

Preface

More than five hundred years ago, humanity was largely poor. Though there were emperors and kings, the standard of living was far below today's level. But as technology began to be created and subsequently diffused into nations, human productivity improved, and man started to live longer. Across societies, there is a positive correlation between quality of life and technology adoption. Technology creates wealth and facilitates the formation of different industries. It provides the platforms to make new products and services to meet the needs of consumers. But these needs are never static; they change with time through acculturation, more purchasing power of consumers, or due to availability of new things that elicit new demand patterns.

Though organizations do grow and survive by focusing on meeting these needs, most times, it is not enough. Understanding the expectations and perceptions of the customers could be vital for business continuity. While the needs are present, expectations anticipate offering higher value than presently done in meeting customer needs. It is like powering the home of an environmental activist with dirty coal. The energy needs are met, but agile firms must understand that the environmentalist expects something more. Offering a green technology like solar or wind will surely suffice consumer expectation on home heating.

However, operating only in the domain of meeting needs and expectations of corporate clients and citizens exposes firms to new threats and business risks. They do not guarantee continuous market leadership. The reason is that a highly dynamic and interconnected world, made possible by the advances of information and communication technologies with all the social network elements, has made customers more informed. They know their choices and can pursue alternatives and substitutes faster, even at no extra cost. The availability of travel websites removes the obscurity in airline tickets. Unlike few decades ago where going from travel agent to another could be time demanding, a few clicks on the Internet can provide enough information for a buyer to make a purchase decision.

But in the process of a faster world and economy, some firms anticipate what customers might need, even before they know they need them. They go beyond their needs and expectations to their perceptions. A good example is what Apple Inc. offers to the world. Few people asked for iPhone, but when it arrived, the world embraced it. There was no focus group, and a network carrier that saw the prototype even rejected it. Apple went to the perception of the customers, beyond their needs and expectations and filled that opportunity and ended up becoming the world most valued company. Apple did not invent a new technology; it used what was available to make a novel product. Such products and services usually create new markets before they begin to challenge already existing markets. They simplify what people do, make processes better, or help discover more efficient tools that help organizational productivity. We know that iPhone has simplified the lives of many; it has made publishing easier for some companies, and it has created new markets for companies that make apps to reach mobile customers.

In 1995, a Harvard Business School Professor, Clayton M. Christensen, co-wrote a paper titled, *Disruptive Technologies: Catching the Wave*, and coined the term *disruptive technologies*. Usually, most disruptive technologies or simply products go beyond meeting customer needs and expectations to their perceptions. Disruptive technologies enable products to become more convenient for customers and promote maximal consumer benefit by breaking through existing and limited production techniques and procedures, commonly deployed by incumbents in a sector or an industry. Yet, technology cannot readily change or disrupt an industry by itself, just as five hundred years ago, there were many inventors and few innovators, and quality of life was not improved significantly. The missing element was traced to lack of legal instruments to stimulate commercialization and intellectual properties, which, after they were developed, were instrumental in spurring innovation in marketplaces. Before then, humans invented things, but few were commercialized, and without market success, technology cannot be classified as innovative.

Accordingly, *disruptive technology* is sometimes interchanged with *disruptive innovation* because technology, without a business model, does not have an intrinsic capacity to be disruptive. A disruptive technology or disruptive innovation is a type of innovation that creates a new market and value network and in the process disrupts existing ones through displacement of incumbents. One distinguishing characteristic is that this innovation improves products or services that exceed customer immediate needs, create new market niche, and then lower price to disrupt the existing market over time. Interestingly, the most important component in disruptive innovation is not the technology, but the business model. This observation by most economists contracts the usual thinking of engineers where the highly advanced and sophisticated technologies will be prime candidates for disruptive innovation. Digital media disrupted the DVD industry, e-book reader did the same to print media; in those examples, no advanced technology was created – it was largely a new business model based on products made from components already in existence.

Disruptive innovation creates a new and usually unexpected market by anticipating the perception of customers and meeting them. This is done by applying a new set of values, which, over time, are improved to the point they can invade established markets. Initially, digital cameras were popular for a segment of the market; over time, they were able to diffuse to more segments and eventually changed film photography. Though new entrants come and disrupt industries, it is rarely because of lack of technology advancement by incumbents.

Under the disruptive innovation framework, two types of innovation have been proposed, e.g., sustaining innovation and disruptive innovation. Christensen differentiates sustaining innovation and disruptive innovation based on technological performance and market segmentation. In sustaining innovation, technologies are developed to help firms sustain and/or generate their growth in the existing or established marketplace to ensure better performance, market growth, and domination. Whether they are incremental or radical, these innovations are exploited successfully by the established industry players and do not lead to revolutionary changes, as the focus is on improving the performance of current products or services. Sustaining innovation generally succeeds in large-scale commercialization. This is due to the fact that compared to their start-up competitors, incumbents tend to have more financial resources, dispose of a larger customer base, and have the processes in place to push the innovation into the market.

On the other hand, compared to existing products and business models, disruptive innovations occur once in a while when new technologies are available and originate in segments that are unattractive for the incumbents, i.e., customers with the lowest demands. They initially have a lower performance in the traditional performance criteria such as functionality, speed, and size, but may be attractive to certain

markets owing to some features not valued by the established marketplace. As they typically underperform the established products in the mainstream market when newly introduced, they are largely ignored by the incumbents. In most cases, disruptive innovation is less complex, typically cheaper, simpler, and frequently more convenient to use as they are usually brought to the markets successfully by new entrants or entrepreneurial firms. Once they establish a foothold in the market, their performance could continue to improve over time toward meeting the performance requirement of mainstream customers.

Disruptive innovation is playing a major role in creating new products and services and in the process of redesigning the world. In emerging economies, disruptive innovations have recently been applied to a wide variety of sectors other than the consumer electronics and ICT sectors, for example: micro lending, mobile banking, portable water filters, and cell phones. It can be assumed that disruptive innovations have a powerful consequence in the improvement of quality of lives of people living below acceptable standard level.

Disruptive innovations often decentralize a traditionally restricted product or service, enabling mass consumption. Traditionally, underserved people have benefitted by accessing tools provided by disruptive innovations. In the Asian continent, an example of disruptive innovation is Grameen Bank, a microcredit provider, which has been considered as a new market disruptor that has changed the lives of the poor people in Bangladesh. Grameen's microcredit scheme, which is a good example of low-end disruption, is spreading rapidly across the developing world.

New technologies and business models have emerged, transforming the ways we do business and, consequently, affecting how we live. For example, Amazon.com simplifies e-Commerce; Dell makes things easier in PC distribution logistics by removing middlemen in its distribution process; Apple redefines the entertainment and comfort level of our lives by introducing portable digital music players, smartphones, and tablets. The Salesforce.com business concept radically altered how the world has distributed enterprise software, originally through CDs. We are increasingly experiencing simplified lifestyles with gadgets that are more portable, cheaper, and easier to use.

Across our world, innovation remains a key driver in wealth creation, and it continues to modernize and make technologies, processes, and tools better. As social media networks advance, outsourcing ideas to the crowd has become common, while inter-company R&D that pools resources together is a new normal. From agriculture to print media, finance to mortgage, and across sectors, industries, and disciplines, the world is being redesigned. The emerging implications are enormous, both positive and negative. There could be need for lesser energy for processing natural resources, less waste in processed raw materials, which translates to positive effects on the environment. Yet, the products of these new processes could be harmful to the environment. But irrespective of the impact of this global redesign and new alignment, innovation will continue to alter human society, and disruptive ones will remain competitive catalysts at both firm and national levels.

One major goal of this book is to highlight the multifaceted issues of disruptive innovation and their relationships with the redesigning world. Then we look at the emerging implications, associated with disruptive innovation and global redesign, which could be social, cultural, and economic, among others. It is an examination of disruptive technologies, innovation, and the overall global redesign along with the emerging implications. More than forty eight experts spread in about fifteen countries with its respective understanding, perspectives and resources provide a very broad audience to accomplish that. This book will be a useful reference for academics, students, policy-makers, and professionals in the field of technology economics and management with focus on innovation and resulting influences in industries and commerce.

STRUCTURE OF THE BOOK

Section 1

Section 1 focuses on disruptive technology and the overall foundation of the book. The first chapter discusses technology, the innovation, and the global redesign that can emanate from these changes along with their implications, highlighting some of the relevant market examples as well as the historical foundation of the field. Chapter 2 takes a look at the innovation risk path assessment for a newly emerging technology, using dye-sensitized solar cells as an illustration. In order to overcome challenges to dye-sensitized solar cells development with identifiable markets, multi-party collaboration appears necessary including the improvement of key technology component selection, technical stability, and maturation rate. An examination of a disruptive product innovation strategy, with a case study of portable music player, is presented in Chapter 3. Blue Ocean Strategy (BOS) provides various tools to assess gaps in an existing market or to create a new market where there is no competition. This chapter uses Apple's iPod product chain to illustrate how BOS tools can create an innovative strategy.

In Chapter 4, the authors examine evidence from developing economies to ascertain if mobile phone could be considered a disruptive technology. While the mobile phone has been hailed for its transformative power, this chapter tentatively concludes that mobile phone's impact in most areas is not primarily disrupting, but rather amplifying existing structures. For the industry first-mover or the early adopters, Chapter 5 looks at the bottom-up, low-cost innovation model. This chapter combines disruptive innovation with industry evolution theory to construct an innovation planning phase, including exploration, assessment, strategy formation, and activity planning, and further verified it using qualitative interviews and quantitative analysis of a successful disruptive innovation case in the IT industry. It is followed by Chapter 6, which examines technology breakthrough and connects it to market disruption and innovation. The dynamic nature of agile firms was looked under mutability management. The evolution trajectories and disruptive features of nano-sciences and nanotechnologies conclude the section in Chapter 7. The disruptive character of nano-sciences and nano-technologies is assessed with the use of experimental data from a bibliographic analysis.

Section 2

Section 2 focuses on innovation practice and theory in the contexts of nations and organizations as well as technologies that facilitate the innovation ecosystem. It begins with Chapter 8, which provides empirical evidence on how firms manage discontinuous innovation. This chapter analyses in detail the relations between search practices, their antecedents (culture, organizational context, R&D expenditure, market turbulence, etc.), and performance (in terms of competences and innovation). Chapter 9 follows and explains the strategy and policy issues associated with nanotechnology innovations in medical education. The chapter explains the need of changing educational systems to achieve integration with new technologies, such as nanotechnology. A SWOT analysis was conducted to show the implementation of nano-sciences education in medicine. Chapter 10 gives an overview of the environmental chemistry, speciation and toxicity of Ni, elaborates on the removal of Ni by phytoremediation processes reported in recent literature, and highlights the key economic and management aspects of Ni phyto-extraction.

This is followed by Chapter 11, which deals with innovation in the financial system of an industry. The innovative financing mechanisms are explained with the help of various cases that can be adopted for ICT projects in developing countries.

Chapter 12 discusses the branding of innovation. This chapter understands how branding works to help companies to benefit from the fruits of their innovation and shows evidence to the lack of any branding strategy and explains the lagging of the Turkish companies in generating critical technologies and show presence in international markets. Chapter 13 uses indigenous cluster in a nation to examine technological learning and innovations that present significant opportunities for local economic transformation and global competitiveness. With all these emerging technologies, Chapter 14 finds out how they can help re-structure oppression and hierarchies in academia. This chapter situates education and academia within a technological/historical-ideological context, follows the global progression and distribution of communications technologies as disruptive technologies, and applying social network theory in establishing cultural practices as articulating global revolutionary or counterrevolutionary practices of virtual education. The section concludes with Chapter 15, which examines two telecommunication technologies and posits a possible roadmap for the industry.

Section 3

In Section 3, we examine how technology innovation has changed industry, commerce, and nations. It begins with Chapter 16, which explains the technology transfer means and process, and why it is important to improve the system of transmitting scientific knowledge and capability to developing world. The research includes recommendations of the best practices of how to improve the system of technology transfer from developed to developing nations from an infrastructural development and sustainability points of view. Chapter 17 highlights planning and designing educational technology for low income communities, pointing out a participatory and proactive approach. Chapter 18 argues that a combination of global and regional issues to explain the failure of the European Union's attempts to increase the level of innovation in member states and discusses the implications for European competitiveness while examining technology and the multi-polar global economy.

Chapter 19 shares insights on communication theories in the Internet era. This study establishes the media behaviors and practices, effectively verifying or disproving an argument that Web technology is masterminding a new revolution, which is uncharacteristically making the mass communication theories null and void. Chapter 20 looks at the adoption of a new platform in the emerging country. The study recommends the link between the dream and reality of digital platform, in particular the organizational motivation and predetermined concept and cultural value should be shaped by rules and regulations. It is followed by market pitfalls and economics of new health technologies in developing nations, as presented in Chapter 21. Examples and cases are used to illustrate the pitfalls. The expansion of access to new health technologies is suggested to be achieved within the global health system framework with a more active involvement of countries. Chapter 22 concludes the section with examination of the expense and the exposure associated with virtual global education. This chapter emphasizes on virtual world of learning, explains the barriers in learning environment, and espouses substantial flaws in the system.

Section 4

In the final section, number 4, the emerging impacts and implications of disruptive innovation and global redesign are highlighted. Its first chapter, Chapter 23, shares the impact of genetic testing and genetic information on ethical, legal, and social issues in North America. It proposes a framework and argues that information and communication technologies and rapid advances in genetics challenge the existing legislation systems. The second one, Chapter 24, looks at technology diffusion and economic progress in Africa by using descriptive and empirical analyses based on ‘imitator-innovator’ framework. A review of new management practices and human capability while examining consequences of disruptive technology is discussed in Chapter 25.

Chapter 27 aims to find out if a Dual-SIM phone is a disruptive technology. This research investigates new trends and user preferences by considering Dual-Sim phones compared to established single-SIM mobile phone manufacturers. It is followed by Chapter 28, which examines policy options for promoting solar PV diffusion into the energy mix of six selected remote villages that were pilot sites for national and foreign assisted solar electrification programs in three ecological regions in African continent. Finally, Chapter 29 discusses coordination, monitoring, and impact evaluation of technology incubators at a national level. This chapter discusses development of incubation looking critically at the performances of the existing ones in terms of efficiency, effectiveness, relevance, utility, and sustainability in order for them to really serve as agents of growth and development.

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