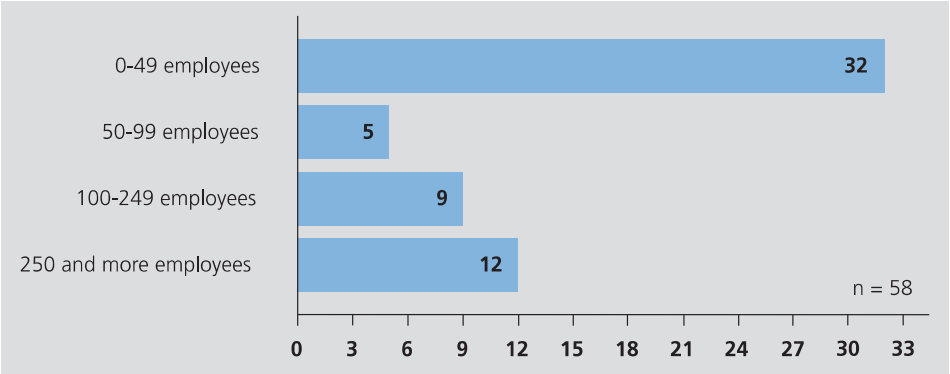


Figure 6: Size according to numbers of employees

The majority of the plants in our sample could be categorised as small- and medium-sized (46 in total). 12 plants are operated by big companies according to their number of employees.

5.3.2 Sector of operation

The participating sewage plants operate in the following sectors (see figure 7):

Sector of operation

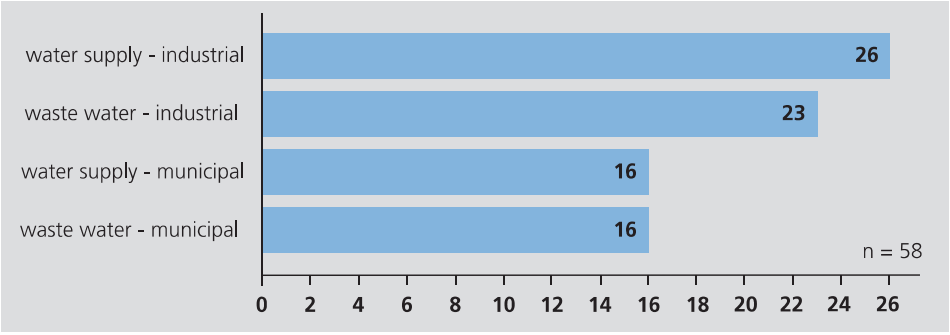


Figure 7: Sector of operation

As illustrated in figure 7, the majority of plants are active in the sector of industrial wastewater (23 in total) and industrial water supply (26 in total). 32 plants in total are active in the sectors of municipal wastewater and municipal water supply.

5.3.3
Functions in the plant

The plants have the following functions (see figure 8).

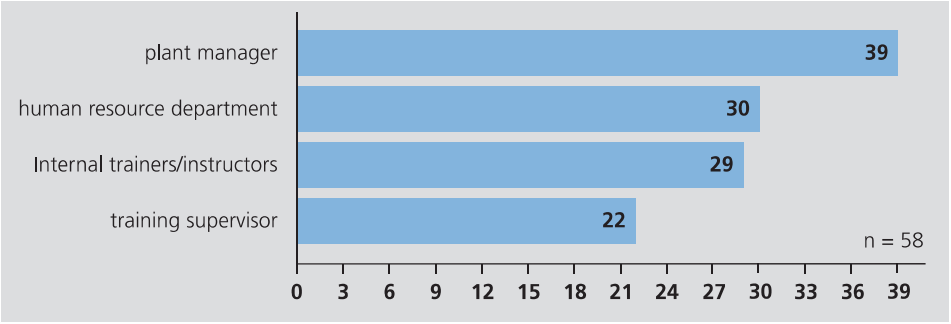


Figure 8: Functions in the plant

As illustrated in figure 8, only 39 of the interviewees state that they have a plant manager on-site and only 30 of the interviewees state that they have a human resources department. 29 of the interviewees have internal trainers and instructors available at their plant or company while only 22 have a training supervisor.

5.4
Study results

In this chapter, the results of the interviews are presented. The study basically shows the overall results of all interviews. The detailed data and information is appended to the publication. For the sake of clarity, the questions asked in the interviews are referenced next to the figures and results.

5.4.1
Study results in terms of technical data

The first part of the interview focuses on questions related to the technical data of the interviewees' plants. Of particular interest were ratings and insights related to the following topics:

- Maintenance and repair tasks
- Availability of sewage systems
- Availability of fluidics systems
- Availability of automatically controlled processes
- Delivery of internal and external technical tasks
- Availability and introduction of new technologies

The questions serve to give you an overview of the technical facilities in India so that recently developed education and training programmes take into account the actual situation on the ground right from the start.

One of the initial questions deals with the extent to which companies have at their disposal dedicated staff or departments for dealing with repairs and maintenance. Since these people are one of the most important target groups for potential training, it is of great

significance to find out whether they are employed directly by the company or whether they are provided by external suppliers.

At first, the interviewees were asked whether their plant has its own maintenance and repair department.

Questions in interviews:
Does your plant have its own maintenance and repair department?
If yes, what is the ratio between internal and external maintenance and repair?

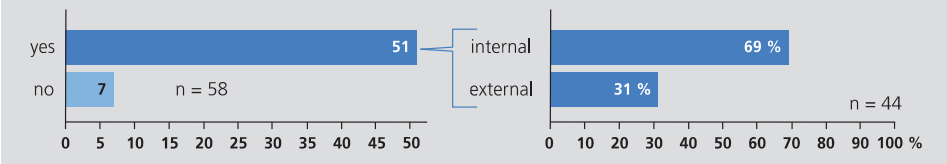


Figure 9: Maintenance and repair

As shown in figure 9, 51 of the operators interviewed stated that they have their own repairs and maintenance department. However, not all work is typically carried out by the company itself, but part of it – an average of 31% – is outsourced. Under closer analysis, it is interesting to note that this figure seems to remain virtually unchanged regardless of the size of the company, i.e. in the four different categories in the survey, it only varies between 29% and 37%. Overall, therefore, it can be concluded that the companies in the survey conduct most of their repair and maintenance work themselves. Additional comments in the interviews indicate that it is primarily maintenance of complex machinery that is outsourced.

The other questions relate to the basic facilities of the system – for example, it was of interest as to whether a sewage system was present. Sewage systems are for the transport of waste water, in addition a pipeline system is for water supply in general.

Question in interviews:
Do you have a sewage system?

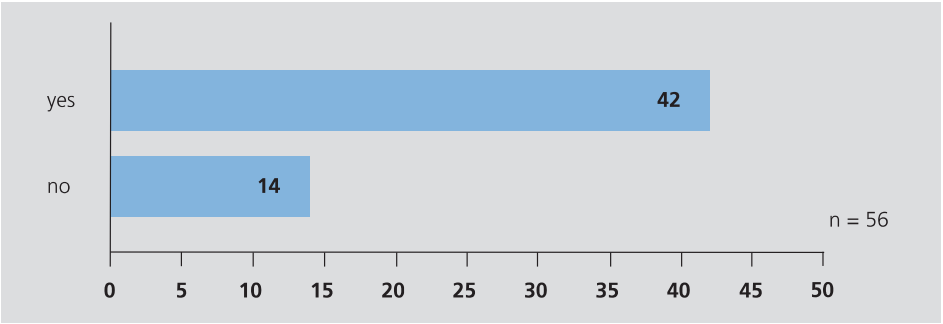
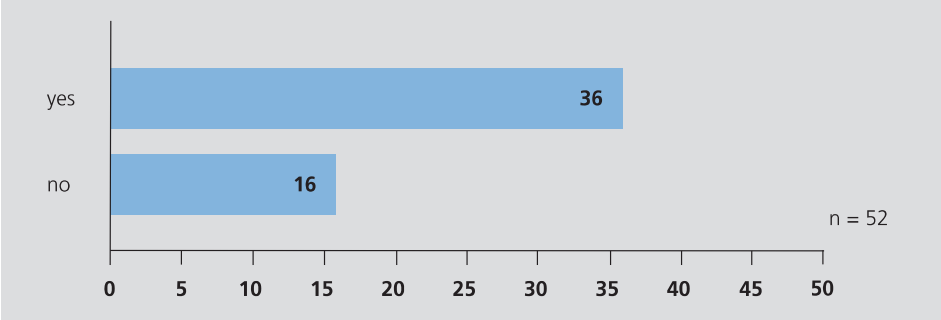


Figure 10: Sewage system

Almost 75 per cent (42 in total) of the responding experts claim to have a sewage system at their plant. However, here there is a clear correlation with the size of the company – while smaller companies often lacked access to a sewage system, over 90% of larger companies with 250 employees or more had one. There are no significant differences in the comparison of municipal and industrial plants, with both equipped with sewage systems to more or less the same degree.
The next question focused on the usage of fluidics systems. Pneumatic systems use pressured air to control valves for example, whereas hydraulic systems use liquid fluid power to do this work.



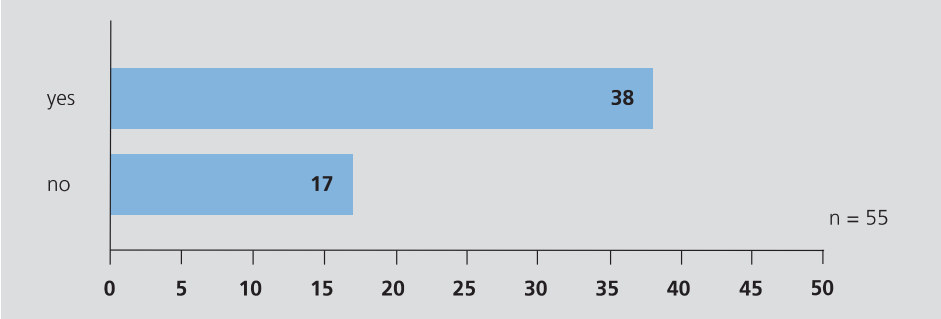
Question in interviews:
Are there any fluidics systems (pneumatic/hydraulic) in use?

operators of sewage plants

Figure 11: Usage of fluidics systems

Almost 70 per cent of the responding experts claim to have fluidics systems, either pneumatic or hydraulic, on their plant. Here, there is once again a clear correlation with the size of the company: more than half – 11 out of 19 – of the smaller companies with fewer than 50 employees have no fluidics system, while most – 8 out of 10 – of the large companies with over 250 members of staff have one.

Furthermore, the interviewees were asked whether they have automatically controlled processes in use.



Questions in interviews:
Do you have any automatically controlled processes?
If yes, is there any process control software in use?

Figure 12: Automatically controlled processes

Figure 12 shows that more than two thirds of the companies in the survey have access to automatically controlled processes. As with the previous questions, it is once again the larger companies that have the better facilities, with 9 out of 11 companies of over 250 employees answering the question in the positive. The interviews also show that automatically controlled processes typically include access control, filtration, steam pressure, pH control, temperature and tank level. Typical software in use includes Carell controllers, DCS, DAS, PLS, SCADA and WCS.

Following the questions on technical facilities, a list of tasks is presented to the interviewees and they are asked to state whether these tasks are carried out by themselves ('internal') or by an external service provider ('external'). Figure 13 shows the results.

Question in interview:
Are the following tasks carried out by yourself ('internal') and/or by external service providers ('external')?

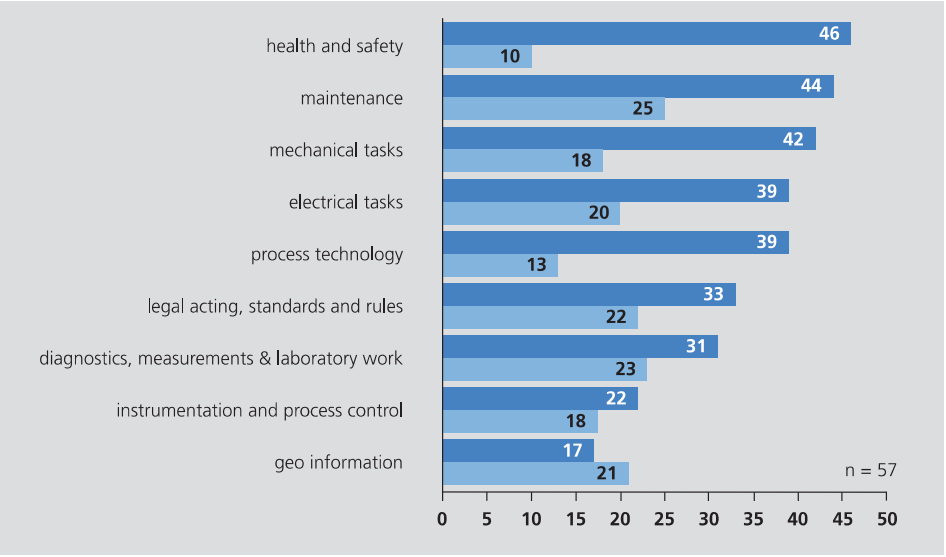


Figure 13: Tasks carried out internally and/or externally

Figure 13 shows that the majority of the tasks are carried out internally. This is especially true for tasks related to health and safety, maintenance, mechanical tasks, electrical tasks and tasks focusing on process technology.

Only tasks related to geo information are mostly carried out by external service providers. Geo information encompasses the capture, storage, manipulation, analysis, management and presentation of all types of geographical data for various purposes. In terms of water resource management, this includes, in particular, groundwater exploration, groundwater protection, system analysis and risk assessment.

Which new technologies do you plan to introduce?

Finally, the interviewed experts are asked to identify future investments in new technologies. The feedback received involves various technologies, which could be categorised as follows.

1. Measurement and automation
2. Advanced treatment processes
3. Gas production/utilisation

Overall, the answers reveal a high degree of interest in new technologies, not least due to increasing requirements from the government (i.e. technical parameters that have to be fulfilled). However, it must be pointed out that a sufficient amount of new-to-the-plant technologies are already available, but it has not yet been shown to be stable and operational for the specific plants (i.e. allowance must be made for training people in how to use it). The solution will not be the purchase of new technology to meet these requirements, but rather the proper use of already existing technology.

5.4.2 Study results in terms of training data

The second part of the interview focuses on questions related to the training data of the interviewees' plants. Of particular interest are ratings and insights related to the following topics:

- Educational level of technical staff
- Difficulties in hiring technical staff

- Hiring process of technical staff
- Training of non-academic technical staff
- Language capabilities of non-academic technical staff
- Length of training for non-academic technical staff

In a first question focusing on training data, the interviewees are requested to estimate the educational level of the technical staff working at their plants. Figure 14 shows the overall results.

Question in interviews: Please estimate the educational level of your technical staff?

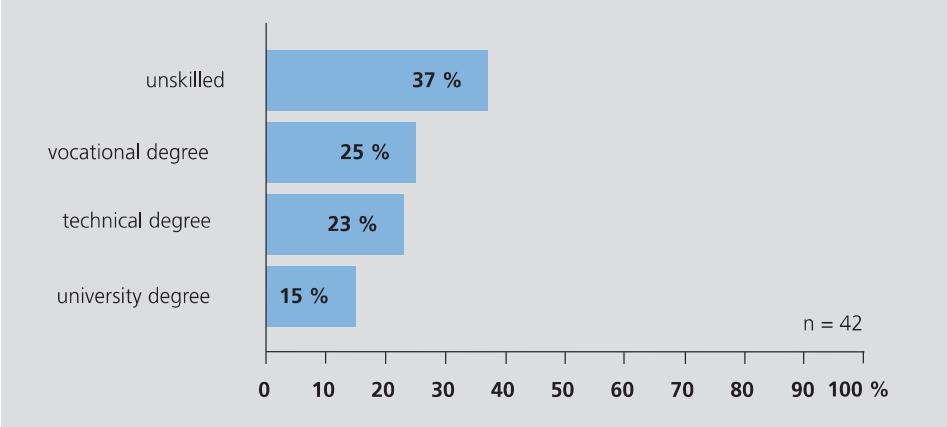


Figure 14: Educational level of technical staff

The replies show that, on average, more than one third of staff does not have any prior training. Most unskilled workers can be found in the larger companies, where more than 50% of employees can be assigned to this category on average. It was also mentioned in the interviews that unskilled workers are the group with the highest staff turnover. It is not uncommon for people to be hired on a daily or weekly basis, or they choose to change employer very quickly as soon as something better comes up. The strategy of many companies would therefore be to establish a stable core workforce and provide it with basic knowledge, which this core workforce could then pass on to the new employees.

On the other side of the qualification scale, it is clear that there are employees with a technical or university degree in every company, and that these people are generally the management. However, the challenge here is often that operational activities are not valued and are therefore delegated to less skilled employees, i.e. the available expertise is not being used.

The next question addresses the recruitment of appropriate technical staff and the situation on the labour market.

Question in interviews: How difficult is it for your organisation to find technical staff on the labour market?

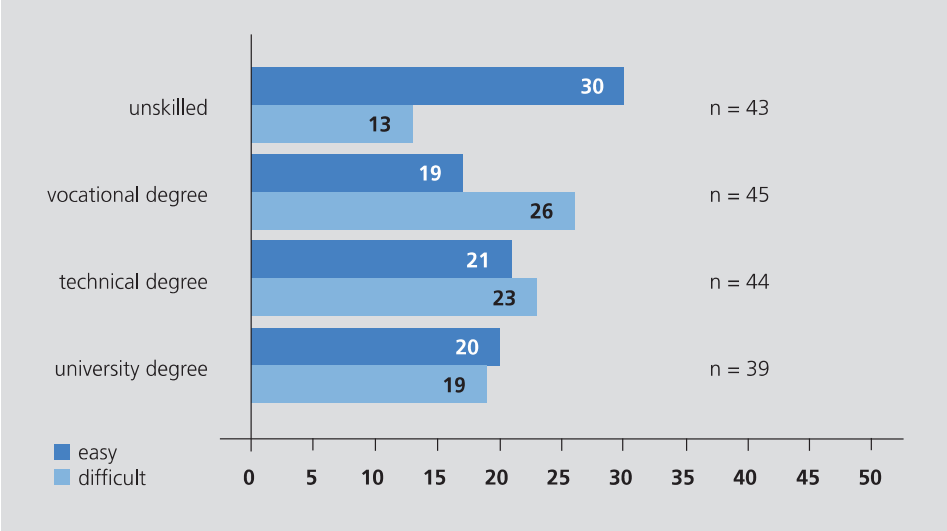


Figure 15: Labour market for technical staff

The replies clearly show that more than half of the companies in the survey have difficulties in finding suitable staff. This is most noticeable for employees with vocational degrees – here, 26 out of 45 companies (58%) state that they have problems. Finding employees with technical or university degrees is also problematic for many companies, while the recruitment of unskilled workers is the easiest.

In addition, the interviews indicate that employees with technical or university degrees in particular are often the ones that have a significant need for training. For one thing, they are subject to greater requirements and, for another, the necessary specialist knowledge is often missing. In addition, respondents complain that it is difficult to find high-quality and affordable training programmes for the qualification of such employees.

Since the study focusses on vocational training, the other topics covered in the interviews primarily deal with non-academic staff. For example, the way in which such staff is recruited (see figure 16).

Question in interviews: How do you hire your non-academic technical staff?

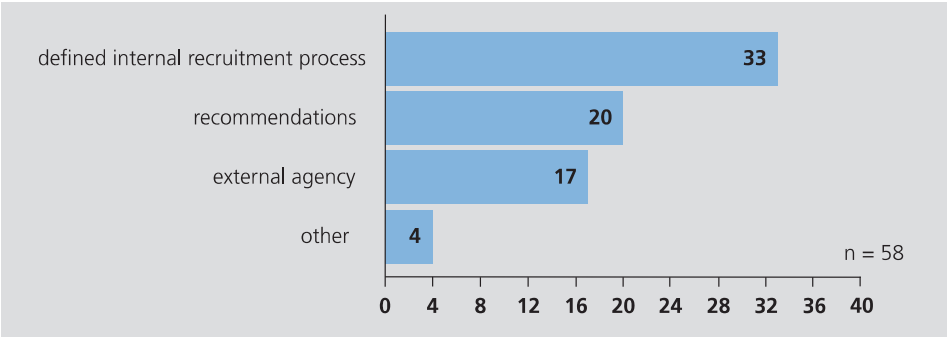


Figure 16: Hiring of non-academic technical staff (multiple answers were possible)

The majority of the companies in the survey – 33 out of 58 – stated that they have clearly defined recruitment processes but that recommendations (20 out of 58) and the use of external agencies (17 out of 58) also play an important role. In terms of the replies given, there is a clear correlation with the size of the company – while smaller companies primarily depend on recommendations, larger ones set greater store on defined processes and the use of recruitment agencies.

In addition to recruitment, the interviews also dealt with the programme for training new, non-academic employees (see figure 17).

Question in interviews: How do you train your non-academic technical staff?

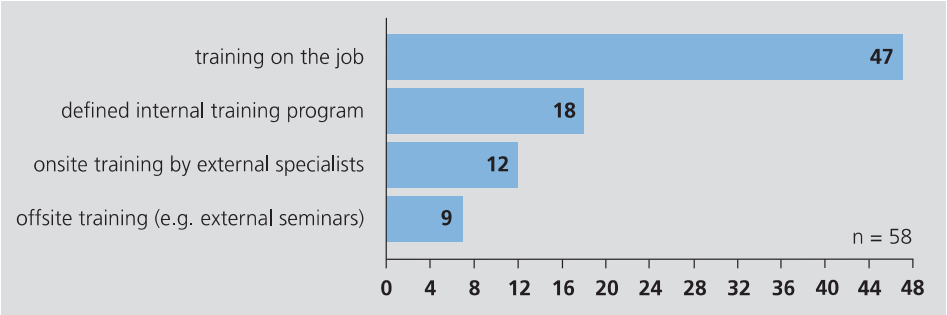


Figure 17: Training approaches for new non-academic technical staff (multiple answers were possible)

It shows that on-the-job training is by far the most significant type and is used by 47 of the 58 companies in the survey (81%). In addition, the larger companies in particular have internal training programmes. The integration of external training partners, whether on- or off-site, is generally uncommon. When asked why this is the case, budgetary concerns are listed but also the lack of availability of suitable programmes.

Another important topic with regard to the design of training programmes in India is the question of the language in which training is given (see figure 18).

Question in interviews: What is the typical language used when training your non-academic technical staff?

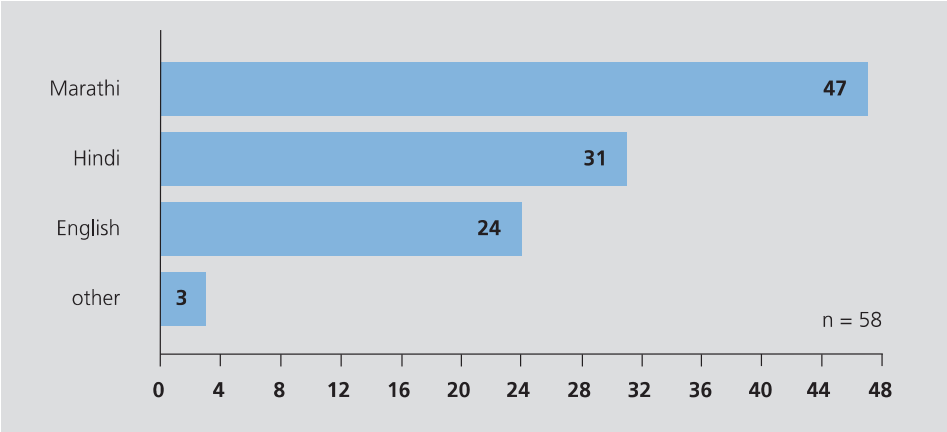


Figure 18: Training languages of non-academic technical staff (multiple answers were possible)

The experts in the survey state that training in non-academic areas is primarily provided in Marathi (in 47 out of 58 companies) but Hindi is also used in most companies. Other languages used for training as listed in the interviews include Gujurati, Telugu and Tamil, although these are only used in a handful of companies.

In addition, 24 companies state that they provide training in English. When asked for details, however, they reveal that this usually took place in generally quite simple English, for example dealing with English-language signs or the operation of foreign machinery. When asked for more details about the level of understanding of English among non-academic staff, the experts estimate that around half of the workforce on average is in a position to be able to understand, read and write English (see figure 19). However, even

those who claim to have employees who understand English say that this is limited at best to basic knowledge and a few specific terms.

Question in interviews: Please estimate the percentage of your non-academic technical staff that are able to understand, read and write English.

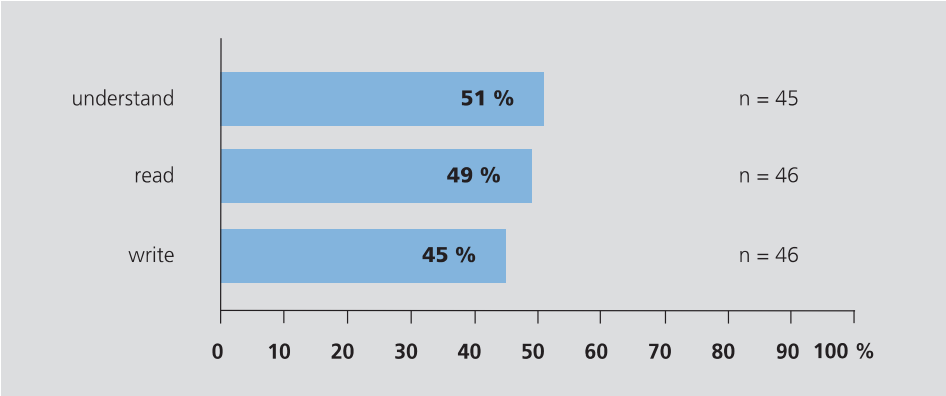


Figure 19: English language abilities of non-academic technical staff

With regard to the language of instruction, the interviews show that it would not be at all sufficient to develop and offer training solely in English. In the non-academic field in particular, it must take place in a local language. In the Pune region, this would be Marathi or Hindi.

After these requirements with regard to language, the scope of the training programme is also of interest. In response to the question as to how many training days are conducted for the non-academic field every year, the interview partners find it hard even to make a guess. Such key figures are only recorded systematically in very few businesses, not least because training sessions very frequently take place outside of actual (paid) working hours.

Question in interviews: Please estimate how many days per year you invest in total training for your non-academic technical staff.

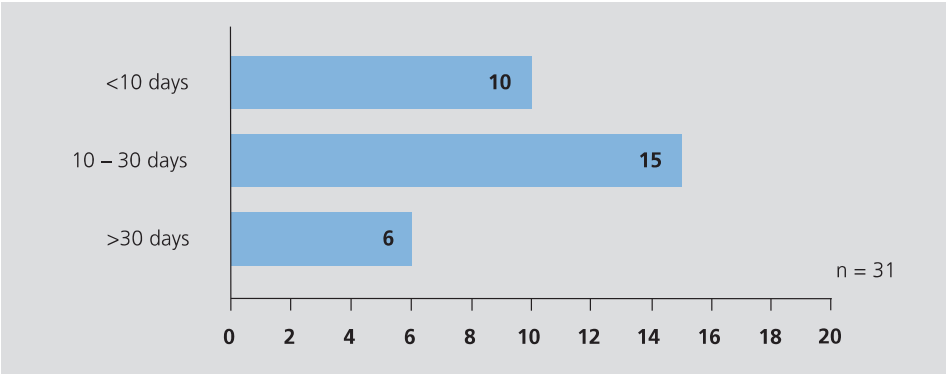


Figure 20: Duration per year of training for non-academic technical staff

Taking into account the fact that only just over half of companies could respond to this question, there was an average of 29 days, which was mainly down to just a few companies with very intensive training programmes. Divided into categories (see figure 20), it is clear that the majority of responses were in the '10 to 30 days' range.

With regard to the duration of training, most training sessions last between one and several hours, while training sessions extending beyond a full working day are seemingly the exception and only occur in 10 out of 50 companies (see figure 21). The reasons are that training sessions mostly take place on the job and while maintaining operations.

Question in interviews:
What is the average length of a typical training for your non-academic technical staff?

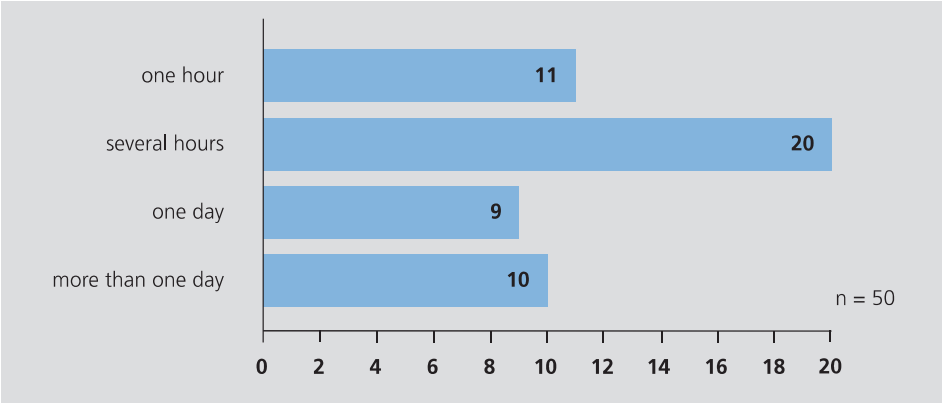


Figure 21: Average length of typical training for non-academic technical staff

With regard to the content of the training sessions, there is a preference for being pragmatic and concentrating on practical needs. As a result, the companies in the survey state that the training content is 71% practical and only 29% theoretical (see figure 22). This ratio is almost identical for all sizes of company in the survey. The experts in the survey also say that theoretical content is primarily communicated to staff with higher qualifications.

Question in interviews:
Please roughly estimate how much practical and theoretical training is carried out for your non-academic technical staff.

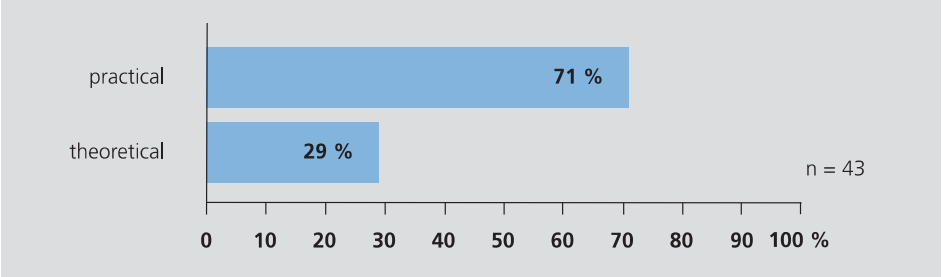


Figure 22: Training carried out for non-academic technical staff

Two thirds of companies have a training room and an LCD projector, although this tended to apply to larger companies in the survey.

Question in interviews:
Which of the following training equipment is available at your plant?

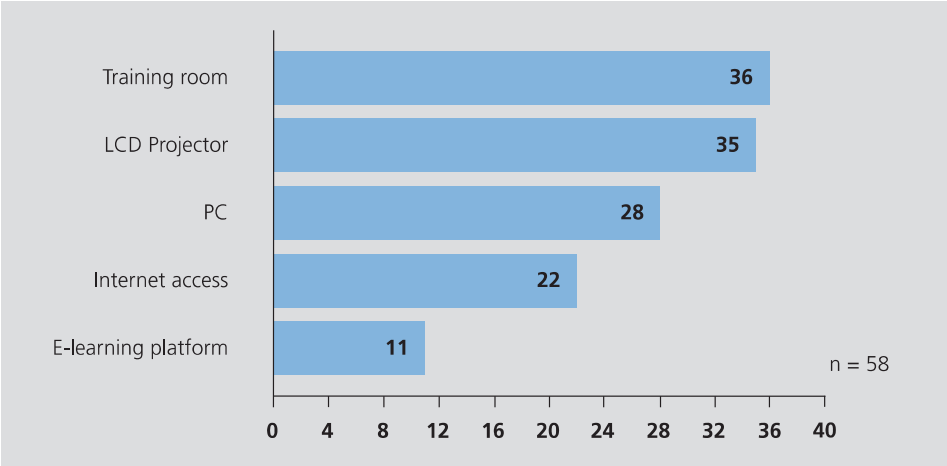


Figure 23: Available training equipment at plants

Overall, we can assume that sufficient training facilities are not available on site. This is borne out by the fact that less than half of the companies are in a position to be able to provide a PC for training purposes. In the development of a training programme, it is therefore important that the necessary facilities are as mobile as possible and easily transported to the location required.

The final question on the topic of training data is on content currently being covered. Respondents are asked to name current training topics and to assign them to predefined categories (see figure 24).

Question in interviews:
Which of the following tasks are part of your training activities for your non-academic technical staff today?

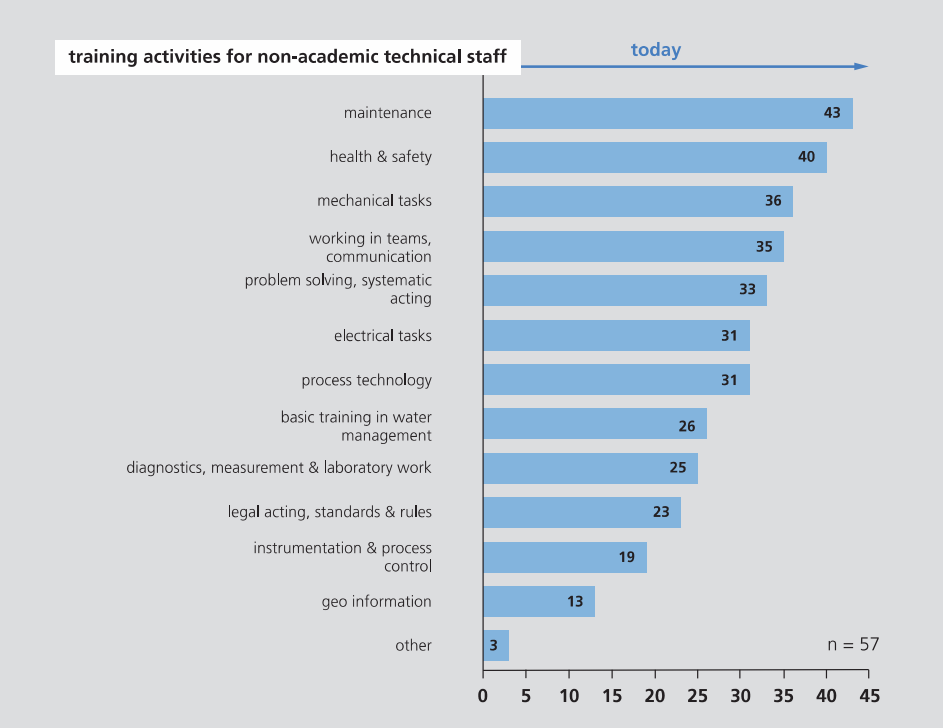


Figure 24: Focus of training activities for non-academic technical staff today

Training sessions on maintenance took first place – with 43 out of 57 companies, or 75%, carrying them out. This is less surprising when we take into consideration that it is one of the routine tasks of non-academic employees in the field of water supply and wastewater. Slightly unexpected was the relatively high number of times that health and safety is mentioned (40 out of 58), although the survey participants state that legal requirements and checks have become more stringent recently. The high values for problem solving and systematic acting (33 out of 57) are just as unexpected, but are likely to be the result of troubleshooting, which is common at the facilities.

Questions in interviews:
In which of the listed areas is your current focus in terms of training measures?
Will this change in future?

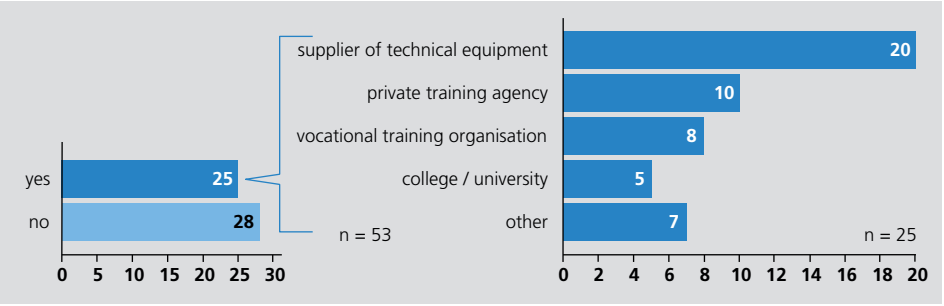
In addition, the experts are asked whether they expect to see changes in the areas of focus for training programmes in the future. Opinions here diverge sharply, although for many the strategy seems to be to provide a basic training session to as many employees as possible, while offering more specialised training sessions to staff with higher qualifications and more experience.

5.4.3
Study results in terms of external support data

The third part of the interviews addresses questions related to external support data. Of particular interest were ratings and insights in relation to the following topics:

- Usage of external training measures
- Future needs in external training support
- Focus of external training delivery
- Budgets for external training support
- Key factors for external training support

The first question in this part focuses on the usage of external training measures (see figure 25).

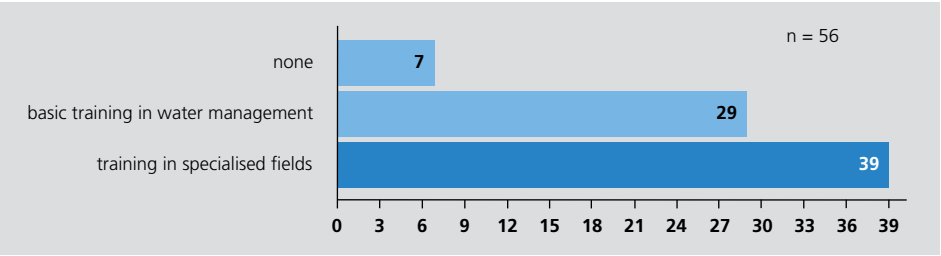


Questions in interviews:
Do you send your non-academic technical staff to external training measures?
If yes, to which kind of organisation?

Figure 25: External training measures

The majority of respondents do not send their non-academic technical staff to external training measures. Those who do, mainly send them to suppliers of technical equipment or private training agencies. Very few staff is sent to vocational training organisations. 'Other' includes, for instance, government agencies that come on-site or individual training experts.

The next questions are asked in order to identify what kind of external training support the interviewees expect to need in the future for their non-academic technical staff and in which specialised fields.



Questions in interviews:
What kind of external training support will you need in future for your non-academic technical staff?
If you need training in specialised fields, please specify.

Figure 26: Need of future external training support for non-academic technical staff

External support is needed in basic training in water management as well as in training in specialised fields. Only six respondents so far claim not to need any external training at all. There are no discernible differences between the estimations given by smaller and larger companies.

When asked about training needs in specialised fields, the companies list maintenance and health and safety. Only process technology is listed more frequently as a training topic by external partners. When considering figure 27, it is also clear that these topics are mentioned with consistently high frequency. This indicates that the experts not only recognised a great need for qualifications, but also see it as necessary to involve external training staff.

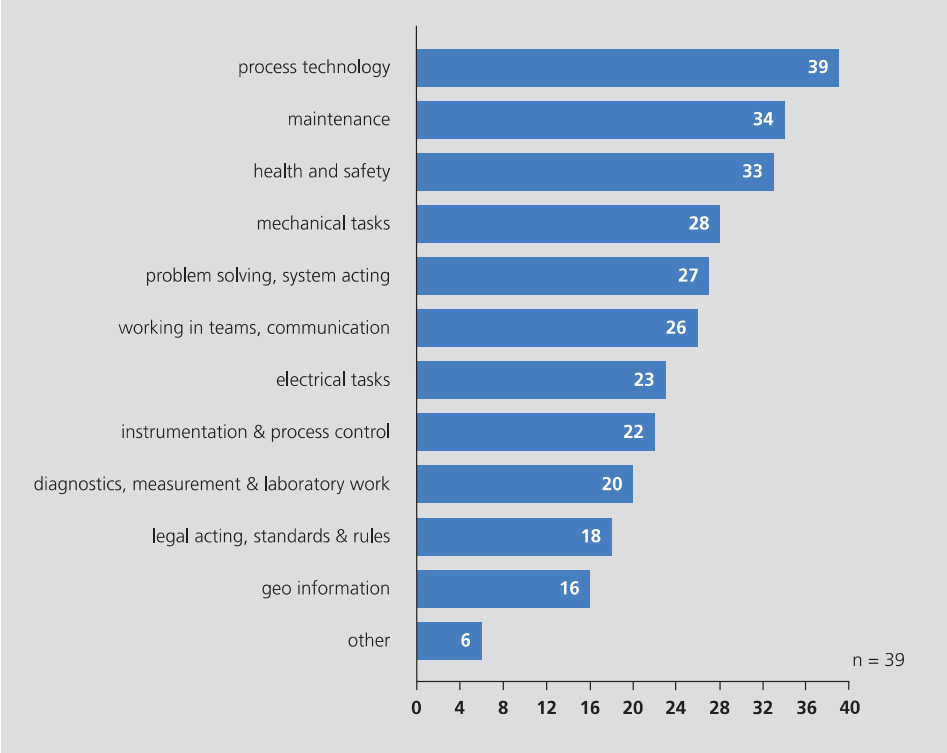


Figure 27: Training needs in specialised fields

Another question deals with the way in which external training sessions should be conducted (see figure 28). This once again highlights the need for a practical approach, particularly the aspect of training sessions on real objects/equipment (36 of 56 mentions), while theoretical training sessions are only requested by 15 of 56 companies. Half of the experts favours the use of models (e.g. miniature plants) while the other half favours more extensive visual support (e.g. pictures, films) (see also chapter 6.5).

Question in interviews: What should be the focus of external training for your non-academic technical staff?

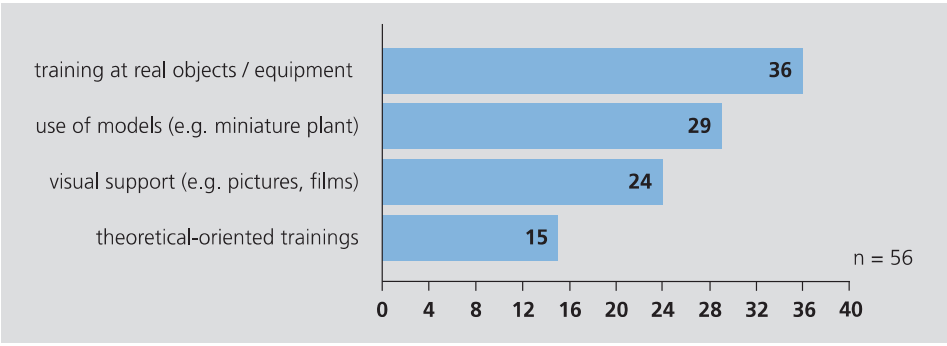


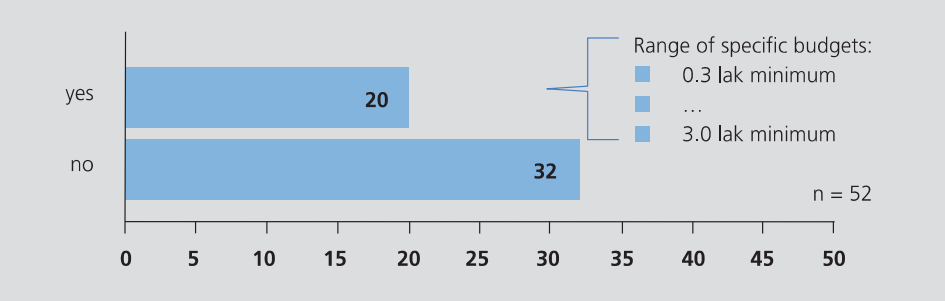
Figure 28: Focus of external trainings for non-academic technical staff

The budget for external training support is a very sensitive issue (see figure 29). There is a noticeable hesitation among most of the companies in the survey here – either because

they do not have the relevant figures available or because they do not want to reveal information about their budgets.

Vocational education and training needs analysis in urban water management: interviews with operators of sewage plants

Questions in interviews:
Do you have a special budget for external training measures for your non-academic technical staff?
If yes, please specify.



However, the answers given are of major importance for the development of qualification opportunities in the field of water management. 20 companies state that they do not have any budgets available for external training measures in the non-academic area. This puts into perspective the previous statements on training requirements. Although the necessity for training is recognised, it remains unclear as to how it might be financed.

Having said this, 32 companies still state that they have budgets available to training measures. The budgets ranged from between 0.3 lakh and 3.0 lakh. In addition, it is noted that budgets are often not fixed but depend on current requirements and ultimately case-by-case decisions.

Question in interviews:
In your opinion, what are the key factors for stronger external support in future?

The experts interviewed are also asked what they deemed the most important factors to be in offering a successful training programme in the field of water management. The majority of respondents explicitly stated that improved qualifications are a central lever in improving the quality of the water supply and wastewater disposal in India. As a result of the growing population and increasing stress on environmental resources, this is practically essential.

Starting with training measures in the non-academic area is the right approach because it addresses precisely the area of the workforce that is responsible for the operation of the facility. As a result of the usual high staff turnover rate, it would make more sense to start with experienced employees in order for the measures to be adopted over as long a time period as possible.

Since the interviews clearly show that many companies can barely process the extensive qualification measures themselves, many experts demand more support from the government – ranging from increasing awareness of qualification measures among the population and facility operators to additional budgets, to clear legal standards and real follow-up checks.

5.4.4
Concluding comments and suggestions

The interviews with Indian experts show a major interest and a clear need for training measures in water management. However, it soon becomes clear that the training concepts and content that have proven themselves over a period of many years in Germany would not necessarily be successful here – on the contrary, it would probably be the biggest mistake imaginable to transfer them directly to the Indian market without further consideration.

The interviews show, rather, clear requirements as to how the training measures should be conducted in order to achieve success in India. The most important findings can be summarised as follows:

- At the level of semi-skilled workers, i.e. employees with basic knowledge below that of academic training, is the right place for training measures to start. As a result of the high staff turnover that is typical for the region, however, experienced employees should be given preference in order to guarantee that the measures are adopted over as long a time period as possible. These employees can then be built up as a knowledge base and share their expertise with newly recruited members of staff.

- From a content point of view, it is necessary to provide basic training that is targeted at the broadest segment of the workforce. Basic topics relating to water management should be covered for people who have not had any in-depth training to date. In addition, more specific training programmes should be developed in order for experienced employees to develop areas of specialism.

- The training content has to be highly adaptable in order to cover actual requirements in the individual companies as efficiently as possible. As a result of the limited amount of time and budgets available for training, the companies will neither accept nor pay for what they see as extraneous content. This means that modular training programmes are ideal – ones that can be configured to individual companies without much effort.

- Training must retain a clear practical link. Training by experienced external trainers at company facilities would be ideal. The content could thus be communicated directly, referencing the machines and equipment available. Both the immediate practicability of the training content and the longer-term learning success would be significantly increased as a result.

- Even if many of the non-academic employees appear to have basic English skills, training in English would not be successful, particularly when it comes to communicating more complex topics. Preparing course content in the local language is absolutely essential.

The budgets for training measures for non-academic staff are extremely limited. The prices that are standard in Germany are definitely not feasible in India. The challenge is to develop new business and price models (e.g. through close involvement of local training organisations) or tap into co-financing options (e.g. public aid programmes).
The companies interviewed were almost unanimous in welcoming the activities in the BIBS project, and hope to see the training concepts developed and implemented as quickly as possible: "start soon and bring people to the market", as one of the experts summed it up at the end of the interview.

6
Vocational education and training system in Germany

Zaheer-Ahmed Shariff, Peter Maurer

This chapter gives an overview of the VET system in Germany and the possibilities of adapting its benefits for the development of a VET system in water management for India.

6.1
Introduction to the vocational education and training system

The demand for a skilled workforce is increasing all the time and it is a persistent challenge for industry to find well-educated staff to meet the rapid technological, economic and social variations. Germany's dual vocational educational training (VET) system has helped to tackle this challenge and provide a highly skilled and trained workforce. This has been a major reason for the success of German industry and the strength of the economy (IHK Darmstadt, 2014).

The German vocational training system aims to promote (1) economic productivity, (2) social integration and (3) individual development, thereby balancing the interests of industries as well as individuals, and is governed by the Vocational Training Act (BBiG), which was later amended by the Vocational Training Reform Act (Mehrotra et.al., 2014).

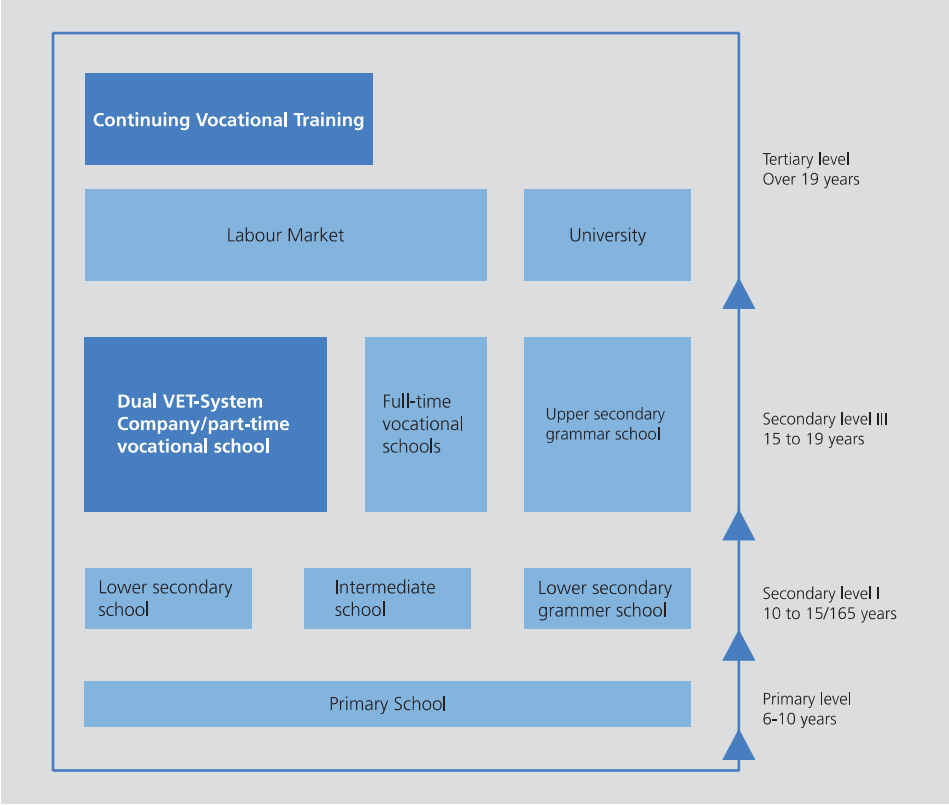


Figure 29: The German education and training system (OECD, 2003)

The objective of the legal framework is to secure and improve training opportunities and ensure that all young people receive high-quality vocational training, irrespective of their social or regional background. The Federal Institute for Vocational Education and Training (BIBB) was set up in 1970 on the basis of the Vocational Training Act as a federal government institution for VET policy, and research and practice in the field of vocational education and training. It is responsible for conducting research and continually upgrading the VET curriculum, anticipation of future skill needs and quality assurance. Overall responsibility for vocational training lies with the Federal Ministry of Education and Research (BIBB, 2013a).

6.2 Dual vocational educational training system: structure, benefits and financing

The German dual VET system comprises of on-the-job training and theoretical education in vocational training schools, offering training in 344 recognised training occupations (2012). It is estimated that about two thirds (2012) of the workforce in Germany have a vocational degree. The typical duration of the training is three years, while some only last for two years and some for up to 3.5 years depending on the types of occupation as well as the prior knowledge and skills of the trainee (BIBB, 2013b).

In the dual VET system, the in-company training or apprenticeship comprises about 75-80 % of the course and learning in school is limited to 1–2 days per week. Learning at these venues is governed by different but coordinated and synchronised regulations.

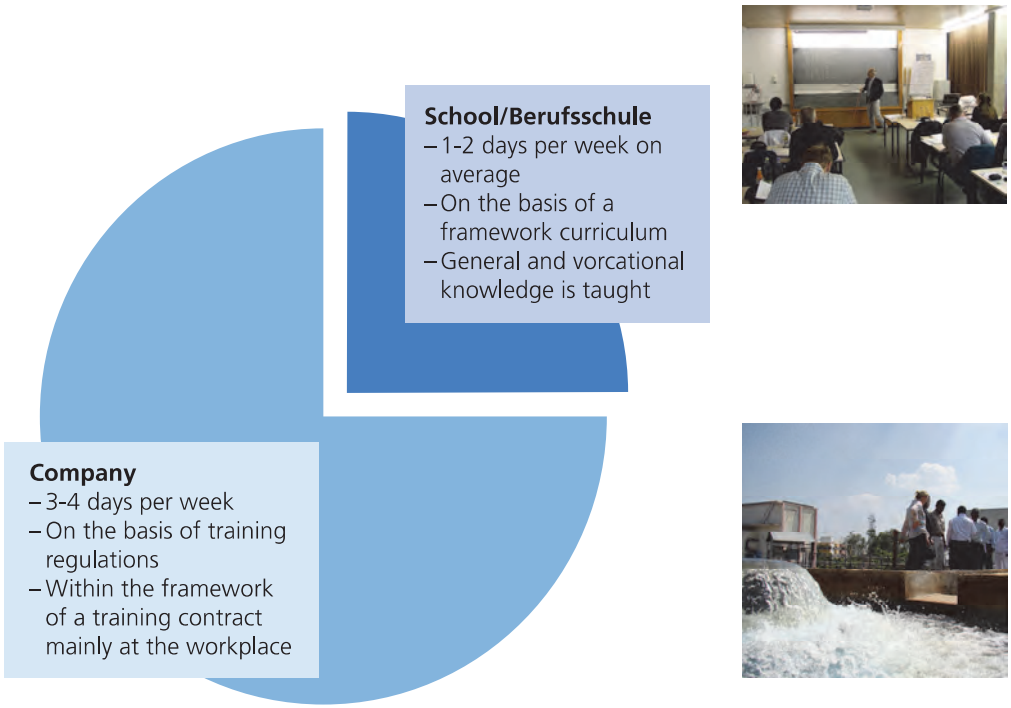


Figure 30: Learning in the dual VET system

The responsibilities for the dual VET system are distributed among the Federal or the State governments, industry and unions or chambers of commerce, and governed according to the German Vocational Training Act (BBiG). Training in the company is also governed by labour law provisions such as the German Civil Code (BGB), Protection of Young Workers Act (JASchG) and Protection of Working Mothers Act (MSchG) (BMBF, 2011).

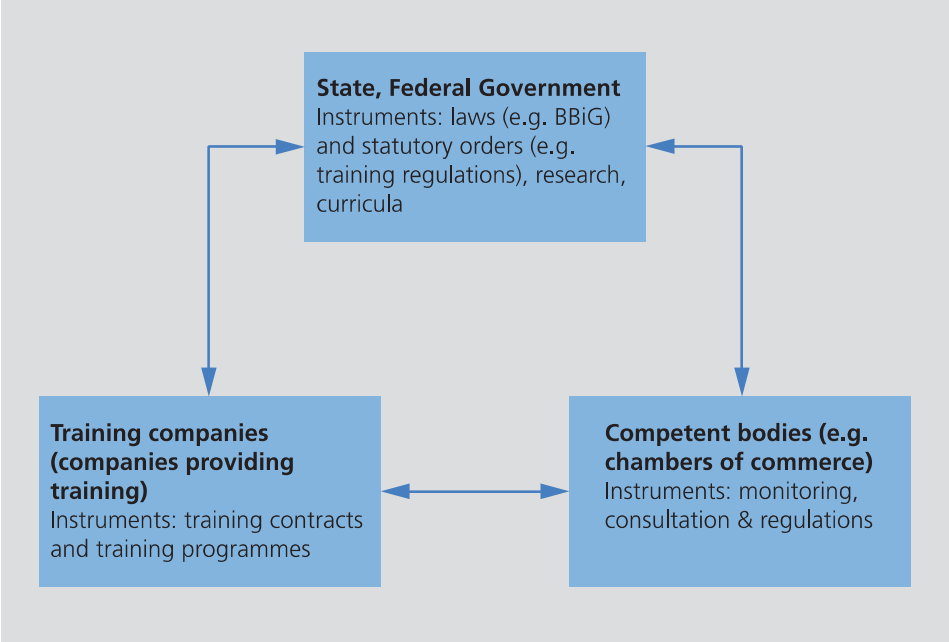


Figure 31: Distributed responsibilities

The dual VET system has been very efficient and effective as it offers advantages to both industry and the young people and students undergoing training. In-company training sessions or apprenticeships are usually remunerated and the companies benefit from the productive work of the trainees (BMBF, 2011).

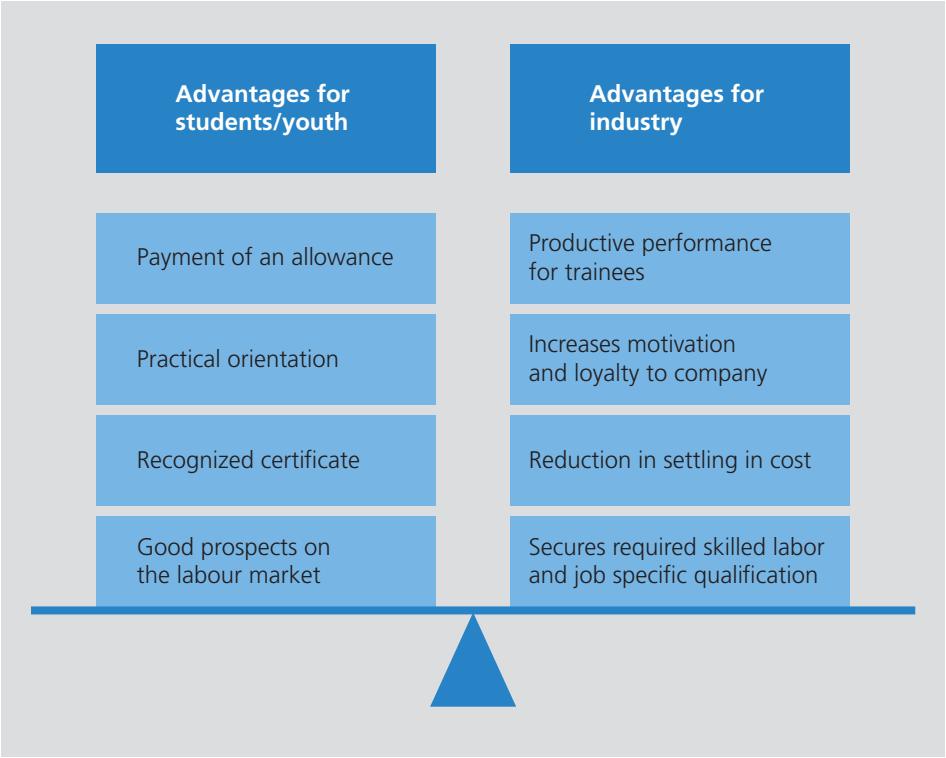


Figure 32: Advantages of dual VET

The financing of VET is shared between the enterprises/companies and the government. The enterprises cover their own training costs (e.g. apprenticeship pay, cost of trainers, material, etc.), and the in-school learning is funded by government. This type of public-private partnership eases the burden on the public budget.

6.3 Dual VET in water and waste sector: environmental technicians

Germany has more than 26 years of experience in the training of environmental technicians and, under the current curriculum of the dual VET courses of the water and waste sector, specialisation in four different streams is offered. The entire training programme is divided into two levels: common core skills (15 months) followed by specialisation skills (18 months) in one of the four streams. This kind of multilevel training, which delivers knowledge and practice not only in specialised trades but also common basic trades, creates a multi-tasking workforce.

Figure 33: VET for environmental technicians

After achieving the common core skills in the basic trades such as safety, environment, tools workshop, basic science, mathematics and administration, the students or trainees have the option of choosing their area of specialisation from the four sectors. The total training duration is 36 months, which takes place both in school as well as at a company. After completion of the training, the trainees have the option of continuing their education further to achieve the certified senior technician certificate. Based on the skill sets possessed by the trainees, they have a number of job opportunities on the market and many times they are hired by the same firm in which they undergo training (Krampe, 2010).

6.4 Vocational education and training system in India

According to the formal Indian VET curriculum, after the completion of elementary education (i.e. from 8th to 12th standard depending on the requirements of different trades) the candidates may opt for vocational training in order to become a semi-skilled worker or a craftsperson. The technical vocational training is mainly provided through government and private Industrial Training Institutes/Industrial Training Centres (ITIs/ITCs) for various trades and the duration varies from six months to three years. The Ministry of Labour and Employment (MoLE) regulates and monitors vocational educational training in ITIs and ITCs through the National Council for Vocational Training (NCVT). The NCVT is responsible for designing, developing and maintaining curricula and monitoring ITIs and ITCs across the country. ITIs are financed by state labour ministries, whereas ITCs are owned, financed and managed by private organisations or NGOs. There are approximately 5,400 public and private institutions in total. There is also the possibility to undergo an on-the-job training programme in the form of an apprenticeship. A total of 254 groups of industries are covered under the Apprenticeship Act of 1961. However, the number of positions is small. There are about 290,448 (as of 2011) apprentice positions, as a result of which this pillar of the VET sector is negligible. Indian authors and the Indian government frequently consider three-year diploma courses offered at polytechnics (which are an element of the technical career path – see figure below) to be part of the VET sector, although according to international standards, they are classified at a higher level than VET, as education at polytechnics aims to prepare students for middle-level or supervisory positions that form a link between engineers and craftsmen or semi-skilled workers (Wucher, 2012).

Various reports also suggest that the formal VET sector overall is very small and therefore insufficient to cater to young Indians aged between 15 and 29. This has resulted in the flourishing of the non-formal VET sector, especially non-profit organisations offering short-term courses responding to employer demands (Wucher, 2012).

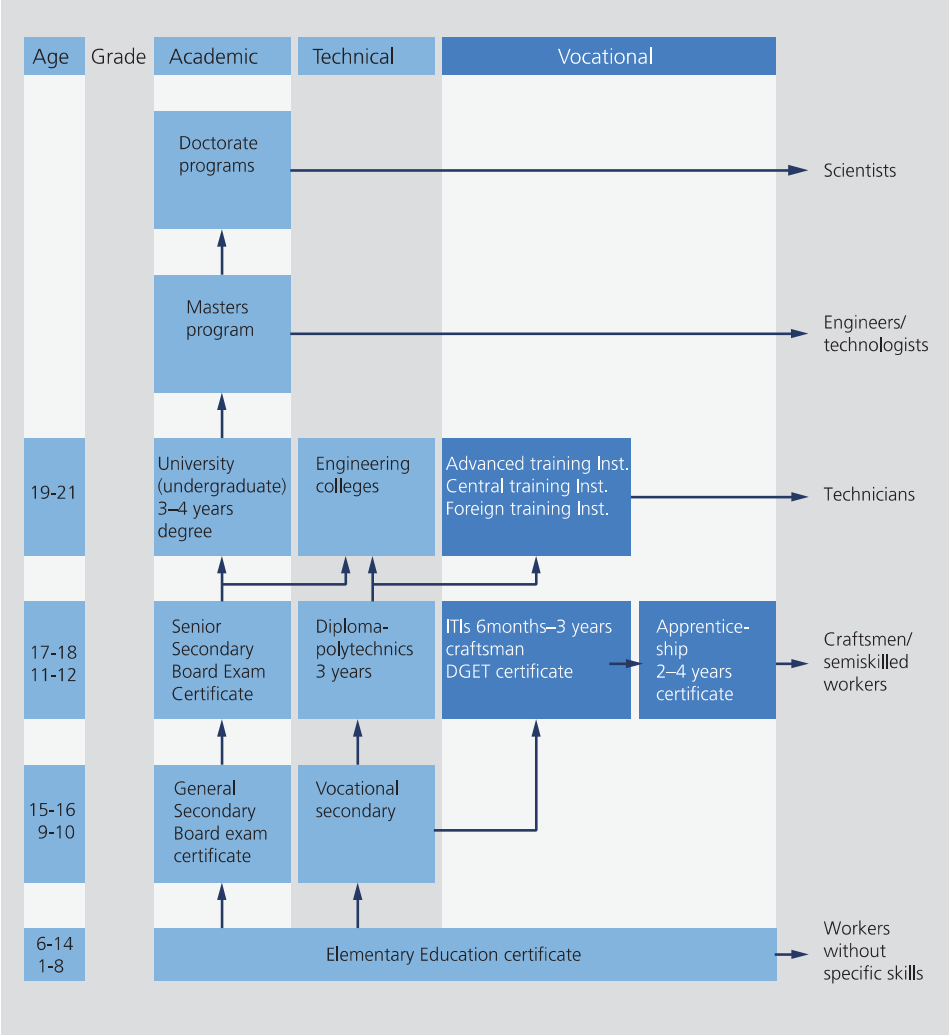


Figure 34: The Indian education and training system (Dar, 2008)

Name of vocational training and education scheme	Approximate no. of vocational training occupations or trades
Craftsperson training scheme (CTS)	70 (engineering trades) and 62 (non-engineering trades)
Modular employable scheme (MES)	68 trades (651 sub modules)
Apprentice training scheme (ATS)	128 trades

Table 3: Vocational Training schemes and trades in India (DGE &T, 2014)

In spite of the efforts of the Indian ministries to develop and promote the VET system, a number of problems affect the vocational education and training system in India. Some of the reasons for the ineffectiveness of VET include: a lack of acceptance by students (mostly students who perform poorly in schools or who cannot afford academic education choose to take up VET) or employers, gaps between vocational training institutes and industry,

lack of understanding of employer needs, and little cooperation from the industries or a lack of public-private partnerships.

Further, in most cases, the Indian VET system offers courses focusing on particular trades such as electricians, fitters etc., and does not offer holistic training for different departments within an industry or company. This results in staff that are specialised in a particular task and not capable of multi-tasking, with little or no knowledge about other departments or tasks within the same industry. However, the authorities have realised this and introduced the modular employable scheme (MES) in 2005–2006 under the auspices of the Skill Development Initiative. Under this scheme, training is offered based on different industrial sectors and trainees have the freedom to select one or more short-term modules from each industrial sector based on their interest. Thus, the trainee can either choose to be specialised in a particular task and possess minimum skills for employment or take up all the modules in a particular sector to have a more holistic skill set.

Some of the problems faced by the Indian VET system may be overcome by modifying and incorporating the pillars of the German dual system. This will improve synchronisation between theory and practice, satisfy employer needs, increase co-operation between public and private actors and help in swift transitioning of the students from school to industries/companies. Employers need satisfaction and a lack of cooperation by industries may be resolved by using advanced physical training models and 3D visualisations as an alternative to in-company training, which would also greatly reduce the training time and expenses.

6.5 Adaptation of German VET model to Indian scenario for the water management sector

With respect to urban water management, which is the focus of the BIBS project, there is no recognised VET offered in water management available in the formal Indian VET sector. The only course related to wastewater treatment operators can be found as a sub-module in the Textile trade of an MES scheme. Based on the interviews with Indian industrial partners and on-site staff in the water industry, it is evident that semi-skilled workers or craftspeople working in the water sector are trained only in the basic trades such as electrical, fitting, pump operation, etc. and do not possess holistic skills related to water treatment or purification. Therefore, a completely new curriculum for water management is being designed, taking the German dual VET model as the basis and adapting it to the MES scheme in India so that the trainees have a broader range of skills and will be able to work in different departments of a water industry sector. The requirement analysis feedback and interviews with players involved in water management from both municipalities and industries are being taken into consideration in order to determine and prioritise the skill set required for non-academic staff in the water industry sector.

The curriculum currently being developed and the depth of training have been closely discussed with staff members of AISSMS management, ITI and engineering colleges, and were also devised in consultation with FESTO (Germany). The 'ABC Need-to-Know' certification guides were also referred to while designing the modules.

In order to have a holistic curriculum under the BIBS project, it will consist of two levels. A basic/common core skills level aimed at building the skills required for further specialisation in water purification or wastewater treatment. Individual topics related to electrical and mechanical trades that are already available in the Indian VET curriculum have been very well designed and will be directly incorporated into the BIBS curriculum, for

example: workshop practice, basic electrical concepts, etc. The specialisation modules will be specific and concentrate on processes involved in the water management sector.

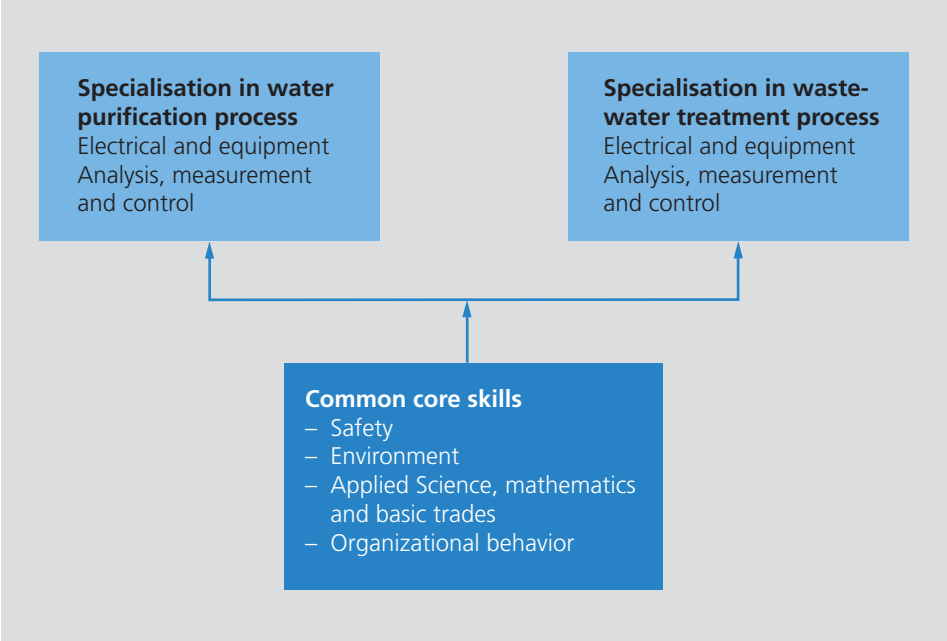


Figure 35: Preliminary BIBS curriculum

Further, each level is organised and further classified into various departments concerned. These departments will consist of sub-modules of a duration not extending more than 3 days for the convenience of trainers as well as students. For individual students taking admission to the course, it will be mandatory to complete the common modules before moving to the specialisation courses. For companies or industries working in the water sector who are interested in training their employees in specialised departments or sub-modules, tailor-made training programmes may be offered based on individual requirements.

The entire duration of training in common core skills and a specialised field will be about three months or more. For tailor-made courses, the training duration will vary depending on the training requirements.

The practical part of the training will be covered using the 'Environmental Discovery System (EDS),' which has been developed by FESTO. EDS is a physical model that simulates the core processes of the water management sector with all the components corresponding to its real counterparts in design and function (see figure 36). 3D visualisations will be used to simulate and familiarise the students with common troubleshooting scenarios on-site (see figure 37). Further, discussions are under way with companies and industries for incorporating in-plant trainings and internships into the curriculum for the trainees.

Figure 36: The Environmental Discovery System

Figure 37: 3D simulation of mechanical screening at a water plant

7
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8
Appendix

8.1
Overview of interview results

Question:
What is your sector of operation?
(multiple answers are possible) (n = 58)

	answers	ratio
Water supply – municipal	16	28%
Water supply – industrial	26	45%
Wastewater – municipal	16	28%
Wastewater – industrial	23	40%

Question:
How many employees do you have?
(n = 58)

	answers	ratio
0–49 employees	32	55%
50–99 employees	5	9%
100–249 employees	9	16%
250 and more employees	12	21%

Question:
Which of the following functions does your plant have?
(multiple answers are possible) (n = 58)

	answers	ratio
Plant manager	39	67%
Human resources department	30	52%
Training supervisor	22	38%
Internal trainers/instructors	29	50%

Question:
Does your plant have its own maintenance and repair department?
(n = 58)

	answers	ratio
Yes	51	88%
No	7	12%

Question:
<u>If yes</u>, what is the ratio between internal and external maintenance and repair?
(n = 44)

	average
Internal (“self-made”)	69%
External (“outsourced”)	31%

Question:
Do you have a sewage system?
(n = 56)

	answers	ratio
Yes	42	75%
No	14	25%

Question:
Are there any fluidics systems (pneumatic/hydraulic) in use?
(n = 52)

	answers	ratio
Yes	36	69%
No	16	31%

Question:
Do you have any automatically controlled processes?
(n = 55)

	answers	ratio
Yes	38	69%
No	17	31%

Question:
Are the following tasks carried out by yourself (“internal”) and/or by external service providers (“external”)?
(n = 57)

	internal		external	
	answers	ratio	answers	ratio
Mechanical tasks	42	74%	18	32%
Electrical tasks	39	68%	20	35%
Process technology	39	68%	13	23%
Instrumentation and process control	22	39%	18	32%
Diagnostics, measurement and laboratory work	31	54%	23	40%
Geoinformation	17	30%	21	37%
Maintenance	44	77%	25	44%

Legal acting, standards and rules	33	58%	22	39%
Health and safety	46	81%	10	18%

Question:
Please estimate the educational level of your technical staff? (i.e. without administration and facility management) ___ per cent (or number)
(n = 50)

	average
Unskilled	37%
Vocational degree	25%
Technical degree	23%
University degree	15%

Question:
How difficult is it for your organisation to find unskilled technical staff on the labour market?
(n = 43)

	answers	ratio
Easy	30	70%
Difficult	13	30%

Question:
How difficult is it for your organisation to find technical staff (vocational degree) on the labour market?
(n = 45)

	answers	ratio
Easy	19	42%
Difficult	26	58%

Question:
How difficult is it for your organisation to find technical staff (technical degree) on the labour market?
(n = 44)

	answers	ratio
Easy	21	48%
Difficult	23	52%

Question:
How difficult is it for your organisation to find technical staff (university degree) on the labour market?
(n = 39)

	answers	ratio
Easy	20	51 %
Difficult	19	49 %

Question:
How do you hire new non-academic technical staff?
(multiple answers are possible) (n = 58)

	answers	ratio
Personal recommendations	20	35%
Defined internal recruitment process	33	57%
External agency	17	29%
Other	4	7%

Question:
How do you train your new non-academic technical staff?
(multiple answers are possible) (n = 58)

	answers	ratio
Training on the job	47	81%
Defined internal training programme	18	31%
On-site training by external specialists	12	21%
Off-site training (e.g. external seminars)	9	16%

Question:
What is the typical language used when training your non-academic technical staff?
(multiple answers are possible) (n = 58)

	answers	ratio
Marathi	47	81%
Hindi	31	53%
English	24	41%
Other	3	5%

Question:
Please estimate the percentage of your non-academic technical staff that are able to understand, read and write English. ___ per cent
(multiple answers are possible) (n = 45)

	average
Understand	51%
Read	49%
Write	45%

Question:
Please estimate how many days per year you invest in total in training for your non-academic technical staff.
(n = 31)

	answers	ratio
<10 days	10	32%
10–30 days	15	48%
<10 days	6	19%

Question:
What is the average length of a typical training session for your non-academic technical staff?
(multiple answers are possible) (n = 50)

	answers	ratio
One hour	11	22%
Several hours	20	40%
One day	9	18%
More than one day	10	20%

Question:
Please roughly estimate how much practical and theoretical instruction is carried out for your non-academic technical staff. ___ per cent
(n = 43)

	average
Practical instruction	71%
Theoretical instruction	29%

Question:
Which of the following training equipment is available at your plant?
(multiple answers are possible) (n = 58)

	answers	ratio
Training room	36	62%
PC	28	48%
LCD projector	35	60%
Internet access	22	38%
E-learning platform	26	46%

Question:
Which of the following tasks are part of your training activities for your non-academic technical staff? (today)
(multiple answers are possible) (n = 57)

	answers	ratio
Training in water management	26	46%
Mechanical tasks	36	63%
Electrical tasks	31	54%
Process technology	19	33%
Diagnostics measurement/laboratory work	25	44%
Geoinformation	13	23%
Maintenance	43	75%
Legal acting, standards, rules	23	40%
Health and safety	40	70%
Problem solving, systematic acting	33	58%
Working in teams, communication	35	61%
Other	3	5%

Question:
Which of the following tasks are part of your training activities for your non-academic technical staff? (in future)
(multiple answers are possible) (n = 57)

	answers	ratio
Training in water management	28	49%
Mechanical tasks	27	48%
Electrical tasks	27	47%
Process technology	23	40%
Diagnostics measurement/laboratory work	28	49%
Geoinformation	21	37%
Maintenance	16	28%
Legal acting, standards, rules	28	49%
Health and safety	21	37%
Problem solving, systematic acting	20	35%

Working in teams, communication	24	42%
Other	9	16%

Question:
Do you send your non-academic technical staff to external training measures?
(n = 53)

	answers	ratio
Yes	25	47%
No	28	53%

Question:
If yes, to which kind of organisation?
(multiple answers are possible) (n = 52)

	answers	ratio
Supplier of technical equipment	20	39%
Private training agency	10	19%
Cocational training organisation	8	15%
College	2	4%
University	3	5%
Other	7	14%

Question:
What kind of external training support will you need in future for your non-academic technical staff?
(items 2 and 3 can be marked at the same time) (n = 56)

	answers	ratio
None	7	13%
Basic training in water management	29	52%
Training in specialised fields	34	71%

Question:
If you need training in specialized fields, please specify.
(multiple answers are possible) (n = 58)

	answers	ratio
Mechanical tasks	28	50%
Electrical tasks	23	41%
Process technology	39	70%
Instrumentation & process control	22	39%
Diagnostics, measurement & laboratory work	20	36%
Geoinformation	16	29%
Maintenance	34	61%
Legal acting, standards & rules	18	32%
Health & safety	33	59%
Problem solving, systematic acting	27	48%

Working in teams, communication	26	46%
Other	6	11%

Question:
What should be the focus of external training for your non-academic technical staff?
(multiple answers are possible) (n = 56)

	answers	ratio
Training on real objects/equipment	36	64%
Use of models (e.g. miniature plants)	29	52%
Visual support (e.g. pictures, films)	24	43%
Theoretically oriented training	15	27%

Question:
Do you have a special budget for external training measures for your non-academic technical staff?
(multiple answers are possible) (n = 52)

	answers	ratio
Yes	20	39%
No	32	62%

8.2
BIBS project consortium

Association of European Social Work, Training and Education (VESBE e.V.)

VESBE, founded in 1999, as a private initiative has many years of experience in both vocational and educational training, as well as in the support and integration of marginalised young people and job seekers. As a non-profit organisation with seven training locations in Germany, it provides vocational education and training courses to people wishing to improve their opportunities on the labour market. To this end, VESBE develops innovative concepts that deal with the structural conditions of the job and vocational training markets, and with the special conditions individuals, both young and old, bring with them. It supports international mobility and the transfer of know-how, complying, in its work, with the European quality standards for vocational education.

VESBE's main focus is on those programmes which help to prepare people to manage their work-life relationships and to become well prepared for a changing working world.

Areas of expertise:

- Consulting and project management in practice-oriented national and EU projects and initiatives aimed at upskilling and preparing people for sustainable employment and social integration
- Training, education and capacity building; retraining and re-employment programmes
- Development and delivery of tailor-made training measures; train-the-trainer courses

- Design and implementation of VET in a variety of sectors and further education courses in both Germany and abroad
- Development of curricula (modular approach) and new professional and occupational profiles
- Development of national qualification systems and vocational qualification frameworks
- Training needs analyses among target groups in industrial/economy sectors
- Establishing VET training centres
- Current regions of activity: Europe-wide, Turkey, India, Kenya

VESBE e.V. offers qualified and customised train-the-trainer courses which are crucial for upgrading and expanding VET in foreign countries as in its current project in India. These courses are designed to meet the needs of the trainers, their culture and the institutions in which they work and are in keeping with the progress of technology and VET pedagogics worldwide.

Focusing, since 2005, on the strategic activities of EU development policies across Europe, a network of partners in many countries has been built up.
Aware of the government of India's formidable goal to upskill its workforce and its wish to learn from German expertise in vocational education and training, VESBE decided in 2012 to take up the challenge and, in the summer of 2013, initiated the BIBS project, 'Exporting Vocational Training in Urban Water Management to India' with the consortium.

Institute for Sanitary Engineering, Water Quality and Solid Waste Management (ISWA), University of Stuttgart

The main tasks of ISWA are research and education as well as supporting federal and state agencies, municipalities and industry in developing solutions for practical problems. This can be accomplished, for example, through external studies of existing plants or research facilities or by providing a collection of basic data on the design and planning of treatment facilities.

ISWA is led by an executive board to which all the professors belong. It is divided into three chairs which are further subdivided into two departments, seven working groups and the Treatment Plant for Education and Research (LFKW). With a total of 150 employees, it is the largest institute of its kind in Europe.

Fraunhofer Institute for Industrial Engineering
Institute of Human Factors and Technology Management (IAT), University of Stuttgart

The activities of the Fraunhofer Institute for Industrial Engineering (Fraunhofer IAO) focus on the investigation of current topics in the field of technology management. A holistic approach is applied to the study of commercial success, employees' interests and social consequences. The Institute helps companies to identify the technologies of relevance to them, and draws up a technology strategy aligned to the competitive environment and the market. It plans the deployment of technology for the entire enterprise, in the business sectors and in individual projects.

Depending on the requirements of the company, the Institute develops or modifies technical systems. The Fraunhofer IAO plans and organises future-oriented structures suitable to the needs of people involved in production, as well as in the administrative and technical departments of companies in industry and the service sector. Research focuses on the development of advanced information and communications systems.

In keeping with the holistic approach pursued, attention is also given to the individual and social values held by people in their working environment. This not only addresses the task of creating ergonomic solutions, but also the additional qualifications required by employees in coping with the decentralised organization of work and the implementation of new technologies and new services.

Fraunhofer IAO offers practicable answers to such questions. Back in the 90s, the institute set up a Service Engineering division that is now internationally acknowledged. Based on the thesis that the service market can learn a lot from classic product development, we supply systematic methods for new service launches or for making existing service portfolios more efficient and customer-friendly as well for service quality assessments in different industries (e.g. machine production, health care, tourism). Design of so called soft factors, for such as the interaction between service provider and customers, plays a major part. Fraunhofer IAO has also established the ServLab, a globally unique innovation and testing platform for service development activities as well as service quality improvements.

Research projects are conducted in close collaboration with small- and medium-sized companies and industrial corporations under direct contract. The Fraunhofer IAO participates in publicly funded research programs, such as the Information Technology and Work and Technology programmes of the German Federal Ministry of Education and Research, in programmes of the European Union, as well as in programmes funded by the State of Baden-Württemberg.

Fraunhofer IAO works in close cooperation with the Institute for Human Factors and Technology Management (IAT) of the University of Stuttgart. Both Institutes employ a permanent staff of over 250. More than ten 200 m² offices, laboratories and technical installations are available to carry out contracted research.

All India Shri Shivaji Memorial Society (AISSMS) College of Engineering

The cooperation partner on site is the All India Shri Shivaji Memorial Society founded by the Maharaj of Kolhapur in 1917 with the sole purpose of promoting education. The society runs 19 educational institutions including the College of Engineering. It also runs an Industrial Training Institute (AISSMS ITI) in Pune which is the only training centre in Maharashtra which is ISO 9001: 2000 certified. With the support of the College of Engineering, AISSMS ITI will design additional courses in urban water management with the consortium and adapt the courses already available to a new training programme.

8.3 BIBS project team

Thomas Burger is a project manager and consultant at Fraunhofer IAO. His main research interests are in the field of developing and designing new services as well as the testing of services. He is a lecturer in service engineering, service innovation and service quality at bachelor's and master's level for several national and international universities. He is also responsible for the ServLab – a platform for the visualisation and testing of services.

Jürgen Lau is the Managing Director and founder of VESBE e.V. and has over 25 years of experience in creating VET concepts and programmes. He has a degree in Social Pedagogics and is a certified systemic therapist. He is an expert in planning and managing EU-funded projects as well as in setting up VET centres and designing curricula.

Peter Maurer (born in 1965) is head of the Education and Research Wastewater Treatment Plant of the University of Stuttgart. He has worked for several years as an engineer and as an engineering consultant for a research institute for environmental energy. During this period, he gained comprehensive practical experience. Today, his main tasks are to manage and further develop the wastewater treatment plant and other semi- and labscale plants. He assists the Institute Research Division as an advisor resolving technical queries. He is responsible for the application and implementation of research results into practical processes and systems. He is a long-term active member of the German Water Association (DWA) with main focus on education and training of technical staff.

Annika Meinecke, BIBS Project Management, is a political scientist and has worked as a teacher of German and politics. She has been working for VESBE e.V. since 2012. She is a specialist in didactics and learning methods and is responsible for project acquisition.

Thomas Meiren studied Industrial Engineering and Management at the University of Karlsruhe (Germany). In 1996, he joined the Fraunhofer Institute for Industrial Engineering as a research assistant. Since 2000, he has been head of the department New Service Development and since 2012 deputy director of the business unit Service Management and Human Resource Management. The main research interests of Thomas Meiren are in the field of developing and designing new services. In numerous research and consulting projects, he has made a significant contribution in establishing the discipline of Service Engineering in Germany. He is the author of more than 120 publications. Thomas Meiren is founder and vice president of the Verein Deutscher Dienstleistungsingenieure (German Association for Service Engineering).

Zaheer Ahmed Shariff is a scientific researcher at the University of Stuttgart and is working on the export of vocational training in water management to India. He is a Chemical Engineering graduate with a master in Environment and Resource Management from Germany. He has been working in the R&D field of water treatment for more than 3 years.

Sylvia Wohlfarth-Bottermann, BIBS project coordination, has an MA in Social Anthropology and Sociology and has worked for six years at VESBE e.V. She has worked for over 20 years as an English trainer for third line development aid experts and in the petrochemical sector. Her specialist areas include international development cooperation, tropical agriculture and intercultural communication.

8.4 Funding Priority

The Federal Ministry of Education and Research (BMBF) cooperates with many countries in the area of vocational training. It supports German providers of initial and continuing vocational training in developing the rapidly growing international education market. In bilateral working groups under the leadership of the BMBF, German representatives and their international counterparts discuss current developments in vocational education. In this area, Germany contributes to finding solutions on the basis of its world-renowned dual system of vocational education and training. In addition, the BMBF maintains dialogues in educational policy with a variety of other countries.

Around the world, education and knowledge and, increasingly, vocational education are identified and acknowledged as drivers of innovation, economic growth and prosperity. However, many countries are unable to meet the existing and growing need for high-level qualifications within their own education systems. Demand, and thus the potential of international education markets, is therefore enormous, in particular in the field of vocational education and training.

From an international perspective, there is a high level of interest in benefitting from Germany's expertise and strengths in the field of vocational education. In a globalised and increasingly knowledge-based world, exporting training is a market that has great potential for the future. Training exports from Germany currently amount to around EUR 9.4 billion. This situation offers a range of opportunities for Germany: The export of services by German training and education providers can result in a direct economic benefit, with the export of services associated with a more dynamic trend than the export of goods. The export of German training and education services also has a leveraging effect on German industry because the export of goods in the field of mechanical engineering or the automotive industry, for example, is often highly dependent on the availability of well-qualified expert staff abroad.

High-quality vocational training will increasingly become a key factor for the competitiveness of German companies on international markets. Well-qualified experts therefore pave the way for further exports for German industry. In addition, well-qualified experts abroad facilitate international business relationships for German companies. Partnership in vocational education also has a socio-economic and political dimension and can contribute to the ongoing strengthening of Germany's positive image abroad.

The German government has therefore put in place a funding programme to support German training and education providers offering research projects that tap into these opportunities for partnership and the associated market potential.

8.5 Imprint

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Bibliographic information published by Die Deutsche Bibliothek:
Die Deutsche Bibliothek lists this publication in the
Deutsche Nationalbibliografie; detailed bibliografic data
is available in the Internet at http://dnb.d-nb.de

ISBN: 978-3-8396-0884-5

Cover-Illustration and Typesetting: SpiegelGrafik, Stuttgart

Printing and Bindery: Mediendienstleistungen
des Fraunhofer-Informationszentrum Raum und
Bau IRB, Stuttgart

Printed on acid-free and chlorine-free bleached paper.

Fraunhofer Information Center for Planning
and Building IRB
P.O. Box 80 04 69, D-70504 Stuttgart
Nobelstraße 12, D-70569 Stuttgart
Phone +49 711 970-2500, Fax -2508
verlag@fraunhofer.de
http://verlag.fraunhofer.de

ISBN 978-3-8396-0884-5