

Internet

- More computer users should be given access to the Internet. This is especially the case for Dzongkhag administrations, corporations, and educational institutions.
- The use of the Internet for research should be promoted.

Human Resources

- Intensive in-country training programs should be implemented immediately to reduce the shortage of IT personnel. Training programs should target unemployed youth, government staff, and students.

Information Management

- The government should continue to develop database systems, and make them available to other organisations as needed; especially in the ministries that have information required by other organisations.

Institutional Arrangements

- Organisations should establish IT units and information units to guide IT development at the agency level and manage their information.

IT Plans

- Resources should be made available for organisations to implement their IT plans.

Survey of IT

in the

Royal Government of Bhutan



Division of Information Technology

March 2001

1 INTRODUCTION

To obtain an impression of the present status of Information Technology in Bhutan, DIT recently carried out a survey focusing on IT infrastructure, human resources, and information management. The results showed that while IT in Bhutan has grown rapidly over the past years, additional IT infrastructure is needed, there is an acute shortage of IT personnel, and information management can be improved.

2 METHODS

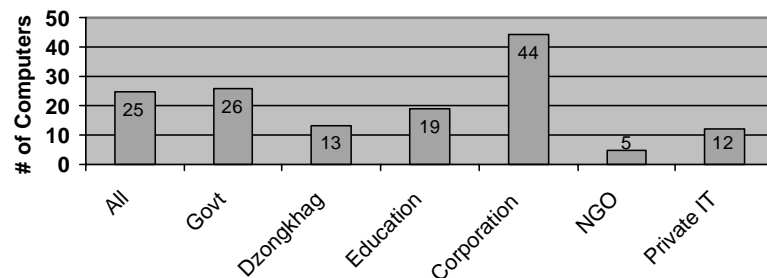
121 questionnaires were distributed, covering all government organisations and corporations, and several private IT companies. Of the 121 organisations that were contacted, 103 responded. Responses were received from 57 government agencies, 10 Dzongkhag administrations, 11 educational institutions, 15 corporations, 5 NGOs, and 5 private IT firms. A copy of the survey form is available from the DIT website at <http://www.dit.gov.bt>.

3 RESULTS

3.1 Infrastructure

The surveyed organisations have a total of 2,550 computers, averaging 25 computers per organisation. Corporations have the highest coverage of computers (44 computers/organisation). The number of computers in the *Dzongkhag* (District) administrations has grown rapidly over the past few years; on average there are now more than 10 computers per administration (Figure 1).

Figure 1 Computers per Organisation



The prevalence of older FoxPro systems in corporations could mean that either corporations have more legacy database systems, or that they have been slower than government organisations in adapting newer database systems.

Institutional Arrangements

There is a clear need to establish additional IT units and information units at the agency level to guide IT development and information management. Especially among the Dzongkhag administrations such units should be established for promotion and efficient use of IT.

IT Plans

The prevalence of specific IT plans throughout the government shows the importance organisations attach to development of IT, and especially the sharing of information. This enthusiasm should be encouraged through the implementation of IT projects to assist organisations in fulfilling their plans.

5 CONCLUSIONS

The results of the survey indicate that although IT in Bhutan is developing rapidly, there are a number of issues that require attention:

Infrastructure

- Dzongkhag administrations may require additional computers in the coming years, especially when the government plans to decentralise its services. The effective use of computers should also be promoted.

Networks

- More networks should be installed, especially in the Dzongkhag administrations. The present networks should be used more effectively, and other uses of networks such as scheduling and internal messaging should be promoted.

business, all computers in an organisation should be given Internet access. The Internet is especially beneficial to Dzongkhag administrations, due to their distance from sources of information. Yet here the number of users with an Internet connection is particularly low. This is undoubtedly caused by the absence of networks in the Dzongkhag administrations. Better infrastructure in the Dzongkhags would probably also increase the use of the Internet for downloading of information and research.

Corporations and educational institutes would also benefit from more Internet connections for all users. The high percentage of networks in corporations should facilitate the provision of Internet access to users.

Human Resources

There is clearly an acute shortage of IT personnel in Bhutan. In the immediate future, government organisations and corporations require more twice as many IT personnel as they now have. In the long term, this number is likely to increase further. Therefore, vocational training programs for IT personnel are urgently required. Database developers, network administrators, and web developers are in highest demand. Considering the proposed increase in use of Internet and Intranets for information sharing, and the small number of trained web developers in Bhutan, the shortage of web developers is the most acute.

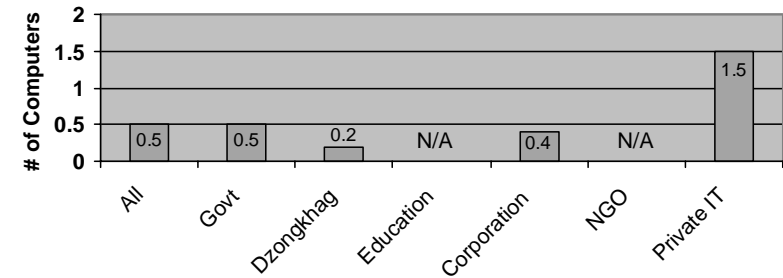
Information Management

The high percentage of organisations with data to share, combined with the large number of organisations which specifically plan to increase data sharing, shows that this is a priority for all organisations. The high importance that Dzongkhag administrations attach to information sharing perhaps reflects the present difficulties in information sharing between the central government and the Dzongkhags.

Fully functional and accessible information systems are especially important for the Ministries of Agriculture, Home Affairs, Education, and Trade and Industry, because their data are required by most other agencies.

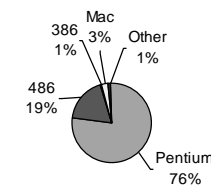
Based on the total number of employees in organisations, the coverage of computers is highest in private IT companies, followed by government organisations. Dzongkhag administrations have the lowest number of computers per number of employees (Figure 2).

Figure 2 Computers per Employee



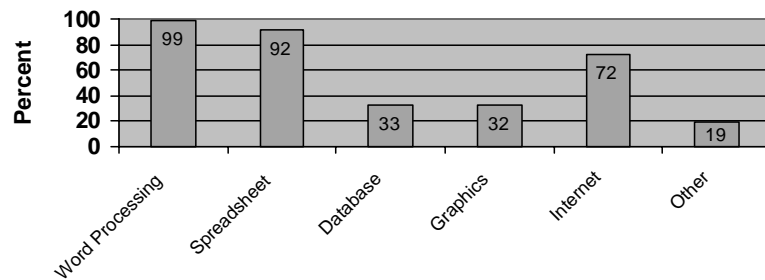
Virtually all computers in Bhutan are PCs (97%), and the rest (3%) are Apple Macs. Of the PCs, 79% are Pentiums (Figure 3).

Figure 3 Computer Types in Bhutan



The survey revealed that 99% of the organizations that responded use computers for word processing, 92% of the organization use computers for spreadsheets, and 72% for Internet access, and 30% for database processing (Figure 4).

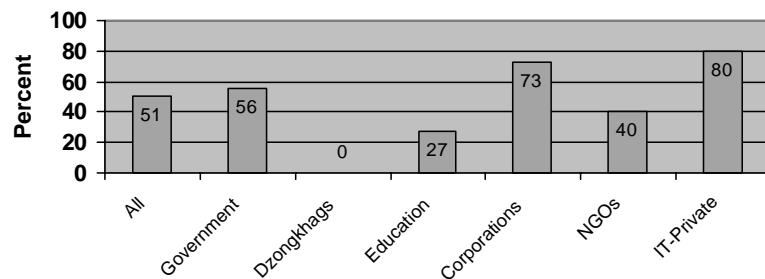
Figure 4 Computer Use



3.2 Networks

Of the 103 agencies surveyed, 52 reported having Local Area Networks (LANs), 32 more LANs than five years ago. The percentage of networks was highest among corporations and the private IT sector, whereas none of the Dzongkhag administrations have installed a network (Figure 5).

Figure 5 Percentage of Organisations with a Network



In organisations that have installed a network, generally 70% or more of computers are linked to the network, although that number is much lower in educational institutes (Figure 6).

4 DISCUSSION

Infrastructure

Based on the number of computers installed in the surveyed organisations, the total number of computers in Bhutan could be as high as 4,000. The number of computers per employee is reasonable in most organisations, although the introduction of computers appears to lag behind in Dzongkhag administrations.

The majority of computers are capable of running the latest operating systems and application software, which allows the introduction of new information systems. However, the results from computer and network use indicate that at present most computers are not yet used optimally. This is not surprising, as information technology has only recently been introduced in most organisations.

Networks

Networks are most urgently needed in Dzongkhag administrations, followed by educational institutes. Most organisations that do not have a network would prefer to install one, provided they are given the necessary resources. To maximise the benefits of a network, all computers in an organisation should have a network connection. Moreover, it will not be possible to provide all government staff with Internet access, unless all computers have been networked. Especially in educational institutes, this still is not the case.

Organisations that have installed a network could improve their use, especially for scheduling, information sharing, and internal communication. File backup and file and printer sharing are basic applications that should be installed on all networks. Especially in government organisations, network file backup can be improved.

Internet

The Internet has gained rapid acceptance in Bhutanese organisations since its introduction two years ago. However, to maximise the benefits of the Internet, including the implementation of e-government and e-

3.7 Future IT Plans

84% of organisations have specific IT plans. In educational institutions and corporations the percentage is even higher (Figure 21). Sharing of information is the most frequently mentioned plan, especially in government organisations and Dzongkhag administrations, while installation of networks is especially important for Dzongkhag administrations (Figure 22).

Figure 21 Percentage of Organisations with IT Plans

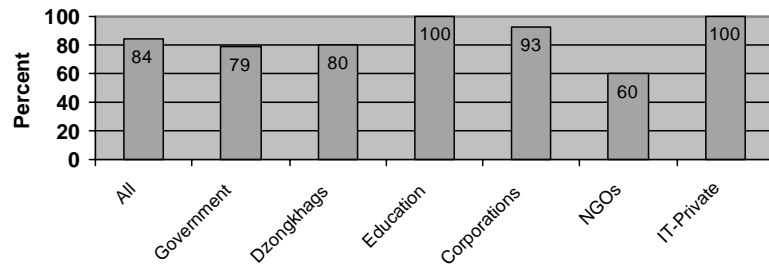


Figure 22 IT Plans

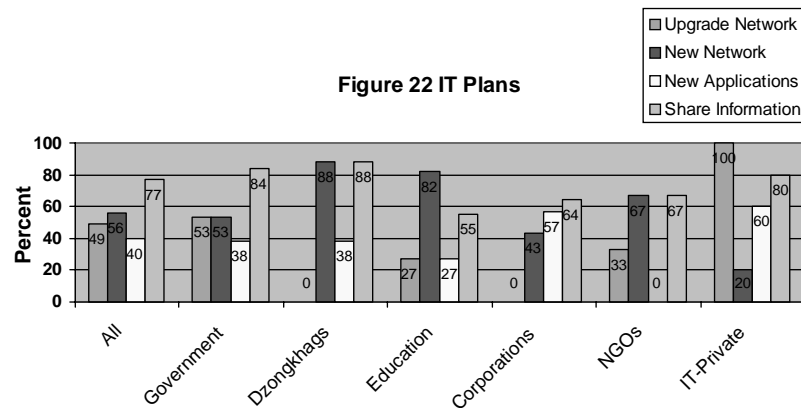
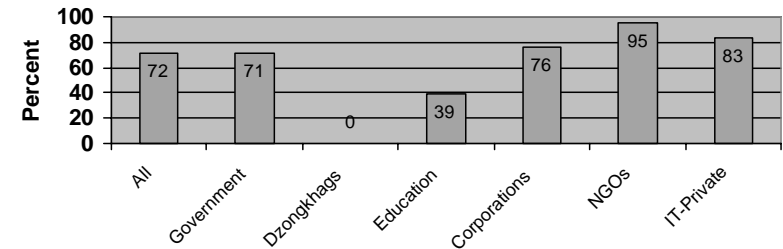
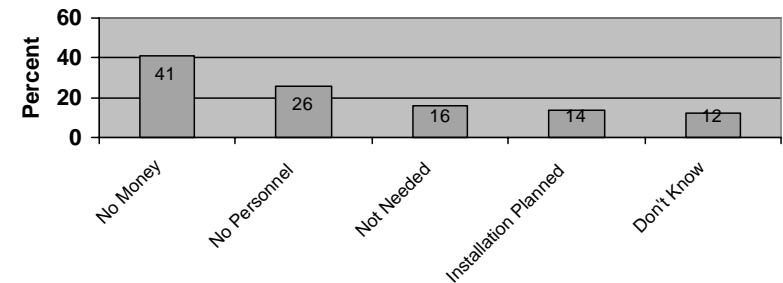


Figure 6 Percentage of Computers Linked to the Network in Organisations with a Network



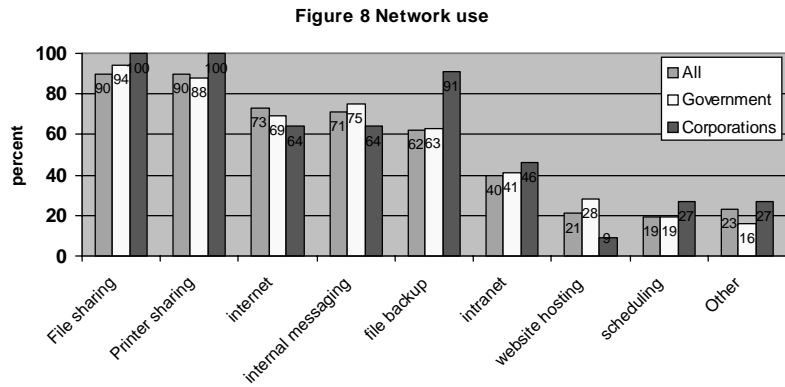
Of the organisations that do not have a network, 47% of organisations reported that they could not install one for lack of money and/or personnel. Only 16% of organisations did not feel a need to install a network (Figure 7).

Figure 7 Reasons for not Installing a Network



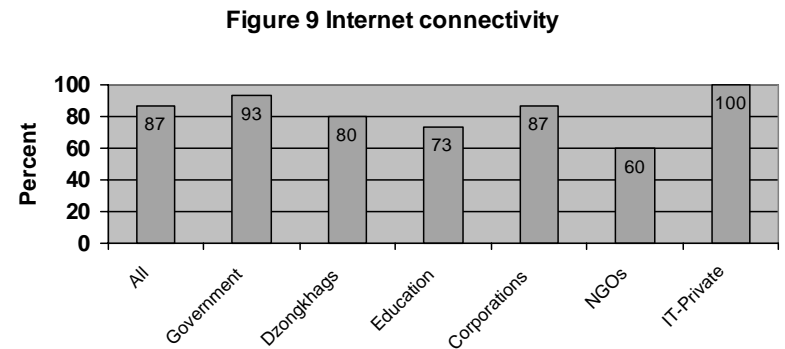
The networks are used mostly for file and printer sharing (90% of organisations), and Internet access (73%). 40% of all networks are used to access an Intranet, but only 21% for scheduling and web hosting. 91% of corporations use their networks to back up their files, versus 63% of government organisations. On the other hand, corporations use their networks less for Internet access (Figure 8). Sample sizes for other

organisations were too small to be able to draw reliable conclusions.



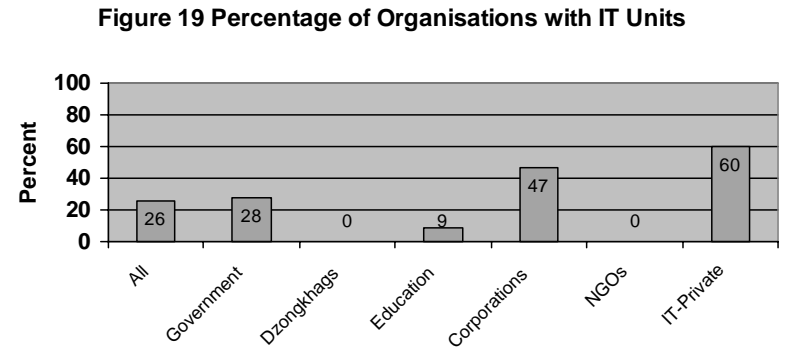
3.3 Internet

87% of surveyed organisations have an Internet connection (Figure 9). However, only 47% of the total number of computers is connected to the Internet in those organisations (Figure 10). In the Dzongkhags, 80% of the administrations have Internet access, but only 21% of their computers are connected to the Internet. Despite the high percentage of networks in corporations, only 35% of their computers have Internet access. 10 organisations have leased-line access to the Internet; the rest have a dial-up connection.

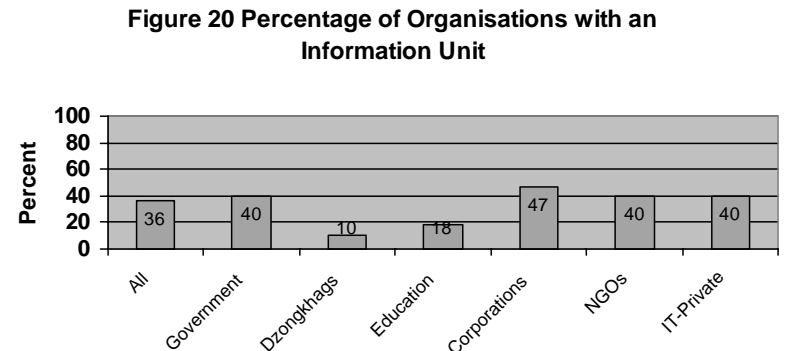


3.6 Institutional Arrangements

On average, only 28% of surveyed government agencies have a designated IT Unit. However, none of the Dzongkhag administrations or NGOs have a designated IT Unit. On the other hand, 47% of the corporations have an IT Unit (Figure 19).

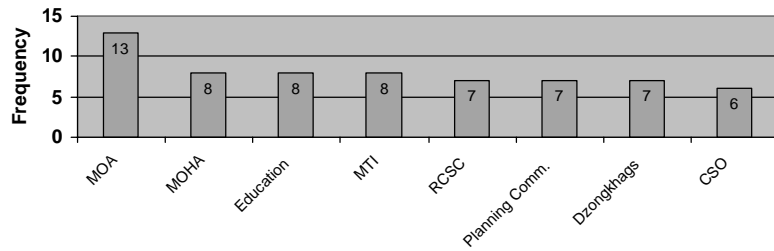


Despite the importance attached to data sharing, only 36% of all organisations have established an information section. Among the surveyed Dzongkhag administrations there is only one designated information section (Figure 20).



Surveyed organisations most frequently need to share information with the Ministry of Agriculture, followed by the Ministry of Home Affairs, Education, and the Ministry of Trade and Industry (Figure 17).

Figure 17 Organisations with whom to Share Information



In government agencies, MS Access is the most commonly used application, whereas in corporations, FoxPro is still more prevalent (Figure 18). In the private IT sector, Visual Basic, MS Access and SQL Server are clearly the applications of preference. None of the surveyed NGOs reported using any database systems.

Figure 18 Application Use

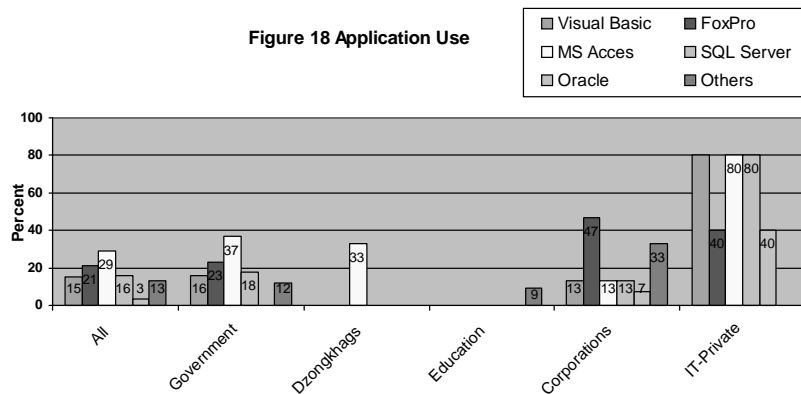
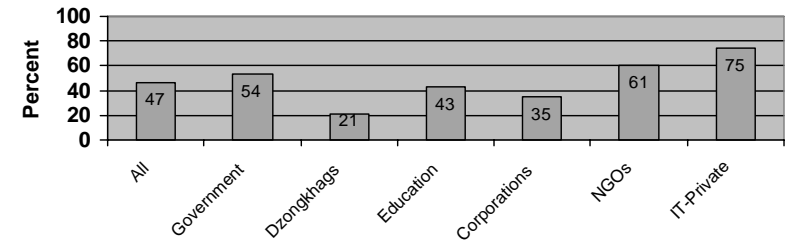
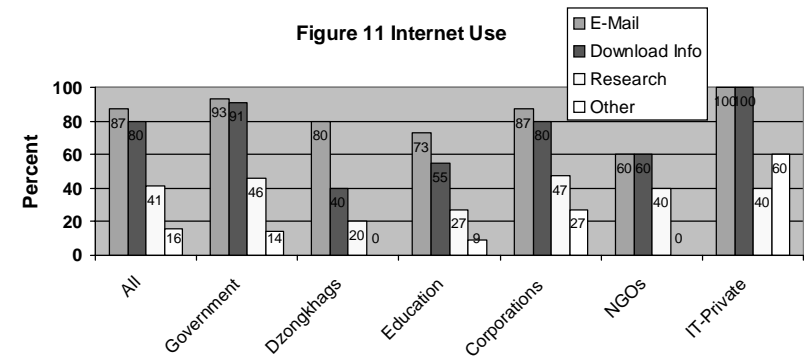


Figure 10 Percentage of Computers with Internet Connection



The Internet is used mainly for e-mail (by 87% of organisations) and downloading of information (80%). Only 41% of organisations use the Internet to do research (Figure 11). Other uses include keeping up with news and training.

Figure 11 Internet Use



3.4 Human Resources

The survey revealed that the RGOB employs around 225 IT personnel, spread over to 60% of organisations. The percentage of organisations with IT personnel varies, with 80% of corporations having IT personnel (Figure 12), whereas only 20% of NGOs have IT staff.

Figure 12 Percentage of Organisations with IT Personnel

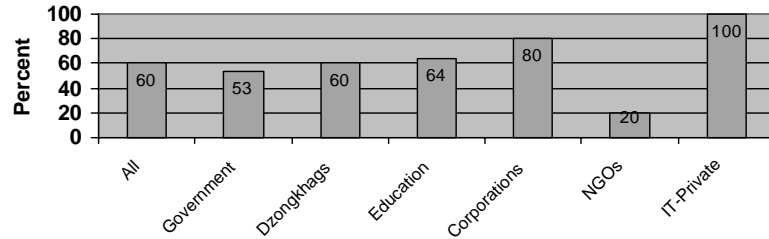
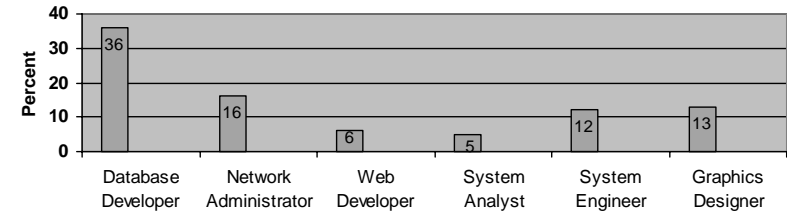


Figure 14 IT personnel



On average there are 3 IT personnel in each organisation, although corporations have 7 IT personnel per organisation (Figure 13). Dzongkhag administrations and NGOs employ on average only 1 IT personnel per administration.

Figure 13 Average Number of IT Personnel per Organisation

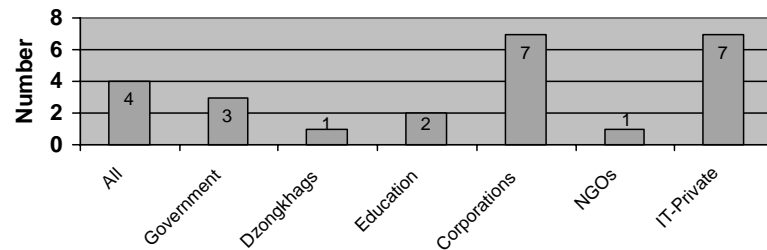
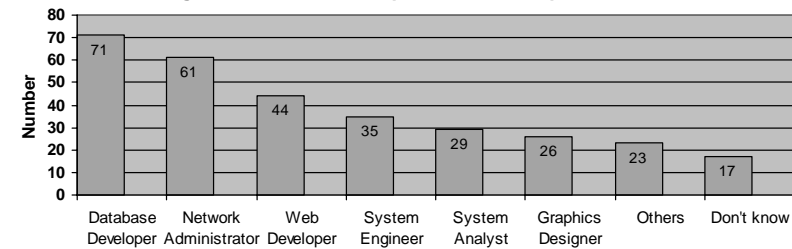


Figure 15 Immediate Requirements for IT personnel



Most of the IT personnel are database developers (36%) and network administrators (16%). Only 6% are web developers (Figure 14).

80% of organisations surveyed requested additional IT personnel, totalling approximately 290 extra IT personnel. Database and application developers (71) are required most, followed by network administrators (61, and web developers (44; Figure 15).

3.5 Information management

90% of organisations that responded to the survey have data to be computerized, and 81% of those have spelt out the need to share at least some of those data with others. Especially Dzongkhag administrations are keen to share data with others (Figure 16). One Dzongkhag administration felt that although it had no data to be computerized, it still needed to share data with other organisations.

Figure 16 Percentage of Organisations with Data to Share

