MANAGING INTERNATIONAL DATA COMMUNICATIONS

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International data communications (IDC) activities are vital to multinational corporations (MNCs) in managing the complexity of information exchanges required for the control and implementation of worldwide business strategies. IDC activities are also critical because they allow MNCs to extract information and move it globally without incurring major time delays, or transportation, reproduction, or inventory costs. Compared with data communications that occur within national borders, IDC encounters more difficulties due to differences in the international technological infrastructure, network systems, culture, government regulations, and the level of technological and economic development. Surprisingly, there has been little empirical research to identify the issues MNCs encounter when performing IDC, and needless to say, no solutions have been widely reported to deal with these issues effectively.

However, several empirical studies have been conducted on the issues of information systems management. One of the earliest studies (1982) surveyed members of the Society for Management Information Systems (SMIS) [1]. Four subsequent studies [2, 3, 6, 9], based upon each other, were performed on the SMIS membership since then in an attempt to build a cumulative research tradition of IS issues in the U.S. Similar studies have also been conducted in other countries (such as [4, 5, 7, 10, 11]) to essentially identify and rate the relative importance of domestic and international IS (IIS) issues as implied by current competitive priorities, major concerns, and technology advancements. Although these studies do not produce uniform findings, network-related concerns have consistently been rated as top IS issues (see Table 1).

This article reports on a two-round Delphi study to prioritize the IDC issues confronting MNCs. A questionnaire was administered to IS executives at 300 Fortune 500 companies. Only U.S.-based MNCs were selected because we wanted to improve the study’s response rate by avoiding international mailings.

The IIS background of the responding MNCs was evaluated and unqualified respondents (those with little or no IIS experience) were removed throughout both rounds. The results, as depicted in Table 2, were used as the basis for the IDC issues study. However, we also conducted follow-up interviews with 11 participants to collect more in-depth responses to the IDC issues.

Top 10 IDC Issues

1. Improving the operational efficiency of networks. Our respondents believed that network operation in the IDC context is a major concern primarily due to complications arising from rapid advances in underlying technology; different regulatory strategies of the various Postal, Telephone, and Telegraph (PTT) authorities; varying levels of network sophistication; and non-uniform quality in telecommunication services. Furthermore, network operational efficiency needs international coordination among carriers, which is generally beyond the control of local network administration.

2. Dealing with different networks. Concern was evident regarding the management of diverse networks arising with different protocols, standards, and architectures. These network diversities may promote complexity and incompatibility in IDC activities and require additional attention by management. Conse-
quently, MNC growth may be limited by the immediate effects of network differences and incompatibilities that cause poor communication, waste telecommunication investments, and duplication of facilities.

3. Managing international telecommunication regulations. In many countries, the PTT authorities were formed to control telecommunication networks and establish communication regulations to protect or to subsidize their interests. Our respondents perceived these PTTs to be bureaucratic and inefficient. They contend many PTT regulations were unnecessary and impeded communication efficiency and effectiveness. Very often, significant cost and effort need to be devoted to resolve these regulatory barriers.

4. International integration of technologies. Organizations are facing more complex multivendor, multiprocessor, and multiprotocol environment. The creation of a seamless international communication platform requires the integration of worldwide processing platforms. However, the integration process is complicated due to existing legacy systems and incompatible technologies in the heterogeneous international processing environment. Furthermore, the logical and physical integration of platforms requires tremendous investment and a level of top management support, which are not readily achievable in many organizations.

5. Controlling data communication security. International networks, as compared to national networks, may give hackers more chances to compromise corporate networks and misuse data. Despite these problems, the respondents thought that IDC ought to sustain communication qualities such as interoperability, transparency, remote access, and performance, while at the same time continue to offer security checks for confidentiality, reliability, and integrity. Unfortunately, the need for security will always conflict with the need for access. Therefore, it is challenging for network managers to design proper security measures that both fulfill security needs and also provide reasonable access to users.

6. Reconciling national differences. Network managers may encounter many communication problems arising from national differences in culture, including habits, customs, values, and laws. A typical example is the translation of data collected in one country to another language for use in another country. Such language translation is required because of possible hardware and software capabilities when used in displaying and processing the language’s local character sets. Though the translation task may be insignificant, the activity represents an extra burden to network administration and network operations and makes information exchange more difficult.

7. Dealing with transborder data flow (TDF) restrictions. The respondents believed these restrictions have not been as problematic as in the past due to the impact of Internet services in supporting global information exchange. In some countries, however, information is still considered a scarce or sensitive commodity that needs restriction. The respondents contend that restricting TDF could substantially increase their operating costs and impact their global IS strategies, which would subsequently impact their future international IS development, investment, and operations.

8. Managing network infrastructure across countries. The constraints on a country’s network infrastructure generally include high transmission costs, limited bandwidth, questionable reliability on some links, and spotty development of up-to-date digital infrastructure. Our respondents indicate their network teams constantly need to resolve communication problems arising from different network infrastructures unique to each country. Hence, infrastructure variation and inferiority represent significant issues for network administration as they can severely impact IDC efficiency and flexibility.

9. Handling international politics. Some respondents expressed concern that some countries may intentionally retard IDC for ideological, religious, strategic, or political reasons. They contend networks may represent a threat to their national sovereignty. Hence, they seek to restrict IDC to maintain distance from the rest of the world. Other international political policies to watch include the confiscation and nationalization of network investments by host countries.
10. Dealing with international tariff structures. Local and international tariffs often increase operating costs substantially. Apart from the large number of telecommunications providers, the increasing variety of the type of services available in the market adds to the complexity of the problem of tariff structure. Worse, fluctuating exchange rates may even make the problem more complicated. With these scenarios, it becomes difficult for network managers or financial managers to accurately budget for the expense of tariffs.

Suggestions for Dealing with IDC Issues
We performed a factor analysis on the top 10 IDC issues to identify issue clusters in order to reduce the problem dimension for analysis and interpretation. The results, depicted in Table 3, suggest IDC issues can be clustered into four groups labeled as network management issues, regulatory issues, technology issues, and country-oriented issues. Based on this clustering, we propose some alternatives to ease IDC management within each group.

Network management issues. The interviewed participants indicated there is no complete solution they could adopt to eliminate all network management issues. In fact, they expressed feelings of helplessness in dealing with unpredictable and, very often, routine network operational tasks. Because service offerings and networking procedures vary widely from country to country, network administrators need to provide proactive measures for network monitoring, fault management, and performance analysis around-the-clock. Our interviewees believed potential problems be identified and corrected before IDC is disrupted only through such proactive services. Furthermore, they claim it is necessary for network administrators to collect data on network performance such as repair times, problems areas, costs, usage, and other corporate operational data. Such data often improves overall network operations and maximizes network management resources and strategic planning.

Most interviewed participants insisted network incompatibility and interoperability could be improved significantly if network standards are followed and open systems are used. TCP/IP is widely believed to be a solution to many IDC network management issues. Our participants indicated that many network administrators are now taking advantage of TCP/IP to bypass network management issues they confronted previously. They were convinced of this solution as TCP/IP has continued to emerge as a cheap, ubiquitous, and interoperable standard protocol. In addition to TCP/IP, X.25, ISDN, SNMP, and TMN are also popular standards and protocols to deal with international network interoperability issues.

Further discussions with our participants indicated that some network management issues could be easily resolved with the implementation of a network security plan. In this regard, network managers need to line up support from user departments and top management and then form a project team to assess and tackle the security issue. Some interviewed participants suggested there are certain sources of danger that required specific attention and control, such as unprotected sensitive information, heavy network use, possible alteration, unsecured hubs, and company policies. For best results, network managers should set priorities for implementing these controls according to the urgency of the needs. Some insurance companies have recently offered insurance coverage for network security problems if companies fulfill their security audit requirements (for example, install firewalls and related equipment). Network managers may also consider such coverage a plausible choice.

Regulatory issues. Network regulations and restrictions are mostly beyond the control of network management. Hence, our interviewees reported they were only able to alter their IIS strategy to accommodate these regulations and reduce their adverse effect on IDC. One recommended strategy would be the establishment of either a distributed or decentralized worldwide IS structure to deal with TDF, politics, and regulations more flexibly. Despite the annoyance of these regulatory issues, our interviewed participants still concurred that network management must recognize the legitimate concerns of all nations exercising TDF restrictions and conform to each country's TDF guidelines. Network administrators must realize that IDC should not be achieved at the expense of the basic rights of personal privacy or national sovereignty. In the interviews, some respondents stated the seriousness of network regulatory issues has become less critical. With the fast development of the Internet

<table>
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<tr>
<th>Table 2. Factor loadings of top 10 IDC issues.</th>
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<tbody>
<tr>
<td><strong>Network management issues (Eigenvalue=3.28)</strong></td>
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<tr>
<td>Improving the operational efficiency of networks 0.91</td>
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<tr>
<td>Dealing with different networks 0.85</td>
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<tr>
<td>Controlling data communication security 0.88</td>
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<tr>
<td><strong>Regulatory issues (Eigenvalue=2.41)</strong></td>
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<tr>
<td>Dealing with transborder data flow restrictions 0.87</td>
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<tr>
<td>Managing international telecommunications regulations 0.78</td>
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<tr>
<td>Handling international politics 0.82</td>
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<tr>
<td><strong>Technology issues (Eigenvalue=1.72)</strong></td>
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<tr>
<td>Managing network infrastructure across countries 0.84</td>
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<tr>
<td>Managing internationalization of technologies 0.79</td>
</tr>
<tr>
<td><strong>Country-oriented issues (Eigenvalue=1.44)</strong></td>
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<tr>
<td>Reconciling national differences 0.72</td>
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<td>Dealing with international tariff structures 0.77</td>
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and the global information superhighway, the borders of the information world is becoming more blurred, thus reducing the impact of TDF restrictions and regulations on IDC.

Another recommendation offered by our participants is to take advantage of private value-added networks that coexist with networks operated by a nation's PTT. These private networks offer network management more flexibility and freedom in dealing with TDF and IDC regulations. Indeed, many countries that formerly enforced TDF restrictions are planning to privatize their PTT operations to enhance their network efficiency and to offer more competitive services. For other countries, their PTT authorities have already detached from the government ministry to achieve an independent status as a public corporation. These PTT structural changes, along with the recent deregulation movement, may significantly improve the competitiveness of IDC services.

**With the advent of e-commerce, the regulatory issues are more exposed, thus demanding immediate attention.** Our participants foresee that more MNCs will move toward the establishment of information partnerships with foreign organizations. This new partnership will not only allow participating organizations to form joint marketing programs, but will also allow a large volume of electronic data to be exchanged more precisely, instantaneously, and cheaply. For any regulations and TDF restrictions that exist within the local country, it will become the responsibility of the local organization for resolution. In this scenario, the regulation issues in IDC become less critical, which eventually lead to an improved network environment for global communications.

**Technology issues.** One participant mentioned his organization was once troubled by some serious technology problems and had even considered shutting down some of its sophisticated online systems in the less-developed countries. To date, these systems are still in operation as the organization sought partnerships with local vendors, outsourcing its IT platform for them to update and maintain. These partnerships provide scale and clout for helping their companies to deal with local technology issues and to satisfy customers in other countries.

Some participants also specified their organizations have tried to decentralize their IIS activities as much as possible to minimize IDC technology problems. These participants were still pessimistic about the infrastructure problem and believed the only solution would come from local governments. They could only resolve issues by outsourcing their IT platform or adopting a more decentralized IS strategy.

While worldwide information exchange is becoming more crucial for many organizations, some participants suggest a more aggressive communication strategy to support IDC—a private global network solution—would perhaps be more appropriate. However, this strategy involves significant investment and is not applicable to most organizations. An alternate solution, which is less effective, is to consider satellite communications with small aperture terminals for direct connection when the reliability of a country's national infrastructure is questionable. When communicating with countries with an inferior network infrastructure, the participants suggested their network administrators consider using techniques like multiple-connected hubs, alternate routing, dial backup, and rapid fault recovery to ensure the reliability of IDC.

Even when a private global network is available, most interviewees still believe standards and open-system architecture provide better solutions to the technology issues of IDC. When organizations deal with technology heterogeneity by conforming to a worldwide standard or open architecture, ubiquitous networks could be developed easily to interconnect global islands of automation. The success of electronic data interchange (EDI) and the widespread application of Internet-related technologies have already demonstrated to IS professionals the benefits and convenience of having IIS standards for worldwide data processing.

**Country-oriented issues.** Many of the participants predicted that cultural- and country-oriented issues will become less significant in the immediate future due to the globalization and virtualization of organizations made possible by the Internet and interorganizational information systems. The recent merger and acquisition trend in the telecommunication industry also provides network managers a way to alleviate the problems of poor tariff structure and fluctuating exchange rates. The trend started in the U.S. and is spreading throughout the world. This trend dramatically increases the coverage of a single telecommunication services provider as more local operators are merged together. It can eliminate different tariff plans in different countries. Although such merging will increase the risk of a worldwide monopoly, it brings many benefits such as fewer bills and tariff plans, better network management and global standards.

Our study also found that many other effective strategies have been implemented in some of our participant's organizations to reconcile national differences. Two of the most highly regarded strategies are to work closely with local partners and to adopt new
technologies that can break language barriers. Hiring local network administrators and providing language training for employees are usually short-term solutions.

Network managers should consider a more ultimate solution—an electronic language translator. Such software may allow English-speaking network administrators to instantly speak several foreign languages and provide full-voice translation and real-time interlanguage communication capability. Such software may also offer advanced features like voice dictation/translation, voice chat, and instant Web page translation that would allow network administrators to deal with language-oriented differences more effectively [7].

Even if all network administrators speak the same language, there is still another language barrier arising from the data languages unique to a local country. These data languages, which comprise the vocabularies and grammars used to encode business data, represent the culture, traditions, and customs of their own country. With only a few exceptions (such as EDI), there are very few common data languages in the business world. This issue, which represents another dimension of cultural and national differences, could possibly cause more hardships for IDC. Software products that could be used to encode business documents in a common format, regardless of which applications generated and processed those documents, are already available in the market. Network managers should consider these technologies when dealing with data language differences.

Our participants agreed that information partnership plays an important role in relieving country-oriented issues. Through such partnership, organizations can work together to accomplish all the activities required to design and operate their network platform. In addition, the partnership could also carry out coordination, control, and management activities so that IDC operations are performed effectively and efficiently without the concerns of country-oriented specific issues. In fact, some participants stated that their organizations are already taking advantage of information partnerships for shelter from varied forms of problems arising from national and cultural differences.

Conclusion
This study utilized prior work to guide a systematic analysis of today’s IDC issues. It represents a significant step beyond anecdotal literature on IDC issues by capturing data from those MNCs that have exposure and experience in IIS management. Our findings indicate IDC issues can be clustered into network management issues, regulatory issues, technology issues, and country-oriented issues. In fact, survey participants perceived network management issues to be the most important. Of the top 10 issues, network efficiency and network incompatibility were rated as the first and second most important IDC concerns. Post-survey interviews with some participants suggested most of the top 10 issues have no perfect solutions. However, our discussions shed some light on how these IDC issues could be alleviated with the application of flexible IIS strategies and with the adoption of advanced information technologies. Information partnerships were also found to be a good strategy to eliminate many IDC issues effectively.

REFERENCES

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