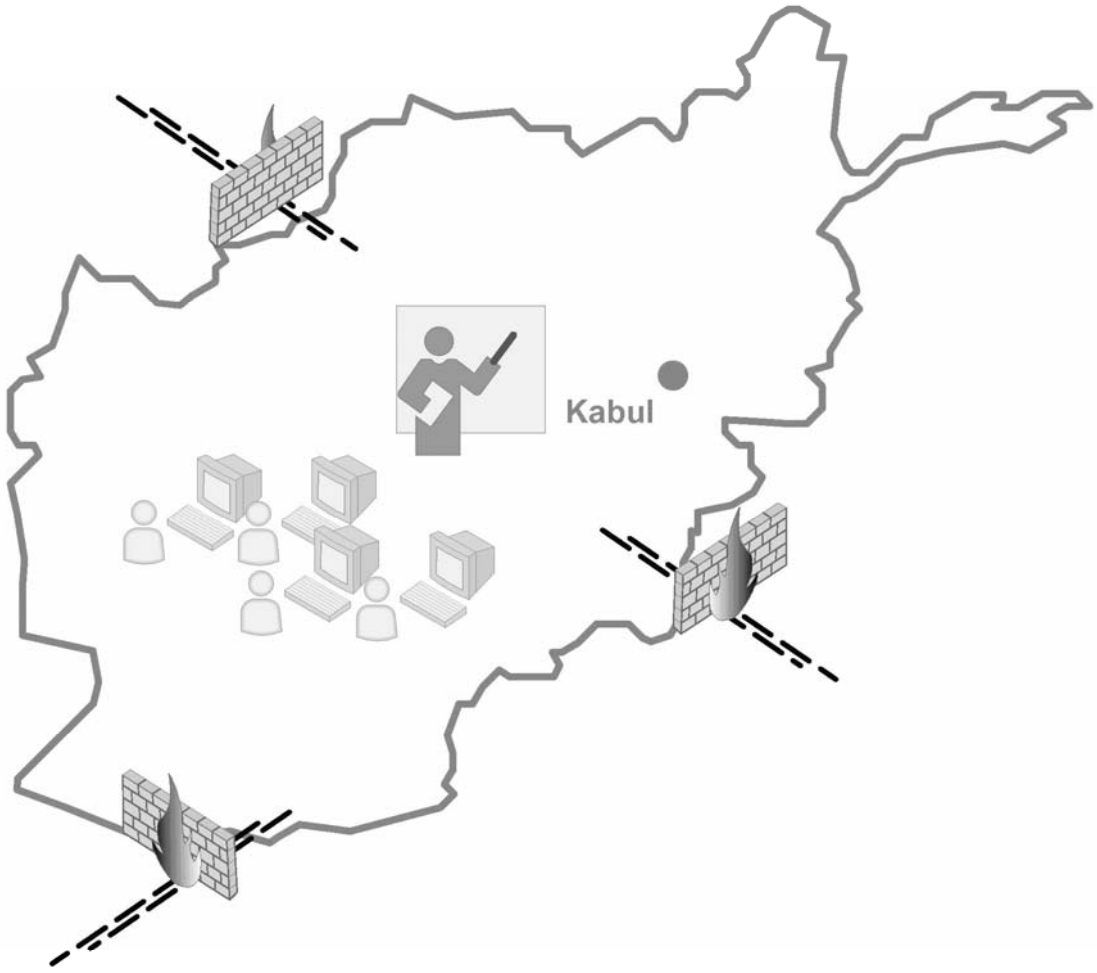
IT-Security in Afghanistan:

Fundamentals for a secure IT-Infrastructure - based on the German IT-Baseline Protection Manual



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Alexander Domene • Björn Stahl

Die selbstständige und eigenhändige Anfertigung versichern wir an Eides Statt.

Berlin, den _____

Alexander Domene	Björn Stahl

Acknowledgement

A journey is easier when you travel together. Interdependence is in this case certainly more valuable than independence. This thesis is the result of a long period of working together whereby we have been accompanied and supported by many people. It is a pleasant aspect that we have now the opportunity to express our gratitude to them.

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Last but not least we are very thankful for the faithful and enduring moral support from our girlfriends Tanja Terruli and Bettina Petersen.

"Knowledge is power. Information is liberating. Education is the premise of progress, in every society, in every family."

Kofi Annan

Seventh Secretary-General of the United Nations, 2001 Nobel Peace Prize.

Contents

1 Introduction

Afghanistan, the country and its people are almost unknown to Germans or Europeans in general, although the media have reported a lot on Afghanistan in the recent past.

The university course "Software Development for Developing Countries" held by Dr. Nazir Peroz at the Technical University of Berlin aims to involve the students into mapping out a strategy for Afghanistan's future. Dr. Peroz fills the lack of knowledge with several student projects and strives for the development of his homeland. The students work independently, developing knowledge data bases, software systems and strategies. The side effect of getting to know Afghanistan better is certainly welcomed.

Probably similarly to many others, our first involvement with Afghanistan occurred with the above mentioned university course. During our studies and even during our spare time, IT security and cryptography occupy most of our time. Our project "IT Strategy in Afghanistan" in the end led us to the conclusion that IT security is unfortunately almost ignored in the process of rebuilding Afghanistan. The objective of this thesis is to find out why, and to make suggestions for change. Being Germans, we naturally examined how this country had approached the matter in the past. Germany failed in establishing a universally valid, strong and manageable set of regulations, while developing its IT infrastructure. Later, the government realized this particular issue and founded a federal office for security in the information technology.[1] An expert group of its employees developed the "IT Baseline Protection Manual" (IT BPM) which became very popular and is now used by many other countries as a template for their own regulations. Although the IT BPM includes configuration advisories for computer and software systems, it is mainly addressed at management.

The structure of the "IT Baseline Protection Manual" is definitely one of the main reasons why it became so popular. The book consists of two separate parts. On the one hand it describes the potential security threats, while on the other hand suggesting solutions. The great advantage to other books of the same kind is that every specific identified secu-

[1] BSI – Bundesamt für Sicherheit in der Informationstechnik

rity threat is directly related to a collection of proposed solutions.

Our idea was to adapt the "IT Baseline Protection Manual" to the conditions of Afghanistan. Soon our research made it very clear to us that Afghanistan is currently in such an early state of development that implementing the IT BPM would make little sense. Furthermore, the form and structure of the IT BPM with its extensibility, regular revisions and the expected high infrastructural standards would make an adoption of it inappropriate. From our view, the superior approach would be to await the development of Afghanistan to a point where the full "IT Baseline Protection Manual" can then be applied.

To decide, on which direction would best suit Afghanistan, the first important step for us would be to understand and know the needs and wishes of the Afghan people.

The first chapter "About Afghanistan" introduces the country and the people of Afghanistan. It offers a historical overview with climatic and geographic classification and explains its people's culture.

With this regard, an extensive and comprehensive description of the different ethnic groups is given, followed by an outline of their respective culture. The implications for management to deploy security regulations and specifications are also pictured.

It is impossible to suggest a proper IT security development plan for Afghanistan without figuring out the preconditions of the "IT Baseline Protection Manual". Therefore, the approach was to emphasize the relevant differences between Afghanistan and Germany and show how they matter for this comparison. The idea is that a country is based on several foundation pillars (infrastructure, politics, education, economy, judiciary, and society). Their conditions influence the current and future situation of a country significantly.

The chapter "Current Situation in Afghanistan" is the result of our efforts to gather reliable data for each of the foundation pillars. The focus of our research was to first gather data on the IT infrastructure and secondly, to collect information and data of those areas which influence the development of IT infrastructure and businesses.

As our current situation analysis was motivated by the need to contrast between the current situations of Afghanistan

and Germany in order to outline the differences. These can be seen as the preconditions of the IT BPM, so we decided to gather the same data for Germany.

The analysis will reveal that Afghanistan is a unique country in many respects. Chapter "General Recommendations for Afghanistan" will give some advice for the selection of software products. In addition, bearing in mind Afghanistan's special climatic conditions, where hardware components design (including commodity PCs) must be suited to that environment, therefore this chapter presents some hardware solutions to resist such extreme climatic conditions.

In addition, "Current Situation in Afghanistan" also reveals a huge lack in the education system. At the moment, IT vocational training solely exists in theory. Obviously, well-trained technicians are needed in order to secure sustainable development. As a consequence, the last chapter designs and implements an educational concept for a new IT vocational training in Afghanistan.

The German vocational training system has a good reputation throughout the world. Therefore we used it as a base to develop a vocational training program for IT all-rounder in Afghanistan. Every German vocational training program focusing on IT is analyzed in "Vocational Training" (chapter 5.5). Based on that, a concise vocational training program to best fit the needs of Afghanistan has been developed, and is outlined in "The Concept: Assistant of Applied Information Technology" (chapter 5.6).

2 About Afghanistan

2.1 Introduction

Unfortunately, one reason why Afghanistan has become know to a larger audience is because of the war with the USSR and during the reign of the Taliban regime. Almost anything about Afghanistan has been discussed by Radio and TV broadcasting stations. A lot of publishers have also stationed reporters in Afghanistan who collect information and report for their media. Coming from a European country obviously the question comes up whether the western media (e.g. CNN, BBC, ARD, and Spiegel) are objective enough to give a solid and fair press coverage, inferring from this claim that the freedom of the press is circumcised would be ridiculous. Cultural misunderstandings, misleading from several lobby groups and disinformation in general might lead to an unobjective view. Sometimes this is caused by a certain lack of deep knowledge about the country, which then again makes one question which information can be relied upon.

At a first glance, it is not quite obvious why a chapter about Afghanistan, its history, climate and culture is useful in this thesis. Although none of these topics are closely related to information technology, they are very important to establishing a concept for an "IT Baseline Protection Manual" or further building an IT-Strategy for this country.

Basically, IT does not exist in a vacuum, it is designed by people, built by people and used by people.

"It's clear to me that computer security is not a problem that technology can solve. Security solutions have a technological component, but security is fundamentally a people problem." (Schneier, Bruce, 2004; p.2)

To better understand Afghanistan and its people, a historical overview is given in the next subchapter followed by a geographical and climatical classification.

Culture is made by humans. It is a product of collective social behavior and thinking of individuals. (lit. Keller, Eugen von, 1982; p. 114 ff)

Therefore culture significantly influences people. In order to design an IT BPM for a specific social group it is necessary to respect and understand their cultural background, which will be introduced in the third subchapter.

2.2 History

The area of Afghanistan was first referred to in the ancient world as the country *Baktria*. Later in 998 A.D., after the Persian Empire was conquered by the Ghaznavid Empire, it was called *Ghazna*. In 1205 A.D. the Shah Muhammad II conquered Persia and also *Ghazna*, but in 1209 A.D., Mongols invaded the territory.

But after Genghis Khan's death in 1227 A.D., weak sovereigns ruled the country, until in the 14th century Timur Lenk, a descendant of Genghis Khan, founded an Asian empire in the area which now forms modern Afghanistan.

At the beginning of the 16th century, Afghanistan was a principality. Babur, the founder of the Moghul Empire, made Kabul the capital of Afghanistan.

In 1747 A.D. the Persian ruler Nadir Shah was assassinated. After this incident the first Loya Jirga (see Politics, chapter 3.3) was assembled with the objective to elect a king. The members agreed upon Ahmad Shah Durrani, a Pashtun. He founded a country with similar borders like today's Afghanistan. Until 1978 all of the following rulers were from the Durrani's Pashtun tribal confederation.

In the 19th century, the Russian and the British Empire influenced Afghanistan through their expansion into Central Asia.

Afghanistan was the buffer between both countries. Military activities, espionage and diplomacy during that time were called "The Great Game".

To influence the succession on the throne of Afghanistan, the British Empire started a war, which is known as the first Anglo-Afghan war (1838-1842). The British failed and Afghanistan was not conquered and affiliated with India. The war ended disastrously for the British army.

The refusal of Amir Shir Ali to accept a British mission in Kabul provoked the second Anglo-Afghan war (1878-1880). At its end, a new king ruled the country, Amir Abdur Rhaman(1880-1901) and the British and Russians established the borders of Afghanistan as they still remain until today. This includes the new border in the North, where Afghanistan adjudged the South of Turkistan. During World War I, Afghanistan remained neutral.

Afghanistan became independent after the third Anglo-Afghan war in 1919; therefore the Afghans celebrate their Independence Day at August 19 when the British concede their struggle to control the foreign affairs of Afghanistan.

The so called "treaty of Rawalpindi" was the predecessor of the treaty of Kabul in 1921. From 1925 on, Afghanistan was governed by a constitutional monarchy.

"The Great Game" ended in 1947 with the withdrawal of the British Army from India.

The first free elections were held in 1965 and, also for the first time, a ministry was held by a woman.

On July 17, 1973, Afghanistan declared itself a republic. Traditional tribes and communists struggled for power. The political situation became unstable and in 1978 the Prime Minister was overthrown and Nur Mohammad Taraki became the new Prime Minister of the Democratic Republic of Afghanistan. He depended on the USSR and tried to modernize the society through secularization and the establishing of women's suffrage. His party, the PDPA, collaborated with the USSR to modernize the infrastructure and the Russians were contracted to build schools, roads and hospitals and they supplied and trained the Afghan army. This new political orientation along with the dependency on the Soviet Union raised resistance in the population led by some members of the traditional government. The Afghan army received the order to stop the rebellion and prevent sabotage against industrial facilities and the infrastructure, but the army was not able to handle the number and frequency of the attacks. The USSR considered sending troops to Afghanistan to support the government of their satellite state.

After the death of Taraki in October 1979 Soviet troops invaded Afghanistan in December 1979. Hafizullah Amin, the initiator of the "coup d'ètat" and the vice president of the Khalq fraction of the PDPA, became the new President. But shortly afterwards, he was assassinated by the KGB[2] Spetsnaz Special Forces (Osnaz – Alpha Group[3]) who seized the presidential palace[4] and Babrak Karmal, the leader of the Parcham fraction of the PDPA, supported by the Soviets, an-

[2] Committee for State Security, soviet intelligence agency and secret police; the successor organisation is the FSB

[3] In that time known as Thunder

[4] This operation was called Storm 333

nounced him as the new President and Prime Minister of the Democratic Republic of Afghanistan.

The invasion of the Soviet Union initiated the war between the USSR and the mujaheddin[5] which lasted for 10 years. The mujaheddin were heavily supported with money and training by the U.S.A. (CIA[6]), Pakistan (ISI[7]) and Saudi Arabia. They forced the Soviet and Afghan army to fight a guerilla war.

In 1986 the Soviets demanded to replace Karmal with Mohammad Najibullah as a result of several conflicts inside the PDPA. At about the same time, the Soviets started their largest attacks on the mujaheddin forces and specifically onto their supply lines to Pakistan. As a result, the U.S.A. and Saudi Arabia increased their military support for the guerilla war of the mujaheddin, which was the major reason why the mujaheddin could withstand the Soviet army. To illustrate this involvement: "The CIA helped supply nearly 500 Stingers[8] (some sources claim 1500) to the mujaheddin militants fighting Soviet forces in Afghanistan".

Stinger missiles proved their effectiveness to fight Russian helicopters. The Mi-24 helicopters were used by the Russians to attack the mujaheddin and their settlements. The Stinger missiles compensated the strategic advantage of helicopters and endangered the Russian army.

The considerable loss of men and the lacking support by their people lead the USSR government to change their mind. The death of Brezhnev and the new leadership of Mikhail Gorbachev combined with his "Perestroika" policy, the opening of the political system to the west. Gorbachev initiated the withdrawal from Afghanistan, which was also part of the Geneva Accords, (1987-1989, negotiations between the USSR and the Democratic Republic of Afghanistan, initiated by the UN). Pakistan influenced Afghanistan with indirect negotiations, although Pakistan did not accept Afghanistan's sovereignty. In 1985, the USSR and DRA agreed on the accords and on February 15, 1989 the remainder of the Soviet army finally left Afghanistan.

[5] Also transliterated as mujāhidīn, mujahedeen, mujahidin, mujaheddin, mujahideen; a holy warrior

[6] CIA stands for Central Intelligence Agency.

[7] ISI stands for Inter-Services Intelligence Directorate.

[8] [8] http://en.wikipedia.org/wiki/FIM-92_Stinger

The withdrawal of the Soviet troops initiated a civil war which lasted for three years. The mujaheddin, who did not participate in the negotiations of Geneva, kept fighting against the national army. Meanwhile, Boris Yeltsin became the leader of the Soviet government. He signed a mutual agreement with the United States to cut off all military aids to both sides of the Afghan civil war.

The mujaheddin suffered during the war mainly because of their own, uncoordinated attacks, while their opponents were a skilled army, who was trained by Soviet Special Forces. But due to political fractions, Kabul was finally conquered by the mujaheddin after several recoils. Najibullah lost his control as the chief commander of the Afghan army and turned over to the mujaheddin.

After president Najibullah left, an Islamic Jihad Council took over. During the first two months it was led by Sibghatullah Mojadeddi, later on Burhanuddin Rabbani became the new president.

In 1996, the Taliban came to power and established their political system. Only two years later they controlled 90% of the country. The Taliban Regime was never diplomatically accepted by the United Nations, in contrast to their opposition, the Northern Alliance[9].

After the terrorist attacks in the United States on September 11, 2001[10] a coalition led by the USA attacked the Taliban regime.

The Taliban were defeated by the coalition forces and a new administration was established with the "Bonn Agreement", which chose leaders of the Afghan factions. After 6 months, Hamid Karzai, the interim president, was officially chosen by the Loya Jirga, convened by the former King Zahir Shah.

(Library of Congress, 2005)

[9] Northern Alliance - cluster of fighters who have opposed the country's Taliban regime for the past five years

[10] Terroists highjacked commercial airplanes and destroyed both towers of the world trade center in NY; see wikipedia: "September 11, 2001 attacks"

2.3 Geography and Climate

2.3.1 Motivation

While thinking about security in IT-Infrastructure, one has to consider the environment in which the IT-Systems operate. If they are to function in an environment with strong heat or high humidity they could suffer serious damage, but these being only two examples of potential hazards. The German "IT Baseline Protection Manual" expects that the climate environment for normal desktop computers or workstations is similar to Germany or climatically similar countries. To achieve a serious improvement towards IT-Security in Afghanistan, especially the reliability of the IT-Systems, the climate and geography of Afghanistan have to be analyzed and checked for different requirements.

2.3.2 Topography

Afghanistan is located in the Southwest of Asia and is a landlocked country.

Afghanistan is surrounded by Turkmenistan, Uzbekistan, and Tajikistan in the North. To the West lays Iran, to the Northeast the People's Republic of China and in the East and South is Pakistan.

Figure 2-1: Afghanistan; from Library of Congress, 2005

The total land area is approximately 650,000 square kilometers with a population of 27 million people. But nearly 63% of the country is mountainous and about a quarter of it lies above 2500 meters of altitude. This mountainous area is called the Hindu Kush consisting of twenty summits, some of which reach a height of over 7,000 meters.

The country is divided by the Hindu Kush into three areas: the Northern plains, the central highlands and the South-Western plateau.

The Amu Darya River (Oxus River) rises in the Pamirs, runs through the North of the Northern plains and forms a natural border to Uzbekistan and Tajikistan. In this very fertile region farming is the main occupation. The natural resources are limited to minerals and natural gas.

The central highlands are affected by the topographical structure of the Hindu Kush - a lot of high mountains with deep narrow valleys. The Khyber Pass is located in the central highlands. It connects Afghanistan with Pakistan and is about 53 kilometers long.

Through the centre of the Southern Plateau runs the Helmand River which is the longest river in Afghanistan.

These flatlands reach to the foothills of the Hindu Kush and the Amu Darya River in the North. To the South the Plateau turns into sand deserts.

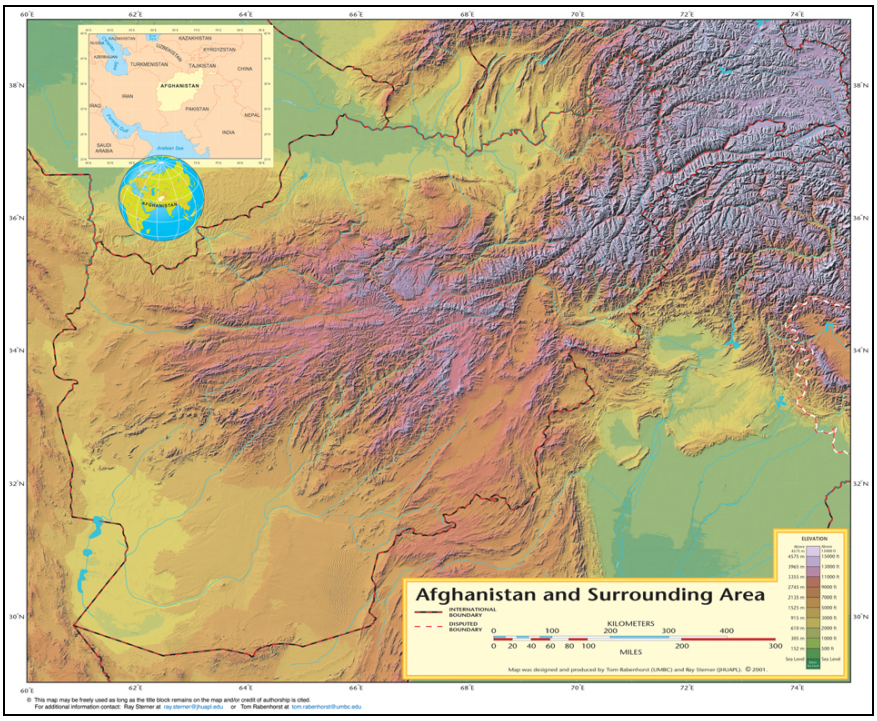


Figure 2-2: Topographical Map

2.3.3 Climate

The climate is continental, which generally means cold winters and hot summers but is very diverse between the various regions. Even between day and night, the temperature change could be considerable. The weather is influenced by the Mediterranean weather fronts. The rainfall is typically low and erratic, so it could be categorized as arid to semi-arid. But the Eastern region of Afghanistan is affected by the monsoon system and influenced by the near Indian subcontinent.

In the central highlands the winter is very cold; the temperature falls below -15°C for several weeks.

The Southern Plateau can reach temperatures in the summer of about 50°C. It has a hot and dry climate.

These climatic conditions demand specific arrangements with regards to computer hardware. Especially the high temperatures in the summer could overheat the computers easily. Two points have to be considered:

- Sand and Dust: Both could block ventilations slots and lower the effectiveness of ventilators inside computer cases.

- Temperature: (i.e. high temperature and quick temperature changes): Several hardware components of a computer produce heat while working, although heat can damage the functioning. An effective cooling system can compensate the heat, but quick temperature changes could excite condensation and cause short circuits

Proper solutions and regulations to face this climatical environment are presented in chapter 4.1 Hardware.

2.4 Culture

"The cultural background has to be considered when introducing science and education into a developing country." (Tedre et al., 2003)

Policies and security guidelines do not only involve the employee, the manager or the system administrator in their role for the company. They also demand a lot of understanding, awareness and a huge sense of responsibility.

The "IT-Baseline Protection Manual" was written and developed by Germans; therefore it might not be directly applicable to Afghanistan.

This is also evident for education plans and the resulting teaching practices which will be discussed in detail in the chapter "An Education Concept".

One approach must be to understand the circumstances that people live with in Afghanistan. The Environment is described in chapter 2.3 and an in-depth analysis of Afghanistan can be found in chapter 3. Society cannot just be described by the facts mentioned in chapter 2.4. The obvious difference between two societies can be described as culture.

Therefore, this chapter will bring up the differences in culture and give some ideas how the "IT-Baseline Protection Manual" could be adopted.

Definition

Before the differences can be analyzed it is important to first define the subject of comparison. Although, for the majority of people, the term "culture" sounds familiar- its definition is still under discussion.

"Among most researchers in this area one definition has become widely accepted." (lit. Prats, Carmen, 2003; p. 16)

"Culture consists of patterns, explicit and implicit of and for behavior acquired and transmitted by symbols, constituting the distinctive achievement of human groups, including their embodiment in artifacts; the essential core of culture consist of traditional (i.e. historically derived and selected) ideas and especially their attached values; culture systems may, on the one hand, be considered as products of action, on the other hand, as conditioning elements of future action." (lit. Prats, Carmen, 2003; p. 16)

Cultural Model

It's always the management whether from a school, company or governmental institution which is taken first into account when Security Policies and Guidelines need to be applied; therefore Geert Hofstede's studies are great to evaluate the applicability of the IT BPM directives and to further estimate how educational units might have to be altered.

Geert Hofstede's research towards comparing cultural differences in management can be seen as the most complex and most widely accepted results in intercultural management research. It offers a scientific proof for the existence of cultural differences in Management-Behavior. Three different research projects formed the base for his culture-model. He surveyed 116'000 employees of IBM (in 64 countries) and discovered that the differences between two societies can be reduced to four dimensions. (Herbrand, Frank, 2002; p.20)

In his research Hofstede mainly focused on the personal values of the employees concerning their work situation and their relationships towards their managers and colleagues. (cp. Prats, Carmen, 2003; p. 20)

IBM was not engaged in Afghanistan during Geert Hofstedes studies and therefore no data could be collected for Afghanistan.

But Geert Hofstede analyzed countries with similar ethnicity and defined a group "Arab World", which includes Egypt, Iraq, Kuwait, Lebanon, Libya, Saudi Arabia, and the United Arab Emirates.

In the following the different ethnic groups in Afghanistan are introduced.

First to estimate whether Afghanistan can be grouped to the "Arab World" and second to introduce the people of Afghanistan to readers who are not familiar with these ethnic groups.

2.4.1 Ethnic Groups

"As a landlocked nation, Afghanistan is at the crossroads for much migration and many settlements. The result of this exposure is a country with diverse ethnic and linguistic groups." (lit. MCI, 2004; p. 20)

Discussing culture and "comparing" the Afghan culture with the German culture must be handled simultaneously to introducing major cultural and ethnic groups. Further, the analysis of different ethnics is an important step for the evaluation on whether and how Afghanistan can be grouped into the list of countries in Geert Hofstede´s cultural studies. This is fundamental for the cultural comparison (see chapter 2.4.2 "Comparison").

Germany is not a country with very distinct ethnics and therefore the IT BPM does not consider the challenges deriving from such diversity.

The IT security guidelines of the IT BPM can only be deployed successfully in Afghanistan when the different ethnics and their social background are carefully considered. What is more important, the subchapter history (see chapter 2.2 "History") has revealed some background on why the relationships between some ethnic groups are still tense. This should be kept in mind.

It is not this thesis´ objective to propose general guidelines for the management of a school, governmental institution or company on how to deal with these differences while deploying IT security guidelines or regulations. Therefore, the goal of the next sections is to give an overview of the major different ethnic groups living in Afghanistan to those readers who are unfamiliar with them. They are based on: MCI (2004), *Afghanistan: An Introduction to the Country and People*.

Figure 2-3 provides a quick overview on the geographic location of the various groups.

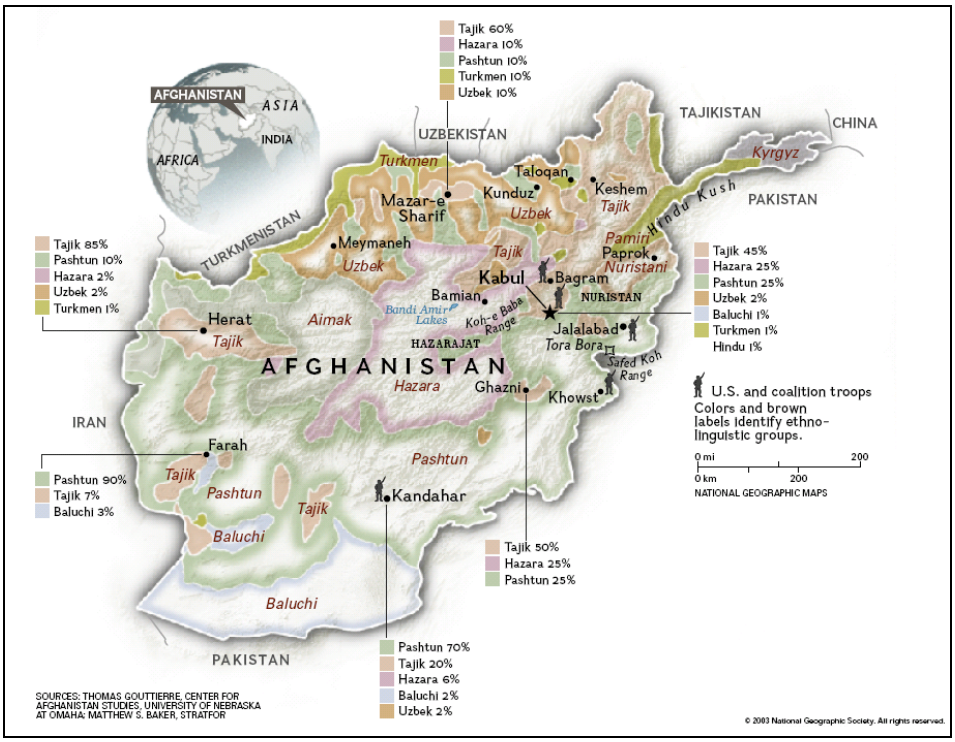


Figure 2-3: Ethnic Groups in Afghanistan from www.afghan-network.net/maps

Pashtun

Pashtuns live mostly in Southern and Eastern Afghanistan from Kabul in the East to Kandahar and Zaranj on the border of Iran, Pashtuns even live in Pakistan.

Pashtuns are Sunni Muslims and speak Pashtu, but many Pashtuns also speak Dari, the second language of Afghanistan.

They make up about 38 % of Afghanistan's population.

Some Pashtuns are herders who move from site to site following the pastures as the season changes. They live in tents made of goat hair. But most of the Pashtuns live in tribal villages, sometimes near a town. Obviously a village is primarily built with regard to the location of water and the suitability to self-defense. Most likely, the Pashtun communities, as many others, have a strong community feeling from where several social rules derive. Family ties determine how far away the groups live relative to the dominant tribe and dominant lineages usually occupy the best land.

Pashtuns earn their livelihood with grain farming and animal husbandry, but their industry usually includes trades such as shoemaking and carpentry, too.

Pashtun villages mostly may have a neutral or defensive attitude against the central government, because they con-

sider that the national government is responsible for conscripting young men into the military and taxation, both of reduces the available resources in their village.

Further, Pashtuns follow several traditional customs. The "Purdah" demands the strict separation of the sexes in public, the "Chadori" obliges women to wear the veil and the "Pakhtunwal" requires: "A mixture of blood-line revenge, hospitality to guests, defense of those who are in one's care, chastity of married women and caring for the weak." (MCI, 2004; p. 13)

Tajik

Tajiks are the principal inhabitants of the republic of Tajikistan. It is not surprising that the Tajiks also live near the border to Tajikistan in the large area North and West of Kabul. as well as around the city of Herat.

Tajiks are Sunni Muslims. They speak the Dari and Tajik languages. Tajik live mostly in urban areas. As they typically are well educated and comparatively wealthy, they form most of the elite of Afghanistan with a great influence in commercial activities. But besides the cities Tajiks have also settled in the rural areas where they make their living by farming and herding, but are a sedentary people whose village leaders usually own the land.

Tajik's are the second largest group close after the Pashtuns. They are competing for the reign of Afghanistan along with the Pashtuns.

The Tajiks also formed an important part of the Northern Alliance, which fought against the Taliban.

Hazara

Hazaras are a smaller ethnic group. They make up to 19 % of the people of Afghanistan. They are Shi'ite Muslims.

Their settlements are widely spread over Afghanistan, in the North, close to the town of Bamian, in the West in Chaghcharan, in the East around Kabul and in the Southeast near the town of Ghazni.

But many Hazaras were forced off their land by the expansion of the Pashtuns and now live in Kabul and other towns.

The Hazaras speak Hazargi, which is a mixture of Farsi (official language of Iran), Mongol and Turkish.

Hazaras make their living of farming and trade. The main crops are wheat, barley and tobacco. Besides, the wool from Hazara sheeps is considered to be the best in Afghanistan.

In difference to the Tajiks, but just like the Pashtuns, the Hazaras live in tribal settlements or large clans. There are about 15 "super-clans" spread over Afghanistan. The members of one clan usually live in the same geographic area.

Their position as a religious and ethnic minority in Afghanistan has been the reason for a constant tension between the local Hazara tribes and the central authority of Afghanistan.

Uzbek

The Uzbeks live in a population belt along the Northern border of Afghanistan from Maymaneh through Mazar-e-Sharif and Kunduz, which parallels to Afghanistan's Northern border with Turkmenistan and Uzbekistan.

The Uzbeks are a Turk-speaking ethnic group, forming about 6% to 8% of the population of Afghanistan. They are also the dominant population of Uzbekistan.

Uzbeks make their living of farming and trading, although they can be separated into two types of groups: Nomads and farmers. The farmers and city residents are mainly tradesmen and businessmen. The nomads raise sheep, cattle and goats.

Both group's main settlement type is the village, the so-called nomadic village being mobile and the so-called farming village being a concentrated, permanent settlement. Both village types are based on kinship.

The Uzbeks, despite being a small group, have always played an important role for Afghanistan in opposing the Taliban.

2.4.2 Comparison

At first glance it might seem that the ethnic groups mentioned above, can not be generalized into one, but there are several similarities:

- make their living either from farming, herding or trading
- were engaged during the war against the Taliban
- are Muslims

Another important common denominator between all of the ethnic groups is also the Islam religion.

In total, it can be stated that Afghanistan is to be grouped within the "Arab World" and that a comparison of the appraisal for the "Arab World" with the appraisal of Germany would also reflect the cultural differences between Germans and Afghans.

Geert Hofstede also defines culture as being "software of the minds" and "mental programming" (lit. Prats, Carmen, 2003; p. 19). This is an analogy to the methodology of computer programming.

"Mental programs' can be interpreted as types of action, emotion and thinking. Of course this does not mean that humans can be, or should be programmed in any manner. Furthermore it is interesting that humans are characterized as being only dependant on mental programs to a specific extent. Basically, humans are capable of thinking in unexpected, creative ways. The mental software does only suggest which reactions corresponding to the human's past are likely and comprehensible. The roots of our mental programs are based in our social environment, where and how we were raised and collected our life experience". (lit. Hofstede, Geert, 1993; p. 18)

Building on this idea, Geert Hofstede conducted one of the most important studies in cultural research.

Geert Hofstede´s cultural model represents the differences of two societies by comparing their rating in five different dimensions (Power Distance, Individualism, Masculinity, Uncertainty Avoidance, and Long-term Orientation). The following paragraphs introduce and explain these dimensions. Later on, the appraisal of these ratings for Germany and Afghani-

stan will be compared. Lastly, the implications of these comparisons will be demonstrated.

Power Distance

Geert Hofstede defines the dimension Power Distance as "the extent to which less powerful members of institutions and organizations accept that power is distributed unequally." (lit. Hofstede, Geert, 1980; p. 419)

In societies with a low Power Distance the emotional distance between the manager and the employee tends to be low. The dependence on the manager is low and a cooperative leadership is preferred. The manager is always available for discussion and the employees have little fear to disagree with their manager.

Managers and employees in societies with high power index accept the unequal distribution of rights as given by nature. Power is concentrated on only a few people, who give their employees clear and straightforward tasks. Typically, an employee is highly dependent from his or her manager. The use of power should derive from a feeling of responsibility and therefore the ideal manager would be a benevolent autocrat. (cp. Herbrand, Frank, 2002; p. 21)

Individualism

The Individualism index describes the degree of the integration of individuals into groups.

A loose relationship between individuals is dominant in individualistic societies, whereas in collectivistic societies the individual sees himself, from birth on, as a part of a group.

The relationship between the manager and the employee can also be seen as a social relationship, which is similar to a relationship in a family where protection and loyalty denote commitments.

In individual societies the relationship between the employer and the employee can be seen as more rational. For example it is widely accepted and legitimate that an employer can fire an employee when unsatisfied with the work of the employee, similarly, an employee can quit his job if he gets a better opportunity.

Individualistic societies expect their members to speak up freely what they think – even if this means to confront others. The confrontation is seen as an approach to an objective truth.

"In contrast, one of the highest principles in a collectivistic society is the preservation of harmony. Direct confrontation with a person is not wanted and seen as impolite." (lit. Herbrand, Frank, 2002; p. 22)

Masculinity

The difference between the two sexes is a biological fact, but since cultures differ they also deal with it in different manners.

"In general women tend to be more modest and provident that man. Men can think the same or follow more competitive values." (lit. Hofstede, Geert, 1997; p. 113))

To illustrate Geert Hofstede's conclusion it can be stated that: "In a more masculine culture conflicts are preferably solved in a fair fight, whereas in more feminine cultures a compromise is sought." (lit. Herbrand, Frank, 2002; p. 22)

As a consequence, masculine cultures have strict role models of men and women. "Men have to be certain, hard, and material, women must be more decent, more sensible and value the quality of life." (lit. Herbrand, Frank, 2002; p. 22)

Uncertainty Avoidance

Uncertainty avoidance can be defined as "The extent to which people feel threatened by ambiguous situation". (lit. Hofstede, Geert, 1980; p. 418)

Every culture has developed several ways to deal with the uncertainty of specific events or the future in general. A culture with a high uncertainty avoidance index tries to control or influence the future by publishing laws and regulations.

"Germany, for example, introduced an emergency act whether Great Britain doesn't even have a written constitution." (lit. Herbrand, Frank, 2002; p. 23)

Long-term Orientation

"The fifth dimension describes the degree to which a society has a pragmatic, future-oriented attitude, compared to a dogmatic present-oriented perspective." (lit. Herbrand, Frank, 2002; p. 24)

Because the practical influences of this dimension are not yet explored, scientific research relevant to companies does not exist.

It is still disputed whether a small or a big difference in this dimension is problematic for the intercultural co-operation.

Index Rating

As mentioned earlier, Geert Hofstede outlines five dimensions that in combination can be used to describe the culture of a country.

But since the intention of this thesis is not a comparison of both cultures in general, just a few of these dimensions will be examined further.

To plan and build a secure IT-Infrastructure in Afghanistan, with the German IT-Baseline Protection Manual in mind, calls for a close look on the differences in the uncertainty avoidance, individualism and power-distance indices. The masculinity and the long-term-orientation might also have an influence on the success of such an operation, but likely more from a general management point of view than from this thesis's concrete view. Although these two dimensions can significantly challenge any manager dealing with employees originating from different cultures, when planning, processing and implementing security policies or building up IT-Systems they are of lesser importance as they do not emboss the work of a company.

The next paragraphs picture the ratings and implications of the differences in the dimensions Uncertainty Avoidance, Individualism, and Power Distance.

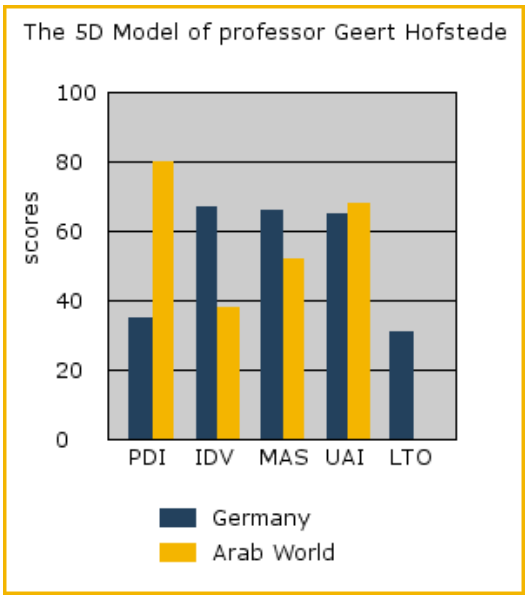


Figure 2-4: Cultural Dimensions from http://www.geert-hofstede.com/hofstede_dimensions.php

Uncertainty Avoidance Index (UAI)

Afghanistan	Germany
68	65

Afghanistan with an UAI of 68 and Germany UAI of 65 do not differ significantly.

In particular this means that the load of regulations coming with the "IT Baseline Protection Manual" satisfies the cultural need of securing and influencing the future - similar to Germany.

In general the companies and organizations in Afghanistan have few to no rules which regulate the administration of IT-Networks (or IT infrastructure in general). For the future, the migration of the "German IT Baseline Protection Manual" from Germany to Afghanistan could be doable, and would be a necessary step to fill the open gap of the cultural need to avoid uncertainty.

Power Distance Index (PDI)

Afghanistan	Germany
80	35

The PDI in Afghanistan is very high and shows the biggest difference to Germany.

The unequal distribution of power between manage rand employee would be more easily accepted by Afghan employees than by German employees.

Employees in Afghanistan typically would expect an established hierarchy whereas German employees might expect more freedom.

Afghanistan's high PDI is a great opportunity to implement fast IT security guidelines, because security guidelines are best deployed in an established and functioning hierarchy. As an example, accepted hierarchies are fundamental for the successful implementation of operational emergency process flows, data backup processes and security awareness guidelines.

Individualism (IDV)

Afghanistan	Germany
38	67

Some Afghans live in tribal villages and even the Afghans who live in cities have a strong commitment to their tribal heritage. The family, the ancestors and the tribe have a huge impact on the development of an individual's personality.

The lower IDV in Afghanistan means that Afghans in general are more likely not to speak up freely and rather try to preserve harmony.

Management working with employees with different cultural backgrounds should bear in mind that harmony within a team may only be a cover for conflicts.

The different IDV of Germany and Afghanistan must not imply any influence on a potential deployment of the IT-Baseline Protection Manual, but it can cause problems if the management does not understand this cultural manner.

2.4.3 Conclusion

The subchapter Culture gives an overview on the Afghan culture and the different ethnic groups living in Afghanistan.

In the beginning, the term culture and its definition were introduced. The goal of pointing out the main cultural differences was approached by using Geert Hofstede´s culture studies. His cultural model is based on five dimensions (Power Distance, Individualism, Masculinity, Uncertainty Avoidance, and Long-term Orientation.

Geert Hofstede developed a questionnaire for his cultural model and involved IBM employees from all over the world as test persons. The result is a rating for each of these cultural dimensions.

IBM was not engaged in Afghanistan at the time of the test, hence no data could be collected for this country.

Nonetheless, by introducing and examining the different ethnic groups living in Afghanistan it can be assessed whether they are culturally virtually equal to one of the groups listed by Geert Hofstede and thus data for this group could be usable. It became clear that Afghanistan's major

ethnic groups are sometimes influenced by the surrounding countries and that all major ethnic groups in Afghanistan are Muslim.

Their obvious common denominator is religion and therefore Afghanistan can be added to Geert Hofstede´s group of the "Arab" countries.

The next subchapter ("Comparison") explains the different dimensions of Geert Hofstede´s model and the differences between Afghanistan and Germany. The different ratings for each dimension and their implications conclude the analysis.

The major differences between the cultures are the Power Distance Index and the Individualism Index.

Firstly, Afghans are more likely to accept the unequal distribution of power than Germans.

Secondly, Afghans wish to be integrated into a social group to a much greater extent than Germans and are more willing to contribute to the preservation of harmony within a social group.

These implications need to be carefully considered for a deployment of the IT BPM in Afghanistan.

2.5 Summary of About Afghanistan

The chapter "About Afghanistan" intended to provide background on the people, the land and the history of Afghanistan.

Within the first subchapter, history, the shattered and war-torn past of Afghanistan was outlined, while the subchapter "Geography and Climate" introduced the unique and outstanding climatical and geographical conditions of this country.

The subchapter Culture described the different ethnics in Afghanistan and gave an overview of their culture. Finally, the German and the Afghan culture were compared based on Geert Hofstede´s widely accepted indices and methodology. Implications were drawn from the differences of these indices in Afghanistan and Germany, and their influence on a potential adaptation of the IT BPM or other regulations in Afghanistan was analyzed.

3 Current Situation in Afghanistan

"Developing nations are beginning to effect changes within their countries. They believe that international organizations can and should help, knowing that such organizations will never build plants, roads, railways, etc., nor will they implement health or educational systems; they will neither introduce programs for restraining the population explosion, nor implement rural energy. These are matters that only national governments can handle." (Hammons, T.J. and Willingham et al., 1999)

3.1 Introduction

The IT BPM was developed in Germany by Germans with the intention to deploy an IT security regulatory.

Afghanistan's development would benefit from an IT BPM which guides through the design, development and maintenance process of their IT systems, but the German IT BPM can not immediately be deployed in Afghanistan. The two countries are too different and the German IT BPM would not successfully enhance Afghanistan's development.

A consistent, sustainable IT security strategy for Afghanistan has to consider the people's culture (chapter 2.4 Culture) as well as the specific geography and climate (chapter 2.3 Geography and Climate), but this will not be sufficient.

An IT security strategy for Afghanistan and Germany respectively needs to take the current situation in Afghanistan and Germany into account, otherwise its sustainability and applicability are questionable. The German IT BPM is based on the current situation in Germany. Therefore to estimate if the German IT BPM can be deployed on Afghanistan, both countries need to be compared with regard to their IT infrastructure.

The Afghan *Ministry of Communication* has released a 5 year development plan to improve the existing communication infrastructure and their regulations. (Ministry of Communications, 2005)

The discussion of foundation pillars for an IT infrastructure and therefore an IT strategy lead us to an abstract model of a state which is shown in Figure 3-1.

The foundations of a state are its country, its people and resources. The six pillars infrastructure, politics, economy, education, judiciary, and society hold the rooftop of the state.

The rooftop is on top of the six foundation pillars and can be described as the *Current Situation* of a country.

The following sub-chapters will introduce each of the pillars for Germany and Afghanistan and explain why they are important to the discussion about IT strategy and what will be examined. Moreover, the implications derived by those differences will be pictured.

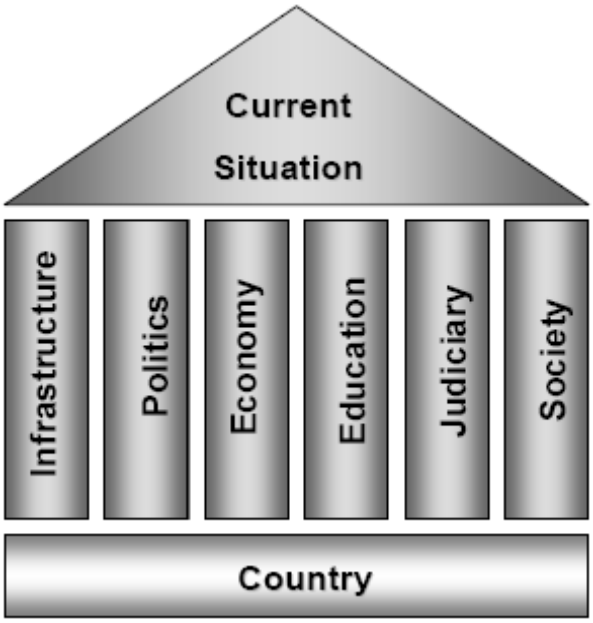


Figure 3-1: Abstract Model of a State

3.2 Infrastructure

Overview

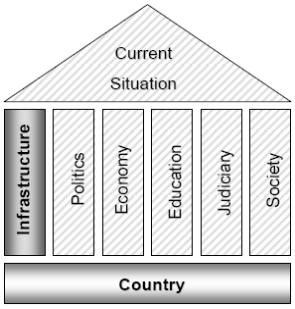


Figure 3-2: Model with Infrastructre

A state's transportation infrastructure is a fundamental subject matter when discussing information technology.

In this chapter an overview will be given about the general infrastructure in Germany and Afghanistan and is subdivided into three parts.

The first part "Infrastructure" gives an overview on the different types of transportation. The next part "Power Supply" explains the general availability, production and distribution of energy.

The last part "Communication" introduces several telephony and internet network generations and their availability and usage.

Germany

The German highways have a total length of 230,735 km and all of them are paved. This includes 11,515 km of expressways. (CIA, 2005b)

Railways, which were privatized in 1991, cover a distance of 49,000 km, 20,100 km of these are electrified. The total amount of railways in Germany is even higher (approximately 80,000 km), but these are not made available for public use. (Ross, S. 2001)

Furthermore, Germany has about 550 Airports and many offer international flights. (CIA, 2005b)

The information infrastructure is usually described through the different types of information distribution - radio, television, telephone and internet. In Germany, there are 787 radio broadcast stations for FM and 51 for AM. For television broadcasting there are 373 broadcasting stations. (CIA, 2005b)

Afghanistan

The infrastructure in Afghanistan was almost completely destroyed during the wars.

It is still in a bad condition and most of the 21,000km highways are unpaved (18,207km). Due to the topographically specific situation of Afghanistan, there are no railways in Afghanistan.

Afghanistan still has only 47 airports and just 10 of them have a paved runway.

Afghanistan has 21 radio broadcast stations for AM and 23 for FM, as well as 10 television broadcast stations. (CIA, 2005a)

In Afghanistan, no city has a functioning sewer system, not even the capital city Kabul. (UNEP, 2003)

3.2.1 Power Supply

"Electrical power is a vital prerequisite for any modern economy. Even in the least developed countries, the availability of a reliable power supply at reasonable cost is important for economic growth and development." (Munasinghe, Mohan, 1989)

The supply of electrical power is one of the most important aspects for the usage of information technology. All computer or information systems are highly dependent on a sound power supply in order to fulfill the desired tasks. The infrastructure has to match these needs. As a result, there needs to be some supply of electricity, whether conveniently available through power plugs or through usage of a generator. Electrical power and the access to it are important for a sustainable development (Khatib, Hisham, 1998). The provision of power supply can assist the education as it provides the ability to extend the day through electrical light which gives the opportunity for longer studies and readings (Haycock, Roger, 1994 and Munasinghe, Mohan, 1990).

But power supply alone is not sufficient to satisfy the operational needs of a company. To operate seriously, companies do require a certain, reliable level of power supply. Unreliable power supplies are a high cost factor for the industrial sector, technical equipment could be damaged and its lifetime reduced. Unfortunately, the power supply is unbearable specifically in developing countries (Khatib, Hisham, 1998 and Haycock, Roger 1994).

> **"Security of electricity supply** is the ability of the electrical power system to provide electricity to end-users with a specified level of continuity and quality in a sustainable manner." (Eurelectric, 2004)

New energy producing technologies like wind power plants and solar energy, highly lack reliability. The solar radiation is not always at the required level (newer solar technology works well even with clouded skies, but the electrical output is reduced) and the wind forces change permanently. To handle these problems, a network of different technologies and companies would be required.

"Generation adequacy is the presence of sufficient generating capacity to meet demand – both in base load and in peak periods – taken together with imports of electricity." (Eurelectric, 2004)

"Network adequacy – covering both transmission and distribution and also cross-border interconnections – is the availability of sufficient network infrastructure to meet demand." (Eurelectric, 2004)

The importance of generation adequacy and network adequacy can be illustrated with an occurrence in Italy in 2003. Italy is dependent on the import of electrical energy but the power supply lines were too weak to cope with the through going power. The power supply lines span from France over Switzerland to Italy. In the hot summer of 2003, Italy needed more power than usual because some water power plants in Italy ran dry and had to be shut down. One power supply line from Switzerland to Italy was cut by a falling tree and as a consequence, the whole power net was overstrained and collapsed. Even the power lines from other countries couldn't absorb this loss. This is also evident for the Italian power grid which could not deliver the 6400 MW leftover energy.

Therefore it can be concluded that one fundamental step towards IT-Security is to ensure a good and stable power supply.

"Short-term security of supply means the operational reliability of the system as a whole and its assets, including the ability to overcome short-term failures of individual components of the system." (Eurelectric 2004)

Germany

Germany has a good standard of security of electrical supply. One measure for this is the average and overall availability of the electric current. The average time of electrical black out in Germany is 15 minutes per year. (VDEW, 2004)

This can be translated into an average availability of almost 100 %s for electrical power based on the transmission network of the "Union for the Coordination of Transmission of Electricity" (UCTE). The borderless transmission of energy throughout Europe ensures a much greater (short term) security of electricity supply than a single country could provide.

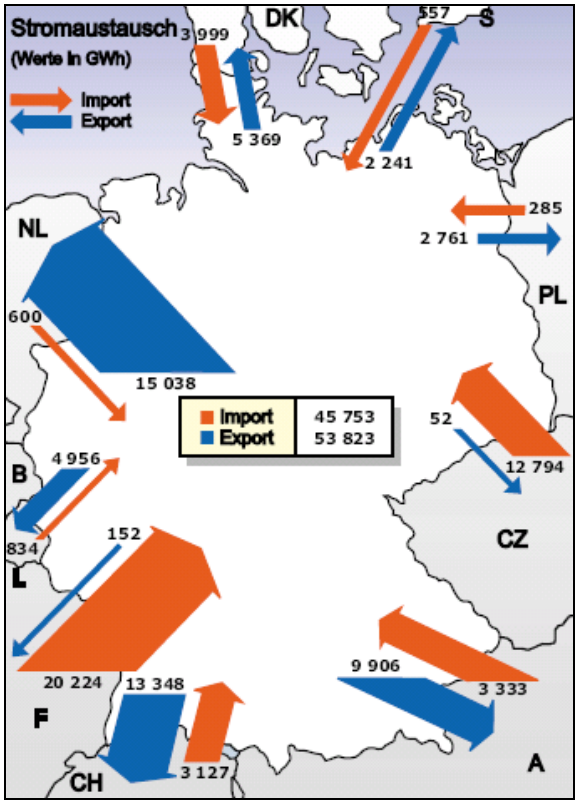


Figure 3-3: Import & Export of electricity in Germany from VDEW, 2004a

If one company produces more energy than needed it can sell the excess supply to other companies, even if they are located in other countries. Within the network of the UCTE, about 450 million people are connected to networks of different energy companies. For Germany, the Figure 3-3 demonstrates that the exports nearly match the imports. Nevertheless, it is important to remain self-sufficient if there are blackouts in other countries. Even then, the German generation adequacy is at an appropriate level to handle eventual issues.

With 544.6 billion kWh of energy, Germany could produce enough power to satisfy its own demands but the interconnection to other countries secures network adequacy.

Electricity support is a continuous process. With the development of technology, the consumption of energy keeps

growing. Germany has had a total electricity consumption of 508.5 TWh in 2003 and a peak of 73.5 GW during one day (UCTE, 2003). This translates into an average consumption of electrical energy of 6222 kWh per person with 82.5 million inhabitants in Germany.

Afghanistan

Afghanistan produced up to 334.8 million kWh in 2001. On the other hand, the Afghans consumed 511.4 million kWh. Thus, approximately one third of energy consumed (200 million kWh) had to be imported, most of it from Pakistan. The required generation adequacy does not exist and in future it has to be established to meet the growth of energy consumption. (CIA 2005a)

As a consequence though, this would lead to an increased dependency on the neighbor countries for the import of the required energy. According to statements from different Afghans, the security of energy supply is currently not guaranteed in Afghanistan.

3.2.2 Communication

Retrieval of information and the access to communication services with a reliable infrastructure becomes more and more important. To demonstrate the differences between the different types of communication systems, some technical background is outlined in the next section.

There are many different communication services. One of them is the internet, but the technologies for gaining access to the internet are very different:

1. Analog (via analog telephone lines)
2. ISDN[11]
3. DSL (e.g. SDLS, ADSL)[12]
4. Satellite
5. Mobile phone (GPRS, UMTS)

[11] ISDN is an abbreviation for Integrated Services Digital Network

[12] DSL is an abbreviation for Digital Subscriber Line;
ADSL is an abbreviation for Asymmetric Digital Subscriber Line,
SDSL is an abbreviation for Symmetrical Digital Subscriber Line

Analog and digital communication services provided by cable commonly use copper wires and fiber optics. Copper wires were the first medium used to transmit electronic signals. Copper has many disadvantages, the bandwidth is limited and the wires are heavy. A better but more expensive solution is fiber optics.

Fiber has a lower attenuation, so fewer repeaters are needed, and fiber optics are independent from power failures and electromagnetic interference. But more interesting is the higher capacity of fiber compared with copper along with its reduced weight. Two fibers optics cables have more capacity than one thousand twisted pairs[13] of copper wires and, at the same length, the twisted pairs weigh 80 times more than the fibers. (cp. Tanenbaum, Andre S., 2003; p.93)

Fiber optic cables have a core made of glass with a diameter of 8 to 10 microns (single mode fibers) or about 50 microns (multi mode fibers). The surrounding is a glass cladding with a lower index of refraction than the glass core to keep the light signal inside. On the outside is a plastic jacket. (cp. Tanenbaum, Andre S., 2003; p. 96)

Lastly, fiber optics can hardly be tapped because they don't leak their light and thus improve security.

Among wireless technologies, uplink/downlink via satellite is a very powerful yet costly alternative. The advantage of satellite communication is the independency from any infrastructure as long as some kind of power supply is guaranteed. Also, the bandwidth can be as high as one is willing to pay. Satellite communication could be used for telephony services and internet access. One disadvantage of this kind of communication are interferences caused by the weather, specifically by rain, that reduce signal quality. Some frequency ranges are more affected than others, particularly frequencies above 4GHz.

Mobile communications is also a growing segment. This method of communication has become popular and economical enough for German standards to allow nearly everybody to use a mobile phone. Mobile phones are a good

[13] A twisted pair consists of two insulated copper wires, typically about 1mm thick. (Tanenbaum, Andrew S., 2003; p.91)

compromise to provide the ability to communicate nearly everywhere without expensive satellite uplink/downlink.

Mobile communication technology today is in its third generation. The following will give an overview about the development of the different generations:

1G: The first generation system was analog and used frequency modulation to transmit speech, which was the only service provided. The access to the system took place through FDMA – (frequency division multiple access) – with a channel spacing of 30kHz. As a consequence, only few people could simultaneously make a phone call within one cell.

2G: Also known as GSM[14], The transmission is digital, the frequency bands are 900, 1800 and 1900 MHz. Each band is divided into 124 carrier bands (200 kHz each) and uses TDMA (time division multiple access). So, each carrier band is divided into eight time slots (577µs). This technique permits 992 simultaneous speech connections per frequency band, which is enough for typical requirements today. The switch to digital technology allows mobile access to the internet, but the speed is very limited (approximately 14.4 kBit/s), even with technological improvements such as GPRS and HSCSD).

3G: Also known as UMTS (Universal Mobile Telecommunications System). The third generation implements packet switching technology and is based on CDMA – code division multiple access. Also, the carrier bands are wider, 5 MHz, as a result, the bandwidth is about 25 times higher than 2G. The connection speed can reach up to 2 MBit/s and could therefore be a good solution for mobile internet access. Unfortunately, the initial cost for this technology is not affordable for developing countries.

(The mobile phone directory, 2004)

[14] GSM is an abbreviation for Global System for Mobile Communications

The term "internet" is an abbreviation for Interconnected Networks. The computers are connected in networks and these networks are interconnected. Depending on their inner structure, networks can be divided into different types. Data is transmitted via communication protocols; the most popular one is the transmission control protocol over internet protocol (TCP/IP). Data is divided into little packages, and every package is independently routed thus making the decentralized internet stable and reliable.

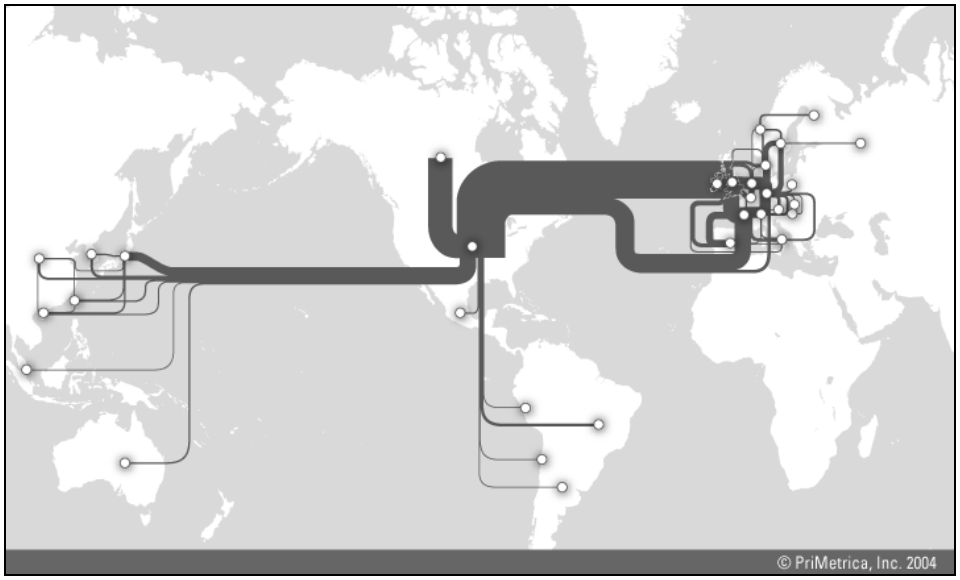


Figure 3-4: Map of Major Interregional Internet Routes, 2004; from (Telegeography, 2005)

Germany

In Germany, 39 million people are internet users, which means that nearly 50% of Germany's population (about 80 million) has access to the internet and the information residing within it. The infrastructure in Germany is based on 2,686,119 hosts supplying access to the internet, information and services.

(CIA, 2005b)

To get an overview of the current communication networks and their services in Germany it is important to understand their past development.

Until 1998, telecommunication services (telephone lines) were controlled and owned by the German state. These services were then privatized and the market was opened up

for competition. A federal office (RegTP[15]) was founded to regulate the market. Specifically the formerly state-owned enterprise (Deutsche Telekom), had to be controlled due to its monopolistic market share.

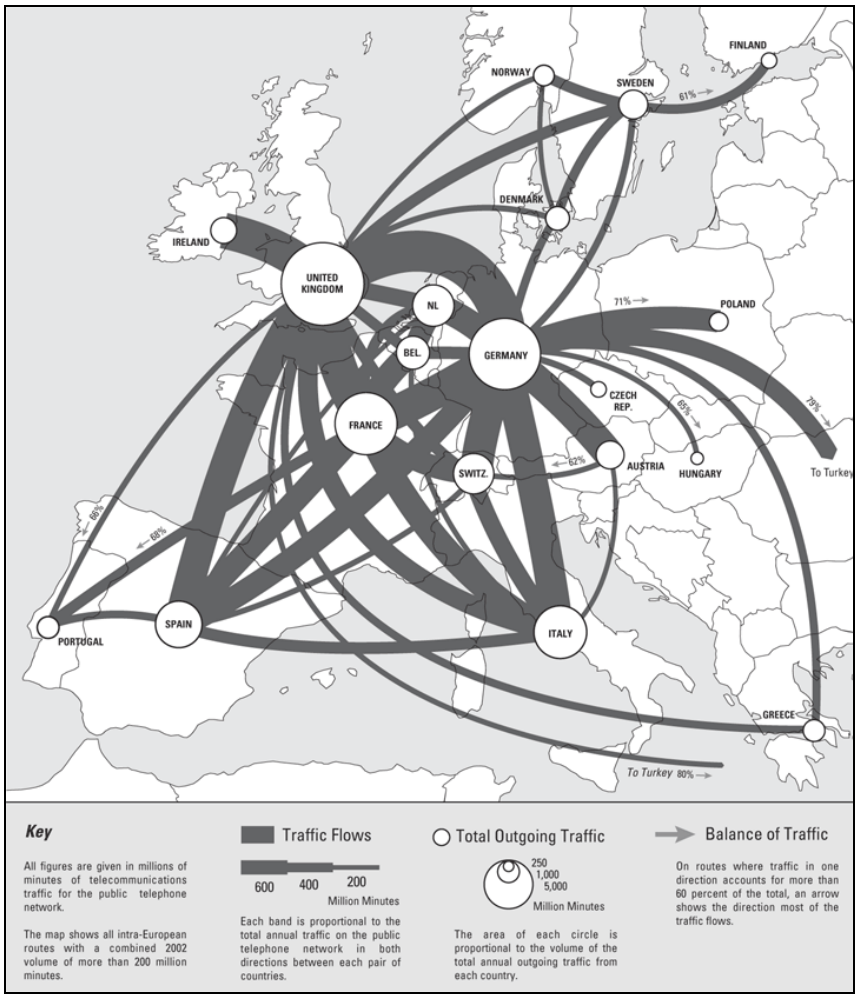


Figure 3-5: European Telecommunications Traffic Flows, 2002; from [Telegeography, 2005];

Most of the communication services with access to the internet are supplied by cable, either copper wire or fiber optics. The telephone companies replaced their backbone cables (copper) by fiber optics because of their excellent characteristics (see above).

The connection to the customer is still provided by copper wire, because it is low-cost and does not need to be changed. But, this limits a further increase of the bandwidth

[15] RegTP stands for Regulatory Authority for Telecommunications and Posts. It was renamed on July 13th, 2005 in Federal Network Agency, for further information see http://www.bundesnetzagentur.de

in the future. Currently, the popular DSL technology continues being based on copper wire.

The annual report of the RegTP states that Germany has now 6.7 million DSL subscribers.

In Germany, in 2004 a total of 54.55 million telephone main lines were in use (see Figure 3-6 and Figure 3-7:). The majority (DT AG have a market share of 92.4%) of the customers are still subscribed to the services of Deutsche Telekom AG. (cp. RegTP, 2005; p. 38)

Share in telephone lines of DT AG and Competitors							
	1998	1999	2000	2001	2002	2003	2004
Competitors							
Lines total/Mio	0,16	0,40	0,86	1,62	2,27	3,12	4,14
analog	15%	22%	17%	12%	11%	10%	12%
ISDN	85%	78%	83%	88%	89%	90%	88%
Number of provider	21	40	55	61	64	65	68
DT AG							
Lines total/Mio	46,37	47,81	49,36	50,83	51,51	51,23	50,41
analog	78%	72%	65%	60%	56%	53,7%	52,6%
ISDN	22%	28%	35%	40%	44%	46,3%	47,4%
Total							
Lines total/Mio	46,53	48,21	50,22	52,45	53,78	54,35	54,55
Share competitors	0,3%	0,8%	1,7%	3,1%	4,2%	5,7%	7,6%
Share DT AG	99,7%	99,2%	98,3%	96,9%	95,8%	94,3%	92,4%

Figure 3-6: Distribution of lines between DT AG and Competitors; from (RegTP, 2005; p.38)

Competitors share in telephone lines						
	2003			2004		
	Total /Mio.	Competitors share Mio	%	Total / Mio.	Competitors share Mio	%
Analog lines (without public tel-net, incl. connections for cable TV-telephony)	27,69	0,296	1,1	26,87	0,477	1,8
ISDN-standard	11,43	1,028	9,0	11,94	1,441	12,1
ISDN-PMX-connections	0,123	0,0256	20,8	0,123	0,0260	21,1
public telephone booths	0,107	0,0036	3,4	0,106	0,0039	3,7
total connections	39,35	1,35	3,4	39,04	1,95	5,0
total lines	54,35	3,12	5,7	54,55	4,14	7,6

Figure 3-7: main lines: total and distribution; from (RegTP, 2005; p.38)

The mobile phone infrastructure (2G - GSM) is widely spread in Germany and very well constructed. As an example, the map in Figure 3-8 shows the availability of just one of the major service providers for mobile communications, Vodafone (D2). The white spots on the map indicate the unavailability of the Vodafone network. One can note immediately that the coverage and general availability of this provider is approximately 99 %. The availability for each of the six other mobile phone service providers is almost the same (GSM Association 2004).

Figure 3-8: GSM coverage map; from [GSM Association, 2004]

The large coverage with services combined with decreasing prices has grown the numbers of consumers since the beginnings in 1993. According to the Regulatory Authority for Telecommunications and Post, all of Germany's 64.8 million mobile phone users possessed at least one mobile phone in 2003 (see Figure 3-9.)

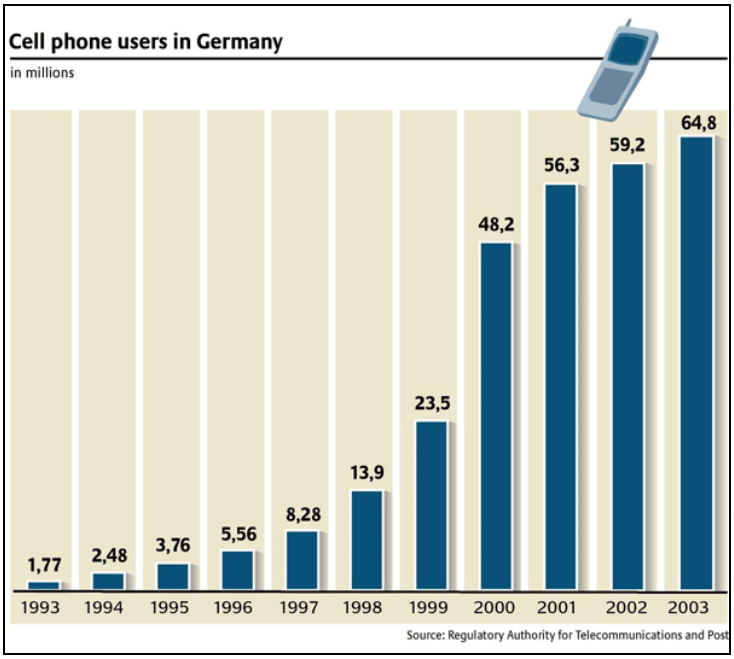


Figure 3-9: Cell phone users in Germany from 1993 to 2003 (Federal Foreign Office, 2005: *Telecommunications*)

Afghanistan

Afghanistan's telephone infrastructure in 2002 consisted of only 33,100 main lines. This is one explanation for the very low number of internet users, being about 1000 users in the same year. In addition to this underdeveloped infrastructure, there is only one local Internet service provider (ISP) in Afghanistan, hence many Afghans need to work with international ISPs at much higher cost to access the internet. (CIA 2005a)

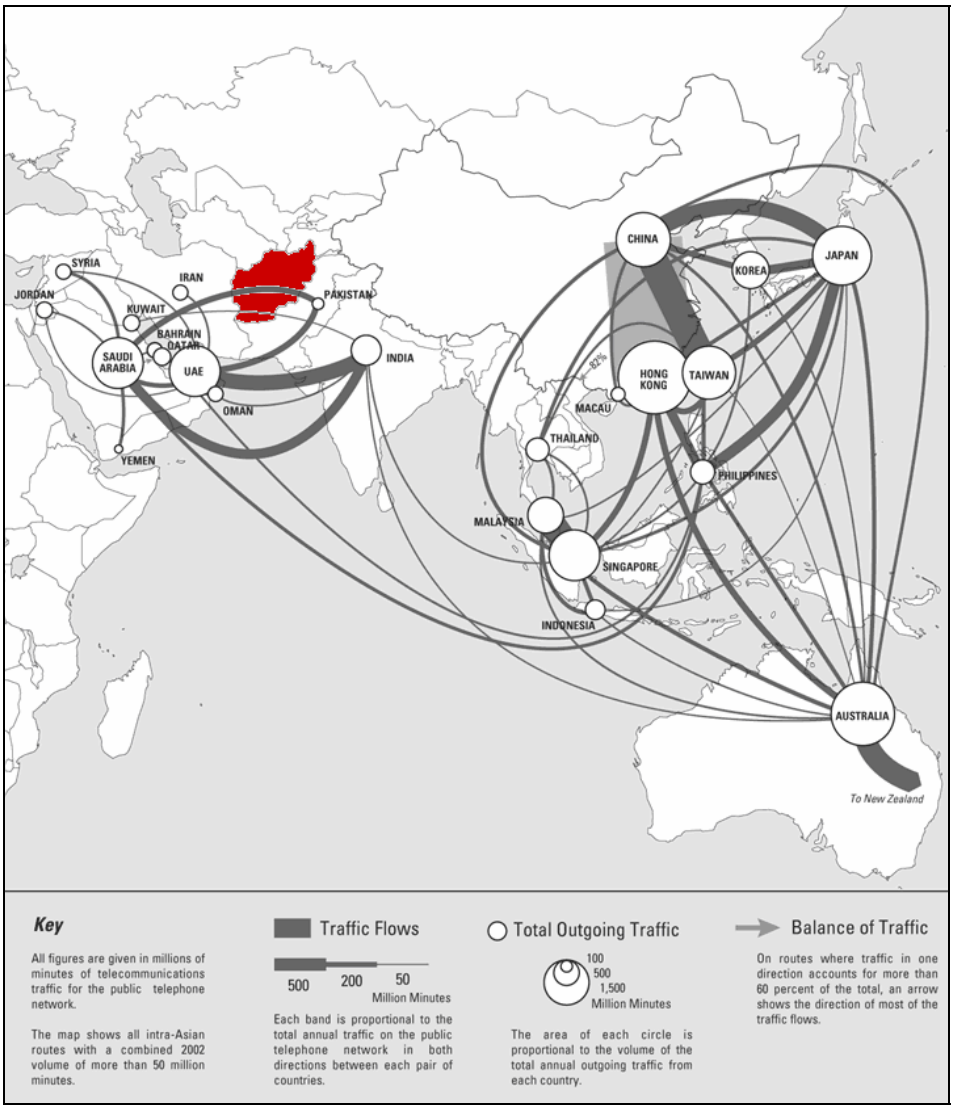


Figure 3-10: Asian Telecommunications Traffic Flows, 2002; from (Telegeography, 2005)

The map in Figure 3-10 illustrates that Afghanistan is not yet connected to the major backbones and communication flows of the internet.

Similarly, mobile communication systems are not widely spread, with a total of only 15,000 mobile phone users.

The availability of mobile communication is basically limited to cities like Kabul and Herat, as illustrated on the map in Figure 3-11.

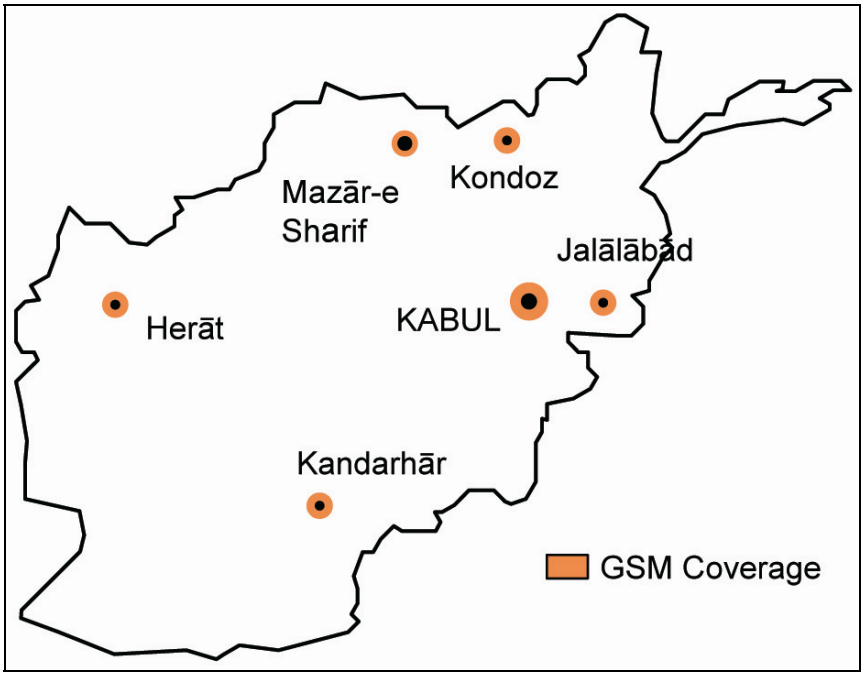


Figure 3-11: GSM coverage map of Afghanistan; from (GSM Association 2004)

In Afghanistan, there are two providers for mobile communications, Roshan and AWCC (Afghan Wireless Communications Company).

Roshan is the brand name of the consortium consisting of Aga Khan Fund for Economic Development (AKFED), Monaco Telecom International (MTI), US-based MCT Corp. and French Alcatel SA. It is called Telecom Development Company Afghanistan Ltd. (TDCA).

TDCA has expanded its network and at the end of 2004 covered 23 cities in Afghanistan with GSM.[16] To improve the service for their customers, Roshan contracted 55 partners for roaming services[17].

To further improve service quality and to enlarge the covered area, Roshan deployed a new Siemens switch in Herat.

[16] The new covered cities are not shown o the map, because the map bases on older data.

[17] To allow mobile stations within mobile communications systems to move from one radio cell to the next without interruption [http://networks.siemens.com/communications/lexicon]

With this deployment, phone calls don't need to be routed from Herat to Kabul anymore and customers can connect to AWCC´s digital lines. (cp. Roshan, 2004)

AWCC is a joint-venture of a TSI[18] subsidiary and the Afghan Ministry of Communications. It is the second provider of wireless services and covers the cities Kabul, Herat, Mazar-i-Sharif and Kandahar. (GSM Association, 2004)

In September 2005, two new mobile licenses were awarded to Investcom and Watan for 40.1 million USD each. (cp. Telegeography's CommsUpdate, 2005)

Investcom announced that it plans to launch GSM services under the brand Areeba in mid 2006.

3.3 Politics

IT-Infrastructure and IT-Services are usually heavily regulated by the state. In politics, political parties, lobbyists and governmental institutions discuss about related topics and propose and enact laws and regulations. Therefore, the legislative can considerably influence the development of the German Information Technology in the future. Further, the laws and regulations from the past build a powerful foundation for new businesses and technologies, since entrepreneurship, security and responsibility can be considered a given in Germany.

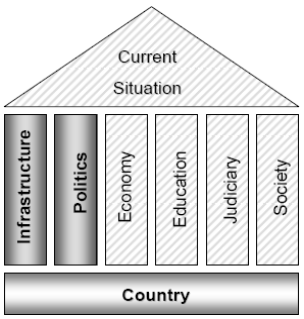


Figure 3-12: Model with Politics

Germany

In Germany, the political system is laid out as a federal representative democracy. The constitution, founded in 1949 after World War II, is called "*Grundgesetz*" (Basic Law). Germany is a federal republic consisting of 16 federal states in a parliamentary system.

Power is divided between the federation and federal states and, as a typical sign of a democracy; power is divided into judiciary, executive and legislature.

The parliament in Germany is composed by the lower house *Bundestag* (Federal Assembly) and the upper house, *Bundesrat* (Federal Council). The 16 federal states are represented by delegates from the governments of the states in

[18] Telephone Systems International

the *Bundesrat*. The parliament´s legislature period is 4 years and the lower house elects the *Bundeskanzler* (federal chancellor). Universal suffrage is an inherent part of the German political system; the active age of suffrage is 18 years.

Head of the state is the *Bundespräsident* (federal president), he is elected by the *Bundesversammlung* (federal assembly), which is an assembly of the entire Bundestag and an equal number of delegates of the state parliaments.

Laws can be enacted in several ways. Typically, a member of the *Bundestag* presents a bill to the assembly, where it will be formally read and decided upon which, after three readings,decides on its passing. Most laws can be passed solely by the *Bundestag* but laws concerning the federal structure or amendments to the constitution have to pass the *Bundesrat*, too.

The *Bundesverfassungsgericht* (Federal Constitutional Court) is the highest legal authority in Germany and ensures that the practice of legislature and the judiciary adhere to the constitution. The *Bundesverfassungsgericht* can not act on its own behalf, it has to be appealed- and every German citizen is empowered to do so. (cp. Federal Foreign Office, 2005)

Several political parties compete in Germany. The largest are SPD (Social Democratic Party), CDU (Christian Democratic Union), Grüne (Green Party), FDP (Free Democratic Party) and the PDS (Party of Democratic Socialism)[19]. A minimum of 5% of all votes are required for entry into the Bundestag as a fraction.

The attitudes towards technology and innovations are fairly different across the major political parties. For example, the FDP proclaims "change through innovation". Their party platform states: "Liberty is progress." (cp. FDP, 1997; p.7)

The SPD focuses on ensuring high employment and use technology and innovation as enablement: "[…]We want to go to any lengths to ensure the quality of science and research[…]" (lit. SPD, 1998; p. 32 & p. 42)

[19] On July 17th, 2005 the PDS was renamed to "Die Linke" the "Left Party"

The CDU claims to strive for the support of innovation and the positioning of Germany as a major economic hub. One of the CDU's objectives is the improvement of vocational training. (cp. CDU, 1994; p. 33)

In contrast, the PDS is rather hostile to technology and innovation. Although this is not clearly stated, readers of their policy statements must assume that they equate "Information Capitalism" with the advances of the information technology. Hence, in their view, "Information capitalism exploits the individual."(cp. PDS, 2003; p. 8).

Differently, the Green Party focuses on the human aspects to technology. They want innovation to satisfy the society needs without ecological damage. Further, they expect a demand of "more, not less creativity and innovation and new technical and social solutions as a consequence."(lit. Grüne, 2002; p.106)

Afghanistan

Afghanistan's political system is that of an independent Islamic republic. The base is the constitution of Afghanistan, which was established in 2003. The constitution refers to Afghanistan as an independent state with Islam as the state religion, but followers of other religions are allowed to exercise their faith as long they do not conflict with law.

Further, the third article says that no law can contradict the beliefs and provisions of the sacred religion of Islam. (Constitution AF, 2004)

Afghanistan is divided into 34 administrative provinces. (CIA, 2005a)

The president is head of state and directly elected by the people. To become president, several qualifications are necessary. The candidate has to be an Afghan citizen of over 40 years of age. Besides, the candidate needs not to have "…been convicted of crimes against humanity, other crimes, or deprivation of the civil rights by a court." (Constitution AF, 2004; Art. 62)

In contrast to Germany, the candidate also needs to be Muslim and born of Afghan parents.

The president, currently Hamid Karzai, simultaneously acts as head of government, appointing ministers, who have to be approved by the national assembly.

The national assembly is a bicameral system. The house of the people (249 seats) is called the Wolesi Jirga and is elected for a legislation period of five years. The house of elders (102 seats) is called the Meshrano Jirga. One third of it is elected from provincial councils for four years, the second third is elected from local district councils for three years and the last third is appointed by the president for duration of five years. Two representatives of the Kuchis must be among these appointees, another two must be disabled and half of the appointees need to be female.

The new constitution was approved by the Loya Jirga, which is an assembly convened only on issues concerning the national sovereignty, territorial integrity, provisions of the constitution and to prosecute the president, if necessary. The Loya Jirga consists of members of the national assembly and chair persons of the provincial and district councils. Once a Loya Jirga is convened, it cannot be interrupted before an agreement has been reached.

The constitution institutes the judiciary as an independent organ. The Afghan judiciary consists of the Supreme Court, High Courts and Primary Courts. (Constitution AF, 2004)

3.4 Economy

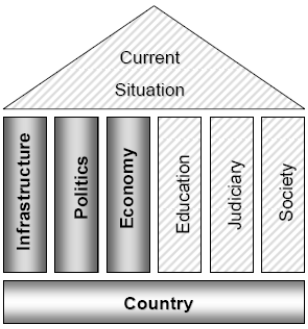


Figure 3-13: Model with Economy

Nowadays, most companies make intensive use of IT for their business and keep investing in new systems. The *German IT Baseline Protection Manual* was designed to support IT security analysts of German companies in securing their companies´ computer systems network. It is important to compare some economical parameters before considering an adaptation of the IT BPM on Afghanistan.

Germany

According to the World Trade Organization, WTO, Germany ranks highest in exports globally. The total share of international trade is 748.4 billion dollars (Federal Foreign Office, 2005) as shown in Figure 3-14. Goods and services exported are valued over 893 billion USD, with imports of over 716 billion dollars. (CIA, 2005b)

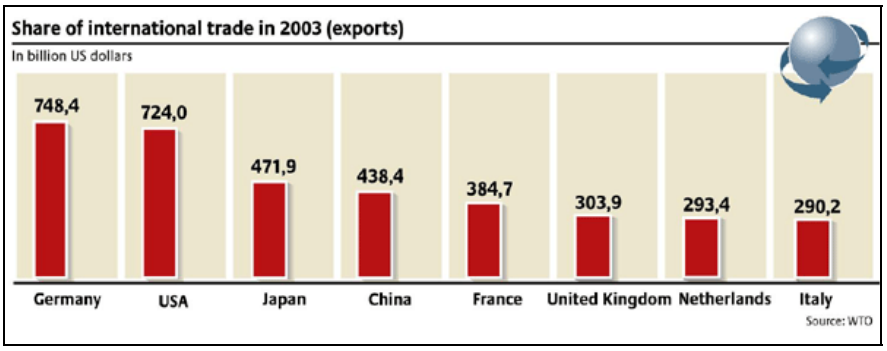


Figure 3-14: Ranking of countries in international trade (Federal Foreign Office, 2005: Foreign Trade)

Germany's GDP of 2.271 trillion USD makes it one of the largest economies in the world, third only to the United States of America and Japan. An analysis of the major economic sectors shows that the larger part of the GDP is generated through services. It is not surprising that Germany has significantly moved from industrial production to the provision of services. While the industrial sector continues being an international heavyweight, today's service sector also covers the design and implementation of software and embedded systems. Most companies rely on IT systems and some were even involved in the development of the IT BPM. Agriculture is the smallest sector in Germany accounting for only 1% of GDP, notwithstanding the production of dairy products and with meat is the largest in the world.

GDP by Sector (Germany)	
Agriculture	1%
Industry	31%
Services	68%

Table 3-1: GDP of Germany by Sector

In Germany the unemployment rate is now at 10.5%, which means 5 millions unemployed people. (Federal Foreign Office, 2005)

Afghanistan

The Afghan economy is just starting to develop again. During the wars against Russia, the times of Taliban repression and the liberation by the U.S.A., Afghanistan was affected by the cruelties and aversion of war. Most men were under arms

and fighting. The majority of the people can't recall a time without war. Their life was determined by uncertainty and danger.

According to general understanding, these are not the ideal circumstances for economical development or even existence. Agriculture remained the economical foundation, although the production of opium was also considerable. Afghanistan was the largest producer of opium poppies in 2002 and narcotics trafficking are a major source of revenue. (cp. United Nations Office on Drugs and Crime, 2002)

In 2003, the GDP reached 21.5 billion USD. Until today, Afghanistan continues producing large amounts of opium and the illegal production and trafficking of narcotics is one of the major reasons why the development of Afghanistan's economy is still slow. The inflation rate of 5.2% compensates even small advances.

It is not surprising that Afghanistan imports goods for more than 3.759 billion USD and exports only 446 million USD (excluding illegal exports). The Afghan economy cannot fund these huge imports, even though a large part is humanitarian aid. Afghanistan's public debt is over 8.5 billion USD, mostly with the World Bank. (CIA, 2005a)

GDP by Sector (Afghanistan)	
Agriculture	60%
Industry	20%
Services	20%

Table 3-2: GDP of Afghanistan by Sector

Afghanistan's economy is behind German standards in growth, size and development.

3.5 Education

Basic education is indispensable for security of computer systems. It is vital that users understand the particular importance of security and how to apply it. Therefore, the different educational systems in Germany and Afghanistan will be compared in the next sections.

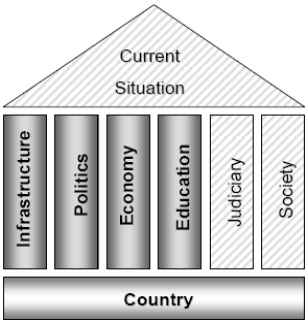


Figure 3-15: Model with Education

Germany

Voluntary pre-school education starts at the age of three. Children learn social and communication skills and some basics like counting, reading the clock and reading their own name.

Mandatory school education lasts for at least nine years. It starts with primary school and teaches subjects like German, mathematics, art and music, basics of biology, chemistry, physics, history and geography.

Primary school ends after four years. After that, parents can decide on the proper secondary school for their children, deciding between several options for secondary education.

Secondary general school covers another 5-6 years. In this type of school, students receive basic education which prepares for practical vocational training afterwards.

So-called intermediate schools cover 4-6 years of secondary education. They provide intermediate preparatory education for various types of occupations. Still, after attending intermediate school, students could continue education and attend grammar school if they wanted to.

Yet another type of secondary education in Germany is provided by grammar schools. These cover 7-9 years of schooling. This is the only school type leading to general qualification for university entrance and for all institutions of higher education.

In Germany, vocational training covers both theory and practice. In part-time vocational schools students are taught theoretical background which they apply in practice in their companies.

Universities and technical universities are the common types of higher education. (Federal Ministry of Education, 2004)

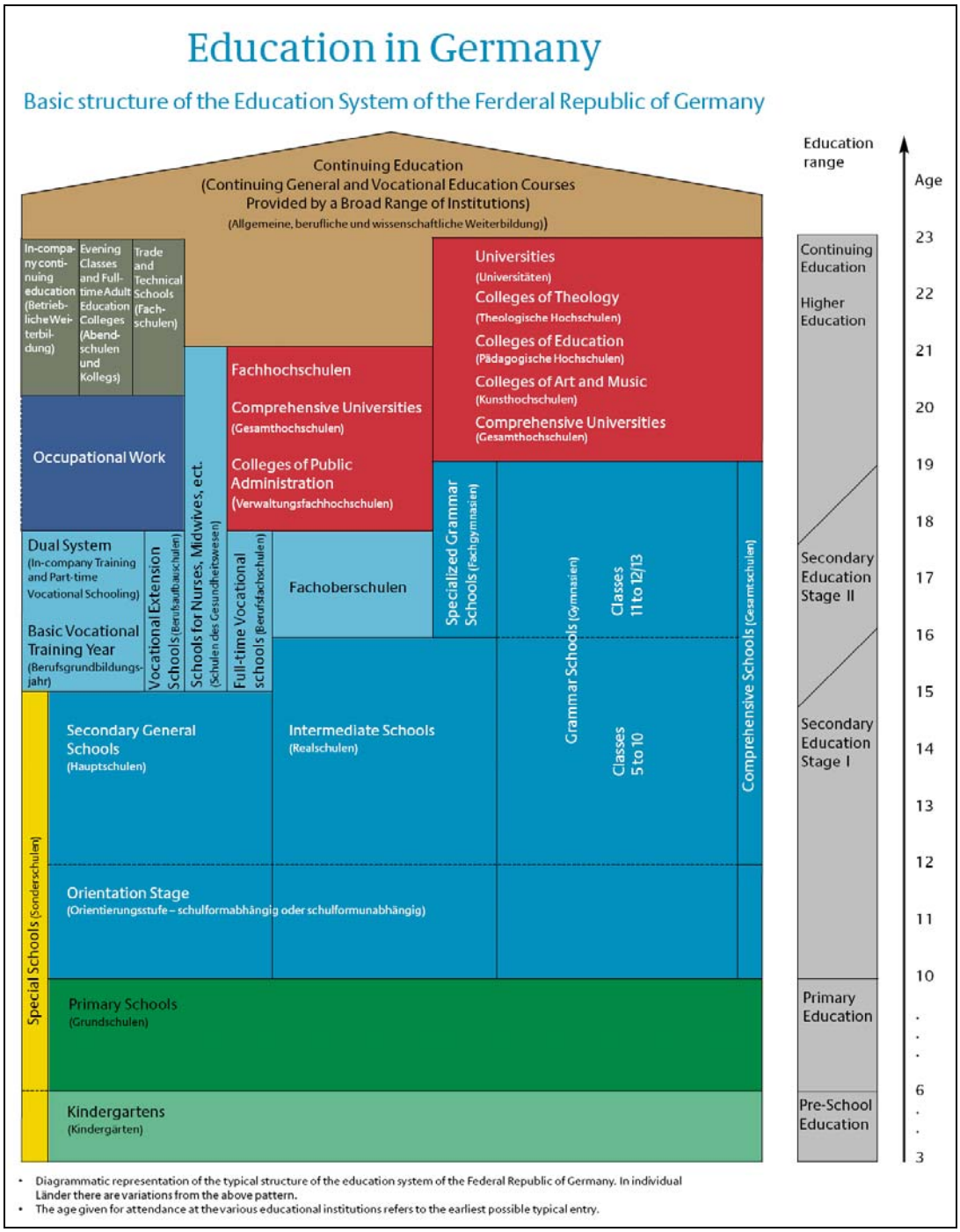


Figure 3-16: An overview of the German education system; from (Federal Ministry of Education, 2004)

Afghanistan

Afghanistan's education system suffered considerably during the wars and the Taliban regime. Most schools and universities were destroyed or damaged, teachers were killed and a whole generation of children were born and raised without running through an education system.

During this time, illiteracy increased to 64% of the population. After the fall of the Taliban regime, the education system is under reconstruction. This is currently progressing well, illustrated by the fact that more than 4 million children attended first grade in 2005. (cp. Unicef, 2005)

The following section introduces the potential of Afghanistan's education system.

Like in Germany, pre school education is voluntary. Compulsory education starts with primary school at the age of 6. The duration of compulsory education covers only the first six years of school. Pashto, Persian/Farsi and English are the languages of instruction.

Successful passing of an exam allows continuation onto secondary school. This consists of two stages: Middle School, grade 7 to 9, and High School, grade 10 to 12. After completion of middle school yet another exam leads to high school. Successful passing of the final high school exam certifies "Baccaluria".

Vocational training, post secondary level education, is provided by businesses, both theory as well as practice.

Higher education is provided by universities. The first stage of higher education is the bachelor degree after four years of studies. Bachelor degree and an entrance exam allow continuation of studies for another two years to reach a masters degree.

(cp. IGHRM, 2002)

3.6 Judiciary

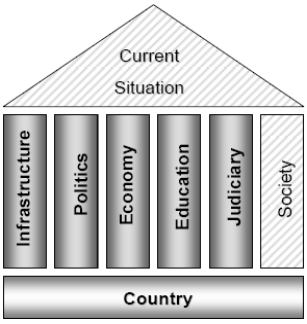


Figure 3-17: Model with Judiciary

A functioning judiciary system is the basis of sustainable economic development, according to most economic theories. The judiciary thus serves to rule or regulate the markets. The IT and telecommunication sector has not been left untouched by regulations, either. International standards of broadcast bandwidth, cellular radio and computer crime further aid the execution of legal regulations. In this context, the laws to protect intellectual properties (copyright and patents) will also be examined for both countries, specifically since Afghanistan got an Observer status at the WTO.

Germany

With regard to telecommunications and computer crime, Germany is extensively regulated. The German patent laws (Patentgesetz - PatG) and German copyright laws (Urheberschutzgesetz – UrhG; § 69a Abs. 1 UrhG, § 69a Abs. 3 UrhG) cover most of the intellectual property rights.

Communications

Telecommunication and postal services were run by the state until 1998 when the state opened the market. But even several years after the liberation there are only a few competitors, therefore, to trigger further competition to enter the market, the Telekommunikationsgesetz (TKG) was passed in 1996. It defines several competition rules. This motivated more companies to enter the market and subsequently prices for phone calls or internet connections dropped. (Ministry of Economics and Labour, 2005)

While discussing the draft of the TKG, the Bundestag viewed the access to telecommunication as a civil liberty and this was even included in the TKG (§78 TKG).

Privacy enforcing laws or data retention regulations were both were defined in the Telekommunikations-Datenschutzverordnung (TDSV § 5 Abs. 1 TDSV, § 6 TDSV, § 4 TDSV).

Computer Crime

The regulations of computer crime need to cover a broad band of legal categories, since with it many facets, it cannot be generalized.

Computer fraud § 263a StGB (e.g. phishing mails) has spread widely. Often, it goes along with falsification of documents (§267a StGB).

Data manipulation is another, unfortunately even more popular, type of computer crime (§303a StGB), and offenses such as writing a virus are indictable.

Companies, governmental institutions and of course users can be affected by computer espionage such as spying on data or credit card numbers (e.g. § 202 a Abs.1 StGB / § 202 a Abs.2 StGB).

What may surprise is the fact that computer hacking itself (e.g. gaining access to a computer system) is not prohibited in Germany. Of course, in order to gain access to most systems, the attacker would need to break at least one of the laws mentioned above and computer sabotage is indeed liable to prosecution (e.g. §303b Abs.1 StGB).

Civil rights

In Germany, data privacy is derived from the human right to privacy and is protected by the *Bundesdatenschutzgesetz* (BDSG)

Online Shopping

Online shopping is the process consumers go through to purchase products or services over the internet.. In the early days of the "dot com revolution" there were no regulations for this process.

Today, the German "distant shopping act" (Fernabsatzgesetz - FernAbsG , § 312b BGB) equates direct mail shopping with online shopping and thus makes the regulations applicable respectively.

Afghanistan

Currently, there are no regulations for computer crime, data privacy or online shopping in Afghanistan. Since the country is an observer of the WTO, several laws regarding copyrights and patent are currently being planned.

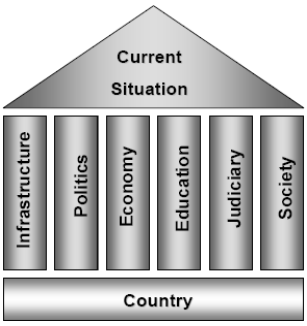


Figure 3-18: Model with Society

3.7 Society

A state does not exist in a vacuum or by its own. A state exists because the people who live in a certain country apply to the rules of the government.

A comprehensive comparison of the German and Afghan IT infrastructure needs to take the values, culture ("culture") and structure of these different societies into account.

Germany

Religion is one characteristic of social conduct. In Germany, 34% of the population are of Christian evangelic belief, 34% are Roman Catholics and 3.7% Muslims.

The German health care system is high standard. Due to modern technology, living standards and the functioning health care system, the life expectancy has reached the mark of 78.54 on average and the infant mortality is only 4.2 / 1000 live births.

While the majority of the population in Germany is German, 91.5%, several foreign ethnic groups live in the country, the Turkish being the largest with 2.4%. (CIA, 2005b)

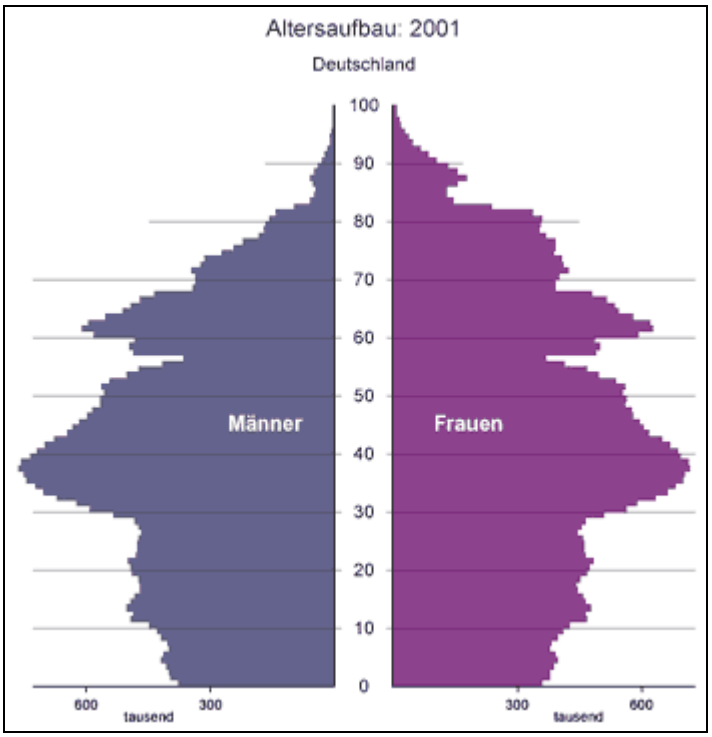


Figure 3-19: Statistic about age structure in Germany, divided in men and women; from (Federal Statistical Office Germany, 2004)

Afghanistan

Most remarkable about Afghanistan's population is the huge variety of different ethnics and religions described earlier in this book. 40% are Pashtuns, 30 % are Tadschiks incl. Qizlbash, 20 % are Hazaras, 5 % are Uzbeks and 5 % are Aimaiks & Nuristanis & Belutschs. Most Afghans are Sunni Muslims (80%). Almost a fifth of Afghanistan's population is of Shia muslim believe (19 %).

Afghanistan´s health care systems are currently of fairly low standard which explains the high infant mortality rate of 165.96 / 1000 live births and the low life expectancy of 42.46 years. (CIA, 2005a)

3.8 Summary of Current Situation in Afghanistan

Afghanistan is a unique country that unfortunately has suffered a lot in the recent past. Most of the infrastructural problems derive from the wars and burdens from the last decade of the Taliban regime. Both this time as well as the defensive wars against the Soviet Union have stopped Afghanistan's development and threw it back for years. Many decades without peace have basically made war to a part of Afghanistan's culture.

In the short term, funding and international assistance will provide some support for Afghanistan to rebuild and restructure the country. While this will surely be a good basis for further development, the chapter 3 "Current Situation in Afghanistan" has shown that there is still a lot to do. In each subchapter, some of the major differences between Germany and Afghanistan have been outlined, as far as they relate to IT infrastructure.

The IT BPM was designed for Germany and Afghanistan is currently in a too early stage of development to implement this regulatory. And its deployment after some more years of development would not be the right solution for this country. Rather, a qualified education program is more important than infrastructural components or direct fund raisings to ensure sustainable development in Afghanistan.

Consequently, it would be in the interest of the Afghan people to invest significantly into education programs first and to acquire devices which require qualified personnel to ensure its reliability afterwards, and not vice versa.

In summary, at this stage of development, a customized vocational IT training program would provide the highest benefit to the people of Afghanistan. This will be outlined in the next chapters.

4 General Recommendations for Afghanistan

In the past, Afghanistan has experienced repressions in many ways - especially under the Taliban Regime. The totalitarian system built by the Taliban stopped the normal evolution of Afghanistan and threw its industry back for many years.

Today, Afghanistan's IT-infrastructure (see chapter 3.2 Infrastructure) is so far apart from the standards like those required by the IT BPM that in addition to rebuilding Afghanistan other opportunities to deploy a widely used and accepted (rudimentary) infrastructure should be evaluated, rather than proceeding like an industrial state would.

One approach could be an open minded thinking towards new types of software and uncommon ideas about hardware devices, instead of accepting standards which do not exactly fit to the country's environment and to its people's needs and challenges. Although developing countries are typically not addressed by vendors from the industrial states, some have changed their minds in the last few years, as some examples will show.

4.1 Hardware

4.1.1 Introduction

Hardware components in commodity personal computers require a certain environment. Sand, heat and humidity decrease the lifetime, reliability and functionality of hardware components.

To ensure IT reliability the workspace needs to be acclimatized or different, more durable and resistant computer hardware must be used.

4.1.2 Requirements and Standards

Semiconductor producers like Intel Corporation[20], AMD[21] and Texas Instruments[22]created guidelines considering temperatures inside the core of a processor and inside the case. Intel has defined different zones for maximum temperatures, because the compensation of heat is the most common problem of IT-Systems. The temperature of the case should not exceed 65° C; since this heat makes serious damage to some electrical components more than likely to happen, especially the power supply unit and the CPU will not be cooled adequately. Finally, the heat can destroy the transistors and other parts which can't be repaired inside the hardware components. As shown above, during summer the temperature can reach over 50° C in Afghanistan. As a consequence the temperature in office buildings without air conditioning systems could rise even above that. Then, the air circulation inside computers cannot provide enough cooling and the system will overheat and, lastly, fail.

Some computer manufacturers have considered these problems and manufactured new computers which are able to function permanently under different types of "extreme" conditions.

Figure 4-1: Logo of the MIL STD 810F Standard

The U.S. American Department of Defense has developed standards for testing computer technology built for usage in extreme environments where the military may be operating. The result of these efforts is the military standard 810F (MIL-STD-810F), the logo is shown in Figure 4-1. The letter *F* describes the revision version of this standard. In addition, there are several other civilian standards. One of them is the German DIN[23] EN 60529, another NEMA 250 or UL 50.

These define the so-called *IP-Codes* for several protection levels. IP stands for "Ingress Protection" but it is sometimes also referred to as "International Protection". A product which fulfills the demands of the IP-Norm is labeled with IP*XY* with *X* as a place holder for the first number and *Y* for the second number. The first number describes the level of protection against dust and foreign substances, with values

[20] Intel – http://www.intel.com

[21] AMD – Advanced Micro Devices, http://www.amd.com

[22] Texas Instruments – http://www.ti.com

[23] DIN is an abbreviation for German Institute for Standardization e.V. ; http://www2.din.de/

ranging from 0 (no protection) to 6 (no dust can penetrate the case and its contents). The second number stands for the level of water resistance, with values ranging from 0 (no protection) to 8 (could resist submergence).

First number – protection against dust and foreign matter		
Level	Protection against Objects	Example of use
0	no protection	for closed, dust-free rooms
1	≥ 50mm	dust-free rooms in which electronics technician works
2	≥ 12,5mm	dust-free rooms, just with raw foreign matter
3	≥ 2,5mm	dust-free rooms, just with small foreign matter
4	≥ 1mm	rooms without fine particulate
5	dust protected	rooms with dust exposure
6	dust tight	rooms with high dust exposure

(Praxis Elektrotechnik, 1998; p. 162)

Second number – level of water resistance		
Level	Protected against	Example of use
0	no protection	dry rooms without condensation
1	vertical dripping water	room with just vertical dripping water
2	dripping water when tilted up to 15°	rooms with vertical dripping water tilted up to 15°
3	spraying water	rooms or outside with spraying water tilted up to 60° from the vertical
4	splashing water	rooms or outside with splashing water from any direction
5	water jets	rooms or outside with water projected by a jet nozzle or climate with constant relative humidity about 80%
6	heavy seas	location where temporary powerful jets occur (from any direc-

		tion)
7	The effects of emersion	location where short immersion is possible
8	submersion	for permanent diving

(Praxis Elektrotechnik, 1998; p. 162)

But in most cases standard commodity computers are used in office environments either because they are cheaper than computers which meet the appropriate IP or MIL-STD-810F standard or because they already exist.

Therefore it should also be considered how the office room can be adapted to meet and guarantee the operating requirements of the IT devices.

Fitting an office environment with acclimatized rooms cause some challenges. Obviously, the high costs would require some considerable investment into the air-conditioning systems and their maintenance. Another problem will be the security of the electrical supply (see chapter 3.2.1 Power Supply). Even if an air conditioning system is attached it is not guaranteed that the air conditioning systems is online for the whole time.

An air-conditioning solution for an office building and its computer hardware is such a high expense and risk that it would be better to initially focus on the investment into special hardware instead.

4.1.3 Solutions

Several independent hardware vendors have developed computers and other IT devices with emerging countries in mind. They have in common that they are inexpensive (compared to the average prices of commodity computers) and robust and limited for sale to developing countries. The following presents some interesting solutions which could be used as alternatives to commodity computers.

AMD has introduced a whole computer system build around a new CPU[24]-core (Geode NX 1250@6W) called the "Personal Internet Communicator (PIC)". The computer case is sealed, therefore no dust can penetrate the system from the outside (see Figure 4-2). The new Geode CPU-core needs only about 6W of energy and does not have to be cooled; there is not even a fan in the system. It is not meant to be an alternative for a computer system with high computing power; rather it is designed for the communication via the internet and is suitable for common office tasks. (AMD, 2005)

Figure 4-2: PIC

More expensive but very reliable solutions are the ruggedized notebooks from Panasonic[25] or roda-Computer GmbH[26].Those are computers (notebooks) which are assembled and customized to withstand extreme environments. They have also passed several tests such as the above-mentioned MIL-STD-810F.

In India, Encore invented the "simputer" (see Figure 4-3). The idea behind the simputer is a low-cost yet modern handheld computer that is independent from permanent power supply. Unfortunately, the project was not successful. The initial price (about 200 USD) was still too expensive to ensure widespread adoption. (Duveskog, Marcus et al. 2004; Bali, Kalika et al. 2002)But the company decided to act socially responsibly and made all specifications and technical details available for free. Furthermore, Encore improved the idea behind the simputer and developed a new tablet-PC-like computer (called *Mobilis*) system for the same price. (Encore, 2005a)

Figure 4-3: Simputer

Mobilis is a representative of the next generation of affordable mobile computing devices (see Figure 4-4). It has a battery that lasts for six hours of computing and makes this device independent from stable power supply. Built-in software fulfils most user needs (e.g. word processor, web browser). The original target market of *Mobilis* is India and therefore the Graphical User Interface is not only available in English but in Hindi, Kannada and Marathi. (Encore, 2005b)

Figure 4-4: Mobilis

[24] CPU is an abbreviation for central processing unit

[25] Panasonic Toughbooks http://www.panasonic.com/business/toughbook/home.asp

[26] roda-Computer GmbH http://www.roda-computer.com

Figure 4-5: SolarPC

Furthermore, SolarPC, a company that develops computer systems for special requirements, developed a PC for only 100 USD built out of standard components to assure that standard software operates on this device (see Figure 4-5). Its design is simple and can be manufactured by every country without the payment of royalties. The design objectives are durability, reliability and a low price, hence a monitor is not included. But an Operating System (Linux) and some Open Source Software packages are included. (SolarPC, 2005)

Figure 4-6: 100$ Notebook

The M.I.T. Media Lab, founded by Nicholas Negroponte, designed and constructed the prototype for a 100 USD notebook (see Figure 4-6). The target group of this initiative are children in the third world. The notebook is durable and the design adapted for children, e.g. the storage battery is also a handle. The display is designed to work indoors as well as outdoors. It can shift from full color to a monochrome mode for better glare resistance. Linux is proposed as the Operating System to keep the cost low. (MIT Media Lab, 2005)

4.1.4 Conclusion

The sub-chapter "Hardware" considered the special hardware requirements of developing countries in general.

Firstly, the challenges for operating computer systems in countries with extreme environments were outlined. Overall, sand, dust, heat, and humidity can cause severe damage to most of the hardware components in a commodity computer.

The American Department of Defence developed a standard to safely operate computer systems in extreme conditions (e.g. battlefield, under-water) and the German Institute for Standardization developed an equivalent civil standard.

Both standards have in common that a certified computer system is robust enough to be operated in countries with the certified conditions. Typically, it is also more expensive than an average commodity computer.

Several different hardware vendors and manufacturers recently recognized the market potential of developing coun-

tries and assembled some interesting hardware solutions. These were presented in the sub-chapter "Solutions".

It is not clear, whether these solutions were certified but they were designed to specifically meet the requirements of developing countries, which mean that they operate under extreme conditions, have lower power consumption and are economical.

For Afghanistan, durable, reliable and inexpensive hardware solutions are a giant leap towards the formation of an information society.

4.2 Software

4.2.1 Introduction

The software installed on the personal computers and on server systems is a key component of any IT infrastructure. In general the software should match the specific requirements of users, be easy to use and offer a wide range of applications. Last but not least, it should not be too costly.

What seems to be obvious is to use (install) open source software (OSS). Although OSS gets more and more accepted through numerous industry and computer users worldwide, there are still some negative rumors and myths about OSS. The type of discussion is blended of ideologies and smattering (Wheatly, M., 2004).

OSS is free in the sense of freedom. Access to the source code is provided free of charge. Maybe this is inherited by the age of enlightenment which is a fundament of the European culture; just like the exchange of knowledge (source code can be seen as information - thus knowledge). Especially for developing countries free access to information is and will be of high value.

Besides, quite a few OSS packages are tremendously successful:

http://httpd.apache.org/: "*Apache has been the most popular web server on the Internet since April of 1996. The February 2005 Netcraft Web Server Survey found that more than 68% of the web sites on the Internet are using Apache, thus making it more widely used than all other web servers combined.*"

http://www.openoffice.org/product/: "When OpenOffice.org 1.0 was released, no one could believe that software this good could be free. An estimated 16 million+ people have downloaded the software; many more have installed it from CDs or were passed copies by enthusiastic users. Community members produced translations in over 30 languages."

http://www.mozilla.org/products/firefox/: "The wait is over. Firefox empowers you to browse faster, more safely and more efficiently than with any other browser. Join more than ***46 million*** *others and make the switch today — Firefox imports your Favorites, settings and other information, so you have nothing to lose."*

Often participants in the discussion about the use, effect and impact of OSS do argue on an emotional level and only few would point out objective arguments.

It would be impossible to outline all arguments from both sides in this book. Therefore, this chapter focuses on total cost of ownership (see chapter 4.2.2), the quality (see chapter 4.2.3), the security (see chapter 4.2.4), the interoperability (see chapter 4.2.5), the quality and availability of applications (see chapter 4.2.6), the usability (see chapter 4.2.7) and the use for education (see chapter 4.2.8).

These categories where chosen to settle objective criteria to support decision for the use of OSS in Afghanistan.

4.2.2 Total Cost of Ownership

Definition

"Total cost of ownership (TCO) with regard to IT infrastructure refers to a type of calculation designed to help consumers and enterprise managers assess direct and indirect costs as well as benefits related to the purchase of computer software or hardware. TCO ideally offers a final statement reflecting not only the cost of purchase but all aspects in the further use and maintenance of the computer components considered. This includes training support personnel and the users of the system. Therefore, TCO is also sometimes referred to as Total Cost of *Operation*."[27]

OSS can reduce TCO in many ways. One of course is the lack of licensing fees, although this does not always mean that the application does not require investment. Even the GPL[28] leaves opportunities to gain money by distributing OSS. But OSS also helps to reduce cost in many ways that are hard to quantify (e.g. security, administration etc.). (Buchholz, A. S., 2003e)

A common example would be the migration of a company from Microsoft Windows to Linux. Linux itself is free of charge but of course different to Microsoft Windows. In addition to the purchase of the licenses other items such as workforce training and future efficiency of resources need to be considered. To deployments in industrialized countries this would usually be costly whereas it should be seen as an advantage to developing countries. This is due to the fact that hardware and software are typically shipped simultaneously and most users in developing countries do not have any experience with computers and thus no need for re-training. The difference in usage of OSS to conventional systems is not given, because in developing countries the implementation of OSS will likely be the first at all.

[27] Definition by wikipedia: http://en.wikipedia.org/wiki/Total_Cost_of_Ownership.

[28] The GNU General Public License (GNU GPL or simply GPL) is a free software license, originally written by Richard Stallman for the GNU project. It has since become the most popular license for free software. The latest version of the license, version 2, was released in 1991. The GNU Lesser General Public License (LGPL) is a modified version of the GPL intended for some software libraries. (wikiedia.org: "GPL")

4.2.3 Quality

Discussing the quality of OSS is very difficult and stigmatized by several different opinions, and varying definitions of quality. Typically, OSS projects are being developed with a completely different process. Commercial products are being produced according to the "cathedral model" (a hierarchical structure where individual parts are being developed in stages), whereas most OSS projects are produced after the "bazaar model"[29] (a lot of different components are assembled only at the very end). Both parties have their arguments why their approach is better to follow. The "cathedral model" is superior for large monolithic programs that serve several purposes and have a huge list of features. For example, the PIM (Personal Information Manager), email-client, calendar, address book and collaboration software from Microsoft "Outlook" will satisfy most users with more features than they can use.

Most OSS projects serve the exact opposite, therefore the "bazaar model" works better for them. Each application has just one purpose. It's still difficult, or even impossible, to estimate if OSS is of good quality or not because for almost every task there are various "competing" projects of different usage, platform, stage of release and features. This is inherited from the roots of OSS where programmers just developed programs to fit their very specific needs and they had fun developing. This inconsistency in the basic concept can also be seen as an advantage. Without the need to pay the developers, some OSS projects tend to lavish human resources and a lot of OSS projects still creep in their alpha stages. Nevertheless, a lot of OSS projects celebrate their success, as could be seen earlier.

Further the opportunity that peers can review the source code to check for bugs or to extend the functionality (also known as peer review) can also improve the quality of the application. (Buchholz, A. S., 2003b)

But finding out which OSS Project fits best for the desired task is a huge challenge and needs deep knowledge.

[29] These models were introduced in 1997 by Eric Steven Raymond and are published in a book named "The Cathedral & the Bazaar. Musings on Linux and Open Source by an Accidental Revolutionary" by O'Reilly & Associates.

4.2.4 Security

The advantages of the peer review process can also have a strong impact for providing good security standards.

But the fact that everybody can access and read the source code freely and without charge, implicates two consequences for ensuring security.

The world of security analysts can be divided into two groups following two complementary principles. On the one hand there are supporters of "security by obscurity" and on the other hand are followers of "security by full-disclosure". "Security by obscurity" is widely spread in most commercial software developing companies, in contrast the open source community believes in "security by full-disclosure", because the source code can be reviewed at any time.

"Security by obscurity" is based on the notion that if nobody can have a look on the source code nobody can find vulnerable spots. It is safe, because potential vulnerabilities are "hidden" to outsiders. Unfortunately, a huge list of exploits (e.g. Sasser Virus, LAND Attack etc.) has proven the opposite.

"Security by full-disclosure" takes the developer, the user and external security analysts into account. All of them are required to volunteer and participate in the process to secure the software, because it can happen at any time that security vulnerability is being discovered and posted on several newsletters. After the disclosure of such gaps, time works against the development team. Meanwhile, every installed systems shows security leaks. Some teams can't cope with this pressure and even well-known open source software packages risk gaining a bad reputation. To illustrate this, the Samba Server is an application which enables Linux and UNIX machines to send and receive files with and from Windows. In the beginning it was a beloved product, but in the meantime a lot of lately resolved security vulnerabilities depreciated the support of many users.

What is the best approach? Both groups kept feeding this discussion with new arguments and their replies for many years. It's impossible to summarize all the opinions in the context of this book, as a lot of them, simply put, are not objective or backed up by a scientific thinking.

A good example to support the approach of "security by full-disclosure" would be the history of cryptography. Since the beginning of modern computational cryptography most algorithms to cipher messages are discussed in public and history has shown that those which could not be reviewed were either unpopular or turned out to be unsafe. Of course most intelligence services have developed their own algorithms. The NSA[30] still hires a lot of mathematicians, physicians and software developers for this purpose only and undoubtedly the NSA accompanies the development with peer reviewers and mathematical strength tests like a public audience would do.

This is often used as an example for the benefits of peer reviews and "open source" (the exact description of the methods / algorithms are public) with regard to security. Popular open source projects benefit from a large number of reviewers, who look through the code, fix some bugs or discover security vulnerabilities.

Generally, the rule of thumb "the more popular a project, the more peer-reviewers will give their support and this can result in a higher level of security" applies to almost any open source project.

But the discussion about security of open source or closed source still continues and it seems that there is no final, objective position.

Robert Gehring, a research associate in the department "Computers and Society" at the Technical University of Berlin, tried to find an answer to this open issue.

His essay "Sicherheit mit Open Source – Die Debatte im Kontext, die Argumente auf dem Prüfstein" in the Open Source Yearbook 2004 identified the foundation pillars of the discussion about the security of Open Source. In Addition he showed the deficits in the discussion and the potential of Open Source.

Finally he states that the question if Open Source is more secure than closed source can be answered with "yes, often". (Gehring, Robert A., 2004)

But to define the security level of a certain application, no matter if closed or open source, there is only one effective

[30] NSA stands for National Security Agency also known as CSS (Central Security Service)

approach - testing. Fortunately, governmental institutions (e.g. BSI) test several software packages throughout per year and attest the security level with a certificate.

4.2.5 Compatibility

The growing popularity of the internet showed that computer systems do not exist in a vacuum. Further, a huge variety (in both quality and quantity) of information of any kind can be found on the internet. This could be a great treasure for developing countries to step closer to the information society and an easy opportunity to learn. But to actually make use of all the information in various formats on the in a proper and useful way the software used to show or to edit these documents must be compatible with the standards used by the rest of the world. Most protocols the internet is based on are standards defined by the IETF[31]. This is a consortium of several companies which has provided the standards implemented in both OSS and in proprietary software like internet browsers, FTP clients or email clients. In addition, the World Wide Web consortium continues extending the HTML standard, an interpreter language which is used to display rich content and which basically all browser software can understand.

The wide spread of Microsoft products and their market dominance forces other software developers (especially OSS) to fight hard for user acceptance.

Now, Microsoft's market dominance with desktop applications for the so-called "Information Worker (the "Office" suite) is threatened by several OSS projects. As an example, the Open Office Suite "copies" the user-interface and feature list from Microsoft Office, while at the same time being more robust than the original Microsoft Office (e.g. recovery of broken Word-Documents).

With regards to compatibility, a wide spread myth needs to be discussed: "Linux does not work with new hardware". This is a varied matter. For hardware to be running properly, drivers are necessary that are usually already integrated into the operating system shipped. For open source operating sys-

[31] IETF stands for Internet Engineering Task Force.

tems these are typically developed by the open source community. The community can only work on that once the hardware is publicly available on the market. This, of course, is due to the strategy of most hardware vendors who do not invest into the development of Linux drivers and focus on Windows instead. As a consequence, brand-new machines with special purpose hardware (e.g. a very powerful graphics card for gamers etc.) and their users who want to unleash the full power of the system typically may not be able to use this hardware on open source operating systems. But: Even the newest unsupported hardware can be run in a "compatible" mode. (Buchholz, A. S., 2003a)

Another piece missing in Linux is a satisfying support of ACPI[32]. Its development stage is still unsatisfying although it is merely a mechanism to save power while the user is not actively using the computer. Hence, missing support does not decrease the value of the operating system.

Developing countries usually run older computer systems with less advanced hardware and therefore the issue of problems with incompatible hardware is almost of no importance to them. In summary, developing countries should be able to find an OSS project for almost any computational information exchange to inexpensively fill the gap.

4.2.6 Applications

Applications are crucial to IT systems. As mentioned above, there are several open source application projects going on at any given point in time so that for most tasks that users may require, there should be an OSS available. The user or administrator can then decide which can best fulfill the tasks and thus best serves their demands.

This applies to the majority of typically required user tasks. But unfortunately, there are some tasks where only unsatisfying software packages currently exist, compared to commercial products for the Windows operating system.

[32] ACPI stands for Advanced Configuration and Power Interface; an open industry standard for hardware configuration and power management

To mention a few examples, there is no OSS project underway at present for a WYSIWYG[33] editor of web pages that would be comparable to commercial products such as Macromedia Dreamweaver, Microsoft FrontPage or Adobe GoLive!. There are a few, but these only offer basic functionality and are generally not comparable to commercial products. This may be due to the fact that OSS developers in the community would expect users of their software to be programmers themselves and WYSIWYG tools are not needed by them.

Another type of application that is not being covered by open source projects at the moment is a professional DTP[34] Solution. The famous, tex/latex, an OSS type-setting system, is not an option for commercial artists or even newspapers.

Yet another example of application not being developed in open source is a professional image manipulation software. The Gimp is a project which tries to fill this gap but does not offer many of the professional features like color separation. However, this may improve, as such features are planned for future versions of the application. Currently, only an unofficial plug-in for "The Gimp" is available and can be installed for rudimentary support of color separation. (Buchholz, A. S., 2003d)

In summary, open source software applications are a good alternative for developing countries like Afghanistan, compared with the high costs of commercial products or even illegal piracy, since these would typically not need the full package of professional features immediately.

The vast variety of available OSS applications raises the question of their usability, which will be discussed in the following subchapter.

[33] WYSIWYG stands for What You See Is What You Get; means an editor which displays exactly how the final document will look on the monitor

[34] DTP is an abbreviation of Desktop Publishing.

4.2.7 Usability

While applications are the functionality needed to solve tasks computationally, the actual man-to-machine interaction will still be a user. This refers specifically to end-user applications like those mentioned above.

The research on the man-to-machine interaction started almost at the same time as the first computer monitor was available.

In the very beginning of IT, most computers could not display graphics and therefore the interaction was based on the so-called "Command Line Interface".

Applications enrich the usage of computers, but the interaction between the computer and the user should be as easy to learn and familiar to the user as possible, for gaining acceptance and efficiency. Additionally, users also call for certain standards they can rely on while evaluating a new application interface. As one approach, among others, to standardize graphical user interfaces, IBM released the SAA - System Application Architecture[35] in 1990 which also defines the layout of graphical user interfaces and how the user is addressed. The SAA initiative aims to achieve:

- Consistent handling (physically, syntactically and semantically)
- Reduced effort for user training
- Increased user acceptance of new applications
- Coordinated assembly of menus.[36]

The Windows platform is based on the SAA standards and this is likely one of the most important reasons why users keep using Windows operating systems.

In general LINUX does not strictly rely on usability standards like the SAA, but LINUX itself is very modular and some components fulfill usability requirements.

[35] Systems Application Architecture (SAA) is a set of standards for computer software, developed by IBM in the 1980s and implemented in IBM operating systems including OS/2. The purpose of the standards was to enable the development of interoperable software on different platforms and operating systems.

[36] For further information see: http://www.kefk.net/Linux/Standards/SAA/index.asp

The fundament of Linux is the command line interface (CLI), which is basically an area where the user can type in commands and can receive their resulting output. The CLI requires intense knowledge to both interpret the results and write the proper commands.

Later on, the user-interface was improved and window mangers were integrated in most distributions. A window manager[37] is an application which allows the user to trigger all commands by using a pointing device (e.g. a mouse).

The two popular projects KDE and GNOME extended the sole function of their window managers with various applications. Therefore, they are called desktops.

Every major distribution offers at least one of these desktops as the standard environment for users.

Both desktops have their own usability concepts which differ significantly.

The diversity of LINUX distributions and desktops complicates the comparison to Microsoft Windows, especially when focusing on usability.

relevantive[38] AG has developed and realized an intensive usability test. The focus of their test was the usability of the Linux desktop in offices of governmental institutions and companies. The company preconfigured a Linux-system (SuSE Linux / KDE Desktop) and a Windows XP system and prepared a list of several tasks (e.g. burning a CD-ROM, displaying of files) for each test person. One group of test persons had to solve the tasks on a Linux-system and the other on Windows XP.

The result was surprising because it disproved the general prejudices against Linux.

"The majority of the test persons felt good while working with the Linux system and claimed to need just one week to reach their old performance level. Hence it can be assumed that positive acceptance and readiness to learn can be expected during the migration process." (lit. Relevantive AG, 2003; p. 4)

[37] More precisely: A window manager is software which controls the interaction, appearance and placement of application windows under the x-server system.

[38] For further reading visit relevantive AG at http://www.relevantive.de/

Further it testified that the performance level[39] of the test persons on Linux-systems were close to the performance level of Windows XP users for most tasks.

The Figure 4-7 shows the average performance levels of the test persons for the different tasks.

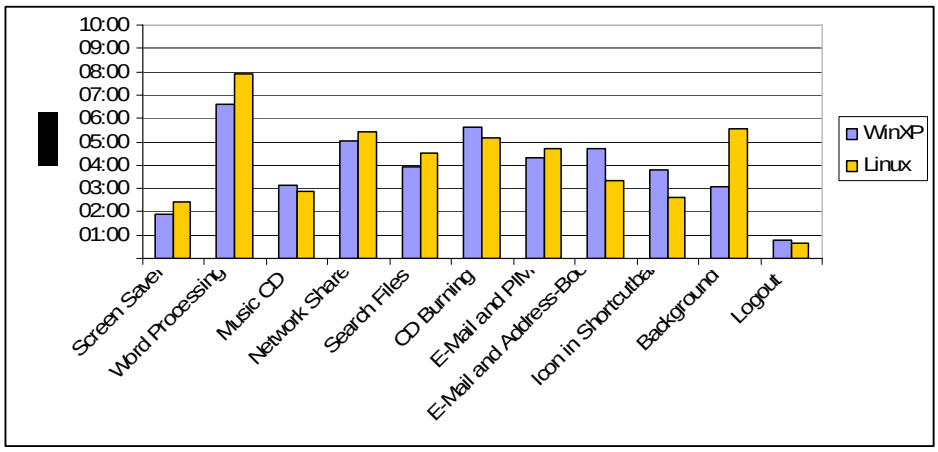


Figure 4-7: Performance Levels, from Relevantive AG, 2003

Linux systems are a good opportunity for developing countries. The user interface can be customized to display a slim and manageable user desktop and the available software packages for the KDE desktop satisfy all common needs.

Further the character of Linux systems enables the interested user to unlock the full functionality of the system.

4.2.8 Education

Improving education levels is likely the uttermost important challenge for a developing country. Today, most international businesses run and rely on several computer systems and networks that are required to be functioning 24x7[40] and need to be supported accordingly. It can be a great chance for developing countries to offer IT services to fulfill this need on a different cost structure. One example of a successful strategy is the development of the area around Bangalore, India. It has developed into being a premier des-

[39] A performance level is the time a user needs to fulfil a task.

[40] 24x7 is an abbreviation for a system, which operates 24 hours a day and 7 days a week.

tination for outsourcing many IT-Support tasks like call centers and software development

But proper education in IT needs to build on literacy and basic education.

For both, IT education and basic education, using computer based training tools can make the learning experience more interesting and facilitate teaching. (Ministry of Communications, 2005)

The KDE project founded a subproject with the purpose to produce a variety of educational programs to that end.[41] Several tools to assist both trainee and trainer are already available.

The Windows environment does not include any course ware but of course they are available from different manufactures sometimes with an associated cost. The cost should not be the only reason to evaluate OSS education purposes in developing countries. As outlined above, OSS expects the user to possess a higher level of knowledge than standard Windows systems, but as a result OSS also offers the chance to learn on computer or specific program functionalities[42].

While using Linux / OSS the user always has the chance to find out exactly what the program is doing and in the end, in an educational sense, benefits more from using a computer.

For developing countries like Afghanistan, a lot of different OSS projects may be of special interest to improve the work with Linux / OSS in education.

[41] For further infomation visit: http://edu.kde.org

[42] As an example, a student may try to find the determinant of a matrix but struggles solving the equations. The student could use *tkmatrix* to find a solution for that and while using, discovers more functions out of curiosity, and in the end even learns how the algorithm work.

4.2.9 Freedom

Maybe "freedom" can be seen as a philosophical topic but when dealing with computers and their software it is an important area for developing countries.

By using closed-source software developing countries could make themselves dependent on a vendor's will.

Even if large companies, such as Microsoft, offer sponsorships for institutions in developing countries, the schools, clubs or ministries still have to apply for the sponsorship and can't be sure to get proper support. In case of Microsoft Windows this may mean that the discounted software license is excluded from necessary update cycles, which prevent systems to be attacked by the enormous spread of worms and viruses.

Another aspect is that by using closed-source the developing countries can not build up their own knowledge base, thus eventually slowing their development.

4.2.10 Recommendable software packages

The following is a recommendation of several open source software packages suitable for Afghanistan. It has been assembled to fit most needs of small or middle sized enterprises and schools:

The idea was to propose a complete set of applications to immediately operate an office, institutional or school computer network.

The server system should be easy to configure and it should include all typical applications (like DHCP, Firewall and more). The client should be run by an easily configurable and installable system. In addition, it should be secure and user-friendly directly "out of the box".

Server System: Arktur

Arktur is a server software system originally designed to enable German schools to build a sophisticated computer network with internet access, firewall and a lot more. The project was initiated by the German computer magazine "c't" and is now continued by a huge group of developers.

The minimum hardware requirements to run Arktur consist of an average commodity computer with two network interface cards, but depending on the size of the network it should be considered to run it on a more powerful com-

puter. The two network interfaces are needed to clearly separate the intranet from the internet. The integration of sophisticated tools such as Linux firewall, file server, ftp-server, ssh-daemon, terminal server, DNS server, web server for intranet and internet, user-directories "/URL/~username", and many more are the reasons why Arktur is such a popular OSS server system.

The difference to other server systems is the useful pre-configuration and the very simple setup. (Arktur, 2005)

Client System: KUbuntu

KUbuntu is a branch of the Ubuntu project and "Ubuntu" is a free and complete Linux-based operating system, with both community and professional support available.

"The Ubuntu community is built on the ideas enshrined in the Ubuntu Manifesto: That software should be available free of charge, that software tools should be usable by people in their local language and despite any disabilities, and that people should have the freedom to customize and alter their software in whatever way they see fit." (Canonical LTD., 2005)

Besides the wide range of different Linux systems and distributions, "debian", the technology base of the Ubuntu project, has a very good reputation among professionals and users. Its package management system is the best method to reduce the complexity of a software update or the installation process. Also, there are several options which support the users in their decision on which software to install by giving recommendations upfront. One of the biggest disadvantages of debian is the almost complete lack of hardware recognition during the install process. This is also the main reason why the original system can not be recommended in this book. In contrast, Ubuntu has its own installation system which recognizes most hardware very well.

The KUbuntu projects aims to develop an Ubuntu distribution with the only difference that the standard desktop Gnome is replaced by KDE.

The decision to recommend KUbuntu over Ubuntu was build upon the conclusions drawn in the sub-chapter 4.2.7 "Usability". The usability test of relevantive AG has proven the ease of usage of the KDE desktop, and, furthermore, in-

cludes several educational applications that can be installed[43].

In addition, the KUbuntu distribution comprises several popular and good software packages (e.g. OpenOffice, KMail) to solve most office tasks.

4.2.11 Conclusion

Comparing both the advantages and disadvantages of open source software with the focus on developing countries, it becomes clear that this would represent a good opportunity for developing countries, specifically Afghanistan.

The sub-chapter "Software" examined all popular prejudices against open source software. Further, the potential applicability of Open Source Software in Afghanistan is discussed.

Most of the common myths about Open Source Software were refuted. The quality, compatibility and usability of open source software are very competitive compared to commercial, closed source software, if users can overcome the absence of some professional features.

For developing countries, the opportunities deriving from the general availability of the source code are even more important.

Afghanistan could build up its own knowledge base when using and modifying OSS and would not need to pay royalty licenses to software vendors.

[43] For further information see http://edu.kde.org

4.3 Summary of General Recommendations for Afghanistan

The purpose of this chapter was to propose some recommendations on the build-up of IT systems tailored for Afghanistan. They are separated into hardware and software suggestions.

The hardware is required to resist the outer conditions. Hence, the devices have to be chosen carefully and considering the operating conditions. Two international standards were introduced, which, if applied thoroughly, solve these issues. Lastly, five different hardware solutions (*PIC*, *simputer*, *Mobilis*, *SolarLite*, and the *100$-laptop*) designed for developing countries were discussed and evaluated in detail. These are designed to meet the special demands of developing countries, such as durability, reliability and affordability.

The software applicable to Afghanistan's background would call for suitable and attractive pricing and should not bind the user to proprietary standards. At the same time, it should be satisfying most user needs. Therefore, different aspects of software (total cost of ownership, quality, security, compatibility and usability) were discussed. Finally, some open source software packages (e.g. KUbuntu, Open Office) were presented to solve different tasks.

5 An Education Concept

"One major obstacle impeding industrialization in developing countries is a severe shortage of trained personnel in technological and information fields." (Al-Wakeel, Sami S., 2001)

5.1 Introduction

Today's situation in Afghanistan has revealed the need for an "IT security" vocational training. But the situation in Afghanistan also clearly shows that a traditional vocational training would last too long and overwhelm the students with unnecessary content elements which do currently not apply to the IT systems used in Afghanistan.

Further a vocational training prepares the apprentice for one specific job profile and is completely different from a university study in computer science; so the way of teaching should be different, too. (Tedre, Matti et al., 2003)

It is necessary to make some assumptions on the knowledge of the to-be students, because passing the vocational training program after the university study would make no sense.

The best option would be to assign some schools dedicated only for the vocational training program; but taking Afghanistan's situation into account a proper building (featuring internet connection, computer, etc.) is not realistic for the next few years and there is still a lack of schooling till the students start with the vocational training program.

One remarkable example how these problems can be dealt with is the "HOLE-IN-THE-WALL" Project which was very successful in elevating the knowledge level of children from urban areas in India just by placing computer terminals in the "hole" of a wall.

Soon children realized the new toy and while playing around they learnt a lot. Of course the "HOLE-IN-THE-WALL" can not replace a traditional education, but it is a great supplementation. (HOLE-IN-THE-WALL EDUCATION LTD. (2005))

But besides talking about location and equipment of the vocational training program its content is of course of great importance and should be considered carefully.

Germany's vocational training, also called "dual vocational training," has a good reputation in the whole world. Its "duality" derives from the clear separation between on-the-job and off-the-job training at designated schools. The costs of these schools are shared by the state and the employers, but solely the state holds the responsibility for the certification, the schooling, and the teaching. (Mokhtar, Gamal A. et al., 2002)

Although the good reputation of the German vocational training program has suffered since its first regulation in 1955 one can still consider it to be an archetype for a new implementation.

The Idea behind the education concept in this book is a compact vocational training program for the "Assistant of Applied Information Technology" in Afghanistan following the examples of the German vocational training programs but reduced to one year. It will enable the students to administer basic IT systems, teach others, and to deepen their knowledge on their own. Of course, to reach this goal some assumptions must be made, but we wanted to keep the entry level as low as possible. Our proposal for the vocational training program expects average knowledge of the English language and basic knowledge of higher mathematics from the student.

The student must not have any experience in using a computer, because the first part of the proposed vocational training program, called "Basic IT Education" leads the student from his first contact with a computer to the general understanding of computer technology.

Further it aligns the knowledge level of the students, which supports a better team spirit and eases the teaching.

The second part is actually the vocational training program which is an adaptation of the German vocational training program.

The following subchapter explains the "Basic IT Education" program, the idea behind it, and the content. Later the German vocational training programs are described and at last the proposed concept of a vocational training program for the "Assistant of Applied Information Technology" in Afghanistan is presented.

5.2 Overview Germany

The decision to choose the German vocational training program as an archetype for the concept presented in this book was based on its good reputation. The concept behind the German vocational training program is outstanding in the world. The combination of on-the-job and off-the-job training in a school, including the exams at the end of each section, guarantees a certain level of knowledge for all students. At the end of the program the student receives a certification and if one of the students applies for a job, then the entrepreneur has a proof on his knowledge and can exactly estimate whether the candidate is qualified for the job or not.

In Germany the companies share the costs of the vocational training with the state. The companies finance the on-the-job training and the state runs the schools where the students attend classes and take exams. Teaching is controlled by the ministry of education in each federal state, although only the IHK (German chamber of commerce and industry) prepares and holds the exams. The vocational training for the student is free of cost and the company has to pay him a small salary.[44][45][46][47]

In Germany the student can choose between several IT-related vocational programs:

- ***Fachinformatiker:*** are experts on the design and implementation of complex IT systems. (Kultusministerkonferenz, 1997)

- ***Systemelektroniker:*** develop or repair electrical and electric components and devices. (Kultusministerkonferenz, 2003b)

- ***Systeminformatiker:*** develop and setup industrial IT systems. (Kultusministerkonferenz, 2003a)

[44] For further information on the cost structure visit http://www.lbs-hoerakustik.de/kosten.htm.

[45] For further information visit http://de.wikipedia.org/wiki/Duale_Ausbildung.

[46] For further information visit http://inhalt.monster.de/1921_de_p1.asp.

[47] BBiG § 6. Abs. 1.

- ***Informationselektroniker:*** offer services for IT systems, including the repair of devices and the instructions for the customers. (Kultusministerkonferenz, 1999b)

- ***Fachangestellter für Medien und Informationsdienste:*** gather information and restructure them for potential users. (Kultusministerkonferenz, 1999a)

The training program *Fachangestellter für Medien und Informationsdienste* focuses mainly on the needs of the "information society" where the amount of Information of any kind and quality is overwhelming and must be filtered to a compact manageable size.

In this training program the technical knowledge is of little importance.

At this stage in the development of Afghanistan a sustainable technical education program is more important and therefore our concept cannot consider this vocational training program.

Maybe at a later stage some elements of the *Fachangestellter für Medien und Informationsdienste* training program can be implemented into our concept.

Unfortunately, all vocational training programs have elements which, at first glance, seem not to fit properly in Afghanistan and they differ in their length.

Therefore it is obvious that – before a new concept for Afghanistan can be designed – it is important to look at Afghanistan's specific requirements.

5.3 Requirements Afghanistan

As shown in the chapter "Current Situation in Afghanistan" the land suffers from the years of war and has a great lack of stability.

The education system is still in a bad condition but the process of rebuilding has begun. The national economy is gaining strength again but still educated personnel are badly needed. The illiteracy rate in Afghanistan (see chapter 3 Current Situation in Afghanistan) is very high and many schools and universities are destroyed. The process of rebuilding focuses on the schools and universities but the vo-

cational education is almost neglected. As shown in the chapter "Current Situation in Afghanistan" Afghanistan has the organizational concept for a vocational training but neither schools nor teachers exist.

Specialized personnel are essential for a company or governmental institution. The different kind of qualifications (school, vocational training, and universities) serve different job profiles, therefore a missing vocational training program forces companies to search for foreign employees. "The lack of specialists forces the companies to get them from abroad whereas locals are still unemployed." (Al-Wakeel, Sami S. 2001)

A sustainable development of Afghanistan will be very difficult if the lack in the education process persists. Fitting all circumstances together, the presented vocational training program includes two different steps: the basic education and the concept for the vocational training program.

The basic education should balance lacks in the education of the students and teach some fundamentals about information technology. They should learn to interact with a personal computer and get some theoretical, technical, and mathematical background. The sole requirements to attend the "Basic Education" are a basic knowledge of the English language and mathematics.

5.4 Basic IT Education

5.4.1 Idea

The idea behind a "Basic IT Education" is the necessity of an equal standard of knowledge between the students. This would guarantee a better team spirit, eases teaching, and makes it possible to develop a vocational training program for Afghanistan. In principle the "Basic IT Education" should fill the gap between schooling and vocational training. In contrast to Germany where the computer, its capabilities, and the equipment are introduced during school lessons, this knowledge cannot be expected in Afghanistan.

The student also needs to pass the "Basic IT Education" in order to be properly prepared for the vocational training. It precedes the vocational training and should be completed after two months.

During these eight weeks it most probably won't be possible to touch every topic associated with information technology. But the idea is not to give a full background view on information technology, but rather to enable the students to follow the classes of the vocational training and to gain the necessary capabilities in order to deepen their knowledge in self-study.

Most important topics get mentioned and the important concepts are introduced. After the "Basic IT Education" program is passed the student has learned how a computer works, what exactly an Application/Operating System is, and some theories behind it.

5.4.2 Content

The following subchapters introduce the basics for a script for the "Basic IT Education". The mentioned content should help the students to get a general idea of what a computer is and how it works. It is no meant as a curriculum but rather as a collection of educational objectives. Sometimes, if needed, further information will be given.

The "Basic IT Education" starts with a brief historical overview on the development of the computer and is followed by the theoretical principles, where the Turing machine and then the Von Neumann computer model are introduced, which should not be taught in detail. The apprentices should just get an idea of how they work.

After the theory the apprentice is introduced to the hardware components, following the Von Neumann computer model. It is suggested that this part of the "Basic IT Education" is taught as a kind of a practical course for a better understanding.

The next part concentrates on the mathematical basics, which are introduced to the apprentices.

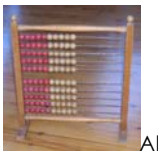
In addition the last part of the "Basic IT Education" introduces the apprentice to all kinds of software applications.

Further some ideas how the curriculum for the "Basic IT Education" should be taught are given in the last subchapter 5.4.3 "Methodology".

A1 Theory

The following paragraphs picture the development of the computer from a historical perspective.

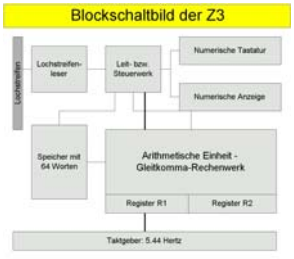
Development of the Computer (historically)


Abacus


Hollerith machine

A famous quote by the IBM Chairman Thomas Watson, 1943. :

"I think there is a world market for maybe five computers."



Mechanical computing machines:

- Abacus – the oldest mechanical computation help.
- 1673 Gottfried Leibniz invents a computational engine, which was capable of all four basic arithmetic operations; he also developed the modern binary number system used in computers.
- 1822 Charles Babbage developed the first (working) difference engine.
- 1889 Herman Hollerith invented the Hollerith machine, a punched card system. It was used in 1890 for the 11th census in the USA. He founded the Tabulating Machine Company, which was sold in 1911 to the Computer Tabulating Recording Company. In 1924, this company was renamed as International Business Machines Corporation (IBM).
- 1937 Alan Turing publishes his article about the *Turing machine* (see Turing Machine)
- 1937 Konrad Zuse filed 2 patents, which already describe all elements of the *Von Neumann* architecture (see von Neumann)
- 1941 Zuse invented the first free programmable (relay) computer, Z3 (the first, Z1 (1938)), was completely mechanical and to some degree programmable; in 1946, Zuse founded the first computer startup company and distributed the Z4, the first commercial computer system).
- 1943 the vacuum tube computer Colossus was build (1946 followed by the Eniac).
- 1947 the transistor was invented, which led to the invention of the microprocessor.
- 1955 the first computer with transistors was built, the TRADIC.
- 1960 DEC built the first minicomputer, the PDP-1.

- 1964 Texas Instruments invented the integrated circuit (IC).
- 1970 Intel built the first mass-produced microprocessor.
- 1976 Apple introduced the first personal computer (PC).

Integrated Circuit

The Turing Machine

Alan Mathison Turing

(1912-1954)

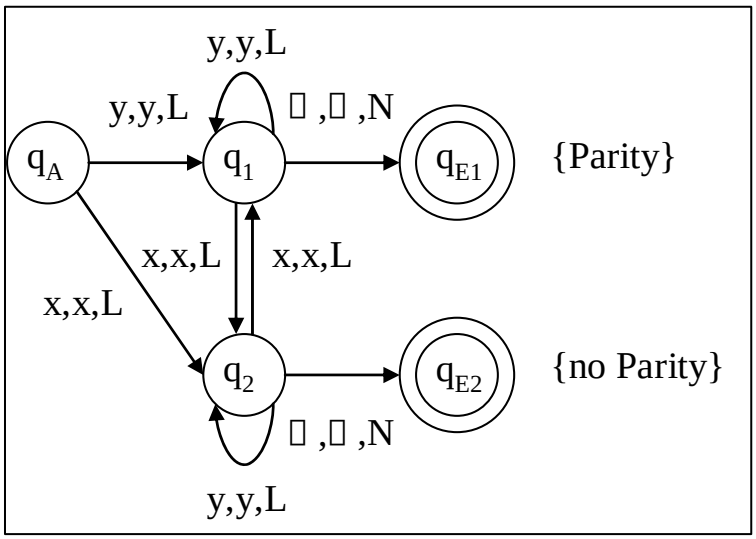
A Turing machine is a mathematical model to create a class of computable functions.

A Turing machine consists of

- an infinite long memory tape divided into infinite fields, each one can contain exactly one symbol;
- a Control Unit, which saves the state of the Turing machine (it has also infinite states);
- a head, which reads, writes, and erases the symbols from the sectors on the tape, it can move to the left and to the right;
- a program defines the movement and action of the head and is described by several transition functions. For example, the triplet (x,x,L) means that if the head reads an x, it writes an x and moves left. In this example nothing changes on the tape, the machine just reads each symbol and writes it back on the tape.

In his well-known work *On computable numbers, with an application to the Entscheidungsproblem* (1937), Alan Turing introduced the Turing machine.

He proposed in 1950 a new test to verify the intelligence of a computer program (AI[48]). It is called the Turing test.



x is the element to count; **y** stands for all other symbols

This Turing machine determines whether the number of elements specified by x are even or odd (parity and no parity) and reads over all other elements. It ends if a blank is found. The final state (double circle) represents the result.

[48] AI stands for Artificial Intelligence

Von Neumann Computer Model

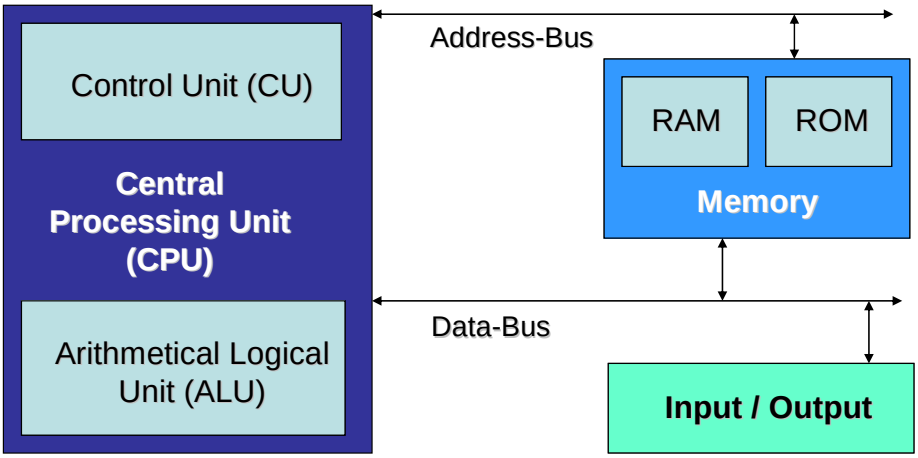
John von Neumann

(1903-1957)

The *Von Neumann architecture* describes a basic concept for a universal computer system. In this concept, a computer typically consists of the following components:

- an Arithmetical Logical Unit (ALU),
- a memory,
- a Control Unit,
- an Input/Output Unit,
- a Bus system to connect the components.

The *Von Neumann architecture* was first described in *First Draft of a Report on the EDVAC* in 1945.



The revolutionary approach of this architecture was the principle of electronic data processing: "Once these [input] instructions are given to the device, it must be able to carry them out completely and without any need for further intelligent human intervention." (Von Neumann, John, 1945; p. 7)

Almost every computer system used today bases on the *Von Neumann* architecture.

Electronic Data Processing means that information is processed automatically. This process is designed according to the Von Neumann computer model and happens in three stages:

- Input (data by keyboard, a mouse click, etc.),
- Data Processing (memory, CPU),
- Output (printer, display).

A2 Hardware

The Central Processing Unit (CPU) is the heart of every computer system. The best known CPUs are Pentium and Athlon.

There exist different CPU architectures:

CISC [Complex Instruction Set Computing], old x86 CPUs had a CISC core, modern Pentium CPUs have a RISC core with some CISC functionality;

RISC [Reduced Instruction Set Computing], DEC Alpha, PowerPC, Suns SPARC;

MIPS [Microprocessor without interlocked pipeline stages], is a subset of RISC.

The BIOS (Basic Input Output System) is the first software that is executed after starting the computer. After the power-on self test (POST) is passed the hardware components are initialized.[49] The Operating System could use several functions which are provided by the BIOS software to access the hardware. Modern Operating Systems like Windows XP have own drivers to access the hardware, e.g., a graphics card. In an appropriate way but during the startup process they have to access the BIOS routines in order to load their own drivers. Most BIOS-software vendors include password protection which can ask for a password before starting the computer. The BIOS also includes a configuration menu to change the settings for the hardware, which is necessary if hardware components are exchanged or added.

The main board (also called motherboard) is the main part of a computer system. It holds the CPU, memory, graphics card, network card, and all other kind of extension cards. There are also several Bus systems integrated in the main board. The different Bus types are ISA PCI, AGP, and PCI Express. Graphics cards demand a high data throughput of the Bus system therefore the AGP[50] bus was invented to comply with the demands. The AGP Bus (and the PCI Bus) will be superseded by the PCI-Express Bus but this Bus system is not limited to graphics cards, so all extensions could be connected by this Bus.

[49] POST: A very basic hardware test during the Startup Process

[50] AGP – Accelerated Graphics Port

The term *memory* describes different parts in a computer system. There are memory modules for the program execution and there are memory devices for the storage of information. Below, the different types of memory are depicted, separated by the physical principle which is applied.

Electric:

- RAM (Random-Access Memory), non-permanent (volatile) memory, used for fast access to execute programs;
- ROM (Read-Only Memory), permanent memory, not changeable, often used for software directly included in hardware;
- FLASH (EEPROM – Electrically Erasable Programmable Read-Only Memory), a kind of ROM that allows content changes – it is used to store the BIOS software.

Magnetic memory:

- HDD (hard disc drive): consists of several rotating discs with a magnetic surface;
- Magnetic tape: typically has a high storage space and is generally used for data backup;
- Floppy discs: a wallet covers a thin disk with a magnetic surface but, contrary to the hard disk, the storage space is very limited (720 kB to 1.44 MB)

Optical memory:

- CD (Compact Disc): also called CD-ROM which stands for Compact-Disc Read-Only Memory and the properties are much the same like the ROM. Once a CD is written (a CD-R in a CD burner) or pressed (all commercial CDs are pressed in a mass production) the content cannot be changed. The content is read and written by a laser.
- DVD (Digital Versatile Disc or Digital Video Disc): the DVD is an improved version of the CD. It is based on the same technology but a new laser with a different wave-length increases the capacity from 800 MB to 1.7 GB.

Input Devices

Input devices could be categorized according to their physical functionality. The most popular input devices are the keyboard and the mouse.

- Keyboard: consists of several (IBM standard: 102) keys to type letters and numbers and to control programs with shortcuts (functionality keys F1-F12, ALT, CTRL).
- Pointing devices: Mouse – an input device for graphical interfaces; the user can move the cursor on the screen by moving the mouse. There exist several mouse types with 2 to 5 keys for commands and a ball or an optical sensor to measure the user's movements.
    - Other pointing devices: Trackball (similar to a reverse mouse), Digitizer Tablet, Touchpad, Touch Screen (the user can directly touch the screen to move the cursor or to give commands).
- Optical digitizer: Scanner, digital cameras, digital video cameras and bar code scanner
- Microphone: for audio input

Output Devices

- Monitor, Beamer, flat screen: these are devices to display directly the output of the graphics card
- Printer, Plotter: these devices print the desired output (e.g., text documents, graphics) on paper using different technologies
- Loudspeakers, Earphones: responsible for audio output

Interfaces

All kind of input and output devices have to be connected with the computer. For a proper connection both the computer and the device have to support the same interface (the plug and the plug socket have to match). There are two kinds of data transfer: parallel and serial.

- Parallel Interface: the most popular parallel port was the printer port (centronics interface or IEEE 1284 standard) but today this interface is only seldom used

- Serial Interface: Serial interfaces transfer data packets in succession; due to an intense development the frequency (of transferring data packets) was much increased, so modern serial interfaces are much faster than any parallel interface: The two most popular serial interfaces are:
    - Universal Serial Bus (USB),
    - IEEE 1394 (Firewire, iLink).

A3 Mathematics

Bits & Bytes and Number Systems (Maginalien)

Computer process and calculate Bits and Bytes. Every different data type has to be "constructed" from these basic types.

A Bit is the most basic information unit and is used in information and computing theory. It can only have one of two values (1/0). This behavior is derived by historical computers where the data was stored in relays, because a relay is either energized or de-energized. Bit is the abbreviation for binary digit. Eight Bits are one Byte. The mathematics is based on the binary system (positional notation with the base 2).

One early approach for a friendlier input, storage and output of textual information was to assign certain 8-Bit code to characters and symbols. This code is called American Standard Code for Information Interchange (ASCII).

The ASCII[51] code is an 8-Bit (= 1 Byte) code which limits the amount of available characters to 256 (2^8 = 256). This is sufficient for western languages based on Latin characters but to support other languages a new code was introduced and standardized, the Unicode. This advanced code uses 16 Bits (2 Bytes) and therefore 65536 characters can be defined.

The core operations made by the CPU are logic operations. Beside the binary system introduced above, which is used for the values of the variables, a set of operations is needed, the *Boolean algebra*. It deals with assertions as values and the binary system fits perfect for this purpose. Value 1 is translated to the assertion TRUE, value 0 is translated to FALSE. These are the basic values and every assertion could have either the value TRUE or FALSE.

The Boolean logic uses the following basic operations: AND, OR, NOT. There exist other common operations being combinations of these three basic operations. When introducing and learning about the Boolean logic it is useful to summa-

[51] ASCII – American Standard Code for Information Interchange.

rize all possible values and results in tables. Mathematicians use to substitute AND, OR, and NOT for the symbols ∧, ∨, ¬.

AND – ∧	0	1
0	0	0
1	0	1

OR – ∨	0	1
0	0	1
1	1	1

NOT – ¬	0	1
	1	0

A4 Software

Definition of Software

Generally, it can be assumed that software is everything of a computer which has no direct physical functionality. Furthermore, several different types of software programs are distinguished.

The Operating System is a huge software component that covers all hardware interaction and displays a Graphical User Interface to simplify the use of the computer. On top of the Operating System runs the Application Software. There are literally millions of applications available, for almost every Operating System, which satisfy lots of different needs (e.g., on the fields of multimedia, office, and science).

Figure 5-1 gives a good impression about the dependencies between these different software types. The hardware components are wrapped by the Operating System and on top of the Operating System run the User Software.

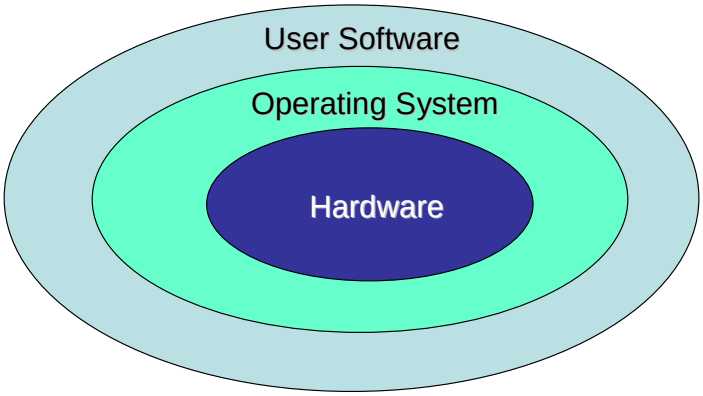


Figure 5-1: Shell Model

Operating System

The Operating System is a software component which enables the usage of a computer. It controls and manages the usage and functionality of the hardware. Further it manages the Input and Output devices attached to the computer and starts Applications.

Operating Systems basically consists of a set of special software (called driver) to use the hardware, and utilities to run and configure the Operating System.

There is a huge variety of Operating Systems which reflects also the huge variety of different processor types and different needs.

Operating Systems can be divided into Multi- and Single-User Systems, where a Multi-User Operating System offers its service to several independent users whether a Single-User System cannot be properly configured for the use by several users.

Microsoft is the most popular software vendor and the producer of the Operating System series Windows which has the highest market share. But besides Microsoft Windows the free Operating System Linux is also a good alternative – although it has not a real vendor and producer because it's developed and licensed as Open Source (see chapter 4.2 Software). These Operating Systems cover most of the hardware components, especially the Processor with a high market share. For different tasks and sometimes for different environments there exist a couple of other Operating Systems like Sun Solaris (which is a derivative of the Linux Ancestor UNIX) and Mac OS (by Apple, focusing on the needs of designers and illustrators).

Software Applications

The computer is a good and efficient servant for almost any work in the office. The user can file data in a database, write a document or a letter, calculate an invoice, charge something on the invoice, collect and store addresses, and much more.

But today the computer has emerged from the office and is used in many other scenarios.

Common audio and video players in most living rooms are more and more displaced by one single computer which can play DVDs or videos stored on its hard drive, play music files, and display photographs. Besides it gives his user still the opportunity to do any other of the above mentioned tasks.

For these two different scenarios there was no need to modify the Operating System. What had to be exchanged or added were suitable Software Applications.

As described above software applications run on the Operating System. Therefore, using a software application which is built for a different Operating System is not possible.

There are literally millions of software applications available on the internet and in the stores – some free or open-source, some for a short amount, and others very expensive.

A good overview, although definitely not all applications are covered, offer so-called download directories. These services sort software applications, either automatic or by hand, into categories (e.g., audio, video, word processor). Some popular services are www.download.com or www.tucows.com (tucows includes also Linux applications).

Popular Software Applications

Although the computer, with its huge load of software applications, is a real multi-talent its most dominant use is to perform as a better typewriter. It is possible to find several stand-alone word processors and stand-alone spreadsheet applications but it makes more sense to use a combined package of applications which all serve the purpose to enhance the productivity of daily office work.

The most popular package, called Suite, is the Microsoft Office Suite. It runs only under Windows Operating Systems and Mac OS X.

Throughout the years first Sun Microsystems but then highly motivated open-source developer created a competitive office package called Open Office, which is fully compatible to the Microsoft Office Suite and also runs on Solaris and Linux Operating Systems. There are users who even pretend that this one is better than the Microsoft Office Suite.

Developing Applications

It is of course comfortable and reasonable to use software applications but sometimes it happens that no application is available for the planned task or only with an insufficient feature set. Developing an own application is also a great opportunity to intuitionally learn the principle functionality of computers. There are a lot of different programming languages available, but in general most of them have different intentions and they, in addition, mostly serve different purposes and/or work on different levels or layers of Figure 5-1.

How it Works

In most cases a programming language is a subset of words or phrases from the English language which simplifies the access to the resources and the functionality of a computer.

The basic, but not the simplest, programming language is Assembler. Assembler is the programming language which can directly work on the hardware layer. Compared to any other programming language Assembler is not a subset of the English language and very mathematical and technical. But besides the high learning curve there is one advantage for the "basic education" because Assembler Listings are processed by the computer line by line (one line matches one command), whereas almost any other language differs from this behavior.

During the "Basic IT Education" program the student should learn the first steps and principles of programming.

As expected, a lot of different programming languages are available for free. The following will give little impression about three very popular and free programming languages working all on a different layer of the computer. At this point it's not interesting what purpose each programming language exactly has or whether it is object-oriented, functional, or imperative. The sole purpose of the presented source code should simply be a first glance on a small, working program.

All of the following programs are so-called "Hello World" programs, which means that the program is as simple as possible, displaying only the string "Hello World" on the computer display. Although this is not a neat functionality it is perfect to see the obvious difference between the three languages and therefore to get an impression on the differences in the three layers.

Assembler (Hardware Layer):

```
MODEL SMALL
IDEAL
STACK 100H
DATASEG
   HW      DB      'Hello World!$'
CODESEG
   MOV AX, @data
   MOV DS, AX
   MOV DX, OFFSET HW
   MOV AH, 09H
   INT 21H
   MOV AX, 4C00H
   INT 21H
END
```

C/ C++ (Operating System Layer / User Software Layer):

```
#include <stdio.h>
int main(void)
{
  printf("Hello World!\n");
  return 0;
}
```

Java (User Software Layer):

```
public class Hallo {
   public static void main(String[] args) {
      System.out.println("Hello World!");
   }
}
```

Compilers, source editors, and further tools are available and needed, for each of the programming languages and for almost any platform. But the availability does not necessarily mean that the source code can be compiled and run on every platform. Where the source code directly uses functions of one specific Operating System the user cannot expect that it will run on another platform.

Obviously, Assembler is affected by this but also C/C++ are designed as platform dependant languages.

The only language which can be compiled and run on almost any platform is Java. Developed by Sun Microsystems this programming language starts a virtual computer (called virtual machine) on the Operating System. Although the Operating Systems remain different as long as a virtual machine can be started (Sun provides Java virtual machines for almost any Operating System), Java programs can work without being changed. This trick makes Java a completely platform-independent programming language.

Java is a state-of-the-art programming language. It is used by a lot of computer software companies and by almost any computer science department of German universities. Besides its modern technology and design, one reason why Java should be used in education is definitely its portability.

Tools for Developers

Basically a programmer needs only a text editor for typing the source code and a compiler for compiling the source code into the binary code.

These tools are sufficient, even for advanced users, but mostly more comfort is appreciated and this is the point where the programmer switches to Integrated Development Environments (IDE). As the name of this type of software already explains an IDE integrates all needed tools into one environment. Moreover, it supports the developer while typing. Some of those even have a visual designer for graphical User Interfaces (GUI) on board.

A popular Open-Source IDE is Eclipse. Originally started by IBM it is now developed by several companies and a lot of Open-Source developers. Its intention is to be a workbench for almost any stuff related to programming. Currently the workspace for developing Java has advanced to a very comfortable environment.

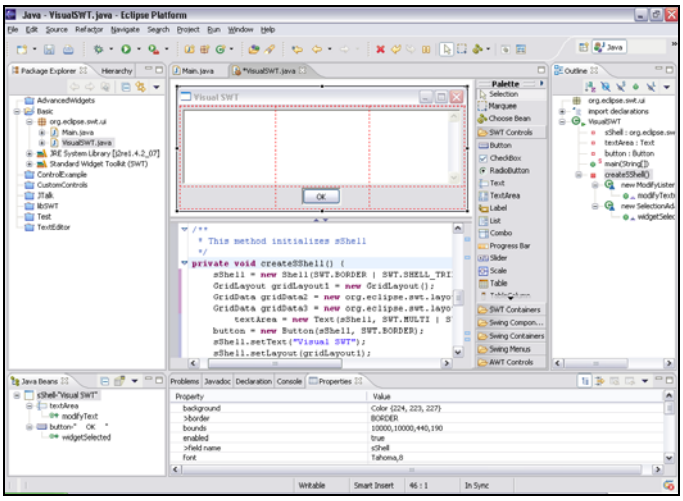


Figure 5-2: Eclipse IDE

Although an Integrated Development Environment means great improvements for programmers, it is only recommendable for advanced users because its supportive intention may reduce the learning effort for the student with the result for the student to have learned less than he would have learned by programming "by hand."

5.4.3 Methodology

The Basic Education is meant as a base for the following vocational training program. Its main purpose is to give an overview on Information Technology and to introduce almost all aspects of IT even those which do not necessarily concern the students in their professional development.

The Basic Education concept/content was intentionally strictly reduced on the pure content elements because we do not want to interfere with any pedagogic experience, concept or guideline which was developed for Afghanistan. Those who will use our concept should have the ability to modify teaching the way it works for their classes, schools, and experience. It makes no sense that we, as computer scientists, set up a teaching concept without having the proper pedagogic background – and, more important, risking to mislead the teachers.

Nonetheless we would like to give some suggestions regarding the methodology of teaching in this chapter.

It can be expected that the students will keep a certain, respectful distance towards the computer – mostly because they fear to break anything. Therefore it is useful to separate the students right from the start, forming small groups, where they should solve small and simple tasks in teamwork. This strengthens the team spirit and forces everyone to share his ideas and discuss them in a group to achieve a good result – a good base for their future professional development. By the way, this idea is also present in the schedules of the computer science education at German universities.

A trend for the education in developing countries is eLearning. eLearning is more a concept than an application. Usually it stands for a special web-based application typically designed to represent the structure of a university including different privileges for teachers, professors, and students. Most eLearning applications require an Internet Browser, but Internet Browsers demand computer skills to be used effectively and, of course, this knowledge should not be expected in developing countries as the base for an educational program.

For the first steps of the training program it is strongly advised to deliberate about the man-to-machine communication in order to enhance and accelerate the learning process.

One way could be to have a look at different ideas.

The U.S. Naval Postgraduate School Center for Information Systems Security Studies and Research (CISR), and Rivermind, Inc.[52] developed a computer game called Cyberciege, which focuses on solving administrative security problems in networked computer systems.

A great opportunity is the intuitive Graphical User Interface and the usage ("game-play") where the complexity is reduced to pushing some buttons.

The main intention to teach future navy system administrators in prevention of security breaches is of course not directly useful for Afghanistan.

The developers have also worked on a designer program which simplifies the programming of new "scenarios"; therefore Cyberciege might be a good tool for the entry level in computer education.

[52] http://cisr.nps.navy.mil/cyberciege/.

Unfortunately, the developer did not allow us to use a trial version and to present a scenario for Afghanistan in this thesis.

Another idea focusing mainly on the communication between machine and user is AliceBot which derives from A.L.I.C.E:

"A.L.I.C.E. (Artificial Linguistic Internet Computer Entity) is an award-winning natural language processing chatterbot — a program that engages in a conversation with a human by applying some heuristical pattern matching rules to the human's input. It was inspired by Joseph Weizenbaum's classical ELIZA program but takes a quite different approach. It is one of the strongest programs of its type and has won the Loebner Prize three times (in 2000, 2001 and 2004). However, the program is unable to pass the Turing test as even the casual user will often expose its mechanistic aspects in short conversations. The name of the Bot was chosen because the computer that ran the first version of the software was called Alice." [53]

A Bot is common parlance on the internet for a software program that is a software agent. A Bot interacts with other network services intended for people as if it were a real person. One typical use of Bots is to gather information. The term is derived from the word "robot," reflecting the autonomous character in the "virtual robot"ness of the concept.

(wikipedia: "bot")

The development of Alice began in 1995. Later the program was rewritten in Java starting in 1998. The result was the current version "Program D". The program uses an XML[54] DTD[55] called AIML (Artificial Intelligence Markup Language) for specifying the heuristic conversation rules. In addition it is released under the copyleft license GPL.

In class, the AliceBot can be a good way to take the load off the teacher by placing a "virtual teacher" on the student's computer.

As introduced above the definition language AIML is suitable for creating a certain heuristic conversation rule.

One idea could be to import an appropriate subset of the English language (which has already been compiled on the web site of the project[56]) and to augment it with some phrases which help the students in difficult situations of the training process.

AliceBot has the clear advantage that the user (the student) can communicate with the computer via English phrases,

[53] http://en.wikipedia.org/wiki/A.L.I.C.E..

[54] XML stands for eXtended Markup Language (http://www.w3.org/XML/).

[55] DTD stands for Document Type Definition.

[56] http://www.alicebot.org/.

receiving concrete and intelligent instructions from the machine.

For a simple example, see below:

```
<category>
<pattern> network problem </pattern>
<template> Did you plug your network cable in?  </template>
</category>
```

In case the student types a phrase which includes the pattern "network problem" he gets the answer "Did you plug your network cable in?" Of course, this example is not really useful but it shows the potential of the AliceBot.

Researchers have not touched on the concept of a virtual teacher, which bases on a Bot system. In this thesis we wanted to give an inspiration about its capabilities and, maybe, we have aroused others to start a project or write another thesis about AliceBot and its applicability to developing countries.

5.4.4 Conclusion

The presented basic education program is a fundamental step in the vocational training program. Although it cannot replace a traditional schooling it pushes all students to one level of knowledge.

The concept focuses on the content but not on educational aspects. The student gets a fundamental overview on information technology and the concepts behind it.

It is planned in advance of the vocational training in Afghanistan to give the teachers a guarantee about the student's standard of knowledge.

5.5 Vocational Training

5.5.1 Introduction

Germany has a variety of vocational training programs. All vocational programs in Germany are supervised by the IHK (*Industrie- und Handelskammer* – chamber of commerce and industry) to guarantee a certain level of quality.

We considered the programs that deal with the IT education. Five of them differ in their contents but are generally related to IT, whereas most programs have lots of elements which are not needed or applicable to Afghanistan and the duration with an average of three years is unacceptable. Although sometimes certain *Lernfelder*, henceforth called Units, evidently won't be relevant for Afghanistan it is hard to decide for the rest of them whether they are important or not.

For the creation of a new curriculum, we evaluated each unit of the German curricula with regard to its applicability to Afghanistan. The next section explains the criteria we established for this evaluation.

5.5.2 Evaluation Process

The evaluation process and the chosen criteria base on the results of the analysis of the country (see chapter 3 Current Situation in Afghanistan). There are four important factors which have to be considered by developing a vocational training for Afghanistan and maybe other developing countries. Following, these factors are introduced in detail.

[a] Sustainability: The development of a vocational training program for developing countries like Afghanistan should be guided by the will to ensure its sustainability. As seen in the chapter 3.5 "Education" in Afghanistan above, the educational system in Afghanistan has some drawbacks, especially the vocational training. To compensate the lack of teaching staff the graduates should have to learn how to teach and how to hold presentations. On the other hand, in order to provide a future-proof concept for a vocational training program one has to consider how to educate the students to teach themselves and to elevate their standard of knowledge on their

own. The Sustainability index measures whether a unit achieves both or not.

[b] Adaptability:

Some units in the presented German vocational trainings require expensive equipment or expect programmable industrial facilities. The chapter "About Afghanistan" indicates clearly that such advanced industrial facilities do not exist. Afghanistan is a country where the people have a strong cultural identity. Each unit has to prove whether it fits in this environment.

[c] Expected Level of Knowledge (E.L.o.K.):

The conceptual vocational training program will take one year at the most. Therefore, most probably not every unit will be considered. The focus is a generic IT vocational training. Any unit calling for specialists or leading to special knowledge will be omitted.

[d] Costs:

To establish a new vocational training it is vital to keep an eye on the costs. It is useless to create a vocational training program which is too expensive to be established. If the estimated costs of a unit exceed the expected educational value for the apprentices and the country, it has to be considered whether to change the content or just to remove the unit.

Each of the four indexes is rated by a ten point scale 0 being the lowest and 10 the best rating. For Afghanistan we considered the indexes Sustainability and Adaptability to be very important, so their points are doubled. The expected level of knowledge and the costs are negative factors and so they are subtracted. As a result, the following formula yields the points for each unit:

$$F(unit) = 2a + 2b - c - d.$$

The best result could be 40 points, the worst one -20 points.

For the evaluation we created a scale from -2 to +2, -2 standing for useless content (in view of our purpose) and +2 standing for a content that fits very well. The following table represents the basis of transforming the results of the rating into the five-stage scale:

Rating Points	Stage
40-26	+2
25-11	+1
10-1	0
0- -9	-1
-10- -20	-2

The decision for this five-stage scale is based on the idea to give some fundamental information for future improvement of the education plan. For example, when the education plan needs to be improved or in case there is more time available for education, the units evaluated with +1 could be integrated, if possible then the units evaluated with 0, and so on. For the sake of simplicity we omitted the "+" leading the numbers.

The following section introduces the vocational programs with a short overview followed by a detailed description.

5.5.3 Fachinformatiker

The education plan for a *Fachinformatiker* in Germany is divided into two separate vocational training programs with slightly different intentions. The only difference between these two plans is that sometimes specific parts of the education should be more comprehensive and thus take more time. A *Fachinformatiker* is able to plan, install, and configure computer systems and networks on his own. He can also maintain and operate information and communication systems. Further, the *Fachinformatiker* is able to customize and integrate software according to customer's specifications. He can train and consult co-workers and customers.

Unit overview		
Unit 1	The Company and its Surroundings	-1
Unit 2	Business Processes and Business Organization	0
Unit 3	Information Sources and Working Methods	1
Unit 4	Simple IT Systems	2
Unit 5	Technical English	1
Unit 6	Developing and Providing Application Systems	0
Unit 7	Networked IT-Systems	1
Unit 8	Connections to the Market and to the Customers	0
Unit 9	Public Networks, Services	2
Unit 10	Administration of IT Systems	2
Unit 11	Accounting and Controlling	-1

Unit 1	***Der Betrieb und sein Umfeld* / The Company and its Surroundings**
educational objectives: • social and economic position of an enterprise • basic economics • introduction to the own enterprise (its products, services, etc.)	
Evaluation: -1	Sustainability [1]: basic economic knowledge is not needed for an IT education at this early stage of development in Afghanistan. Adaptability [0]: Afghanistan is far away from implementing economic strategies. E.L.o.K. [2]: the expected level of knowledge is low. Costs [2]: the unit requires no special equipment.

Unit 2	***Geschäftsprozesse und betriebliche Organisation* / Business Processes and Business Organization**
educational objectives: • workflow organization • function-/process-oriented organization • analyses and organization of business processes • business processes modeling and management • business process controlling	
Evaluation: 0	Sustainability [3]: the objectives workflow improvement and enhanced business processes will become important in future. Adaptability [2]: the objectives workflow organization and business processes have to be readjusted considering the different culture. E.L.o.K. [5]: requires unit 1. Costs [2]: the costs of this unit are not high, no special equipment is necessary.

Unit 3	***Informationsquellen und Arbeitsmethoden* / Information Sources and Working Methods**
educational objectives: • dealing with different kind of information sources • methods of working in a team and alone • presentation and visualization of information • management of conflicts	
Evaluation: 1 Comment: This unit could be an important step to follow the proposed voca-	Sustainability [7]: the objectives usage of information sources and their presentation prepare for teaching. Adaptability [3]: the objectives team and conflict management have to be readjusted considering the different culture. E.L.o.K. [1]: the expected level of knowl-

tional training program.	edge is the basic education. Costs [3]: the equipment exists already.

Unit 4	***Einfache IT-Systeme* / Simple IT Systems**
educational objectives: • creation of specifications according to the demands of the customer • selection of the appropriate components for the IT system • knowledge of their functionality and interoperability • installation and improvement of workstations • basic knowledge of mathematics, number systems, Boolean algebra • documentation of the own work	
Evaluation: 2	Sustainability [10]: the provided basic understanding of IT systems assures the appropriate handling. Adaptability [9]: the objectives do not depend on a country. E.L.o.K. [4]: basic knowledge of mathematics and electro-technics. Costs [6]: this unit requires some technical material which has low wastage.

Unit 5	***Fachliches Englisch* / Technical English**
educational objectives: • basic business English • technical English	
Evaluation: 1	Sustainability [7]: the improved English skills assure a better understanding of technical manuals and articles and allow for further self-study Adaptability [8]: basically this unit is a spe-

	cialized language course and could be taught with just minor changes. E.L.o.K. [7]: basic English skills. Costs [5]: this unit calls for small working groups with dedicated teachers.

Unit 6	***Entwickeln und Bereitstellen von Anwendungssystemen* / Developing and Providing Application Systems**
educational objectives: • projecting of application systems • different development models • databases and data structures • data security • backup methods	
Evaluation: 0	Sustainability [4]: only the objectives data security and the backup methods are important for a sustainable development of the IT sector. Adaptability [5]: the objectives projecting methods and data security strategies have to be adjusted. E.L.o.K. [3]: knowledge of computational algorithms is expected. Costs [5]: this unit calls for small working groups with dedicated teachers, and some technical equipment is needed.

Unit 7	***Vernetzte IT-Systeme* / Networked IT Systems**
educational objectives: • principles of electrical engineering • ISO/OSI model, network architectures • choice, installation, and configuration of hardware	

and software components • quality assurance • presentation of results • system maintenance	
Evaluation: 1	Sustainability [8]: the fundamental understanding of network theories, quality assurance, and system maintenance are important for further education and teaching. Adaptability [7]: the objectives presentation and maintenance have to be adjusted taking Afghanistan's culture into account. E.L.o.K. [7]: intense knowledge of IT systems and electronic components is of utmost importance. Costs [6]: technical equipment like electronic measuring instruments and network equipment is required.

Unit 8	***Markt und Kundenbeziehungen* / Connections to the Market and to the Customers**
educational objectives: • market structures and their effects • market reconnaissance and market research • terms and pricing policies • tender preparation • acquisition of external services	
Evaluation: 0	Sustainability [3]: the structure of Afghanistan's economy is very different compared to the German economy. Adaptability [2]: see above. E.L.o.K. [3]: basic economic knowledge. Costs [2]: inexpensive unit as its content is mostly theoretic.

Unit 9	***Öffentliche Netze, Dienste* / Public Networks, Services**
educational objectives: • public networks and services • architecture of different networks and their characteristics • access to information and communication services • data protection and data integrity	
Evaluation: 2	Sustainability [10]: good knowledge of communication networks is important for the development of the IT sector. Adaptability [8]: some details have to be adjusted in order to prepare for the environment in Afghanistan. E.L.o.K. [5]: basic knowledge of networks. Costs [4]: no special hardware or software components are needed.

Unit 10	***Betreuen von IT-Systemen* / Administration of IT Systems**
educational objectives: • maintenance of hardware and software components • data exchange • detection and analyses of malfunctions • backup methods, data security • virus protection, virus removal • documentation of products and configurations • training of staffers • service contracts	
Evaluation: 2	Sustainability [10]: the objectives maintenance and protection of IT systems are important to maintain IT systems. Adaptability [9]: the objective training

	methods have to be adjusted according to the cultural demands of Afghanistan. E.L.o.K. [6]: basic knowledge of hardware, software, and presentation. Costs [5]: special equipment is necessary to train the students.

Unit 11	***Rechnungswesen und Controlling* / Accounting and Controlling**
educational objectives: • roles and areas of a company's accountancy • cost and performance accounting • controlling	
Evaluation: -1	Sustainability [1]: accounting and controlling is not included in the new vocational training program. Adaptability [1]: the objective accounting has to be adapted to local regulations and laws. E.L.o.K. [6]: basic economic and mathematical knowledge is required. Costs [3]: inexpensive unit.

Conclusion

Unit 4	Simple IT Systems	2
Unit 9	Public Networks, Services	2
Unit 10	Administration of IT Systems	2

The vocational training program of the *Fachinformatiker* includes three units which are useful for the curriculum of the *Assistant of Applied Information Technology*.

5.5.4 Systemelektroniker

A *Systemelektroniker* advises and consults customers about concepts for electronic devices and systems. They know technical regulations and are able to understand data sheets and technical instructions. They can design electronic components, plan workflows, document all steps and results, and maintain and configure devices and industrial facilities.

Unit overview		
Unit 1	Analyze Electronic Systems and Test their Functions	0
Unit 2	Design and Implementation of Electric Installations	0
Unit 3	Analysis and Customization of Controllers	-1
Unit 4	Provision of IT Systems	2
Unit 5	Ensuring Power Supply and Security for Devices and Systems	1
Unit 6	Planning, Designing, and Verifying Electronic Devices	-1
Unit 7	Configuration of Assembly Groups Using Hard- and Software	0
Unit 8	Production and Verification of Devices	-2
Unit 9	Maintenance of Devices and Systems	1
Unit 10	Installation of Industrial Facilities	-2
Unit 11	Implementation and Usage of Exercisers	-1
Unit 12	Planning and Implementing Devices and Systems	1
Unit 13	Maintenance of Production Facilities and Exercisers	-2

Unit 1	***Elektrotechnische Systeme analysieren und Funktionen prüfen* / Analyze Electronic Systems and Test their Functions**
educational objectives: • internal organization of the company • introduction to its products and services • workflow organization • quantities and equations of electrical engineering • measuring techniques • dealing with different sources of information • working in a team	
Evaluation: 0	Sustainability [5]: the basic knowledge of electronics is useful to locate and repair defective components. Adaptability [7]: the objectives presentation and maintenance require marginal changes adjusted corresponding to the different culture of Afghanistan. E.L.o.K. [7]: basic mathematical and electronic knowledge. Costs [7]: a lot of technical equipment like electronic measuring instruments and electronic devices is needed.

Unit 2	***Elektrische Installationen planen und ausführen* / Design and Implementation of Electric Installations**
educational objectives: • determination of the power demand of electronic devices • characteristics of electric equipment • development of circuit diagrams and choice of components • proposal preparation	

• knowledge of security rules	
Evaluation: 0	Sustainability [7]: the knowledge of electrical installations is useful to maintain existent, or to design and build new installations. Adaptability [2]: regulations and specifications have to be adapted to the local regulations and specifications or have to be established in case they do not exist. E.L.o.K. [3]: basic knowledge of electronic equipment. Costs [8]: a lot of electronic equipment and electronic devices is necessary.

Unit 3	***Steuerungen analysieren und anpassen* / Analysis and Customization of Controllers**
educational objectives: • analysis and customization of controller interfaces • electronic data processing (input, data processing, output) • usage of programmable logic controllers	
Evaluation: -1	Sustainability [2]: the objectives are too special and focus too much on electrotechnics. Adaptability [5]: changes have to be made for the adaptation of regulations and specifications. E.L.o.K. [7]: intense knowledge of electronic equipment and devices. Costs [8]: a lot of expensive technical equipment like programmable logic controllers is needed.

Unit 4	***Informationstechnische Systeme bereitstellen* / Provision of IT Systems**
educational objectives: • how to create a customer requirements and a system specification • knowledge of hardware, software, and business software • installation and configuration of hardware and software components • integration of IT systems into existing networks • introduction to the concept of ergonomic workspaces • basics of data security and data protection • presentation methods	
Evaluation: 2	Sustainability [10]: the provided basic knowledge of IT systems assures to handle them appropriately. Adaptability [9]: the objectives do not depend on a country or its culture. E.L.o.K. [4]: basic knowledge of mathematics and electro-technics. Costs [5]: this unit demands some technical components which have low wastage.

Unit 5	***Elektroenergieversorgung für Geräte und Systeme realisieren und deren Sicherheit gewährleisten* / Ensuring Power Supply and Security for Devices and Systems**
educational objectives: • choice of electronic power supply units • choice of appropriate uninterruptible power supplies (UPS) • creation of circuits and wiring diagrams • electromagnetic compatibility (EMC)	

• safety regulations	
Evaluation: 1 Comment: Because of the importance of UPS, this part of the Unit will be integrated in the vocational training.	Sustainability [8]: the objective appropriate power supply ensures a reliable performance of IT systems. Adaptability [9]: the objectives do not depend on a country. E.L.o.K. [6]: knowledge of electric current and its physical principles. Costs [7]: expensive hardware is needed but the gained knowledge is essential.

Unit 6	***Elektronische Baugruppen von Geräten konzipieren, herstellen und prüfen* / Planning, Designing, and Verifying Electronic Devices**
educational objectives: • development of analogue and digital circuits • usage of software suites to design, develop, and optimize the layout of complex circuits • planning the production of circuit boards • different measurement methods to test the circuit boards	
Evaluation: -1	Sustainability [1]: the objectives are too special. Adaptability [8]: the objectives do not depend on a country. E.L.o.K. [9]: principles of electrical engineering. Costs [9]: expensive equipment is necessary.

Unit 7	***Baugruppen hard- und softwareseitig konfigurieren* / Configuration of Assembly Groups Using Hard- and Software**
educational objectives: • analysis of the construction and functionality of hardware components • machine-level programming languages, understanding and modification of the source codes of programmable devices • simulation of program flows and system verification • different methods of testing and analyzing	
Evaluation: 0	Sustainability [5]: the provided knowledge of IT systems assures to handle them appropriately Adaptability [8]: the objectives do not depend on a country E.L.o.K. [8]: knowledge of hardware and software components besides programming. Costs [8]: some expensive hardware is needed.

Unit 8	***Geräte herstellen und prüfen* / Production and Verification of Devices**
educational objectives: • design of devices according to system specifications • writing technical documentations • assembly of components • security rules, precautions • functionality verification of devices • explaining new devices to others	
Evaluation: -2	Sustainability [2]: the objectives are too special. Adaptability [2]: unit needs adjustments

	according to Afghanistan's regulations and specifications. E.L.o.K. [9]: knowledge of electrical engineering and hardware. Costs [9]: a lot of expensive hardware is required.

Unit 9	***Geräte und Systeme in Stand halten* / Maintenance of Devices and Systems**
educational objectives: • testing and maintenance of devices • repairing defective components • writing service protocols • proper disposal of defective components	
Evaluation: 1	Sustainability [8]: the provided knowledge of IT systems assures their appropriate handling and operation. Adaptability [8]: the objectives do not depend on a country E.L.o.K. [6]: deep knowledge of hardware components. Costs [7]: some special hardware component is needed.

Unit 10	***Fertigungsanlagen einrichten* / Installation of Industrial Facilities**
educational objectives: • analysis of industrial facilities • knowledge of typical components of industrial facilities • modification of controlling processes • optimization of production processes • verification methods and debugging	

Evaluation: -2	Sustainability [1]: the objectives are beyond the scope of Afghanistan at that stage of development. Adaptability [2]: changes have to be made for the adaptation of specification and regulations. E.L.o.K. [9]: principles of electrical engineering and economics. Costs [10]: industrial facilities are expected.

Unit 11	***Prüfsysteme einrichten und anwenden* / Implementation and Usage of Exercisers**
educational objectives: • knowledge of exercisers • installation of exercisers in industrial facilities • development of software for exercisers • evaluation of exerciser results and optimization of production processes using the results	
Evaluation: -1	Sustainability [1]: the objectives are too special. Adaptability [7]: most of the objectives do not depend on a country. E.L.o.K. [10]: requires Unit 10. Costs [10]: industrial facilities and exercisers are needed.

Unit 12	***Geräte und Systeme planen und realisieren* / Planning and Implementing Devices and Systems**
educational objectives: • typical project activities like project planning, gathering of information, and break-up of tasks • documentation of every project step and their review after the project is finished	

• cost accounting	
Evaluation: 1	Sustainability [6]: the objectives ensure the development of the IT sector. Adaptability [6]: most of the objectives do not depend on a country. E.L.o.K. [7]: basic economics. Costs [4]: basic hardware and software components are needed.

Unit 13	***Fertigungs- und Prüfsysteme in Stand halten* / Maintenance of Production Facilities and Exercisers**
educational objectives: • development of maintenance plans for production facilities • inspection and maintenance of production facilities • error and wear-out analysis and creation of prevention plans • economy analysis	
Evaluation: -2	Sustainability [1]: the objectives are too special. Adaptability [2]: changes have to be made for the adaptation of specifications and regulations. E.L.o.K. [10]: require Unit 10 and Unit 11. Costs [10]: industrial facilities and exercisers are needed.

Conclusion

Unit 4	Provision of IT Systems	2

The curriculum of the *Systemelektroniker* is focused on the electrical engineering. Only one unit has educational objectives, which are useful for the new vocational training program.

5.5.5 Systeminformatiker

A *Systeminformatiker* advises and consults customers about concepts for networked industrial systems. He knows the technical regulations and understands technical data sheets and technical instructions. He develops software components and software applications either alone or in a team. A *Systeminformatiker* installs, maintains, and optimizes components of IT systems and analyzes and removes potential failures. He plans and manages workflows and documents his proceedings and results.

Unit overview		
Unit 1	Analyzing Electric Systems and Testing their Functions	0
Unit 2	Design and Implementation of Electric Installations	0
Unit 3	Analyzing and Customizing Controllers	-1
Unit 4	Provision of IT Systems	2
Unit 5	Ensuring Power Supply and Security for Devices and Systems	1
Unit 6	Analysis of Interfaces in Industrial Systems and Localization of Errors	0
Unit 7	Analysis und Customization of IT Systems	2
Unit 8	Development and Documentation of Software Modules for Industrial Systems	0
Unit 9	Development and Customization of Software for Industrial Systems	0

Unit 10	Integration of Hard- and Software Components and Testing the System	-1
Unit 11	Optimization of Networked Industrial Systems and Analysis of Faults	1
Unit 12	Development and Optimization of Exercisers	0
Unit 13	Put Industrial Systems into Operation and Delivery	-1

Unit 1	***Elektrotechnische Systeme analysieren und Funktionen prüfen /* Analyzing Electric Systems and Testing their Functions**
educational objectives: • internal organization of the company • introduction to products and services • workflow organization • quantities and equations of electrical engineering • measuring techniques • dealing with different sources of information • working in a team	
Evaluation: 0	Sustainability [5]: the basic knowledge of electronics is useful to locate and repair defective components. Adaptability [7]: the objectives presentation and maintenance require marginal changes because Afghanistan has a different culture. E.L.o.K. [7]: basic mathematical and electronic knowledge. Costs [7]: a lot of technical equipment like electronic measuring instruments and electronic devices are expected.

Unit 2	***Elektrische Installationen planen und ausführen* / Design and Implementation of Electric Installations**
educational objectives: • determination of the power demand of electronic devices • characteristics of electric equipment • development of circuit diagrams and choice of components • proposal preparation • knowledge of security rules	
Evaluation: 0	Sustainability [7]: the knowledge of electrical installations is useful to maintain existing or create new installations. Adaptability [2]: regulations and specifications have to be adapted to local regulations and specifications or have to be established in case they do not exist. E.L.o.K. [3]: basic knowledge of electronic equipment. Costs [8]: a lot of electronic equipment and electronic devices are expected.

Unit 3	***Steuerungen analysieren und anpassen* / Analyzing and Customizing Controllers**
educational objectives: • analysis and customization of controller interfaces • electronic data processing (input, data processing, output) • usage of programmable logic controllers	
Evaluation: -1	Sustainability [2]: the objectives are too special. Adaptability [5]: changes have to be made for the adaptation of regulations and specifications.

	E.L.o.K. [7]: knowledge of electronic equipment and devices. Costs [8]: a lot of expensive technical equipment like programmable logic controllers is needed.

Unit 4	***Informationstechnische Systeme bereitstellen* / Provision of IT Systems**
educational objectives: • how to create a customer requirement specification and a system specification • knowledge of hardware, software, and business software • installation and configuration of hardware and software components • integration of IT systems into existing networks • installation and improvement of workstations • basics of data security and data protection • presentation methods	
Evaluation: 2	Sustainability [10]: the provided basic understanding of IT systems assures their appropriate handling. Adaptability [9]: the objectives fo not depend on a country E.L.o.K. [4]: basic knowledge of mathematics and electro-technics. Costs [6]: this unit requires some technical material which has low wastage.

Unit 5	***Elektroenergieversorgung für Geräte und Systeme realisieren und deren Sicherheit gewährleisten I* Ensuring Power Supply and Security for Devices and Systems**
educational objectives: • choice of electronic power supply units • choice of appropriate uninterruptible power supplies (UPS) • creation of circuits and wiring diagrams • electromagnetic compatibility (EMC) • safety regulations	
Evaluation: 1 Comment: The objective UPS will be integrated in the vocational training because of its importance for Afghanistan.	Sustainability [8]: the objective appropriate power supply ensures the reliability performance of IT systems. Adaptability [9]: the objectives do not depend on a country. E.L.o.K. [6]: knowledge of electric current and its physical principles. Costs [7]: expensive hardware is needed.

Unit 6	***Schnittstellen in industriellen Systemen analysieren und Fehler lokalisieren I* Analysis of Interfaces in Industrial Systems and Localization of Errors**
educational objectives: • analysis of interfaces in industrial systems and their information flow • knowledge of different measuring methods and diagnostic tools, signals, and error codes • localization of errors and their repairing • knowledge of memory, different kind of addressing, and sensors	
Evaluation: 0	Sustainability [2]: the objectives are too

	special. Adaptability [8]: the objectives do not depend on a country. E.L.o.K. [9]: principles of electrical engineering. Costs [9]: expensive specialized equipment is expected.

Unit 7	***Informationstechnische Systeme analysieren und anpassen* / Analysis und Customization of IT Systems**
educational objectives: • analysis of what IT components of industrial systems demand • corresponding to the results, the students have to choose appropriate components and software to create the industrial system • security of IT systems, data security, and backup methods • knowledge of network protocols • integration of IT systems into existing networks	
Evaluation: 2	Sustainability [10]: intensive knowledge of IT systems assures to handle them appropriately. Adaptability [9]: the objectives do not depend on a country. E.L.o.K. [4]: knowledge of hardware and software. Costs [6]: this unit requires some technical components which have low wastage.

Unit 8	***Softwaremodule industrieller Systeme entwickeln und dokumentieren* / Development and Documentation of Software Modules for Industrial Systems**
educational objectives: • problem analysis and creation of a system specification • knowledge of software design tools and programming languages • modulation of system specification • implementation of the system • testing, debugging, and documentation	
Evaluation: 0	Sustainability [2]: the objectives too much focus on software engineering. Adaptability [7]: most of the objectives do not depend on a country. E.L.o.K. [6]: intense knowledge of hardware and software. Costs [3]: the costs of this unit are low.

Unit 9	***Software industrieller Systeme entwickeln und anpassen* / Development and Customization of Software for Industrial Systems**
educational objectives: • creation of requirement and system specifications according to the results • introduction to the concept of object-oriented development • implementation of the concepts • knowledge of databases and their accessibility • integration of software modules into existing projects • modification and optimization of the projects according to the target system • instructing the customer in the usage of the new sys-	

tem	
Evaluation: 0	Sustainability [2]: the objectives are too special. Adaptability [7]: most of the objectives do not depend on a country. E.L.o.K. [7]: basics of software engineering. Costs [8]: industrial systems and facilities are expected.

Unit 10	***Hard- und Softwarekomponenten integrieren und im System testen /* Integration of Hard- and Software Components and Testing the System**
educational objectives: • designing complex electric systems according to the expected data flow • measurement, analysis, and visualization of data streams • knowledge of programmable chips • usage of machine-level programming languages to extend existing software projects and to integrate communication interfaces	
Evaluation: -1	Sustainability [1]: the objectives are too special. Adaptability [7]: most of the objectives do not depend on a country. E.L.o.K. [10]: knowledge of software and electrical engineering. Costs [9]: expensive equipment is needed.

Unit 11	***Vernetzte industrielle Systeme optimieren und Fehler analysieren I* Optimization of Networked Industrial Systems and Analysis of Faults**
educational objectives: • optimization of the data flow in a network • localization of errors in networks using network analysis tools • data security, access rights • creation and analysis of protocols	
Evaluation: 1	Sustainability [7]: the objectives data security and localization of network errors are important to maintain an IT system. Adaptability [7]: most of the objectives do not depend on a country. E.L.o.K. [8]: knowledge of software, hardware, and networks. Costs [6]: some extra equipment is needed.

Unit 12	***Prüfsysteme entwickeln und optimieren I* Development and Optimization of Exercisers**
educational objectives: • development of methods and criteria to analyze products • design of exercisers under consideration of the expected working environment • installation and configuration of exercisers • setup of database management systems to save and evaluate measured data • documentation of the exercising environment and the verification process	
Evaluation: 0	Sustainability [1]: the objectives are too special.

	Adaptability [8]: most of the objectives do not depend on a country. E.L.o.K. [8]: principles of software engineering. Costs [9]: industrial facilities are necessary for the usage of the exercisers.

Unit 13	***Industrielle Systeme in Betrieb nehmen und übergeben* / Put Industrial Systems into Operation and Delivery**
education objectives: • implementation of systems in consideration of operating procedures • operating the system • knowledge of methods to find and debug errors • preparation of system documentations and instruction manuals • presentation of the project	
Evaluation: -1	Sustainability [1]: the objectives focus too much on industrial facilities. Adaptability [6]: the objectives presentation and instruction manuals require marginal changes because Afghanistan has a different culture. E.L.o.K. [10]: deep knowledge of hardware and software. Costs [9]: industrial facilities are needed.

Conclusion

Unit 4	Provision of IT Systems	2
Unit 7	Analysis und Customization of IT Systems	2

The unit 4 of the *Systeminformatiker* and the unit 4 of the *Systemelektroniker* have the same educational objectives. The unit 7 deepens the knowledge of the unit 4 and is useful to complement the vocational training program of the *Assistant of Applied Information Technology*.

5.5.6 Informationselektroniker

The education of the *Informationselektroniker* has two main focuses *Bürosystemtechnik* and *Geräte- und Systemtechnik*, although the first nine parts of the education are equal. He learns how to install IT systems and how to use business applications such as business intelligence applications (SAP, SIEBEL). They learn to configure workstations, design programs, and install and present software corresponding to the customer's specifications.

Bürosystemtechnik deals with the implementation and administration of databases, the installation of IT devices, and the development of software applications.

The other branch, *Geräte- und Systemtechnik*, imparts knowledge of communication systems and their installation and configuration. He does even learn how to find faults in multimedia systems.

Unit overview		
Unit 1	Installing Devices, Assets, and Systems	1
Unit 2	Collecting and Representing Signal-Processing Operations in IT Systems	0
Unit 3	Using Business Applications and Standard Software in Consideration of a Chosen Operating System	2
Unit 4	Communication with Customers and Associates	1

Unit 5	Analysis of Functions of IT Device Components	0
Unit 6	Configure and Optimize a Single-User Workstation Corresponding to the Customer's Specification	2
Unit 7	Develop Programs and Design them Demand-Driven	0
Unit 8	Installing System and User Software Corresponding to Customers Specifications and Representing the Result	1
Unit 9	Planning System Configurations Depending on Customer's Specifications and Consulting Customers regarding IT Products and Services	1
Unit 10a	Implementation and Maintenance of Data Bases Corresponding to Customers' Specifications	0
Unit 11a	Installation and Integration of Devices and Systems	2
Unit 12a	Analysis of Errors in Devices and Office IT Systems	2
Unit 13a	Analyzing Devices and Office Systems and Placing them into Operation	1
Unit 14a	Setup of Interconnected Office Systems, Placing them into Operation and Administrating them	1
Unit 15a	Developing Custom Software and integrating it into Existing Systems	0
Unit 16a	Setup and Usage of Services and Multimedia Components	1
Unit 10b	Problem-Oriented Setting, Administration, and Usage of Databases	0
Unit 11b	Installing Communication Systems and Connecting them to Public Networks and Services	0
Unit 12b	Analysis of Errors on Elements and Devices	-2
Unit 13b	Analysis of Errors in Devices and Systems	0
Unit 14b	Configuring, Placing into Operation and Administrating Devices and Interconnected Sys-	-1

	tems	
Unit 15b	Setup of Multimedia-Based Consumer Devices	-1
Unit 16b	Installing Wired and Wireless Transmission Systems, Placing them into Operation and Performing Functional Tests	-1

Unit 1	***Geräte, Anlagen und Systeme der Informationstechnik installieren /* Installing Devices, Assets, and Systems**
educational objectives: • knowledge of quantities and equations of electrical engineering, voltage sources • ensuring the safety of devices and improvement of interference resistance • ergonomical design of work spaces • quality characteristics of office supplies	
Evaluation: 1	Sustainability [6]: the objectives ensure a proper handling of IT systems. Adaptability [8]: the objectives do not depend on a country E.L.o.K. [2]: basic education. Costs [4]: some hardware is needed.

Unit 2	***Signalverarbeitungsvorgänge in Einrichtungen der Informationstechnik erfassen und darstellen /* Collecting and Representing Signal-Processing Operations in IT Systems**
educational objectives: • knowledge of numbers and number systems, codes, and digital and analogue signals • principles of digital and analogue signal processing • characteristics of integrated circuits • measurement of electrical quantities	

• knowledge of different kinds of signals, their transmission, and transmission protocols	
Evaluation: 0	Sustainability [3]: the objectives are too special. Adaptability [8]: the objectives do not depend on a country. E.L.o.K. [6]: Unit 1. Costs [6]: technical equipment, such as electronic measuring instruments and electronic devices, is needed.

Unit 3	***Branchenspezifische Software und Standardsoftware unter Anwendung eines ausgewählten Betriebssystems nutzen I*** **Using Business Applications and Standard Software in Consideration of a Chosen Operating System**
educational objectives: • creation and management of documents • basic functions of the Operating System and peripheral devices • design of texts and charts • backup and data security strategies	
Evaluation: 2	Sustainability [10]: the provided software skills are important for using IT systems efficiently. Adaptability [9]: the objectives do not depend on a country. E.L.o.K. [2]: basic education. Costs [4]: the equipment exists already.

Unit 4	***Mit Kunden und Mitarbeitern kommunizieren und Kundenbeziehungen pflegen* / Communication with Customers and Associates**
educational objectives: • training communication with the customer and associates in different situations (e.g., on the phone, face to face) • appropriate preparation of technical data for the addressee • introducing customers and associates to devices and systems	
Evaluation: 1	Sustainability [7]: the objectives communication training and preparation of technical data prepare for teaching. Adaptability [3]: the objectives have to be readjusted considering the different culture. E.L.o.K. [5]: basic education and Unit 2. Costs [3]: this unit requires small working groups with dedicated teachers.

Unit 5	***Die Funktion ausgewählter Baugruppen und Bauelemente von Geräten der Informationstechnik analysieren* / Analysis of Functions of IT Device Components**
educational objectives: • knowledge of the functionality of several components and modules in IT systems • analysis of their functionality • dealing with circuit diagrams and data sheets to create technical documentations and manuals	
Evaluation: 0	Sustainability [5]: the basic knowledge of devices assures their proper handling. Adaptability [7]: the objectives do not depend on a country.

	E.L.o.K. [7]: basic electronic knowledge and Unit 2. Costs [7]: technical equipment like electronic measuring instruments and electronic devices are necessary.

Unit 6	***Ein Einzelplatzcomputersystem auftragsgerecht konfigurieren und optimieren* / Configure and Optimize a Single-User Workstation Corresponding to the Customer's Specification**
educational objectives: • setup of a single-user workstation • choice, installation, and configuration of the appropriate hardware and software • knowledge of structure and functionality of the entire system • configuration of interfaces and connecting to peripheral devices	
Evaluation: 2	Sustainability [10]: the provided basic understanding of IT systems assures their appropriate handling. Adaptability [9]: the objectives do not depend on a country. E.L.o.K. [4]: basic education and Unit 3. Costs [7]: this unit requires some technical material which has low wastage.

Unit 7	***Programme erstellen und bedarfsgerecht gestalten* / Develop Programs and Design them Demand-Driven**
educational objectives: • knowledge of program design • implementation and testing of programs • dealing with the available assistance during the pro-	

gramming process	
Evaluation: 0	Sustainability [2]: the objectives focus too much on software engineering. Adaptability [7]: most of the objectives do not depend on a country. E.L.o.K. [7]: knowledge of hardware and software. Costs [4]: the equipment exists already.

Unit 8	***System- und Anwendersoftware kundengerecht installieren und präsentieren* / Installing System and User Software Corresponding to Customers Specifications and Representing the Result**
educational objectives: • creation of customer requirements and appropriate solutions • installation, configuration, and presentation of Operating Systems, standard software and business applications • preparation of user manuals and information for the customer	
Evaluation: 1	Sustainability [7]: the provided knowledge of software assures to handle them appropriately. Adaptability [7]: the objectives presentation and preparation of user manuals have to be adjusted. E.L.o.K. [4]: basic software knowledge. Costs [4]: this unit requires no special equipment.

Unit 9	***Systemausstattung kundengerecht planen und Kunden über Produkte und Dienste der Informationstechnik beraten* / Planning System Configurations Depending on Customer's Specifications and Consulting Customers regarding IT Products and Services.**
educational objectives: • using different sources of information • evaluation of IT systems considering their market capabilities and economical aspects • customer instruction service • proposal preparation	
Evaluation: 1	Sustainability [8]: the objectives assure future development of the IT sector. Adaptability [6]: the objectives have to be adapted to the culture of Afghanistan. E.L.o.K. [4]: basic knowledge of hardware and software. Costs [4]: this unit requires no special equipment.

Special issue: *Bürosystemtechnik*

Unit 10a	***Datenbanken nach Kundenvorgaben einrichten und Datenbestände pflegen* / Implementation and Maintenance of Data Bases Corresponding to Customers' Specifications**
educational objectives: • creating database concepts corresponding to the customer's specification • setup a database • using databases as information sources • knowledge of data security and copyright	
Evaluation: 0	Sustainability [4]: the objectives focus too much on databases.

	Adaptability [5]: the objectives do not depend on a country. E.L.o.K. [4]: basic software knowledge. Costs [4]: no special equipment is necessary.

Unit 11a	***Geräte und Anlagen der Bürosystemtechnik installieren und an bestehende Netze anbinden* / Installation and Integration of Devices and Systems**
educational objectives: • choice of components and devices under consideration of ergonomic aspects • user-oriented setup of systems and their integration into existing networks • explaining a system to the user • preparing a documentation	
Evaluation: 2	Sustainability [10]: the comprehension of IT systems assures their appropriate handling. Adaptability [8]: some objectives have to be adjusted. E.L.o.K. [4]: knowledge of hardware and software. Costs [6]: this unit requires some technical material which has low wastage.

Unit 12a	***Fehler an Geräten und Anlagen der Bürosystemtechnik analysieren* / Analysis of Errors in Devices and Office IT Systems**
educational objectives: • testing the functionality and identifying errors in devices, systems, and networks • documentation of errors and proposing solutions • maintenance of IT systems	

• proper waste disposal and handling of hazardous material	
Evaluation: 2	Sustainability [9]: the objectives assure to handle and maintain IT systems appropriately. Adaptability [8]: the objective waste disposal has to be localized. E.L.o.K. [4]: knowledge of hardware. Costs [4]: some technical equipment is needed.

Unit 13a	***Geräte und Anlagen der Bürosystemtechnik analysieren und in Betrieb nehmen I* Analyzing Devices and Office Systems and Placing them into Operation**
educational objectives: • knowledge of structure and functionality of devices and systems • customer instruction service • installation, configuration, and disassembly of devices and systems	
Evaluation: 1	Sustainability [8]: the objectives assure to handle and maintain IT systems properly. Adaptability [6]: the objective customer instruction service has to be localized. E.L.o.K. [7]: consolidated knowledge of hardware. Costs [5]: some technical equipment is needed.

Unit 14a	***Vernetzte Bürosysteme einrichten in Betrieb nehmen und administrieren /* Setup of Interconnected Office Systems, Placing them into Operation and Administrating them**
educational objectives: • recording and evaluating network traffic • knowledge of network types, protocols, and structures • recognizing and removing network errors • design of office systems and communication networks, their implementation and roll-out • developing system specifications and system documentations • knowledge of data security, backup methods, and strategies	
Evaluation: 1	Sustainability [7]: the fundamental understanding of network theories and quality assurance are important for further education and teaching. Adaptability [7]: some objectives have to be adjusted. E.L.o.K. [9]: knowledge of IT systems and electronic components is of utmost importance. Costs [7]: a lot of technical equipment, such as electronic measuring instruments and network equipment, is required.

Unit 15a	***Kundenspezifische Softwarelösungen entwickeln und in vorhandene Systeme integrieren /* Developing Custom Software and integrating it into Existing Systems**
educational objectives: • planning, designing, implementing, and testing software modules corresponding to customers' requirements • dealing with technical terms	

• using tools and methods to ensure data security and virus protection	
Evaluation: 0	Sustainability [3]: only the objectives data security and virus protection are important for a sustainable development of the IT sector. Adaptability [7]: the objectives do not depend on a country. E.L.o.K. [8]: knowledge of algorithms and Unit 7. Costs [5]: this unit calls for small working groups with dedicated teachers and some technical equipment.

Unit 16a	***Dienste und Multimediakomponenten bedarfsgerecht einrichten und nutzen I* Setup and Usage of Services and Multimedia Components**
educational objectives: • evaluation of communication services • usage of hardware and software for network services • functional tests and configuration of communication devices and IT systems • design and development; designing web sites	
Evaluation: 1	Sustainability [8]: the objectives communication services and configuration of communication devices are important for future development. Adaptability [8]: some objectives have to be localized. E.L.o.K. [8]: consolidated knowledge of hardware and software. Costs [6]: this unit requires some technical material which has low wastage.

Special issue: *Geräte- und Systemtechnik*

Unit 10b	***Datenbanken problembezogen einrichten, verwalten und nutzen /* Problem-Oriented Setting, Administration, and Usage of Databases**
educational objectives: • creation of a database concept corresponding to customer's specification • setup of the database • usage of databases as information sources • knowledge of data security and copyright	
Evaluation: 0	Sustainability [4]: the objectives too much focus on databases. Adaptability [5]: the objectives do not depend on a country. E.L.o.K. [4]: basic software knowledge. Costs [4]: no special equipment is needed.

Unit 11b	***Telekommunikationsanlagen installieren und an öffentliche Netze anbinden /* Installing Communication Systems and Connecting them to Public Networks and Services**
educational objectives: • choice of communication devices (speech, voice, text, data) according to customer requirements • setup and operation of communication systems • explaining the usage to the customer • administrating and maintaining the communication system	
Evaluation: 0	Sustainability [8]: the objectives assure to handle devices appropriately. Adaptability [4]: the objectives have to be localized. E.L.o.K. [7]: knowledge of hardware and

	software is needed. Costs [8]: a lot of technical equipment is needed.

Unit 12b	***Fehler an Baugruppen und Geräten der Bild-, Ton- und Datentechnik analysieren I* Analysis of Errors on Elements and Devices**
education objectives: • knowledge of the transmission and storage of data and electronic signals • analysis of the functionality of complex elements and their concurrence • choice of the appropriate tools and measuring devices to locate and analyze errors • exchange of defective components and modules and their reconfiguration	
Evaluation: -2	Sustainability [2]: the objectives are too special. Adaptability [2]: changes have to be made for the adaptation of norms and rules. E.L.o.K. [9]: principles of electrical engineering and Unit 5. Costs [9]: a lot of expensive hardware is needed.

Unit 13b	***Fehler an Geräten und Systemen der Bild, Ton und Datentechnik analysieren I* Analysis of Errors in Devices and Systems**
educational objectives: • adjustment and configuration of devices and IT systems corresponding to service manuals • analysis and optimization of the concurrence of devices in an IT system • programming of interfaces	

• determination of errors by using verification routines	
Evaluation: 0	Sustainability [7]: the provided understanding of IT systems assures to handle them appropriately. Adaptability [2]: the objectives do not depend on a country. E.L.o.K. [9]: principles of electrical engineering and Unit 5. Costs [9]: a lot of expensive hardware is needed.

Unit 14b	***Geräte und vernetzte Systeme einrichten, in Betrieb nehmen und administrieren* / Configuring, Placing into Operation and Administrating Devices and Interconnected Systems**
education objectives: • design and implementation of interconnected IT systems • record and analysis of the network traffic • establishing backup and data security concepts • knowledge of Bus systems for the transmission of information • knowledge of devices which communicate via Bus systems	
Evaluation: -1	Sustainability [1]: the objectives are too sophisticated. Adaptability [6]: some objectives have to be adjusted. E.L.o.K. [9]: knowledge of IT systems, networks, and electronic components is of utmost importance. Costs [8]: a lot of technical equipment is necessary.

Unit 15b	***Multimediale Consumergeräte einrichten /* Setup of Multimedia-Based Consumer Devices**
educational objectives: • planning and configuring multimedia hardware and software for usage of multimedia consumer services • functional testing of multimedia devices • deployment and configuration of multimedia devices • dealing with multimedia installations	
Evaluation: -1	Sustainability [1]: the objectives are not needed at that early stage of development in Afghanistan. Adaptability [3]: some objectives have to be localized. E.L.o.K. [7]: knowledge about hardware, software, and networks. Costs [8]: a lot of expensive equipment is needed.

Unit 16b	***Drahtgebundene und drahtlose Übertragungssysteme installieren, in Betrieb nehmen und prüfen /* Installing Wired and Wireless Transmission Systems, Placing them into Operation and Performing Functional Tests**
educational objectives: • design and deployment of terrestrial and satellite receiving systems according to customers' requirements • choice of proper equipment for different receiving and distribution systems • verification of compliance with required technical parameters • performing antenna measures and analyzing the gained data	
Evaluation: -1	Sustainability [1]: the objectives are too sophisticated.

	Adaptability [3]: some objectives have to be localized. E.L.o.K. [9]: advanced knowledge about hardware, software, and networks. Costs [8]: a lot of expensive equipment and measuring devices are needed.

Conclusion

Unit 3	Using Business Applications and Standard Software in Consideration of a Chosen Operating System	2
Unit 6	Configure and Optimize a Single-User Workstation Corresponding to the Customer's Specification	2
Unit 11a	Installation and Integration of Devices and Systems	2
Unit 12a	Analysis of Errors in Devices and Office IT Systems	2

The *Informationselektroniker* includes four units which are adequate for the new vocational training program. The last two units are from the special issue "Bürokommunikation" which focuses on the usage of IT systems in offices. Their educational objectives are appropriate for the educational objectives of the Assistant of Applied Information Technology.

5.6 The Concept: Assistant of Applied Information Technology

5.6.1 Introduction

The evaluation of the vocational training programs rated every learning unit with a specific score. To decide whether a learning unit and its educational objectives are included in the new vocational training program depends on the score and on the duration of the unit, as the new vocational training program should last one year.

The result of the evaluation was that all of the best-rated learning units are included in the new program. Moreover a few units with the rate 1 were also included because some of their educational objectives are of high importance for the development of Afghanistan.

The evaluation also showed that the different vocational training programs in Germany sometimes hold similar learning units. It makes no sense to include similar learning units into the new vocational training program although they were rated with 2.

Therefore, in a next step the educational objectives of each relevant learning unit were extracted and arranged into groups of new categories of the new vocational training program.

This procedure could significantly reduce the estimated redundancy in the teaching.

The following tables show the new learning units and their educational objectives briefly describing the content of each category and giving the estimated duration.

The estimated duration results from the individual durations of each educational objective in the category and should be taken for an advice only. The kind, progress and methods of the teaching in Afghanistan should be developed and planned by experienced specialists.

5.6.2 Content

Unit 1	IT System Basics
Continuation of the theoretical principles from the *Basic Education*. The acquired knowledge will be enhanced with mathematical background and electrical basics for a better understanding of the functionality of computer systems.	
Data processing in IT systems - meaning and display format of information - number systems - codes - logical digital functions - Boolean Algebra - basics of electric - basic electrical principles - electrostatics - limit values - analogue and digital signals - electromagnetic compatibility (EMC)	
	1 month

Unit 2	Configuration and Optimization of a Single User Workstation
Continuation of the hardware basics from the *Basic Education*. This part of education is designed to impart practical experience along with the usage of the acquired knowledge for the basic education. The apprentice learns how to install hardware and software and how to find faults.	
– hardware design of a computer – Bus systems – structure and tasks of CPU – basic functionality of elementary computer modules and their interaction – internal and external memory	

– parallel and serial interfaces – installation of driver software – configuration files – Operating Systems – application software – installation and configuration of hardware and software components – industry standards – system stability and fail-safe – launching and commissioning – troubleshooting – tools and methods for diagnosis and fault repair – documentation of the system and presentation	
	3 months

Unit 3	**Usage of Sectoral Software and Standard Software in Consideration of a Chosen Operating System**
The apprentice learns how to use peripheral devices like printer or scanner. He becomes familiar with sectoral software and the creation and proper handling of documents. He knows about the importance of a backup and the protection of personal data. At last, some presentation techniques are taught in order to enable the trainee to impart his knowledge to other people.	
– peripheral devices of a single-user workstation – handling of peripheral devices – tasks and usage of an Operating System – design and administration of documents – backup methods – personal data protection – presentation techniques and methods	
	1 month

Unit 4	Installation and Integration of Devices and Systems
This educational unit imparts knowledge of network basics and protocols. The apprentices learn how to keep a network alive and how to protect computer systems against electrical power outage. They know the differences between several network services and how to use them in an appropriate way. At last, they are able to connect an IT system to an existing network and to ensure data protection.	
– local, global networks (LAN, MAN, WAN), network protocols – communication models – architecture of different communication networks and their characteristics – services and their characteristics of communication networks – access to information and communication services – performance characteristics of devices and system components – active network components – network interfaces, connections – hardware and software components – personal computer as a multifunctional device – networks for speech, text, data and video communication – network structure and hubs: fixed network, wireless network – gateways – fail-save, UPS (uninterruptible power supply), generators – documentation – connection of a simple IT system – system interfaces – data protection and data security – remote maintenance	
	3 months

Unit 5	Administration of IT Systems
In the last part of the education the apprentices learn how to maintain an IT system in order to ensure the system's functionality. To prevent system failures they know about hardware and software compatibilities, virus protection and different backup methods. Finally they learn how to document system configuration and to prepare training courses to teach colleagues.	
– functional testing – maintenance, maintenance contracts – fault analysis and isolation, fault clearance – post mortem analyses and fault clearance – compatibility of hardware and software – service settings – recycling, environmental sound waste disposal – handling hazardous materials – data processing media, data formats and data exchange – data protection, different backup techniques and archiving – virus protection and removal – copyright – customer care – documentation of product information, configurations and procedures – training courses – presentation	
	2 months

5.6.3 Conclusion

The presented vocational training program for the Assistant of Applied Information Technology is an essence of the four German IT vocational training programs which focus on IT.

The idea was to create a vocational training with a maximum duration of one year and preparing apprentices who are able to administer IT systems and networks, to deepen their knowledge on their own, and to teach others.

The four German vocational training programs are customized for specific job profiles, but the Assistant of Applied Information Technology should be an all-rounder.

German vocational training programs generally have a very good reputation throughout the world. Its unique system of sharing the costs between the state and the companies together with the high quality of the training make the German system a splendid example.

Therefore, we decided that Afghanistan should benefit from German vocational training programs and extracted some units from each of the four programs.

Sustainability, Adaptability, Expected Level Knowledge and Costs are crucial criteria for the new vocational training program and were considered in the evaluation function (introduced in chapter 5.5.2 Evaluation Process) which was needed in order to rate every unit of all four German vocational training programs.

The result is a concept for a compact but universal one-year IT vocational training program for Afghanistan. The details of the teaching should be discussed and implemented by qualified pedagogues.

5.7 Summary of An Education Concept

The chapter 5 "An Education Concept" results from the education part of analyzing the "Current Situation in Afghanistan." The lack of a vocational training program for an IT allrounder and the lack of qualified IT personnel led us to the decision to create a new IT vocational training program tailored for the demands of Afghanistan.

The high illiteracy rate combined with the slow rebuilding process of the educational system leads to the necessity of an education before the vocational training can start.

The subchapter "Basic IT Education" proposes a curriculum which equips the apprentice with the appropriate basic knowledge of mathematics, computer hardware, and computer software. In the end of the sub-chapter "Basic IT Education" some ideas are given to support the trainer.

The sub-chapter "Vocational Training" explains why the German vocational training program is considered to be an archetype throughout the world.

In addition the four relevant German vocational training programs are introduced. It is examined in detail how far their units meet the crucial criteria (Sustainability, Adaptability, Expected Level of Knowledge and Costs).

The resulting units were composed to the curriculum for the created vocational training program "Assistant of Applied Information Technology." However, the curriculum will leave enough space for the future trainers to apply their own methods of teaching.

6 Summary

Today's IT infrastructure is characterized by its heterogeneity. To ensure certain IT security levels, a successful strategy would need to consider more than the entities of those systems. IT security guidelines, specifications, and concepts, which are accepted as international standards do usually base on the requirements and preconditions within industrialized countries.

The first part of this thesis has given an in-depth overview on Afghanistan. The main areas of discussion were the culture of the people of Afghanistan, their heritage, and the climate. One result of our research is that the environmental conditions of Afghanistan are not appropriate for properly operating standard commodity PCs. Sand, dust, and humidity endanger the reliability, lifetime, and functionality of standard IT systems. For Afghanistan, durable, reliable and inexpensive hardware solutions would represent a giant leap towards the formation of an information society. Several different hardware vendors and manufacturers recently recognized the market potential of developing countries and assembled some interesting hardware solutions. Therefore, in chapter 4 "General Recommendations for Afghanistan" we presented several hardware solutions.

First, we introduced international standards for computers, which have to operate under extreme environmental conditions. Naturally, the military in general has a huge interest in IT systems working reliably under extreme conditions. But several civil standards also exist. These standards can be applied for IT systems to withstand the local conditions in Afghanistan. Hardware solutions, which fully comply with the standards presented, are so called *ruggedized* notebooks. Unfortunately they are expensive and therefore we assembled a set of alternatives for developing countries and outlined them in chapter 4.1 "Hardware".

Further, to ensure sustainable development of Afghanistan and other developing countries, affordable access to IT systems is required, with both hardware and software. This can be supported by the presented set of hardware solutions. Appropriate, affordable, and robust personal computers are one requirement for the people of Afghanistan to become part of the information society. The process of self educational studies can be enhanced and accelerated by the use

of proper, customized software. In chapter 4.2 "Software" we examined the advantages and disadvantages of open source software with regard to the special conditions of a developing country. As a result, we analyzed and proposed several software packages to that end.

The research for chapter 3 "Current Situation in Afghanistan" revealed the lack of an IT vocational training program in Afghanistan. As has been outlined, this program is a necessary step toward the development of IT infrastructure and security in the country. Also, it provides the base for future research.

The chapter 5 "An Education Concept" provided a solution to fill the gap. We examined four German IT vocational training programs in detail to create a new, customized one for the requirements of Afghanistan.

The expected high demand for well-trained technicians convinced us, that this need could only be quickly covered through a concise one year program. Thus, we aimed to fit all of the relevant education objectives of the new vocational training program into just one year. This could be achieved by analyzing each single module of the German programs based on criteria relevant to Afghanistan and selecting only those that rated best, and are thus best suited for the new program. The analysis was based on an evaluation function developed just for this purpose, reflecting criteria chosen appropriately. The dimensions utilized include sustainability and adaptability, the expected level of knowledge, as well as the cost associated with it. Our research concludes with the outline of a proposed new vocational training program for an "Assistant of Applied Information Technology", customized to meet Afghanistan's specific requirements.

We hope that a possible implementation of our proposed vocational training program in Afghanistan will constitute another step for the country to become part of the global information society and hence contribute to sustainable development.

If you are planning for a year, sow rice;
if you are planning for a decade, plant trees;
if you are planning for a lifetime, educate people.

Chinese proverb

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8 Table of Figures

9 List of Abbreviations

ADSL	Asymmetric Digital Subscriber Line
BSI	Bundesamt für Sicherheit in der Informationstechnik
CIA	Central Intelligence Agency
CSS	Central Security Service
DSL	Digital Subscriber Line
GSM	Global System for Mobile communications
ISDN	Integrated Services Digital Network
ISI	Inter-Services Intelligence Directorate
IT BPM	IT Baseline Protection Manual
NSA	National Security Agency
RegTP	Regulatory Authority for Telecommunications and Posts
SDSL	Symmetrical Digital Subscriber Line
UCTE	Union for the Coordination of Transmission of Electricity
UMTS	Universal Mobile Telecommunications System
USSR	Union of Socialist Soviet Republics

10 Appendix A

Kapitel	Unterkapitel	Bearbeiter
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11 Appendix B

Zusammenfassung

Die heutige IT- Infrastruktur ist charakterisiert durch ihre Heterogenität. Um bestimmte IT Sicherheits-Level abzusichern, müsste eine erfolgreiche Strategie mehr als nur die Entitäten eines Systems berücksichtigen. IT Sicherheitsrichtlinien, Vorschriften und Konzepte, welche bereits als internationale Standards akzeptiert sind, basieren in der Regel auf den Anforderungen und Voraussetzungen von Industrieländern.

Im ersten Teil der Diplomarbeit wurde ein Überblick über Afghanistan gegeben. Die Schwerpunkte waren die Kultur, die Volksgruppen und das Klima des Landes. Als ein Ergebnis konnte festgehalten werden, dass die klimatischen Bedingungen in Afghanistan den sicheren Betrieb von Standard-Computern erheblich beinträchtigen bzw. sogar gefährden können. Sowohl Sand und Staub als auch die Feuchtigkeit haben einen negativen Einfluss auf Zuverlässigkeit, Lebensdauer, und Funktionsfähigkeit von IT- Systemen. Für Afghanistan würde der Einsatz von haltbaren, zuverlässigen, und günstigen Hardware-Lösungen ein großer Schritt in Richtung einer sicheren Informationsgesellschaft sein.

Einige Hardwarehersteller haben diesen Markt erkannt und bieten einige interessante Hardware Lösungen an. Deswegen haben wir im Kapitel 4.1„Hardware“ einige dieser Lösungen vorgestellt. Zuerst wurden aber einige internationale Standards für Computer für den Einsatz unter extremen Bedingungen vorgestellt. Natürlich hat vor allem das Militär ein grosses Interesse an IT-Systemen, die unter extremen Bedingungen arbeiten können, aber es gibt auch eine ganze Reihe Standards für den zivilen Gebrauch. Diese Standards können angewandt werden, um IT Systeme an die in Afghanistan vorherrschenden Bedingungen anzupassen. Unter den von uns vorgestellten Hardware Lösungen befinden sich die so genannten *ruggedized* Notebooks, leider sind diese Notebooks aber auch sehr teuer und daher momentan nicht interessant für Afghanistan. Aus diesem Grund haben wir im Kapitel 4.1.3 „Solutions“ einige geeignetere und günstigere Lösungen zusammengestellt.

Des Weiteren, ist es wichtig, um eine nachhaltige Entwicklung von Afghanistan und anderen Entwicklungsländern zu gewährleisten, den Zugang zu IT-Systemen günstig zu gestalten. Die vorgestellten Hardwarelösungen können dies unter-

stützen, jedoch ist es auch notwendig, über die geeignete Software nachzudenken. Das Selbststudium und damit autonomes lernen kann durch den Einsatz der richtigen Software erheblich verbessert und beschleunigt werden. Im Kapitel 4.2 „Software“ haben wir erstmal die Vor- und Nachteile von OpenSource Software mit dem Blick auf den Einsatz in Entwicklungsländern dargelegt. Das Ergebnis dieses Exkurses war, dass der Einsatz von Open Source in Entwicklungsländern nur mit einigen Einschränkungen empfohlen werden kann, daher haben wir zum Ende dieses Kapitels einige Software Pakete genauer vorgestellt.

Die Forschung für das Kapitel 3 „Current Situation in Afghanistan“ hat gezeigt, dass in Afghanistan kein Ausbildungsprogramm für IT-Berufe existiert. Wie bereits dargelegt, ist eine umfangreiche Ausbildung notwendig, um eine nachhaltige Entwicklung der IT in Afghanistan zu gewährleisten.

Das Kapitel 5 „An Education Concept“ stellt hierfür eine Lösung bereit. Wir untersuchten die deutschen Ausbildungsprogramme auf Lerninhalte, welche geeignet wären für ein entsprechendes Ausbildungsprogramm in Afghanistan. Hierbei musste ein Kompromiss getroffen werden. Einerseits braucht Afghanistan so schnell wie möglich qualifiziertes Personal, aber andererseits würde ein länger als ein Jahr andauerndes Ausbildungsprogramm z. Z. kaum durchführbar sein. Daher fand die Auswahl der geeigneten Lernfelder anhand der Kriterien „Nachhaltigkeit“, „Anwendbarkeit“, „Wert des erlernten Wissens“ und die „zu erwarteten Kosten“ statt.

Das Ergebnis haben wir in dem Ausbildungsprogramm „The Concept: Assistant of Applied Information Technology“ zusammengefasst. Dieses stellt den wichtigsten Schwerpunkt unserer Diplomarbeit dar, und ist im Prinzip auch auf andere Entwicklungsländer anwendbar.

Wir hoffen dass die mögliche Umsetzung von unserem Vorschlag ein weiterer Schritt in der Entwicklung Afghanistans in Richtung der Informationsgesellschaft ist, und somit zu einer nachhaltigen Entwicklung dieses Landes beiträgt.