Preface

Despite a rising scepticism of digital technologies and a darker side depicted by authors on the issues of digital divide, the prominence of information and Internet technologies is well recognised in all spheres of our lives. Be it becoming educated, automating business processes, accelerating research procedures, effectiveness in teaching, finding holiday destinations and booking tickets, or retrieving information on different issues, we find information technology (IT) and Internet support everywhere. Recent work on digital divide focuses on the implications of the technology being unequally accessed and used by individuals from different classes of society, depending upon their economic, geographic, demographic, and physical abilities. However, pervasive computing has also provided solutions to many of the issues related to digital divide in its infant stage.

Pervasive computing is becoming integral to our daily lives. It has capabilities to economically connect everyday devices via sensors, and provide services at any time and place. Utility computing is also set to minimize the costs and provide need based computing to everyone. Pervasive computing along with utility computing is simplifying information processing and database handling. Anyone with a little bit knowledge of the features can play with these devices and avail the vast services provided by utility service providers. In the very near future, individuals will do their jobs without the headache of buying individual software, applications, or maintaining an ever increasing pool of complex databases. Businesses will focus on their core activities rather than spending lot of time and resources acquiring, implementing, and managing frequently changing technologies. Kids will avail all the education and entertainment services from a single platform, updated with technology upgrades, as they grow and their needs change. One little device will control all the devices at home and in the office. The day when you will create your own imaginative dream house is not far, and this is made possible by Grid Computing and Ambient intelligence; that are already supporting Pervasive Computing technologies.

Doctors are now able to monitor and treat many patients together, some of whom may be in remote areas. This is undertaken by receiving health reports using pervasive devices and sensors embedded in e-intensive care units, where patients do not feel that they are surrounded by such electronic devices. Pervasive devices are economic and can be used by individuals for pervasive learning, eliminating gender, age, social, geographic, or other biases. The reduction of a digital divide is demonstrated by the fact that the number of mobile devices is increasing exponentially in countries like India and China, and being used by all classes of society. Whether it is a matter of availing health care or emergency services, finding company in old age , running a business, publishing and reaching the whole world, studying weather conditions, building intelligent and safe homes, entertaining oneself, working from remote places and staying in touch, or finding and judging a life partner, pervasive computing is there for support.

"Pervasive devices have become proxies for their owners. For instance, a cell phone directly mediates personal communication by projecting some aspect of his or her personality to make a desirable impression. These devices act as payment proxies.For example, when a ticketing fee is automatically charged

by Tokyo subway system to your device as you pass through the subway barrier, or when your car's e-tag is charged automatically when you pass a toll booth on a motor way in Sydney" (Want, 2008). These devices can be used to pay all your supermarkets, petrol stations, electricity, telephone, and restaurant, bills. Your proxy device can be scanned as security when you enter a building or an office. You can use proxy call replier to answer your loved ones when you are in a meeting, giving a favourable expression. You can order food and even pull the curtains off the window using proxy.

E-business brought with itself an era in which new services and business models emerged and changed industry structure and corporate strategies. It is governed by simple rules of integrating Internet technologies and business processes, and diffusing personal computers to facilitate new business opportunities. This started with the development of a Web site and posting catalogue and company history. However, it is now about relationships with stakeholders, product development, telecommuting, quality assurance, increasing efficiency, and cutting costs. Businesses have not been able to catch their breath; tackling e-business models and the positive and negative aspects of e-business technologies and pervasive computing. Pervasive computing is now available to help businesses provide value to customers through the introduction of initiatives such as RFIDs, e-tags, NFC , and mobile communication technologies in business processes. Business leaders are adopting pervasive computing to obtain benefit from millions of autonomous tiny entities interacting with each other. Pervasive business complements e-business. Therefore, business models are further evolving with new developments in the pervasive computing field and applications in conjunction with Internet technologies.

For example, pervasive crowd-sourcing is a contemporary method being adopted by businesses to obtain innovative ideas, applications, and even quality services from all over the world in an economical way. You can use the wisdom of millions of people in decision making in areas including product design, buying a new machine, opening a retail outlet, or even selecting a distribution channel. Needless to say, the successful outcome of crowd-sourcing requires proper judgement from a decision-maker. The decision maker has access to the quality and quantity of the members participating in the process and should use statistical tools to assess the quality of predictions. Organisations are adopting crowd-sourcing in parallel with existing business intelligence tools for competitive advantage.

Context aware pervasive computing makes performance management systems more productive and aligned with business or organisational goals. Context is set to business goals which will identify key performance indicators along with their units of measurement. Key performance indictors are measured using pervasive devices and sensors. Collected data is then sent to business intelligence units where the data is processed and compared with the set context. The result is more appropriate alignment of operations with business goals. Pervasive devices and sensor networks make it easier to identify key problem areas, prioritise the activities in real-time, and help decision-making to improve the performance. Pervasive devices and sensors are used in production, service, and other departments for measurement, assessment, control, and management of quality of processes and products. Context aware systems can help in successful conceptualisation and implementation of balanced scorecards in the organisations, by focusing on contexts such as customer satisfaction, financial factors, level of innovation and learning, and quality of processes, products, and services.

Enterprise resource planning (ERP) systems have common relational databases to integrate all the processes of an enterprise, including marketing, accounting, production, inventory control, and sales. Enterprise resource planning systems can be used to empower employees by providing real-time context-based data, and updating the database in real-time to provide value-based services to the customers. Suppliers of products and services integrated with ERP systems using pervasive devices and sensors increase the productivity by executing transactions from even remote areas. RFIDs and sensor networks enable real-time inventory management and help with just-in-time inventory management, giving ben-

efits of cost saving and better decision-making. Customer satisfaction increases when customers can access consistent services from any place and at anytime; that results in more loyal customers and thus increased profitability.

The paradox is that even though there are immense opportunities, pervasive computing also exposes businesses, individuals, organisations, hospitals, educational institutes, and other users to risks. Risks start with access of personal information provided for context-aware services. This information will enable increased knowledge about the personality and behaviour of individuals and businesses, and provide them with more proxy type services. This raises significant concerns about privacy. There are also technical issues requiring further research and focus (for example, limitations on memory and power usage, as well as software, hardware, and network complications).

Pervasive computing not only improves organisational processes and conditions of living and work, but is also capable of amplifying already existing problems that are related to the environment, human health, society, and culture. Environmental impacts of pervasive computing may include an increase in power consumption for digital networks, because pervasive devices and sensors are always switched on. There is environmental risk from pervasive computing, including the release of pollutants caused by the disposal of the resulting waste. For instance, end-of-life waste from devices and e-waste streams, may increase pollution. Human health problems may also increase as a result of exposure to non-ionizing radiation emitted by pervasive devices and sensors because they are near to the human body, or may be implanted to provide services. "Pervasive computing could also cause psychological stress in individuals because of issues such as poor network coverage, distraction, and disturbance. Social and cultural effects are also possible. The loss of customers' choice and concern about privacy are examples. Individuals may even feel overloaded with information, causing increased psychological stress," (Koehler & Som, 2005).

The use of pervasive computing also involves operational risks. In business and organisational environments, operational risks of pervasive computing develop from the fact that there are no predefined business models and structures for its adoption. This includes usage with existing e-business technologies already struggling to receive operational clarification. Pervasive computing environments are new for the organisations and may reflect an initial stage of financial loss. Pervasive computing applications need to be evaluated for implementation in context of readiness of the organisation to adopt the change. Business process reengineering may help in streamlining the processes, structures and models, and in identifying gaps where pervasive computing applications can assist in increasing productivity and efficiency. Organisations may eventually find new structures and models that are more profitable and effective compared to existing structures. However, many will go out of business or face serious financial or reputation losses. Similarly, educational institutes and health service providers also face uncertainties and consequences because of the new scenarios and legal repercussions of using pervasive computing to provide services, anywhere and at anytime.

Security, privacy, and secrecy issues are more serious because pervasive computing offers rich information. Rich information is the information that includes other types of information, which tends to leak . The personal and confidential information passes through many wired and wireless networks which can be public or private. Information is then stored in different databases in different countries which may have a range of legal views on privacy and secrecy. These pervasive devices may be accessed by unauthorized people, further complicating the situation. Even though new systems, such as rule-based authorization systems and sensing technologies, have been introduced to define context-sensitive rules and validation, there is still work to be done before we have secure and private environments.

Equally, like any new technology project, there are financial risks due to large investments. Businesses and other service providers also need to keep pace with the technological developments in pervasive

computing. Furthermore, it is hard to identify intangible benefits of pervasive technologies and justify and support investments in these technologies. However, it will soon not be an option to use or not to use the pervasive technologies. These devices will be essential for competition and sustaining competitiveness. Pervasive computing will be a must for white- and blue-collar workers to stay in touch with employers, peers and friends, and avail work and relationship opportunities.

Service providers and users are exposed to new legal scenarios in the pervasive computing environment because smart objects are capable of providing facilities anywhere and any time. They deal with issues of jurisdiction, trademarks, copyrights, intellectual property, defamation, taxation, and contracts and so forth. Therefore, legal risk needs to be assessed and addressed. It is important to know where you are providing services and know the laws within that country. Moreover, pervasive computing will also have an impact on interactions between individuals, cultures, and genders. There will be more and more information sharing and communication between individuals and groups in order to stay in touch with each other. This will lead to changes in cultural values, attitudes, and beliefs. Pervasive computing will increase the flexibility and convenience in the work environment and provide holidays that are more enjoyable. However, at the same time there will be new health and relationship problems in society. For example, pervasive computing may interfere with holidays because of the decreasing distinction between work and holidays. It is also a well-known fact that the new technology is first used by illegal elements, then by others. Pervasive computing may be used for illegal purposes, such as by terrorist groups, due to its convenience and reach.

Service providers are adopting Pervasive computing with passion, but at the same time, they are aware of operational, ethical, legal, and financial risks involved. Service providers want their employees to have an understanding of the risks involved in pervasive computing and knowledge about managing these risks. This book intends to provide comprehensive information about pervasive computing and fulfilling the demands of employers, practitioners, and academics. This book also provides extensive information about pervasive computing, its implications from operational, legal, and ethical perspectives, so that current and future pervasive service providers can make responsible decisions about where, when, and how to use this technology. Information about uncertainties of financial benefits, lack of clear models, risk, and privacy concerns are also canvassed. This book also clarifies the legal, ethical, and social issues in implementing the pervasive computing technologies.

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