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The Effect of Firm Strategy and Corporate Performance on Software Market Growth in
Emerging Regions

Presented By
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To

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In partial fulfillment of the requirements for the degree of
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Abstract

The purpose of this research is to evaluate the impact of firm strategies and corporate performance on enterprise software market growth in emerging regions. The emerging regions of Asia Pacific, Eastern Europe, the Middle East and Africa, and Latin America, currently represent smaller overall markets for software vendors, but exhibit high growth rates and potential for greater opportunity as infrastructures improve, technology adoption accelerates, and firms refine their emerging market strategies. The research analyzes a data set of 102 publicly traded software firms which conduct business in at least one emerging region outside their home country headquarters location, and compares aspects of firm product strategy, go-to-market strategy, delivery models, research and development location investments, and corporate profitability ratios to aggregate emerging market growth rates. Findings indicate that decisions on product strategies (software only versus hardware and software), channel strategies (single vs. multichannel), and delivery models (multiple delivery models vs. SaaS/Cloud computing or on-premise only) are directionally associated with firm growth rates as predicted. Results also suggest that firm size and position within the industry life cycle and technology maturity curve are factors which may firm impact growth rates, and offer opportunities for further research.

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Chapter 1 – Introduction

Statement of the Research

The growth of markets and the cyclical nature of their development has been the subject of many research initiatives for over a century. Within and in addition to this body of literature, the markets for technologies and new and technically complex products have been a topic of research on a broad scale. As a subset of this research, global growth of the enterprise software markets has been attributed to supply-based firm innovation, demand-driven technology adoption, and more general theories of commercial globalization, foreign direct investment, and the impact of macro-level forces such as economic indicators, measures of technology readiness and cultural fit, or government policy decisions. Business strategy research has contributed to explanations of software market development by offering theories regarding firm performance, firm structure, and industry competitiveness that have all been used to account for growth of the markets and major market players. Many theories and frameworks exist which provide a perspective on technology market growth in general, most of which offer partial explanations of software market growth from specific perspectives. To date these have provided acceptable alternatives to describe market evolution and technology trends in western markets, and in particular the U.S., which until the early 21st century represented the largest consumer of information technologies in general for most of the larger enterprise software vendors.

But the regional demand composition of the software market is changing, and a

greater percentage of software firm revenues are earned outside the U.S. every year.

Though Western Europe now represents a larger share of the market, growth projections

in emerging regions are outpacing western economies on a consistent basis, offering

above-market growth potential for software firms and investors alike. Market

opportunity in the emerging regions of Eastern Europe, Latin America, Asia Pacific, and

the Middle East and Africa has become increasingly attractive as commercial

environments gradually improve and the potential for wider technology adoption grows.

From a regional perspective, emerging markets are somewhat heterogeneous in nature

due to the varying commercial maturity of individual countries, though regions overall

exhibit different characteristics than their western counterparts, and existing models of

lifecycle evolution, innovation, and technology adoption may or may not apply. The

viability of commonly accepted theories should be examined as appropriate frameworks

to evaluate and explain key elements of market growth in these emerging areas.

Researchers agree that there is a need to study the extent to which theories traditionally

applied to mature economies are relevant to the context in emerging economies as an

important contribution to the literature.[1]

Business and academic research approach the subject of technology market

development and growth through three major arenas: firm-focused (technology provider)

innovation, demand-focused (technology buyers) technology adoption, and broader

market and technology lifecycles and trends which frame market evolution. Each of

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[1] Wright, Mike, Igor Filatotchev, Robert E. Hoskisson and Mike W. Peng, "Strategy Research in Emerging Economies: Challenging the Conventional Wisdom". Journal of Management Studies 42: 1 January 2005, 0022-2380.

these three areas encompasses a specific body of research across various industries, and all cannot be properly addressed within the scope of this initiative. The purpose of this research is to focus primarily on determinants of firm business strategy, innovation, and growth within the software markets, identify and examine a critical subset of firm performance metrics on market impact, then evaluate these firm-based measures in the context of emerging regional markets to determine their capacity to account for the likelihood of market growth potential. Due to market interdependencies, questions of firm-based impact on growth cannot be adequately examined in the complete absence of demand factors. As appropriate, demand factors such as technology adoption and related buyer behaviors will be addressed to supplement supply-side analysis.

Background: The Evolution of the Enterprise Information and Communications Technology (ICT) Industry, 1960-2010

The enterprise ICT industry is comprised of many markets and submarkets, and has experienced significant changes in technological evolution, buyer adoption patterns, and industry rivalry during the past fifty years. Commercial adoption of information technologies began gaining traction during the 1960's, and during the next five decades, the nature of ICT deployments transitioned from primarily government and large enterprises to a broader range of firms and a consumer-based applications and devices. Major trends shaping the industry during this period include:

- An increase in hardware, software, and network reliability

- A significant decrease in hardware & software costs illustrated by Moore's law,[2] also precipitating an increase in services required to manipulate the new environment

- The extension of technology from a secure enterprise "glass house" computer room environment to small businesses and consumer products (homes, cars, personal devices), opening up new business models for technology providers[3]

- The perception of ICT by consumers as a commodity, the "information utility"

- The availability of instantaneous information access through global information sources and communication vehicles

- An acceptance and use of technology as a potential competitive tool across user bases

- A shift in ICT from primarily government and commercial computing to address social interactions through social media and ethical issues such as sustainability, and governance, risk, and compliance

The development of the software industry is closely linked with technological advances in the hardware industry, as discussed by Shapiro and Varian as a "leading example of complements."[4] Software industry growth in the 1960's was initiated by business use of mainframe computing; it then accelerated in the 1970's with the advent of minicomputers; following which it transitioned to workstations and client-server technologies in the 1980's and focused on standards to mitigate the "islands of

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[2] Messerschmitt, David G. and Clemens Szyperski, <u>Software Ecosystem: Understanding an Indispensible Technology and Industry</u>. Cambridge, Massachusetts: The MIT Press, 2003. The authors define Moore's law as "the performance per unit cost of material information technologies increases exponentially with time."
[3] Ibid.
[4] Shapiro, Carl, and Hal R. Varian, <u>Information Rules: A Strategic Guide to the Network Economy.</u> Boston, Massachusetts: Harvard Business School Press, 1999.

information" brought about by unconnected multi-vendor environments; shifted from

client-server computing to PC's and personal devices in the 1990's; then experienced

explosive growth in the early 21st century due to the widespread use of the internet,

pervasive computing and mobility, and cloud computing. Table 1 provides a summary of

this business and technology evolution by decade, highlighting various characteristics of

the computing environment and corresponding firm impacts.

Table 1: Information Technology Trends, 1960-2010

	1960	1970	1980	1990	2000	2010
Computing Model	Computing resources are located in secure, central area	Computing resources are located in secure, central area – terminals are now remotely located to users	Advent of distributed computing; PCs; client/server model	Technologies enable move to "federated" model	Technologies enable move to internet-based, Web 2.0 model	Technologies transition to mobile, cloud, pervasive computing.
Business Uses of Computing	automation of routine tasks (payroll, general ledger, etc.)	Additional applications available; loose integration of manufacturing applications	Enterprise integration applications; personal productivity & word processing; expanded transaction processing capabilities; enhanced R&D (computer aided design or CAD).	Electronic commerce; enterprise integration; workgroup/workflow; shared resources & services.	E-commerce; services-based; collaboration; highly distributed virtual workforces; industry specific uses (e-trading; e-discovery, etc.)	Enterprise application access from mobile devices; anytime/anywhere data/voice/video; highly distributed virtual workforces; multi-channel commerce; individually targeted marketing and services
Hardware/Network Characteristics	Hardware is costly; frequently unstable; limited memory; little choice in peripherals; extremely high-cost wide area networks (WANs)	Hardware costs still high; some improvement in reliability; more choice in memory & peripherals. Data stored on magnetic tape.Telecomm facilities extend terminals to business users & data entry clerks.	Hardware reliability increases; minicomputers threaten mainframes; LAN technology becomes pervasive	Reliable, low cost computing; WAN/LAN technologies enhanced; enormous increase in bandwidth use; laptops & personal devices begin replacing terminal networks.	High-speed, high-bandwidth pervasive computing; mobile technologies gain consumer and commercial acceptance; personal devices & smartphones hit consumer price points and global availability	Increasing global availability of high-speed, high-bandwidth pervasive computing; tablets, smartphones & devices replace PCs; nanotechnologies extend reach to humans, consumer goods, and across industries
Software Attributes	Operating systems and applications developed for proprietary platforms; new applications are multi-year projects	Functional applications; increased operating system functionality & tools; some loosely integrated processing.	Push to implement standards for email, electronic commerce, networking, application interfaces to rationalize multi-vendor environments	Huge volume of low-cost consumer applications; increased sophistication in enterprise integration; growing adoption of inter-enterprise computing.	Huge volume of inexpensive consumer downloadable applications; web 2.0 and services-based solutions gain traction; increased inter-enterprise collaboration and use of social media	No cost consumer downloadable apps; analytics extend beyond enterprises to consumers; social media engages both businesses and consumers.

	1960	1970	1980	1990	2000	2010
Software Development Environment Considerations	Systems programmed through hardware switches, paper tape, or punched cards	Teletype; cards; keypunch to tape; increased use of commercial programming languages; terminal entry.	Increased use of development tools; developer workstations; shared development environments.	GUI-based; object-oriented; enhanced tools & development environments; substantial increase in end-user development.	Enhanced GUI-based; emergence of cloud-based development platforms; focus on role-based scenarios	Enhanced GUI-based; extension of cloud-based development platforms; focus on role-based scenarios; agile becomes more prevalent.
User Interface and User Interaction	Users were systems & applications programmers - business users normally received hard-copy reports	Terminals with character display	Terminals; PCs; Graphical User Interface (GUI)	GUIs; Web; Multimedia	Smartphones and touch-based devices are the new monitors	Smart/touch-based devices, gesture recognition replace PCs
Firm Organizational Implications	Centralized, highly-skilled IT; little participation from the business community	Centralized IT; business user community limited to IT-developed screens/menu selection.	Centralized or distributed for IT; entry of "power user" to business community; increased empowerment of user base; remote access.	IT focus on business unit partnership/relationships; increased reliability of HW/Net enables more efficient centralized management of global computing.	IT focus on business, greater executive involvement; globally distributed organization may require decentralized services to accommodate localization requirements	IT fuses with business strategy; globally distributed businesses use new technologies to focus international business operations
Related Process Requirements	Centralized control by operations; users are primarily technology professionals	Centralization continues; users submit requests and await IT response.	User communities demand more autonomy & control, enforce requirements through budgetary control	Business users fund IT & are active in decisions, empowered by technology	Lines of business are more active in decisions; consumerization of IT impacts procurement and management choices	Individuals and communities create business process change; individual choice of computing devices complicates IT management
Information Currency	24-hour update at best case	Generally 24-hour	"Real-time" updates to data; immediate information sharing via email, videotext, etc.	Can be immediate worldwide	Instantaneous; social media drives immediacy.	Immediate and globally accessible computing and greater information transparency.

Source: Author

Enterprise Software Markets Defined

The enterprise software markets in 2010 as defined by Gartner[5], a U.S.-headquartered information technology research and advisory company, consist of twenty major application and infrastructure markets which provide software products, maintenance and technical support, and subscription-based services (Figure 1). Firms

[5] Graham, et.al, "Market Definitions: Software." Gartner: G00209728, December 22, 2010.

and institutions use these technologies to enable business process execution and

productivity, effectively communicate and conduct business with external parties (buyers,

suppliers, customers), and gain access to data and services which provide firms with

information on the industry and competitive environment. Buyers of enterprise software

are businesses or public sector institutions of all types and sizes, where decision makers

can be line of business executives, chief financial officers (CFOs), chief information

officers (CIOs), or, in the case of large enterprise-wide deployments, CEOs or boards of

directors. In the public sector, decisions on software acquisition can be governed through

contractual awards, or standards set by procurement offices, institutions, or centralized

technology functions. The enterprise software markets do not include gaming,

entertainment, or other consumer-based software products and services which are not

associated with enterprise computing functions such as financials, human resource

management, supply chain management, and others. Though the trend toward the

consumerization of IT[6] impacts enterprise software market growth, software purchased

solely for the personal use of and by individuals is not included in this analysis, including

home office products or consumer-focused smart device applications.

The enterprise software markets are divided into two broad macromarkets:

infrastructure and applications. The focus of infrastructure software is to build, run and

manage the performance of IT resources. Infrastructure is built in anticipation of

application demand or usage, and provides a foundational set of technologies which

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[6] Escherich, Meike, "Search Analytics Trends: The Inevitable Consumerization of Corporate IT". Gartner, G00211075, March 16, 2011. "The consumerization of IT focuses on how enterprises will be affected by new technologies which are brought into the work environment by private owners – rather than being deployed by IT departments."

create the operational basis for higher-level functions and end-user applications.[7]

Examples of infrastructure software include operating systems, database management

systems, network management solutions, and virtualization infrastructure technologies.

The focus of application software is to increase the performance of users or personal

resources. It enables users to leverage the power of computers toward achievement of

their business, personal, or objectives professional or goals. Examples of application

software include enterprise resource management, customer relationship management,

supply chain management, and office suites (email, calendaring, word processing, etc.).

Appendix 1 provides definitions for each of the individual software markets included in

the application and infrastructure macro-market definitions.

Software market revenue estimates ("total software revenue") as defined by

Gartner[8] are used throughout this analysis to size the markets and provide a measure of

vendor market position and revenue performance. This metric is based upon estimates

from reported revenue information from publicly traded companies and estimates from

privately held firms based on other publicly available sources of information such as

press releases, annual reports, and industry analyst input. Total software revenue consists

of revenue allocations from new software licenses, subscription services, maintenance,

updates and technical support.[9] New license is a measure of demand, and investments

can if needed be postponed by buyers, though at the cost of sacrificing access to the latest

functionality which may hamper market competitiveness. Maintenance revenues

measure utility or need and cannot readily be postponed, as software updates are often

required to take advantage of code enhancements containing solutions to problems

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[7] Graham, et.al., op.cit.
[8] Ibid.
[9] Ibid.

encountered in previous versions. While some firms choose to delay investments in

maintenance releases, they do so implicitly acknowledging that their software code bases

and functionality are dated, which may create outages and business disruption in the

future. Updates represent periodic software releases which typically include incremental

functionality, and technical support services which assist buyers with routine usage issues

or problem reporting, resolution, and tracking. Subscription revenues are based on a

deployment option which charges buyers on a per user, per month fee (as opposed to

perpetual licensing) which is typically sold as a multi-year contract. Software as a

Service (SaaS), the application layer of the cloud computing stack, is usually offered on a

subscription basis, though can be delivered on a pay-per-use basis in transactionally-

focused business environments. Revenues attributed to professional services, such as

vendor-provided education, development, or consulting services, and broader outsourcing

services, are not included in the total software revenue metric.

Figure 1: Enterprise Software Markets

"Enterprise Software" Consists of 20 Major Software Markets

Enterprise Applications

1. Customer Relationship Mgmt
2. Enterprise Resource Planning
3. Supply Chain Mgmt
4. Digital Content Creation
5. Enterprise Content Mgmt
6. Web Conferencing and Team Collaboration
7. Office Suites
8. Other Application Software
9. Project & Portfolio Mgmt

The focus for application software is to increase the performance of business or personal resources. It enables users to leverage the power of computers toward achievement of their business, professional or personal objectives or goals.

Infrastructure Software

1. Application Development
2. Application Infrastructure and Middleware
3. Business Intelligence
4. Data Integration Tools & Data Quality Tools
5. Database Mgmt Systems
6. IT Operations
7. Storage Mgmt
8. Security
9. Operating Systems
10. Other Infrastructure Software
11. Virtualization Infrastructure Software

The focus of infrastructure software is to build, run and manage the performance of IT resources.

Source: Gartner
Dataquest Guide: Software Market Research Definitions, March 2011

Software Market Size, Structure and Growth Characteristics

The enterprise software markets worldwide exceeded $244B in 2010 in total software revenues.[10] The market is expected to exceed $351B by 2015, with an overall compound annual growth rate of 7.5%. Emerging market growth exceeds that of mature markets[11], with compound annual growth rates of 14.5% and 7.3% respectively. Each year, the regional allocation of enterprise software market shares in North America

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[10] Forecast data and growth rates are from Graham, et. al., "Forecast: Enterprise Software Markets, Worldwide, 2008-2015, 3Q11 Update". Gartner, Inc., G00217223, September, 2011.

[11] In this context emerging markets are defined as regions which have low-to-midrange per capita income, and IT penetration is limited relative to mature markets. For reasons of simplification, in this study we consider in the emerging regions all the countries in Eastern Europe, the Middle East and Africa, Asia/Pacific, and Latin America. While country markets such as Australia can be considered mature, they represent a very small percentage of the overall software market forecast and do not materially impact the analysis.

declines, with the U.S. now representing just over 53% of the enterprise software markets worldwide.[12]   Correspondingly, regional revenue allocations outside North America continue to grow for the major software firms (Figure 2). Firms seeking to improve their market positions, grow revenues, and increase profitability are compelled to invest more aggressively in their international business initiatives. Vendor penetration in emerging markets is also of interest to the investment community due to higher growth rates in emerging economies.

Figure 2: Top 10 Software Vendors, Worldwide, North America and Rest of World, 2010

Most Megavendor Revenues Originate Outside North America; Concentration Centers on the Top 10

Top 10 Software Vendors by Market Share, Total Software Revenues North America and Rest-of-World, 2010
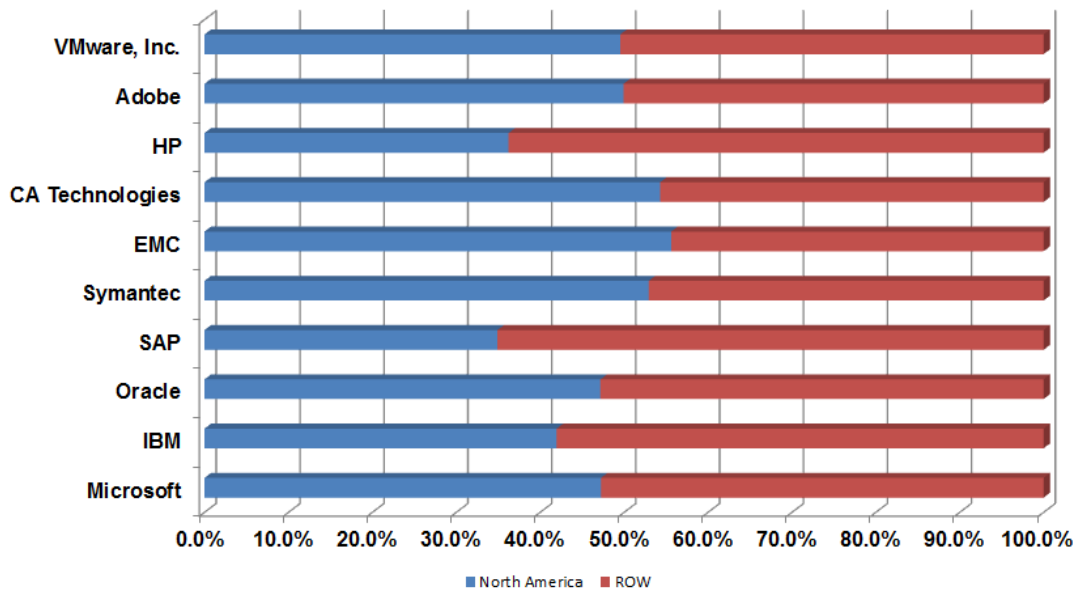
The top 10 vendors represent 58% of the worldwide enterprise software revenues, up from 56% in 2009

Source: Gartner, March 2011

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[12] Market share data is sourced from Graham, et. al., "Market Share: All Software Markets, Worldwide, 2010." Gartner, Inc.: G00211976, March 30, 2011.

Market growth is a complex mosaic of interdependent elements and dynamic systems which are often difficult to examine as discrete entities. In addition to firm growth and investment, development of the software markets is driven by many supply and demand side business and technology factors, and is influenced by broader market trends. The market evolves through life cycles which include stages of growth and consolidation slowed or accelerated by innovation and technology adoption. Increasingly powerful business and consumer ecosystems reinforced by pervasive technologies accessing digitized information and content influence buyer sentiment globally and impact purchase decisions. Macroeconomic forces such as financial market viability and government policy decisions concerning privacy, foreign direct investment, and technology development affect regional growth prospects. Basic foundational requirements such as availability of technology infrastructure, accessibility of new technologies, and the ability of firms to absorb innovation vary by region and country. Demographic preferences and shifts in labor market composition alter buyer expectations and user adoption patterns which ultimately influence enterprise technology choices and strategies. These trends and supply and demand side drivers and inhibitors can be consistent globally or can vary based on regional or country requirements. Figure 3 provides a graphical two-dimensional depiction of key macro, market level, and supply and demand factors and their relationships. Firms must craft their strategies in response to, and to take advantage of, these elements in the market environment to sustain growth globally.

Many of the software markets are volatile and continuously shifting, and vary in level of maturity. The degree of firm concentration or fragmentation varies considerably

both among and within the markets. Infrastructure markets provide the functional basis

for application markets and are the most mature within the software industry. Examples

of highly concentrated infrastructure markets include database management systems and

operating systems, where a small number of vendors with proprietary technologies

predominate and control sizable percentages of the market share, such as IBM, Oracle

and Microsoft in database management systems, and IBM and Microsoft in operating

systems. In contrast, application markets such as Customer Relationship Management

(CRM) are fragmented and are comprised of hundreds of vendors, often focused on

fulfilling regional- or industry-specific demands, even though in 2010 the top 10 vendors

accounted for over 72% of the total software revenue.[13] In the application markets, a

high degree of vendor acquisition activity is common, whether to gain share by acquiring

an installed base, eliminate a competitor or forestall a competitive bid, enter emerging

markets, or fill gaps in product or solution portfolios. This level of acquisition activity is

representative of Agarwal and Gort's findings that on average, 5-10 % of firms in a given

market leave that market over the span of a single year.[14] New entrants focusing on

innovative technologies such as social software, sustainability solutions, and web

analytics, or alternative delivery models such as SaaS enter the market, creating new

arenas of competition in a rapidly changing industry environment.

Figure 3: Software Industry Model

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[13] Ibid.
[14] Agarwal, Rajshree, and Michael Gort, "Firm and Product Life Cycles and Firm Survival."
Technological Change, Vol. 92, No. 2, May, 2002, pp. 184-190.
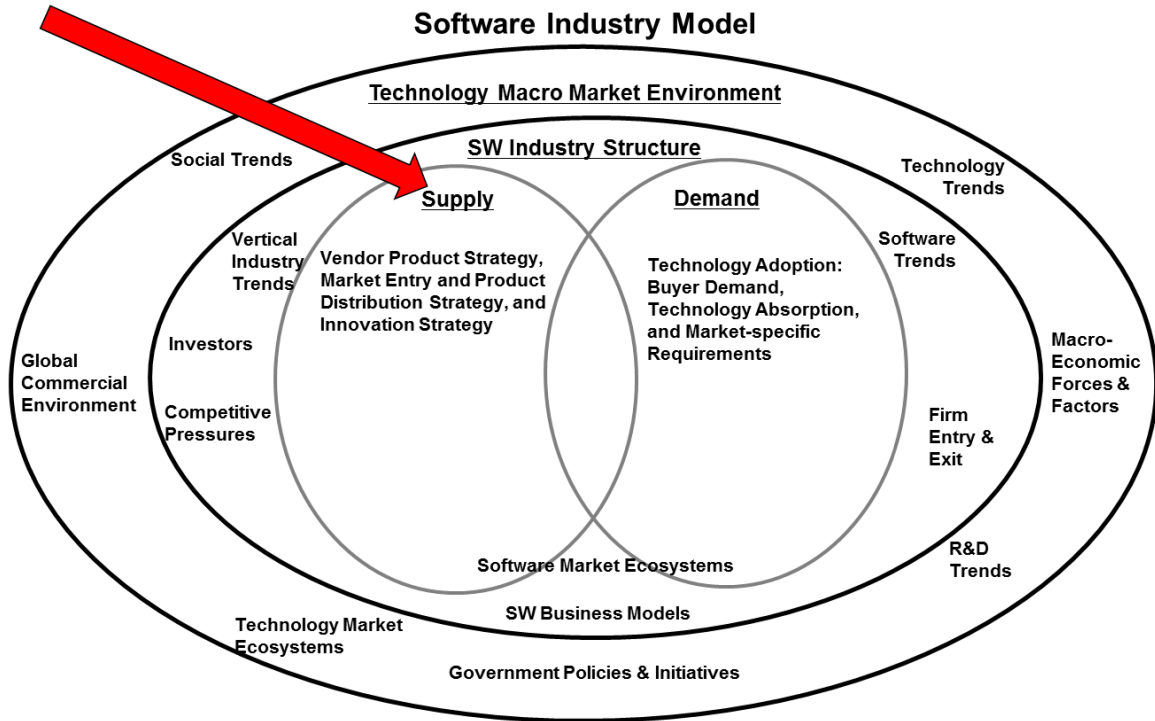
Source: Author

Software Vendor Business Strategy Overview

Vendor business strategies and models respond to enterprise buyers' functional requirements, budget cycles, and consumption patterns as well as industry competition, but are typically focused on developing unique product capabilities when entering the market. Enterprise software firms primarily follow strategies of differentiation for product offerings, focusing on elements such as feature sets, industry-specific functionality, integration or interoperability capabilities, or localized product versions at the country level, whether delivered as a product or a service. Low cost initiatives at the enterprise software level are often seen at the project pricing level on competitive bids (given basic functional requirements are met), or in sponsorship strategies[15] where the

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[15] Katz, Michael L., and Carl Shapiro, "Technology Adoption in the Presence of Network Externalities". The University of Chicago: Journal of Political Economy, 1986, vol. 94, no. 4, pp. 822-841. See also

objective is to penetrate the market, gain mindshare, and create a basis for lock-in and further upsell to the installed base as network effects are realized. Other sources of competitive advantage include channel strategies[16], where the indirect channel represents the predominant revenue stream (such as Microsoft), or partnerships offering entry points into local markets, industry segments beyond the core competencies of the firm, or access to broader project opportunities through alliances with complementary providers of products such as hardware. Partnership strategies between software vendors and consultancies or professional service providers are also common as a means of complementing products with required business consulting or service delivery capabilities, entering new geographic markets, or gaining entry to and establishing relationships with new clients. These strategies also benefit software firms by enabling focus on their core competencies and limiting exposure to lower margins associated with customized product development, and in general, labor-based professional services. Software vendor revenue models primarily depend upon a combination of new product sales or software delivered as a service, and downstream maintenance, update, and technical support revenues. Research indicates that the optimum profitability mix is about 70 percent product revenues and 30 percent maintenance and service revenues[17], which, with some exceptions,[18] is generally observable in software industry research as a

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Milling, Peter M., "Understanding and Managing Innovation Processes." System Dynamics Review Vol. 18, No. 1 (Spring 2002), pp. 73-86.

[16] Bova, Tiffani, "Sales Channel Strategy High-Tech Initiative Overview". Gartner, Inc., G00211686, March 16, 2011. "Sales channel strategy focuses on the strategic choices and related programmatic efforts providers undertake as to how and where they will sell and/or distribute their offerings based on preferred customer buying channels and business goals."

[17] Cusumano, Michael A., "The Changing Software Business: Moving from Products to Services". IEEE Computer Society, Computer, January 2008, pp.20-27.

[18] Overall vendors maintain approximately a 70/30 or 60/40 split in product versus maintenance and services revenue, though larger vendors who make fewer investments in new product development show

common revenue allocation. Other sources of revenue also include the resale of products through partnership arrangements, or from the licensing of technologies, though the latter normally does not represent the primary source of income unless the firm strategy is heavily dependent upon revenues derived from licensing technologies based on a strong patent portfolio.

Growth strategies for software market firms are often a combination of organic growth and acquisition activity, though some firms are clearly more acquisitive than others. Firms focusing solely on organic growth are often small to mid-size entities with annual revenues of approximately $50 million or less, though they also often begin acquiring to broaden product offerings as customer demand for greater functionality grows. Other common motivations for acquisition among software firms of all sizes include acquiring intellectual property, patents, or expertise; buying a customer base and accompanying revenue streams; entering new geographic markets; acquiring critical intellectual property (IP) third party assets in a competitive strike against rivals; buying direct competitors to neutralize threats; or supplementing product portfolios by incrementing offerings or extending into adjacent markets. Examples of predominant vendors diversifying by expanding into adjacent information technology markets and services during the past decade include Oracle's acquisition of Sun Microsystems; IBM's acquisition of several application software providers such as Cognos, SPSS, and Unica, and consultancies such as PriceWaterhouseCoopers; and HP's acquisition of EDS. This is supported in the research by findings that diversification is positively related to firm

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increasing maintenance and services revenue streams. Other exceptions include vendors which are focused on leveraging product sales to support a growing managed services business.

size, so that the largest firms have the broadest product portfolios.[19] Post-acquisition strategies overall can range from acquired firms operating as a distinct entity under the umbrella of the parent, to tighter integration of product sets and organizations.

Many vendors participate in multiple technology markets and submarkets, as well as regional markets, though entities trading publicly are not obliged to report technology market-specific revenues to the Securities and Exchange Commission (SEC) or to other international stock exchange oversight organizations, increasing the challenges of estimating market and submarket positions and examining regional-specific growth rates and trends. This information is often, however, provided by vendors in publicly available documents due to an increased focus on business transparency, and interest concerning international growth strategies from the investment community.

Underpinning successful vendor growth strategies are key competencies which have evolved over years of execution in often highly competitive markets. In addition to traditional measures of product superiority resulting from innovation and R&D investment, firms rely on internal capabilities to create advantage over rivals which are often difficult to imitate, despite organizational churn and attrition. Core competencies which have been instrumental in software firm growth and profitability include focused and effective management of alliances and market and sales channels, a corps of expatriate (expat) professionals, and the successful management of the life cycle of product and patent portfolios.

Market Landscape and Growth in Emerging Economies

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[19] Klepper, Steven, and Peter Thompson, "Submarkets and the Evolution of Market Structure". RAND Journal of Economics, Vol. 37, No.4, Winter 2006, pp. 861-886.

Growth of the software markets internationally has been attributed to a combination of comparative advantage at the macro level and firm resources and capabilities at the micro level,[20] supporting the supply-focused growth perspective. Arora takes the position that firm advantages in emerging markets do not stem from factor endowments, but that technology multinational enterprises (MNEs) investing in these regions have a comparative advantage in learning and experience, as the fixed costs of acquiring expertise are already sunk by the time the developing markets arise.[21] Emerging markets in general are no longer considered just a lower-cost outsourcing destination, but are gaining on their Western counterparts with more-widespread IT adoption and higher growth prospects. Goldman Sachs Global Investment research now projects, for example, that by 2032, the BRIC economies, among the largest within the emerging regions, could exceed the current G7 in terms of share of global growth.[22] Software market growth estimates for 2011 indicate that growth in the emerging markets outperform the total market growth worldwide by 20-60% (see Figure 4)[23]. These economies, particularly those with greater addressable market potential such as India and China, represent significant growth markets for software vendors despite the common emerging market challenges of intellectual property rights violation, identifying and penetrating the channel, and the time and resource investment required to establish a viable local presence in a non-Western commercial business environment.

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[20] Arora, Ashish, and Alfonso Gambardella, ed., From Underdogs to Tigers: The Rise and Growth of the Software Industry in Brazil, China, India, Ireland, and Israel. New York: Oxford University Press, Inc., 2005.

[21] Arora, Ashish, Andrea Fosfuri and Alfonso Gambardella, Markets for Technology: The Economics of Innovation and Corporate Strategy. Cambridge, Massachusetts: Massachusetts Institute of Technology, 2001.

[22]. Goldman Sachs Emerging Equity Markets Team, "Building a Portfolio Brick by BRIC". Goldman, Sachs & Co., February 24, 2010.

[23] Graham Colleen, et.al., "Market Share: All Software Markets, Worldwide, 2011." Gartner, Inc., G00217223, September, 2011.

Figure 4: Estimated Software Market Growth, Emerging Regions and Total Worldwide Markets, 2011

Source: Gartner, September 2011

Not surprisingly, the factors influencing the software market structure of emerging economies exhibit different characteristics than those in Western regions. Commercial business institutions and legal structures, economic climate, intellectual property protection, and government policies and initiatives can be in early stages of development and impact software market development and growth. Supporting technology infrastructures, such as the availability of consistent power sources or stable and affordable high-speed networks and related services, are often less well-developed than in Western regions and can either drive or inhibit market growth. Technology innovation can be inspired within locally-based firms, or can primarily be the product of well-developed offshore R&D investment strategies by large multinational corporations

(MNCs). Social and cultural environments can support or counteract adoption and takeoff rates of various technologies, or specific deployment alternatives (such as SaaS and Cloud Computing)[24], as can demographic distributions and concentration, or regionally-specific consumption patterns within each country. Increasing availability of devices with attractive price points and intuitive user interfaces connected to a global internet encourage usage and build technology fluency for users, subsequently providing applicable skills for enterprise computing environments, facilitating commercial adoption. These conditions and more can challenge traditionally accepted models of industry and technology lifecycles, firm structure and competitive position, innovation and technology adoption, and subsequently market growth.

Research Focus & Research Questions

The purpose of this research is to focus on aspects of firm business strategy, innovation, and growth within the software markets, identify and examine a critical subset of firm performance metrics on market impact, then evaluate these firm-based measures in the context of emerging regional markets to determine their capacity to account for the likelihood of market growth potential. Firm specific determinants of growth examined within the research include performance factors of profitability, and firm business strategies and models which address key decisions such as product strategy, growth strategy, go-to-market strategy and delivery model.

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[24] SaaS, or Software as a Service, is "Software delivered remotely and managed by a third party as a one-to-many service through subscription or pay for use." Cloud computing is defined as "a style of computing where scalable and elastic IT-enabled capabilities are provided 'as a service' to external customers using Internet Technologies." (Gartner, 2011).

Firm strategies and impacts cannot be adequately examined in the complete absence of demand factors or other market dependencies. Certain technology adoption theories and the impact of technology and market lifecycles are included to support firm-specific analysis when appropriate, but are not the primary focus of the initiative. Corresponding forces shaping the market such as consolidation, shift to alternative delivery models, and other relevant technology and market trends are explored as needed to complement these major themes.

The following questions are used to direct a firm-specific focus on the research effort.

- What elements of the firm's business strategy are most impactful on firm and software market growth in emerging markets?

- How do firm-level decisions concerning product and go-to-market strategies impact firm and software market growth in emerging regions?

- How do firm-level decisions on product and solution delivery models impact firm and software market growth in emerging regions?

- How does the degree of firm innovative activity affect the structure and growth of firms and software markets in emerging regions?

- Is the level of firm profitability an indicator of firm and software market growth in emerging regions?

Contribution to the Field

The literature has numerous examples which address the growth of markets, but existing academic research primarily either focuses on specific elements such as firm size, market entry strategy, and consumer choice, or theories such as increasing returns

and network externalities, technology and vendor lock-in, or product sponsorship to explain software market growth. Apart from applied (commercial) market research publications which rely on factors such as market share, market forecasting, and adjacent product and service impact to model growth projections, limited academic research has been conducted which explicitly addresses growth from the firm perspective in the software markets in general, or in emerging regions. This research:

- Provides a summary of major theories related to international market entry, the context for technology and software markets, and the impact of innovation on firm performance

- Examines the applicability of specific existing theories for industry growth, innovation, and firm strategies to software market growth patterns

- Analyzes the potential impact of vendor technology, market, and delivery strategies and firm performance on software market growth

- Evaluates and tests the likelihood of firm strategies and profitability to drive software firm and software market growth in the emerging regions

The outcome of the research effort is also expected to offer additional opportunities for future investigation of firm effect on market performance, market growth impact of emerging technology trends and alternative delivery models, and related topics in firm location, investments, and strategies on emerging market growth.

 This research is organized as follows. Chapter 2 provides an overview of related commercial applied research, and summarizes key themes of firm strategy, business models, innovation, and software market structure within the scholarly research. Chapter 3 offers a set of testable hypotheses addressing elements of the research questions

provided above. Chapter 4 describes the research methodology and data sources used to

test the hypotheses. Chapter 5 includes a description of the data set, and provides an

analysis and discussion of hypothesis testing outcomes from Chapter 3. Chapter 6

includes summary case studies of the four leading firms in the market, and offers a

narrative comparing a subset of the major vendors' strategies and performance with

hypotheses results. Chapter 7 provides conclusions and suggests topics for future

research.

Chapter 2 - Literature Review

Related Applied and Institutional Research

A volume of academic literature exists which addresses the spread of technologies, globalization of technologies, and development of markets for technologies and knowledge-based industries in general: however, comparatively little of this beyond commercial industry-specific research or government-sponsored initiatives address the software industry and software markets primarily. Applied and institutional research areas are typically interdependent and are focused as follows:

- At the macro-level: discussing the impact of economic indicators such as GDP fluctuations, world economic indicators[25], or force majeure events, such as the 2011 tsunami in Japan, on industry and market performance[26]

- At the industry level: projecting inter-market trend impact on complementary market movements, such as the impact of PC shipments on operating systems market performance[27] or downstream impact of application software sales on global systems integrator (GSI) pipelines.[28]

- At the market level: evaluating vendor performance, buyer adoption patterns, technology refresh cycles, and the competitive landscape on overall market performance. Submarket performance is also of interest in many markets due

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[25] The World Bank, World DataBank World Development indicators and Global Development Finance, 2012. http://databank.worldbank.org/Data/Views/VariableSelection/SelectVariables.aspx?source=World%20Development%20Indicators%20and%20Global%20Development%20Finance#

[26] Moons, Lucien, "Impact of Japanese Earthquake and Tsunami", http://www.businessandsoftwarestrategyforglobalisation.com/impact-of-japanese-earthquake-and-tsunami/, April 22, 2011.

[27] Nusca, Andrew, "Lenovo Tops HP to Become No. 1 PC Maker". http://www.zdnet.com/lenovo-tops-hp-to-become-no-1-pc-maker-7000005576/, October 10, 2012.

[28] Examples of Global Systems Integrators include Accenture, Deloitte, and others.

to the preponderance of one specific subsegment (such as Sales Force

Automation within CRM)[29] or emergence of a new technology or application

innovation within markets[30] as accelerators or decelerators of growth.

- At the firm level: analysis of vendor financial viability, ability to execute,

  revenue growth projections, investment in innovation, product and service

  evaluation, and competitive positioning[31].

- At the regional and country level: research and projects on the impact of both

  quantitative and qualitative inputs on market attractiveness and growth.

  Indicators can range from macro-level measures[32] such as level of education

  or internet availability, to degree of intellectual property protection or public

  policy decisions supporting technology investment, or maturity of the

  commercial legal environment [33]as a basis for firm growth and development.

International institutions and funded research initiatives provide a wealth of related

data considered potential barometers of technology adoption projections at the country

level, for example:

- INSEAD's Global Innovation Index[34]

- National Science Foundation's Science and Engineering Indicators[35]

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[29] Mertz, Sharon, Chris Pang, Yanna Dharmasthira and Kensuke Kawabe, "Market Share: CRM Software, Worldwide, 2008." Gartner, Inc., G00168851, June, 2009.

[30] Mertz, Sharon A., "Market Share Snapshot: CRM Software, 2011". Gartner, Inc., G00233998, April 26, 2012.

[31] Otter, et. al., "Vendor Rating: SAP". Gartner, Inc., G00170262, October 13, 2009.

[32] Anavitarte, Luis, "Emerging Markets: Watch for the Differences". Gartner, Inc., G00169880, August 13, 2009.

[33] Greenwald, Jay, International Markets for Enterprise Software Vendors. Jay B. Greenwald, International Revenue *ACCELERATION*, 2011.

[34] Dutta, Soumitra, ed., "The Global Innovation Index 2011: Accelerating Growth and Development". INSEAD, 2011.

[35] National Science Board, Science and Engineering Indicators 2010. Arlington, VA: National Science Foundation (NSB 10-01).

- Organization for Economic Co-operation and Development, Directorate for Science, Technology and Industry, country-level reports[36]

- World Economic Forum's Global Competitiveness Report[37]

- World Economic Forum's Global Information Technology Report[38], including the Networked Readiness Index (NRI)

In addition, country specific government and commercially-backed institutions also provide research and publications highlighting technology opportunities and adoption for businesses within the country to promote global commerce and foreign investment. Albeit most are designed to encourage investment inflows or otherwise accelerate the development of the industry within the country, these often provide statistics on market performance within the country and offer a local view of the technology trends and local players and events. For example:

- Brazil: Brazil Association of Information Technology and Communication Companies, BRASSCOM, www.brasscom.org.br

- Russia: Russian Software Developers Association, RUSSOFT, http://www.russoft.org/russoft/

- India: National Association of Software and Services Companies, NASSCOM, www.nasscom.org. and All India Information Technology Association, AIITA, www.aita.org

- China: China Software Industry Association, CSIA, www.csia.org.cn

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[36] For example: Schaaper, Martin, "Measuring China's Innovation System National Specificities and International Comparisons". Paris: Organization for Economic Co-operation and Development, Directorate for Science, Technology and Industry, January 15, 2009.

[37] Schwab, Klaus, ed., "The Global Competitiveness Report, 2010-2011". Geneva: World Economic Forum, 2010.

[38] Dutta, Soumitra, and Irene Mia, editors, "Global Information Technology Report 2010-2011: Transformations 2.0". Geneva: World Economic Forum, 2011.

Commonly-available sources of industry research on the software markets

specifically include:

- Market research firms such as Forrester, Gartner, IDC, and others

- Research arms of investment houses such as Goldman Sachs and Morgan
  Stanley

- Research divisions of major business and technology consultancies, such as
  McKinsey and Accenture

- Competitive research divisions of major technology vendors, such as IBM

- Economic research firms such as IHS Global Insight

Data sources can be either qualitative or quantitative in nature. Empirical research is

often based on company case studies, larger surveys which measure buyer preferences

and technology investment intentions, or other primary research market analysis. Other

quantitative measures, often based upon secondary research, include patent production

statistics or science paper production as measures of country technology competitiveness,

country educational and workforce demographics as determinants of technology adoption

potential, or various indices derived from a combination of statistical sources based on

surveys or statistical models designed to provide a baseline for country technology

investment attractiveness.

The majority of the research noted above is conducted for and consumed by the

commercial technology vendor community, investment firms, and governments seeking

to attain greater economic prosperity, social welfare gains, and increased global

competitiveness through foreign direct investments, productivity acceleration from

technology, and a more technology-capable population. Research outputs are generally

centered on market sizing and forecast, firm competitive position, and general technology

and adoption trends, and provide market guidance to firms or advice for technology

professionals on how to most effectively leverage technology investments. Sources may

use proprietary quantitative models to test assumptions and clarify research positions,

resulting in positions describing the ability of enterprises to absorb technologies and

apply them to greater business benefit within specific industries, company size ranges,

and regions or countries.

Theoretical Background and Scholarly Research Perspectives

Not surprisingly, scholarly research initiatives on technology and software

markets in the United States are often centered in leading universities located near

regional technology corridors surrounding major metropolitan areas and include

institutions such as Boston University, MIT, Carnegie Mellon, Northwestern University,

Stanford, the University of Southern California, and others. The concentration of

research in these large metropolitan areas confirms Arora's finding that the software

industry tends to locate in areas of significant economic activity.[39] Other notable

software-specific research is frequently conducted at many other international

universities through government-sponsored initiatives as mentioned above, or through

commercially-sponsored projects or grants. Academic research analysis and discussion

includes, though is not limited to, the following topic areas:

- Theoretical research addressing firm international investment and production

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[39] Arora and Gambardella, op.cit.

- The impact of innovation on firm performance

- The impact of firm entry and exit and firm size on markets

- The impact of firm size, and location of firm R&D investments

- The characteristics of the software markets

- Software market perspectives in emerging economies

Research representative of these areas which is germane to the topic addressed is summarized below.

International Expansion of Firms

A critical element of the business strategy is determining within which geographic arenas the firm will choose to compete, and poses unique opportunities and challenges for technology providers overall and software vendors specifically. A more general body of traditionally accepted theoretical research exists on industry competitiveness and foreign direct investment which offer theories pertaining to the international expansion of firms and markets. Though not necessarily specific to the technology or software markets, some of the key supporting international business theories addressing firm investment and competitiveness, international production, and globalization are included in Table 2. The format for the summary is adapted from de la Torre and Moxon[40], and is representative, though not all-inclusive, of major theories. Porter's five forces model, the resource-based view of the firm, and the profiting from innovation (PFI) framework are not considered primarily international theories but are included in the table due to their

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[40] De la Torre, Jose, and Richard W. Moxon, "Introduction to the Symposium E-Commerce and Global Business: The Impact of the Information and Communication Technology Revolution on the Conduct of International Business". Journal of International Business Studies, Fourth Quarter 2001, pp. 617-639.

importance to business research overall and implications for software firm strategies and

market growth in emerging economies.

Table 2: Impact of Business Theories on ICT Markets and Software Market Context

Author	Theoretical Construct	Selected Elements of the Construct	ICT Market Context	Example Software Market Context
Coase; Williamson	Transaction cost theory	Examines the efficiency of firm vertical integration versus joint ventures or global networks integrating value-adding activities to achieve transactional economies	- original technology suppliers developed and manufactured hardware & software, and provided technology support and other related services	- Industry and firms have evolved to reliance on alliances and partnerships based on firm specialization, need to accelerate market entry, access to emerging markets, and other time- and cost-critical imperatives.
Dunning	Eclectic Paradigm	Attributes firm competitiveness to advantages of ownership, location, and internalization (OLI)	-ownership advantages in size and proprietary technologies;lower cost labor for manufacturing or skilled local resources;internalization advantages for large global players (scale and internal resources and capabilities)	-Global presence can provide software for and service large MNEs; local labor expedites localization requirements and cost-effective development; internal expertise in global expansion reduces risk of emerging market entry
Heckscher-Ohlin-Samuelson	Factor proportion theory	Advantage stems from factor endowments most abundant in the nation	Highly skilled low cost labor pools offer firm advantages for: cost-effective technology manufacturing and assembly and technology R&D	-Abundance of low-cost highly skilled technical resources in emerging markets which have been leveraged by software vendors for more cost-effective R&D, to acquire critical expertise, or to expedite localization requirements
Hymer	Market imperfection theory	Large MNEs enjoy benefits due to firm size through advantages such as proprietary technologies, scale, product differentiation, and control of distribution systems.	-Megavendors enjoy advantages of scale, early market entry due to ability to distribute financial risk, proprietary technology lock-in, more highly developed channel position (distribution)	- Large MNEs offer software solutions suitable to governments and large global enterprises; invest in development of many industry-specific solutions; offer attractive partner relationships for local vendors; have scale advantages of market sponsorship* on new product introduction and adoption
Johansen & Vahlne	Psychic Distance Theory	Firms attempt internationalization in firms which are psychically close	-Initial investments for large MNEs often go to countries with lower language or cultural barriers; US-based MNEs usually prosper in areas where English is accepted as a language of commerce**	-Initial entry for software vendors is normally influenced by the common language base or English, US and Europe being the largest regional markets. Asian markets present higher language and cultural barriers.
Penrose; Barney; Mowery	Resource Based View (RBV)	Maintains that firm performance and competitive advantage is contingent upon acquiring and exploiting critical firm resources	- Common examples of critical resources include patents, related intellectual property, acquired capabilities such as ex-pat competencies, acquisition integration, organizational skills in knowledge transfer and new product development, etc.	-Software vendor competitive advantage reflects ICT market context, also includes capabilities in organizational agility, alliance development, sales and marketing, etc.
Peng	Strategy Tripod	Firm strategic choices are driven by three elements: industry conditions, firm resources and capabilities, and institutions (the "tripod").	-Institutional conditions such as potential country requirements to establish manufacturing operations (hardware) or laws governing intellectual property impact firm investment decisions in international markets	- Lack of IP enforcement, an underdeveloped commercial business environment, and poor understanding of informal channel constructs often limit either entry decisions or later firm success
Porter	Five forces theory	Framework for industry competitiveness used to evaluate power of buyers and suppliers, threat of substitutes and new entrants or barriers to entry on firm rivalry and industry dynamics. National competitive advantage can be gained through highly localized processes.	-Power of buyers and suppliers varies; new entrants pose threats primarily in non-infrastructure markets; threat of substitutes has escalated in the 21st century;barriers to entry can be high in certain markets and very low in others	-Power of buyers and suppliers tracks ICT; substitutes for enterprise software grow due to SaaS, Cloud; Consumerization of IT: barriers to entry can be low in applications markets and higher in mature infrastructure markets
Teece	Profiting From Innovation (PFI)	Determines who wins from innovation: the first to market, followers, or firms with related capabilities needed by the innovator. The framework consists of three elements: the appropriability regime, complementary assets, and the dominant design paradigm	- Appropriability regime is generally weaker in emerging economies, IP theft and reverse engineering is common; hardware, software, services and sales/marketing capabilities are critical complementary assets; defacto or dejure standards reinforce dominant design	-Weak appropriability regimes are tolerated by larger software firms for advantages of market penetration, avoided by smaller ones; complementary assets vary in importance among players; dominant designs are often tolerated by emerging market firms for cultural (brand recognition) or ability to compete globally
Vernon	Product life cycle theory	Maintains that growth in an industry evolves through stages following product innovation, which is then characterized by changes in location and product and market composition	-Numerous examples in ICT pertaining to locational shift in manufacturing, development, localization, shifting entire lines of business to emerging economies	-Most prevalent examples are offshore R&D; follow-the-sun development and support;acquisition of local firms to accelerate regional presence and development

Source: Author

* for a discussion of market sponsorship see Katz and Shapiro, "Technology Adoption in the Presence of Network Externalities". The University of Chicago: Journal of Political Economy, 1986, vol. 94, no. 4, pp. 822-841.
** see Greenwald, <u>International Markets for Enterprise Software Vendors</u>, for additional detail

These sources and others provide the theoretical background for more specific discussions of the global software market acceleration resulting from firm innovation strategies and investment decisions which represent drivers of technology adoption and market growth.

There is also a growing compilation of research which specifically addresses technology firms and foreign direct investment. Brouthers, et.al., show that the majority of small and medium-sized software firms appeared to have a primarily market-seeking motivation for foreign entry[41], though more recent research indicates a growing focus on technology-seeking investments.[42] Paul and Wooster also conclude that market-seeking motivations of US firms trigger expansion in transition economies, and that firms in concentrated industries were more likely to enter the region with a higher equity commitment.[43] Burgel and Murray find that small technology firms choose entry modes which are not resource intensive, and that the choice is often a trade-off between

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[41] Brouthers, Keith D., Lance Eliot Brouthers and Steve Werner, "Dunning's Eclectic Theory and the Smaller Firm: the Impact of Ownership and Locational Advantages on the Choice of Entry-modes in the Computer Software Industry". International Business Review, Vol. 5, No. 4, pp. 377-394, 1996.
[42] Mertz, Sharon A. and Chad Eschinger, "Market Insight: Enterprise Software, Worldwide Directions for Offshore R&D, 2011." Gartner, Inc., G00210296, February 3, 2011.
[43] Paul, Donna L. and Rossitza B. Wooster, "Strategic Investments by US Firms in Transition Economies". Journal of International Business Studies (2008) 39, 249-266. The firms used in the study included technology-intensive firms but these were not exclusive to the population.

available resources and post-sales customer support needs.[44] These positions are also supported by observable trends in industry-based research.

Innovation and Firm Performance

Technology innovation is a key driver of market growth in both mature and emerging markets by offering buyer benefits of increased productivity, better market visibility and transparency, and more-rapid market entry capabilities. Growth is ranked by some analysts as being even more important than profitability as an indicator of future revenues and profits, as for most firms new product introduction is a primary driver of growth.[45] Chiang and Mensah show that investors actually value increases in R&D spending for software firms in anticipation of successful new innovations, but only if firms have a larger market share.[46] In mature technology markets with fewer large incumbents, new product developments replace older technologies, often with more cost-effective alternatives or through newer deployment models (such as Cloud and SaaS), and offer opportunities for greater competitive positioning. Emerging markets which are not burdened by legacy technology investments often see substantial gains from greenfield deployments of new technology advancements such as cellular technologies, smart devices, and intuitive user interfaces which mitigate former user barriers to adoption.

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[44] Burgel, Oliver, and Gordon C. Murray, "The International Market Entry Choices of Start-Up Companies in High-Technology Industries". Journal of International Marketing, Vol. 8, No. 2, 2000, pp. 33-62.

[45] Stremersch, Stefan, and Gerard J. Tellis, "Understanding and Managing International Growth of New Products". International Journal of Research and Marketing, 21, (2004), pp. 421-438.

[46] Chiang, C. Catherine and Yaw M. Mensah, "The Determinants of Investor Valuation of R&D Expenditure in the Software Industry". Review of Quantitative Finance and Accounting, 22:293-313, 2004.

Porter and Stern use aggregate R&D expenditures as one variable in assessing the quality of the common innovation infrastructure, as well as private R&D funding to determine the innovation environment.[47] Both Porter and Stern[48] and Cantwell and Piscitello[49] use number of patents as a measure of innovation, though both acknowledge the limitations of this criterion.   Other measures of innovation typically include science paper production,[50] various indices derived from a combination of statistical sources,[51] and other data sources from both public institutions and primary research organizations.

Innovation can result in new products, unique and difficult-to-imitate processes, or creative business models. Though strategy research often focuses on the firm's product scope[52], the resource-based view of the firm holds that advantage stems from difficult-to-imitate resources and capabilities, often based on tacit knowledge[53], which are vital to the success of firms in the technology industries. Capabilities extend beyond the obvious technical expertise critical to firms in the ICT industry to the managerial expertise capable of translating the firm's resources into economic performance.[54] Process-based innovations are typically more difficult than product innovations for rivals to imitate, and offer benefits of sustained competitive advantage by transforming the

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[47] Porter, Michael E., and Scott Stern. "The New Challenge to America's Prosperity: Findings from the Innovation Index". Washington, D.C.: Council on Competitiveness Publications Office, 1999.

[48] Ibid.

[49] Cantwell, John, and Lucia Piscitello, "The Recent Location of Foreign R&D Activities by Large MNCs in the European Regions. The Role of Different Sources of Spillovers". Paper submitted to ERSA Congress, 2003.

[50] Aspray, William, Frank Mayadas, and Moshe Y. Vardi, ed., "Globalization and Offshoring of Software: A Report of the ACM Job Migration Task Force." Association for Computing Machinery, 2006.

[51] Dutta, op.cit. See also Porter and Stern, op.cit.

[52] Peng, Mike W., Sunny Li Sun, Brian Pinkham, and Hao Chen, "The Institution-Based View as a Third Leg for a Strategy Tripod". Academy of Management *Perspectives*, August, 2009, pp. 63-81.

[53] Mowery, David C., Jaonne E. Oxley and Brian S. Silverman, "Technological Overlap and Interfirm Cooperation: Implications for the Resource-Based View of the Firm". Research Policy 27 (1998), pp. 507-523.

[54] Barney, Jay, "Firm Resources and Sustained Competitive Advantage". Journal of Management, Vol. 17. No. 1, 1991, pp. 99-120.

firm's internal capabilities.[55] These innovations are experience-based and are

incremental in nature, and are designed to lower a firm's average cost of production,[56]

such as more streamlined methods of expertise transfer and development or more-

sophisticated methods of alliance management or intra-firm licensing arrangements.

Experience curves as such can create powerful barriers to entry[57], and can create a long-

run impact on the firm's competitive position.[58]

Business model research, like the field of business strategy research, is

fragmented in nature,[59] and the understanding of the term as well as definitions among

authors are inconsistent.[60] Much of the literature emphasizes the procedural nature of the

business model, and focuses on creating value through sets of activities, processes, and

transactions.[61] Though business researchers have different interpretations of the construct

and its relationship to business strategy, they agree that the business model can be a

source of competitive advantage for the firm. The definition which will be used in this

analysis follows Rajala's understanding of the business model as an "appearance or

manifestation of business strategy"[62], including a broader commercial interpretation of

strategies and actions contributing to revenue generation. Recent studies show that the

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[55] Geroski, Paul, Market Structure, Corporate Performance, and Innovative Activity. New York: Oxford University Press, Inc., 1994.

[56] Klepper, Steven, "Entry, Exit, Growth, and Innovation over the Product Life Cycle". The American Economic Review, Vol. 86, No. 3, June, 1996, pp. 562-583.

[57] Porter, Michael E., On Competition. Boston: Harvard Business School Publishing, 1998.

[58] Sapienza, Alice M., "Assessing the R&D Capability of the Japanese Pharmaceutical Industry". Cambridge, MA: R&D Management 23,1 1993, pp. 3-16.

[59] Hedman, Jonas, and Thomas Kalling, "The business model concept: theoretical underpinnings and empirical illustrations". European Journal of Information Systems, 12, 2003, pp. 49-59.

[60] Ghaziani, Amin, and Marc J. Ventresca, "Keywords and Cultural Change: Frame Analysis of Business Model Public Talk, 1975-2000". Sociological Forum, Vol, 20, No. 4, December, 2005, pp. 523-559.

[61] Rajala, Risto, Matti Rossi and Virpi Kristiina Tuuainen, "A Framework for Analyzing Software Business Models". Academy of Finland research project 674917, http://sdaw.info/asp/aspecis/20030126.pdf, May, 2003.

[62] Ibid.

majority of senior managers prefer business model innovation to more costly product or

process innovations as a source of competitive advantage[63]. The authors attribute

performance gains in margin and stock price by large firms such as IBM and Apple to

business model innovations, through actions such as creating a new market or allowing

the company to create and exploit new opportunities in existing markets.[64]

For purposes of this research, innovation will focus primarily on product-based

research and development investments by enterprise software industry vendors, and

secondarily on process innovations or business model innovations which create

advantages leveraged through internal resources and capabilities.

Firm Size and R&D Initiatives

Firm innovation in terms of products and processes, the degree and nature of

R&D investments, and location of R&D activities have been researched extensively from

a variety of perspectives. Many authors investigate innovation and the likelihood of firm

survival from the perspective of firm size, market position (new entrants or incumbents),

number of innovations (usually patents) and R&D investment. Agarwal and Audretsch[65]

find that in technologically advanced industries in a mature life cycle, small firms are just

as likely to survive as large firms by occupying niche markets, though large firms are

advantaged in low-tech industries and in early stages of the industry life cycle. While

large incumbent technology firms such as IBM and Microsoft historically lead the

industry in patent production (which although a lagging indicator is often used as a proxy

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[63] Amit, Raphael, and Christoph Zott, "Creating Value Through Business Model Innovation". Sloan Management Review, Spring, 2012, pp. 41-49. The authors cite studies by the Economist and IBM as well as their own research which indicates a growing focus on business model innovation.
[64] Ibid.
[65] Agrawal, Rajshree, and David B. Audretsch, "Does Entry Size Matter? The Impact of the Life Cycle and Technology on Firm Survival." The Journal of Industrial Economics, Vol. XLIX, March, 2001.

for innovation) and R&D investments, Klepper[66] finds that smaller entrants account for a disproportionate share of innovations relative to incumbents. This, however, does not necessarily disadvantage larger firms. While the number of patents and innovations per dollar of R&D decreases with firm size, the larger the firm, the greater the output over which it can apply benefits of innovations, therefore deriving greater returns from the investment.[67] Chandy and Tellis[68], however, report that over a 150 year period, small firms and non-incumbents introduced only slightly more radical product innovations than large firms and incumbents. They find that the "incumbent's curse" – where large incumbent firms rarely introduce radical product innovations to preserve installed based revenue streams from existing products – does not necessarily apply in the post-World War II era. Alternatively, Christensen and Bower [69] show that while established firms lead the industry in sustaining technologies, those introducing disruptive architectural technologies are overwhelmingly new entrants rather than incumbents. This finding is readily observed and supported in the software markets by tracking the target firm size and nature of acquisitions among large incumbents, most obviously in the application markets[70] where M&A activities are higher. Mansfield[71] cites a series of studies focused on firm R&D investments that show increases in firm size are not associated with more

[66] Klepper, op. cit.

[67] Cohen, Wesley M., and Steven Klepper, "A Reprise of Size and R&D". The Economic Journal, 106, July 1996, pp. 925-951.

[68] Chandy, Rajesh K. and Gerard J. Tellis, "The Incumbent's Curse? Incumbency, Size, and Radical Product Innovation." Journal of Marketing, Vol. 64, July, 2000.

[69] Christensen, Clayton M. and Joseph L. Bower, "Customer Power, Strategic Investment, and the Failure of Leading Firms." Strategic Management Journal, Vol. 17, 1996.

[70] Mertz, Sharon A., "Market Share Analysis: Customer Relationship Management Software, Worldwide, 2010." Gartner, Inc., G00212711, April 27, 2011. The merger and acquisition table provides examples of firm acquisitions representing smaller vendors acquired for their technology innovation. In particular, see acquisitions made by Salesforce.com and Unica.

[71] Mansfield, Edwin, "Composition of R&D Expenditures: Relationship to Size of Firm, Concentration, and Innovative Output." The Review of Economics and Statistics, Vol 63, No. 4, November, 1981.

than proportional increases in total R&D expenditures. Cohen and Klepper also show that larger firms have a greater likelihood of internal R&D spillovers due to greater diversification, and the greater likelihood that larger firms can capitalize on the innovations due to strong complementary capabilities.[72]

A recent Gartner evaluation of R&D expenditures for 50 software firms of various sizes and product focus areas[73] confirms that most larger, mature enterprise software vendors only vary R&D investment as a percentage of revenues by 1% or less on a year over year basis, suggesting that they manage to a specific budgetary allocation. Though the ratio remains relatively constant over time for these firms, actual expenditures increase as revenues increase, and opportunities for innovation accelerate as resource pools grow due to lower-cost labor in offshore locations. The location of software R&D has shifted to a wider range of emerging countries, such as Hungary, Malaysia, Mexico, the Philippines, Slovakia, South Africa and the Ukraine, though the U.S., India, China, Canada and the UK represent the top five areas of R&D investment based on the research sample.[74] As a comparison, National Science Foundation research shows that across all industries the top 10 countries by descending order of overall R&D investment are: the United States, Japan, China, Germany, France, South Korea, the United Kingdom, the Russian Federation, Canada, and Italy,[75] with India conspicuously absent. This may be due to the higher concentration of technology and service investment in India, while NSF data covers a broader range of industries. Motivations for establishing a presence

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[72] Cohen and Klepper, op. cit.
[73] Mertz and Eschinger, op. cit.
[74] Ibid.
[75] National Science Board, Science and Engineering Indicators 2010. Arlington, VA: National Science Foundation (NSB 10-01).

internationally has gradually shifted to more technology-seeking activities, as the Gartner

study findings reveal that less than 40% of respondents were making international R&D

investments for cost reduction purposes, and only 11% invested to increase their global

presence (see Figure 5).[76]

Figure 5: Motivations to Internationalize R&D Efforts
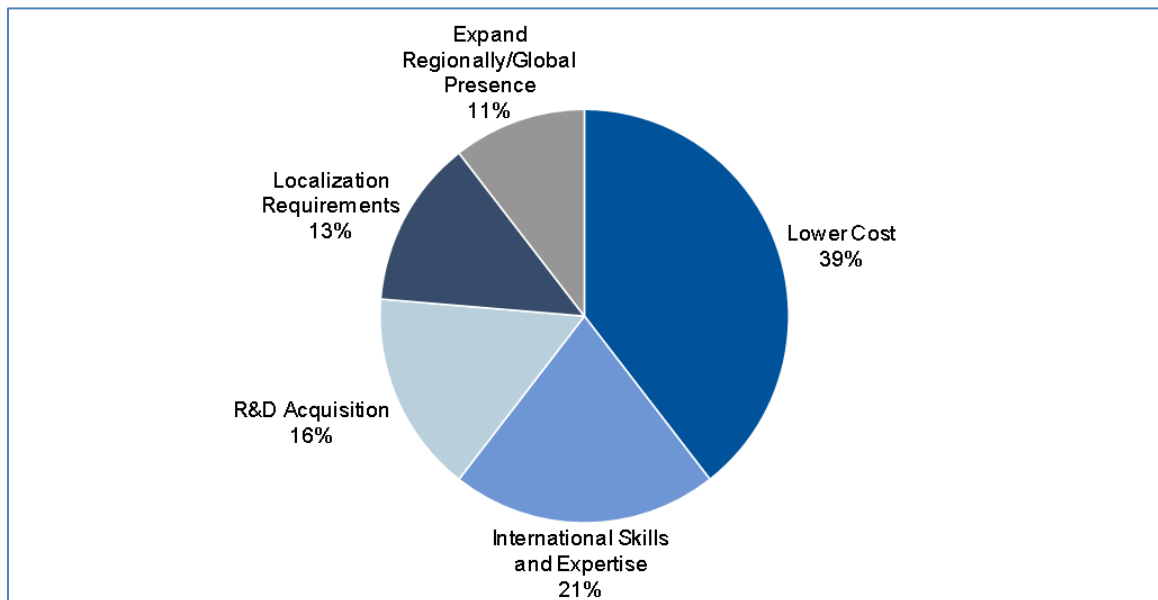
Characteristics of the Software Markets

Software is considered by researchers as an information good with high fixed

costs and low marginal costs[77], and is completely dependent on the underlying equipment

(i.e. computing and communications infrastructure) which constitutes its execution

environment.[78] Despite this hard dependency, researchers have questioned whether

hardware or software investments by firms should come first, though recent findings

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[76] Mertz & Eschinger, op. cit.
[77] Shapiro and Varian, op.cit.
[78] Messerschmitt and Szyperski, op. cit.

support the theory of supply-side indirect network effects where hardware sales lead

software availability. [79] Though this conclusion appears intuitive, arguments rightfully

exist that buyers will not invest in hardware absent available software functionality. [80]

This functional prerequisite demands that hardware vendors who do not also develop and

market infrastructure or application software invest in partnership arrangements with

external software developers early enough in the engineering lifecycle to ensure system

functionality and buyer value upon product general availability. Positive network effects

are characteristic of many software markets,[81] where value increases with a higher

number of adopters[82]. Arthur discusses this concept of increasing returns, which leads to

the potential for lock-in[83] due to high switching costs resulting from durable investments

in complementary assets[84], as well as organizational learning. This leads to a propensity

to monopolize,[85] though depending on the market the monopoly may be temporary in

nature due to the introduction of superior technologies.[86] Research shows that the

greatest market share impact stems from the product's innovation attributes relative to

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[79] Stremersch, Stefan, Gerard J. Tellis, Philip Hans Franses and Jeroen L.G. Binken, "Indirect Network Effects in New Product Growth". Erasmus Universiteit Rotterdam, ERIM Report Series *Research In Management,* ERS-2007-019-MKT, March 2007.

[80] Tellis, Gerard J., "Important research questions in technology and innovation". Industrial Marketing Management, 37, (2008), pp. 629-632.

[81] Messerschmitt and Szyperski, op.cit.

[82] Gallaugher, John M., and Yu-Ming Wang, "Understanding Network Effects in Software Markets: Evidence from Web Server Pricing". MIS Quarterly, Vol. 26, No. 4, December, 2002, pp.303-327.

[83] Arthur, W. Brian, "Competing Technologies, Increasing Returns, and Lock-in by Historical Events". The Economic Journal, **99,** (March 1989), pp. 116-131.

[84] Sharpiro and Varian, op.cit.

[85] Von Westarp, Falk, Modeling Software Markets: Empirical Analysis, Network Simulations, and Marketing Implications. Heidelberg: Physica-Verlag, 2003.

[86] Shapiro and Varian, op.cit.

competing products,[87] or advantages resulting from new or enhanced design features based upon consumer preferences.[88]

Firm market expansion and submarket development often play a critical role in the growth of markets and increasing firm performance. Klepper and Thompson find that the survival of firms is positively related to the number of submarkets in which a firm is active, and that the number also increases with the firm's age.[89] Industry software research supports these conclusions. By 2010, the three largest software vendors, Microsoft, IBM, and Oracle, developed and marketed products in the majority of the 20 software markets listed in Figure 1 (Microsoft – 16 markets; IBM and Oracle - 18 markets).[90] In addition, a more granular view indicates that submarkets within these markets also often represent a disproportionate amount of the market revenue allocations, as do specific segments within these markets.[91] Growth of the markets and submarkets varies between regions and is particularly noteworthy in emerging regions due to varying regional maturity and adoption patterns.[92]

Software and the software industry have been discussed in conjunction with other technology based industries such as chemicals and biotechnology,[93] but have specific

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[87] Robinson, William T., "Product Innovation and Start-up Business Market Share Performance". Management Science, Vol. 36, No. 10, October 1990, pp. 1279-1289
[88] Windrum, Paul & Chris Birchenhall, "Technological diffusion, welfare and growth: technological succession in the presence of network externalities". Maastricht: Maastricht Economic Research Institute on Innovation and Technology, MERIT Infonomics Research Memorandum Series, 2002.
[89] Klepper and Thompson, op. cit.
[90] Graham, et.al., op.cit.
[91] Mertz, op.cited. For example, the growth of sales force automation and e-commerce within the sales submarket of CRM is instrumental to market growth within the current research.
[92] Graham, et. al., op. cit. Regional market and submarket performance is also based on anecdotal evidence from software vendors.
[93] Arora, Ashish, Andrea Fosfuri and Alfonso Gambardella, Markets for Technology: The Economics of Innovation and Corporate Strategy. Cambridge, Massachusetts: Massachusetts Institute of Technology, 2001.

characteristics which are inherently different from other product-based industries.[94]

Messerschmitt and Szyperski identify a number of characteristics which are unique to the

industry, including the ubiquitous nature of the products in enterprise processes and

consumer goods and devices; the complex nature of cross-industry infrastructure

coordination, and the highly social nature of software requirements definition, creation,

and management.[95] Unit costs have historically been basically zero, thereby requiring

vendors to price their information goods according to buyer value[96], and the more recent

shift to electronic software delivery and SaaS has largely eliminated the manufacturing

and distribution costs associated with physical media. As an information good, software

is also protected by copyright or in some cases can incorporate patented inventions,[97]

though intellectual property protection is clearly an issue in the developing regions and

can be an inhibitor for firms seeking international expansion. Other characteristics of the

software markets include instant scalability, where suppliers can respond very quickly to

increased demand.[98] It should be noted that this is a product and distribution distinction,

and that whereas firms can respond rapidly to increased product demand, they continue to

face challenges common in high-growth markets such as organizational scalability,

customer support issues, and potential disruption in sales and marketing coverage

models.

[94] Messerschmitt and Szyperski, op.cit.
[95] Ibid.
[96] Shapiro and Varian, op.cit.
[97] Messerschmitt and Szyperski, op. cit.
[98] Von Westarp, op. cit.

Software Market Perspectives in Emerging Economies

In addition to the overview in Chapter 1 and related institutional and commercial sources given above, research efforts covering the international technology markets address the globalization of technologies, and country-specific initiatives directed toward the markets for technologies and local conditions accelerating or inhibiting adoption. As a subset of this research, a significant amount of more detailed coverage of the software markets exhibit a certain commonality of approach in examining vendor impact and opportunity in emerging economies, and assessing country and regional readiness for software adoption, only a sample of which will be included here. Anavitarte, et.al., emphasize the importance of strong economic growth in emerging regions as a market driver, and encourages software vendors to concentrate efforts on large enterprises, channel development, and addressing localization issues.[99] Not surprisingly, emerging markets are largely dominated by infrastructure software and basic application software from the penetration perspective,[100] though more sophisticated software applications will tend to exhibit higher growth rates from a smaller base. Greenwald also analyzes international software markets in part through measurements of regional wealth based on GDP and PPP, but also considers the acceptance of technology and English as a language of commerce, as well as the technology sales and buying culture when assessing regional attractiveness.[101] He cites East Asia as a crucial growth region due to its rapid development, but also considers it a challenging environment for Western firms due to

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[99] Anavitarte, Luis, Wm. L. Hahn, Tiffani Bova, Federico Da Silva Leon, Lillian M. Alvardo, Samina Malik, Naveen Mishra, April Adams, Donna Taylor, Fabrizio Biscotti, Yanna Dharmasthira, and Ian Marriott, "Market Trends: Unveiling IT Trends in Emerging Regions." Gartner, Inc., G00154092, December 18, 2007.

[100] Ibid.

[101] Greenwald, Jay, International Markets for Enterprise Software Vendors. Jay B. Greenwald, International Revenue *ACCELERATION*, 2011.

the diversity of countries in cultures, business practices, countries, and vast geographical

areas.[102] Cultural aspects can also impact software growth in emerging regions, as seen

in comparisons of information technologies to Hofstede's classification,[103] and evidence

from other research that favors MNE solutions over local providers due to a preference

for strong brands, or a reluctance to embrace SaaS due to issues of trust.[104] Intellectual

property protection and issues with the sporadic enforcement of TRIPS[105] increase the

risk for software firms to enter emerging markets, as does a weak appropriability

regime.[106] These institutional factors are more noticeable in emerging or developing

economies[107], creating additional challenges for firms as the "rules of the game" or most

effective operational choices are not completely known.[108]

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[102] Ibid.

[103] Langenberg, Dirk, and Melanie Welker, "Knowledge Management in Virtual Communities". Open Journal of Knowledge Management", III, 2011.

[104] Mertz, Sharon A., and Dan Sommer, "Market Trends: Software Markets, Russia, 2008-2012". Gartner, Inc., G00165295, February 25, 2009.

[105] Ahdieh, Robert B., Zhu Lee, Srividhya Ragavan, Kevin Noonan, and Clinton W. Francis, "The Existing Legal Infrastructure of BRICs: Where Have We Been and Where Are We Going?". Northwestern Journal of Technology and Intellectual Property, Vol. 5, No. 3, Summer, 2007.

[106] Orozco, David, "Will India and China Profit from Technological Innovation?" Northwestern Journal of technology and Intellectual Property, Vol. 5, No. 3, Summer, 2007, pp.426-435.

[107] Appendix 2 provides a taxonomy listing countries by advanced, developing, and emerging country categories.

[108] Peng, Mike W., Denis YL Wang and Yi Jiang, "An Institution-based View of International Business Strategy: a Focus on Emerging Economies". Journal of International Business Studies, March, 2008, pp. 1-17.

Chapter 3 - Research Questions and Hypotheses

Hypothesis Development

Chapter 1 outlines five key questions to direct the research effort. The overarching question is centered on the firm business strategy: which elements of the firm business strategy are most impactful on firm and software market growth in emerging markets? Which business models are more likely to drive growth in emerging markets? Related questions are focused on more specific aspects of the firm business strategy and performance metrics which may influence their growth and the software market growth in emerging regions.

This chapter presents seven testable hypotheses to evaluate the likelihood of these indicators as useful predictors of software vendor impact and subsequent market growth in emerging regions.[109] In each case, the dependent variable is the aggregate emerging market growth rate, or 17.7%, whereas the predictor variables are specific for each hypothesis.

The Impact of Product Strategy and Go-to-Market Strategies

How do firm-level decisions concerning product and go-to-market strategies impact firm and market growth in emerging regions?

Multiple research sources confirm the tight linkages between hardware and software and the importance of complementaries in the software markets. Recent developments in the market have also witnessed a shift in hardware vendors extending

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[109] The author thanks Martin Slade, MPH, Yale School of Medicine, for his assistance in framing the hypotheses and analyzing the results of the data.

their portfolios with software offerings in supporting submarkets and software vendors acquiring hardware firms. This shift marks another evolution in the development of the market, and suggests that firm market and growth advantage stems from increasing diversity in the product portfolio. During the 1960's and 1970's (see Table 1), much of the software developed for enterprise markets originated from organizations which developed and marketed both hardware and software, such as IBM, Hewlett-Packard, and Digital Equipment Corporation, and was focused on infrastructure products such as operating systems, middleware, and network and system management products which were specific to and enabled enterprise usage of the platform to meet computing needs. Hardware vendors either developed applications products for their platforms, or partnered with a growing community of application software producers to extend the adoption of their products and solutions to a broader buyer base. During the next two decades, the industry witnessed a rapidly expanding ecosystem of software firms specializing in both application and infrastructure submarket solutions, driven by vendor requirements for functionality to support new hardware platforms, buyer demand, and an escalating number of entrepreneurial ventures as new market entrants providing new products enabled by innovative technologies and fueled by a growing investment and venture capital community. Following the year-2000 (Y2K) fervor of the millenium, where buyers made heavy investments in new technologies and conversion projects to maintain enterprise solutions, firm growth declined due to both Y2K budget flush and the subsequent economic shock and market contraction following the 911 terrorist attack on the World Trade Towers. During this period the plethora of software firms which previously entered the market either stabilized and prospered, or exited the market via

acquisition or business closure. The next few years (2005-2008) witnessed a renewal in

software firm growth, where many prospered due to general market uplift in spite of

potentially weaker product, market, or innovation investment strategies. The market, and

with it, firm performance, then began to stall and then often precipitously declined

following the economic crisis in 2008. During the next two years, software firms without

solid product and market strategies, or those which were highly dependent upon fragile

industries (i.e., financial services), were frequently acquired at asset sales or other

undervalued takeover transactions, and market consolidation escalated, particularly

among mature markets and submarkets. In addition, technology transitions prompted

other rounds of consolidation, such as the business intelligence firm consolidation which

occurred during 2007 when Oracle acquired Hyperion, SAP acquired Business Objects,

and IBM acquired Cognos, in order to integrate this functionality into their technology

stacks and increment their market growth. Information technology market consolidation

overall continued as Oracle acquired Sun Microsystems, IBM acquired the consulting

firm PriceWaterhouseCoopers, and HP acquired EDS. In addition, the importance of

complementaries has been reinforced by the commercial availability of in-memory

databases requiring a combination of hardware and software, which, though a topic of

research since the 1980's and earlier, is now within commercial buyer reach due to more

cost-effective hardware technologies, and is fueled by buyer requirements to process and

analyze significantly increasing volumes of data. The rapidly escalating demand for

information technology security solutions has, in certain cases, also required

interdependent hardware and software products as an integrated solution. Firms which

are capable of providing these interdependent hardware and software solutions benefit

commercially by offering a single procurement channel for buyers, while buyers benefit

from the technology performance and execution advantage of a tightly-coupled solution.

This evolution of technologies, firm research and development initiatives, market

consolidation, and buyer demand have resulted in a transition to these more closely

integrated hardware and software solutions, and corresponding shifts in firm product

portfolios. This is, in turn, shifts firm growth and market share positions for vendors

developing and marketing both hardware and software solutions, and may afford vendors

offering both a competitive advantage over firms only developing and marketing

software.

However, a larger number of firms within the worldwide software markets offer

only software products, covering a wide range of functional requirements for both

horizontal applications and more vertically-specific feature sets. In 2010, Gartner

software market coverage included an analysis of firms participating in 104 software

submarkets worldwide[110]. Each of these 104 submarkets can further be segmented into

more granular submarkets: for example, there are over 50 sub-submarkets within the

three major submarkets defined under Customer Relationship Management software.[111]

This industry dynamic provides a larger market opportunity for firms focusing solely on

software development within these functionally-specific and highly fragmented markets:

though characterized by firms of all sizes, these markets represent a greater number of

small-to-midsize firms, often exhibiting higher growth than the large incumbents while

starting from a smaller base.

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[110] Graham, et.al., op.cit.
[111] Thompson, Ed, "CRM Vendor Landscape: How to Leverage Emerging Trends and Tackle Long-Term Uncertainties". Conference Presentation, Gartner Customer Relationship Management Summit, London, UK, March 18-19, 2008.

The first hypothesis tests whether firms which develop and market both hardware and software or firms which only develop and market software products in emerging regions are likely to exceed aggregate market growth.

Hypothesis 1:

- H_0: There is no difference in the probability of exceeding aggregate market growth in emerging regions between software firms which develop and market both hardware and software and those that only develop and market software products.

- H_a: Software firms which develop and market both hardware and software products are less likely to exceed aggregate market growth in emerging regions than vendors who only develop and market software products.

Research also indicates that infrastructure software enjoys higher market penetration in emerging markets, but that application software exhibits higher growth due to a smaller initial base.[112] Infrastructure providers have a natural market advantage due to buyer necessity for their products in advance of acquiring and implementing applications. Application providers have broader market opportunity due to the large number of niche markets within the software industry, but may be disadvantaged in emerging regions due to lower adoption within certain specific application markets which are either embryonic in nature or just beginning their growth cycles. Infrastructure and application software can also be considered complementaries as the applications cannot operate without the infrastructure foundation comprised of operating systems, middleware, and system

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[112] Graham, et.al., op.cit.

management components. Firms only developing and marketing infrastructure software are also dependent upon application providers to develop end user solutions upon their platforms and provide applications which leverage their infrastructure base.

Firms offering both enjoy similar advantages of those developing and marketing both hardware and software. Buyers benefit from infrastructure and applications solutions that are more tightly coupled, reduced integration issues, improved performance, and often a single source for procurement and support. Firms benefit by offering products across a wider number of markets, extending their market opportunity, and potentially increasing their opportunity for survival.[113]

Not all firms develop and market both types of software. Similar to the first hypothesis, benefits of more tightly coupled software solutions can bring advantages of performance to buyers, and in addition, more streamlined support and maintenance processes and costs to vendors, as well as a more complete product portfolio. The second hypothesis tests whether there is a difference in the probability of exceeding market growth in emerging regions between software firms which develop and market both infrastructure and application software and those which only develop and market software in a single macromarket.

Hypothesis 2:

- H_0: There is no difference in the probability of exceeding market growth in emerging regions between software firms which develop and market both infrastructure and application software and those that only develop and market either infrastructure or application software.

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[113] Klepper and Thompson, op. cit.

- H_a: Software firms which develop and market both infrastructure and application software are less likely to exceed aggregate market growth in emerging regions than software firms which only develop and market either infrastructure or application software.

Emerging market entry is often conducted through indirect channels, demanding that firms identify and form relationships with the appropriate channel partners in order to be successful. Channel partners can be other software vendors, hardware vendors, distributors, systems integrators, governments, or other firms which have buyer relationships and sell into the local markets. Not all firms in emerging markets conduct business through multiple channels, which may disadvantage their market performance. Firms which enter emerging markets through only a direct model face heavier investments in local salesforces, capital, and facilities, and may lack the local expertise and personal relationships which are often critical to engage buyers. Smaller firms choosing less resource-intensive modes of entry[114] reduce the investment risk and expertise gap required through direct engagement, but are also constrained by an arm's-length relationship (or none at all) with the eventual buyer, limiting direct exposure to customer requirements, and increasing the risk of customer satisfaction issues. A multi-channel strategy enables firms to expand their market reach and penetration by partnering with locally entrenched businesses, selling to and servicing larger accounts, establishing a relationship with local authorities and commercial entities, and making sometimes necessary investments in local workforces or real estate. Physical presence and the

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[114] Burgel and Murray, op.cit.

ability to create personal relationships is more critical in high-context cultures,[115] and is often an imperative in cultures with less-developed commercial environments and greater expectations of direct contact in business transactions.[116] These characteristics of emerging market distribution environments suggest that market advantages are enjoyed by firms with multi-channel strategies. The third hypothesis tests the probability of exceeding aggregate market growth in emerging regions between software firms which market and sell through multiple channels and those which market and sell through a single channel.

Channels can be direct, indirect, online and phone. For purposes of the research, discussions within this research will be limited to the direct and indirect channel.

Hypothesis 3:

- H_0: There is no difference in the probability of exceeding aggregate market growth in emerging regions between software firms which market and sell through multiple channels and those which market and sell through a single channel.

- H_a: Software firms which market and sell through multiple channels are less likely to exceed aggregate market growth in emerging regions than software firms which only offer software through a single sales channel.

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[115] Trompenaars, Fons, and Charles Hampden-Turner, <u>Riding the Waves of Culture</u>. London: Nicholas Brealey Publishing, third edition, 2012.
[116] Mertz and Sommer, op.cit.

The Choice of Delivery Models

Do firm-level decisions on product and solution delivery models impact firm and market growth in emerging regions?

Historically most enterprise software firms developed and marketed products as on-premises[117] solutions to customers, whether delivered electronically or through tangible media. Some firms today still follow this model, but the growing trend is either to offer only SaaS/Cloud delivery models, or multiple delivery options to customers through on-premises solutions in addition to service-based models in a SaaS or Cloud computing environment. These alternative delivery models have infrastructure dependencies on robust, stable network availability which may disadvantage emerging region delivery, but can also have advantages of lower cost, which is often a buying criteria associated with emerging markets. Many governments outside North America, including countries in mature as well as emerging regions, have data privacy laws and regulations[118] which prohibit data from residing in data centers outside the country, forcing cloud computing firms to either construct data centers within the countries or partner with existing in-country data center providers to offer the required infrastructure services. Firms offering SaaS/Cloud offerings may also be disadvantaged in cultures which are more product-centric in nature, where buyers may be more averse to adopting a services-based solution.[119] In addition, firms must assume the incremental development and support costs to provide local language functionality, offer payment terms and

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[117] "on-premises" refers to software which is installed, run, and managed at a physical customer location.
[118] Casper, Carsten, "A World With Secrets: The Relationship Between Identity and Privacy". Conference presentation, Identity and Access Management Summit 2009, London, March 23-24, 2009.
[119] Mertz, Sharon A., and Dan Sommer, "Market Trends: Software Markets, Russia, 2008-2012". Gartner, Inc., G00165295, February 25, 2009.

mechanisms which enable small to mid-size enterprises to adopt the solution, and carefully consider the business case of offering lower cost solutions for a potentially low-to-negative margin opportunity, particularly in the short term. Despite continuing industry shifts toward more services-based delivery models, firms offering multiple delivery models may incur costs, risks, and limited adoption which cause them to underperform the market.

However, regional network infrastructures are improving, and governments are investing in infrastructure initiatives to promote the use of the internet and internet technologies to further education and commerce, and reduce costs of public services. Firms are also developing relationships with local telecomm providers to enable adoption of enterprise software solutions through the established infrastructure using a Cloud-based model.[120] Large global incumbents are translating Cloud-based offering into local languages, and others are establishing agreements with value-added distributors to extend their local presence.[121] In addition, local vendors have been establishing SaaS solutions within emerging countries, and have had reasonable success, indicating buyer demand is growing.[122]

Hypothesis 4 tests the probability of exceeding aggregate market growth in emerging regions between software firms which develop and market software using a single delivery model and those which develop and market through multiple delivery models. For purposes of the research, services-based delivery models will refer to SaaS

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[120] Taylor, Paul, "SAP-China Telecom deal to offer cloud-based services in China". Financial Times, May 16, 2011. http://www.ft.com/cms/s/0/1b1f345a-7fdf-11e0-b018-00144feabdc0.html#axzz2NH1eN2UN
[121] Mertz, Sharon A., Chad Eschinger, Tom Eid, Chris Pang, Hai Hong Swinehart, Yanna Dharmasthira, Laurie F. Wurster, Tsuyoshi Ebina, and Akimasa Nakao, "Forecast: Software as a Service, All Regions, 2010-2015, 1H12 Update". Gartner, Inc., G00228690, March 13, 2012.
[122] Ibid.

or Cloud deployments interchangeably and will not include managed services, outsourcing, or other forms of hosting.

Hypothesis 4:

- H_0: There is no difference in the probability of exceeding aggregate market growth in emerging regions between software firms which develop and market software using a single delivery model and those which develop and market through multiple delivery models.

- H_a: Software firms which develop and market software using a single delivery model are less likely to exceed aggregate market growth rates in emerging regions than software firms which offer software through multiple delivery models.

The Effect of Firm Innovative Activity

How does the degree of firm innovative activity affect the structure and growth of software firms and markets in emerging regions?

Many software firms have been increasing investments in international research organizations to benefit from cost savings, critical expertise pools unavailable in their home country location, and talent to adapt products to accommodate emerging region requirements. Smaller firms in early stages of product development cycles often exhibit higher levels of R&D investment, though some of the larger, relatively more recent market entrants pursuing newer technology solutions and deployment models (compared to traditional incumbents) also exhibit growing R&D expenditures as a percentage of

sales.[123]   Firms which maintain a steady R&D investment to sales ratio (plus or minus 1.5% annually)[124] and benefit from consistently growing revenue streams not only increase their R&D expenditures, but can also increase the number of R&D resources by transferring development operations to lower cost locations.   International R&D locations are frequently stand-alone operations and do not necessarily guarantee the presence of firm sales offices or other established partner relationships that imply local revenue opportunities and firm growth.   There is, however, organizational learning associated with conducting business in emerging markets that contributes to firm capabilities, which could be used to leverage growth opportunities in other emerging regions.

In contrast, many firms do not pursue international R&D opportunities due to the availability of local talent within their headquarters region or local country.[125]   Highly skilled technology talent pools in lower cost local areas can afford firms more cost-effective options, requiring less direct oversight and cost associated with the management and project coordination of international teams.   In addition, local talent in developed nations may often have critical skill sets and business process knowledge required for new product development in emerging technologies which cannot be sourced in lower-cost international destinations. These elements often discourage firms from seeking development resources in emerging nations based on an insufficient business case justification, but does not limit them from pursuing market opportunities in emerging regions.

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[123] Mertz and Eschinger, op.cit.
[124] Ibid.
[125] Mertz and Eschinger, op.cit. Sources also include executive interviews with multinational R&D executives, 2005-2012.

The fifth hypothesis tests the probability of exceeding aggregate market growth in emerging regions between software firms which make R&D investments in emerging regions and those that do not make R&D investments in emerging regions.

Hypothesis 5:

- H_0: There is no difference in the probability of exceeding aggregate market growth in emerging regions between software firms which make R&D investments in emerging regions and those that do not make R&D investments in emerging regions.

- H_a: Software firms which make R&D investments in emerging regions are less likely to exceed aggregate market growth rates in emerging regions than software firms which do not make R&D investments in emerging regions.

The Impact of Firm Profitability

Is the level of firm profitability an indicator of software firm and market growth in emerging regions?

The level of firm R&D investment is considered an important precursor to firm growth, as it anticipates new product development and future revenue streams. Firms exhibit different levels of R&D investment, based in part on firm size, maturity, and portfolio mix. Firm size impacts the ratio of R&D expense/revenue, as continued firm growth actually increases investment even though the ratio may remain relatively constant. With few exceptions, firms which are more mature exhibit ratios which are lower than average, vary slightly or are flat based on a year-on-year comparison,[126] while

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[126] Ibid.

newer entrants in early growth stages have higher investments. These firms may not be well-established in emerging markets, and experience lower growth, in part due to underdeveloped sales coverage models or less-experienced international executive talent. In addition, firms which transition their product portfolio mix to more services-based offerings can exhibit declines in R&D investment.

Increasing investor demands for profitability and shareholder value pressure firms to optimize investments in R&D through lower cost resources, often encouraging the relocation of software development activities to emerging economies to meet a specific investment level without sacrificing productivity. The ratio of R&D investment as a percentage of sales is measured at the corporate level, and may or may not be a good indicator of software growth in emerging regions, particularly for firms developing and selling multiple product lines. The sixth hypothesis tests the difference in probability of exceeding aggregate market growth in emerging regions between multinational software firms with higher than average investments in R&D as a percentage of sales and those with lower than average investments as a percentage of sales.

Hypothesis 6:

- H_0: There is no difference in the probability of exceeding aggregate market growth in emerging regions between multinational software firms with higher than average investments in R&D as a percentage of sales and those with lower than average investments in R&D as a percentage of sales.

- H_a: Multinational software firms with higher than average investments in R&D as a percentage of sales are less likely to exceed aggregate market growth rates in emerging regions.

Common measures of firm profitability, such as profit margins, are indicators to stakeholders of the health and sound management execution by the firm's leadership. Higher profit margins can result from operational effectiveness, growing recurring revenue streams (such as maintenance), or other cost containment measures which positively affect bottom line revenues. These are also measured and reported at the firm level and do not describe operations at the line of business or product level. Firms with high profit margins may or may not be successful in emerging economies based on their product revenue mix and investments needed to develop and maintain business operations in the emerging regions. Firms with lower profit margins may enjoy higher growth in emerging regions, but could be starting from a much smaller initial revenue base. In addition, these firms may suffer from higher internal costs due to intentional business investments or poor operational execution. The seventh hypothesis tests the difference in probability of exceeding aggregate market growth in emerging regions between software firms with higher than average profit margins and those with lower than average profit margins.

Hypothesis 7:

- H_0: There is no difference in the probability of exceeding aggregate market growth in emerging regions between software firms with higher than average profit margins and those with lower than average profit margins.

- H_a: Software firms with higher than average profit margins are less likely to exceed aggregate market growth rates in emerging regions.

Chapter 4 - Research Methodology

Firm Level Research Focus

The firm level research was based on an initial sample size of approximately 150 publicly traded software firms which conduct business internationally (i.e. have operations and/or revenue streams in at least one region outside their corporate headquarters). Firms in the sample were selected from approximately 450 firms analyzed by Gartner software market research in preparing the 2010 worldwide market share analysis,[127] market trend reports, competitive analyses, and other software market industry publications. The sample represents a combination of vendors providing both hardware and software, or software only, which develop software products for either the infrastructure markets, application markets, or both. The initial sample of 150 firms was subsequently reviewed and reduced to 102 to eliminate those which did not meet the base criteria, did not conduct business in emerging markets, or in cases where data required for analysis could not be obtained from publicly available sources due to issues such as acquisition activity, or in some cases, inconsistencies in international reporting requirements. Firms which only conducted business within mature regions were also eliminated from the sample. Note that while these firms may offer professional services, this particular market segment is not a specific component of the analysis.

Firm analysis included macromarket, market, and regional revenue inputs. Profitability ratios and other indicators of performance were sourced from content

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[127] Graham, et. al., op.cit.

aggregators such as OneSource Global Business Browser, international stock exchange

filings, company annual reports and investor relations documents, and other generally

available financial market analyst reports. Firm strategy, business models, operational

and R&D locations, and evidence of critical resources and capabilities were also derived

from other publicly available sources such as company web sites, annual reports, 10K or

20F SEC filings, press releases, and other sources of market and firm analysis developed

by industry analysts and consultants.

Chapter 5 - Research Analysis and Discussion

Data Set Characteristics and Results

The following summary characterizes the research sample, consisting of 102 technology firms which develop and market software products within multiple regions and in emerging economies. The total sample is used in the analysis for all hypotheses except those using profitability ratios (hypotheses 6 and 7), where data could not be obtained for all firms due to inconsistencies in reporting requirements or acquisition activity. The latter samples consist of 64 firms (hypothesis 6) and 66 firms (hypothesis 7) respectively, and is described in more detail within the hypothesis testing.

Firm Size, Market Share, and Headquarters Location

Research sample firm size varies from very small to very large based on estimated total software revenues derived from publicly available financial reports. Revenue estimates were taken from the Gartner publication "Market Share: All Software Markets, Worldwide, 2010"[128]. Total software revenues range from less than $50 million USD to over $1 billion USD and were used to group firms into revenue bands for potential further analysis. Appendix 4 contains a list of these firms by company size band based on total software revenues.

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[128] Ibid.

Figure 6 shows the firm data set distribution by total software revenue expressed in millions of US Dollars. Firm size bands are adapted from Gartner company size breakouts, and have been adjusted to provide size categories which are more reflective of market activity. Of these, over 20% had total software revenues of over $1 billion, representing nearly 87% of the combined revenues in the research sample. Over 51% of the firms (53) represented the broader mid-market, with revenues ranging from $50 million - $500 million USD, but representing just 6.2% of total data set revenues.

Figure 6: Firm Distribution by Company Size, Total Software Revenue, 2010, USD Millions
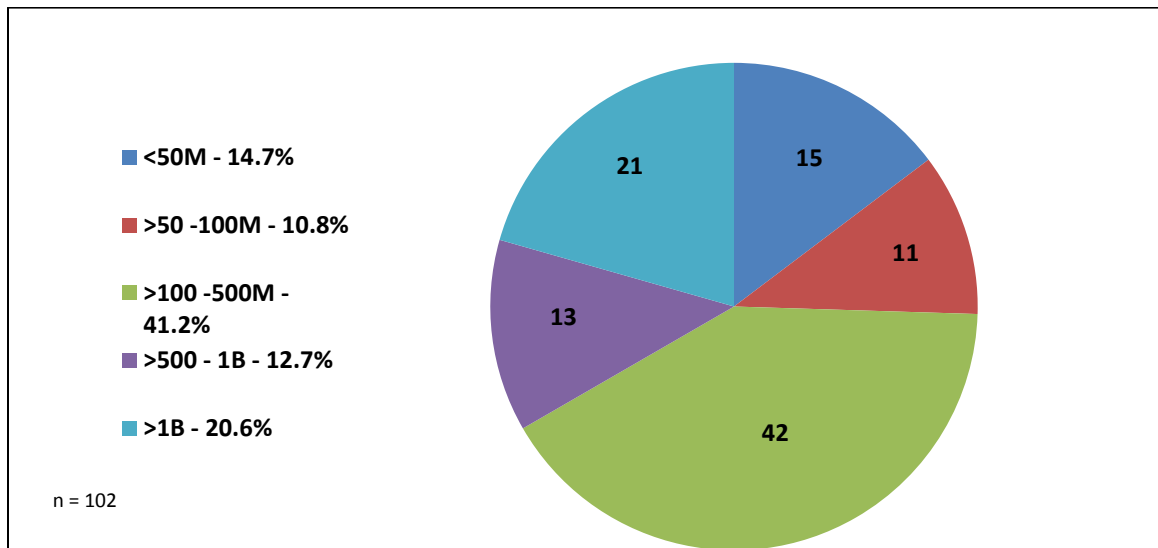
Source: Research Population

Firm headquarters' locations spanned 14 countries, with U.S. firms comprising the majority with nearly 70% of the firms. This was followed by Germany at just under 5% of the total firms, then the UK and Japan at just below 4% each. Figure 7 provides the complete distribution of corporate headquarters locations. Not surprisingly, countries within the Triad[129] represent 91.3% of the corporate headquarters locations.

Figure 7: Firm Distribution by Corporate Headquarters
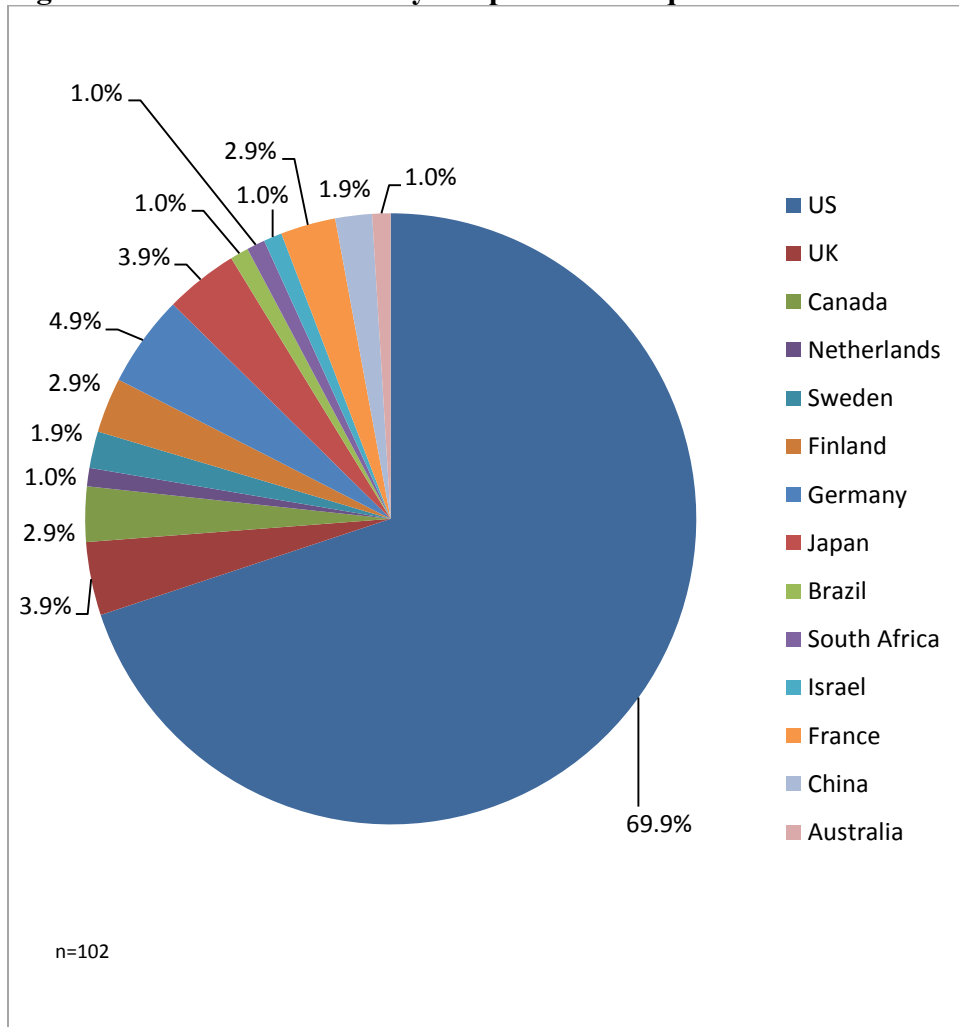
Source: Research Population

Firm Strategy: Product, Go-to-Market, and Delivery Models

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[129] In international business literature, the Triad typically refers broadly to North America, Western Europe, and Japan.

Most firms developed and marketed software only (89), with the remaining 13 offering a mix of hardware and software. Of those 13, 11 were based in the U.S., with 2 in Japan. Nine of the 13 each represented over $1B in total software revenues, suggesting a potential market share advantage for those firms offering complementary products. Thirty-four percent of the total developed and marketed both infrastructure and applications software, 24.3% provided infrastructure only, and 41.7% were application vendors (Figure 8). Fifteen of the 21 firms in the top revenue tier (greater than $1B in total software revenue) offered both infrastructure and applications products, while only one in that category provided applications only.

Figure 8: Firm Software Product Distribution by Macromarket
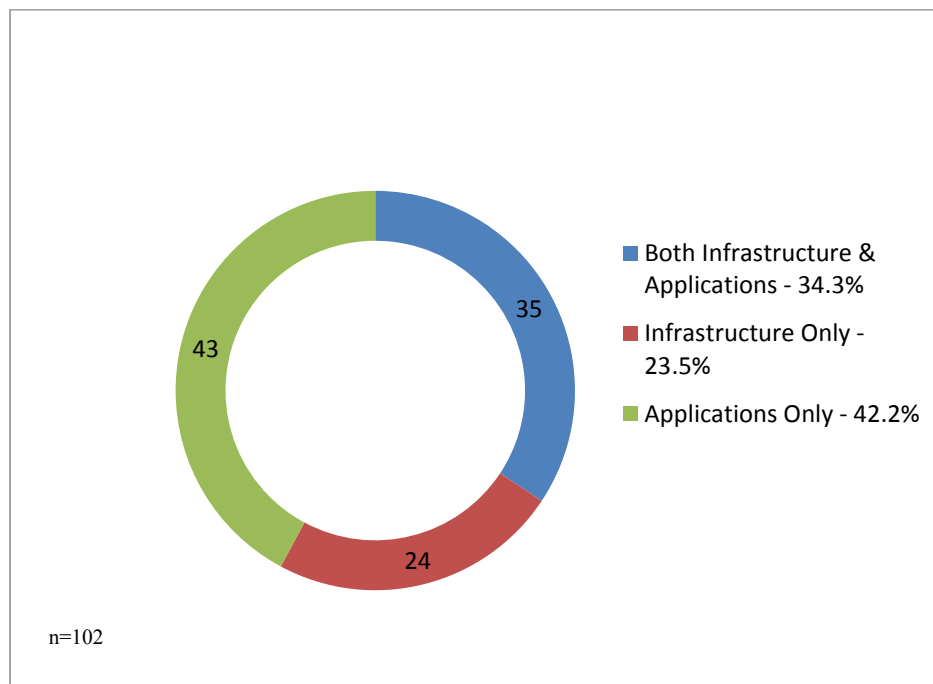
Source: Research Population

The majority of firms – nearly 75% - entered the emerging markets using multiple delivery channels. Just under 15% used a direct sales model only, while just under 11% entered the market through the indirect channel.

Figure 9: Firm Distribution by Channel
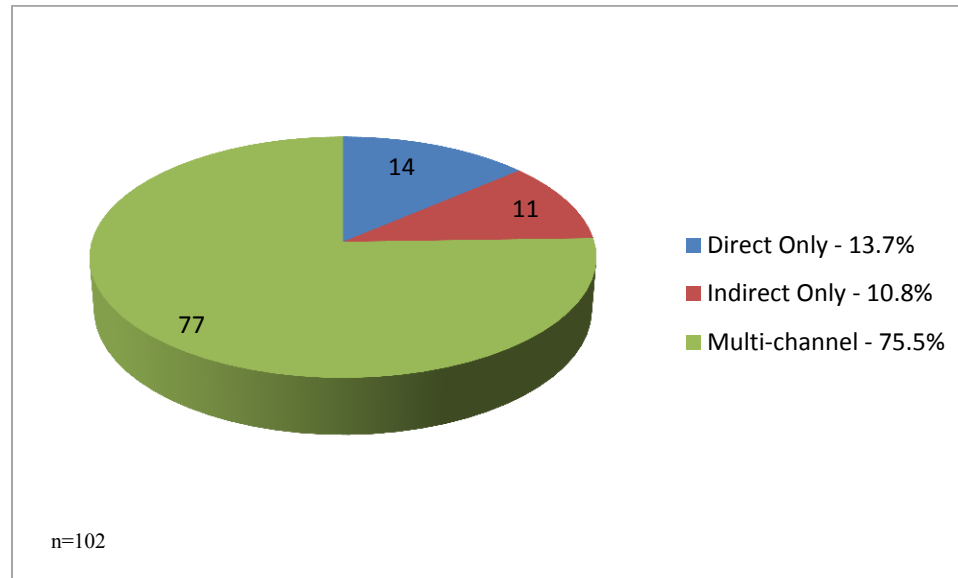
Source: Research Population

The choice of delivery models among firms revealed that the majority offered multiple delivery models. While just under 60% offered multiple delivery models (on-premises and SaaS/Cloud), 35% of firms delivered their solutions using a traditional on-premises mode, and the remaining 5.8% were pure-play SaaS/Cloud vendors (see Figure 10). Not all product lines in each firm offering multiple delivery models include SaaS/Cloud deployment options, with many firms offering this deployment model in only targeted application areas. The percentage of firms offering multiple models appears high based on industry trends, but not surprising among a group of publicly traded firms,

given the growing interest from the investment community in Cloud computing and the

subsequent pressure on firms to offer this model by both buyers and investors.

Figure 10: Firm Distribution by Delivery Model
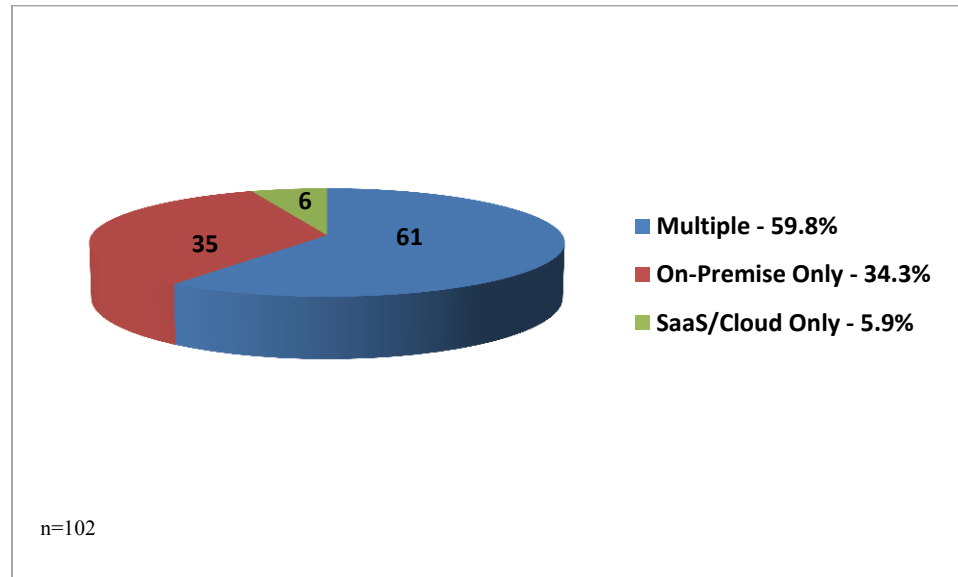
Source: Research Population

Firm R&D Investment Locations

Firms conducted R&D activities within 43 different countries in total. Not all of

the 102 firms conducted R&D outside their home country location: nearly 23% do not

list multiple sites, and over half of these were companies with under $100 million USD in

total software revenues. Just under 64% of the total conducted R&D in emerging

markets. Overall, 375 locations were noted for R&D activities among the 102 firms.

Figure 11 illustrates the combined distribution of R&D locations for all firms.

Figure 11: Number of R&D Locations, Country Distribution

Number of R&D Locations
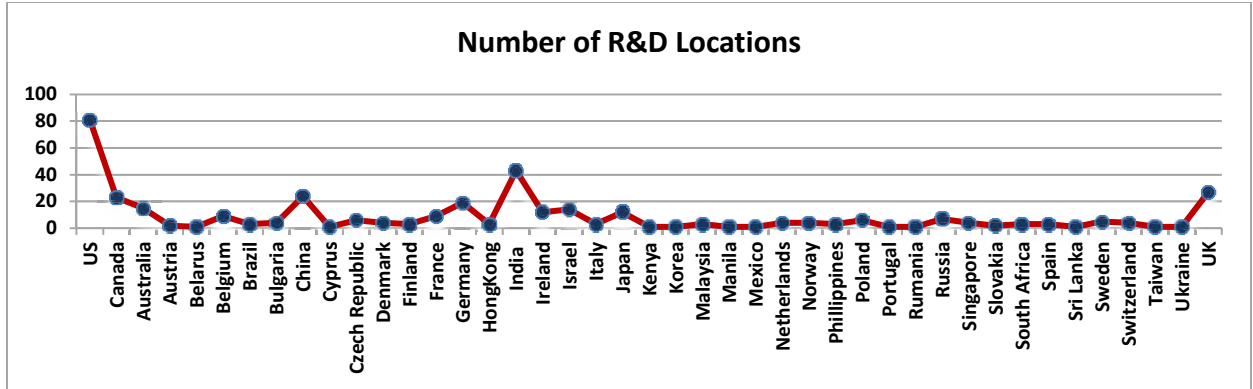
Source: Research Population

Western Europe had the greatest number of R&D locations cited among firms (110). Consistent with previous research, R&D within the EU was heavily dominated by the largest countries, Germany, the UK, and France.[130] North America was the second largest R&D destination (104), with the U.S. clearly predominating in number of R&D sites, not surprising given the concentration of corporate headquarters and other supporting data on R&D investments.[131] Figure 12 provides a regional distribution of R&D locations represented by all firms.

Figure 12: Firm R&D Locations, Regional Distribution

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[130] Lindmark, Sven, Geomina Turlea and Martin Ulbrich,"Mapping R&D Investment by the European ICT Business Sector". European Commission Joint Research Centre, Institute for Prospective Technological Studies, 2008.
[131] National Science Board, op. cit.

North America - 27.7%

Latin America - 1.1%

Western Europe - 29.3%

Eastern Europe - 7.5%

MEA (Middle East & Africa) - 4.8%

Japan - 3.2%

Asia Pacific - 26.4%
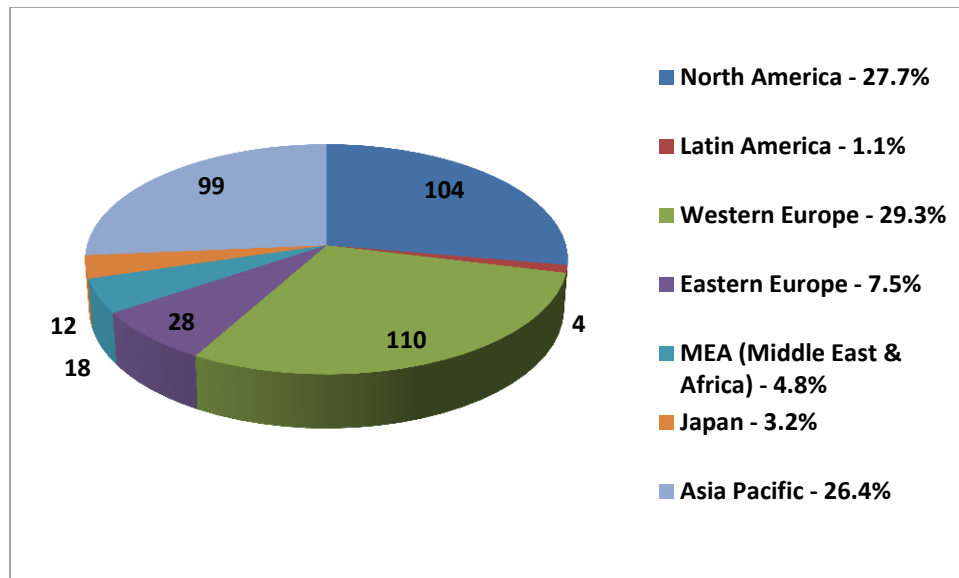
Source: Research Population

Consistent with previous research,[132] the five most frequently cited R&D destinations among all countries are the U.S., India, the U.K., Canada and China, representing 52.8% of all firms (Figure 13). The U.S. and India make up nearly 63% of the locations within the top five most-often cited countries (Figure 14).

The five most-often cited emerging country R&D destinations are India, China, Russia, the Czech Republic, and Poland, totaling approximately 30% of the total, or 112 instances. Not surprisingly, India and China account for about 60% of the emerging region locations. Figures 15 and 16 show the emerging country locations in relation to the total, and the country distribution among emerging regions, respectively.

Figure 13: Top Five and Other R&D Locations, All Firms

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[132] Mertz & Eschinger, op.cit.
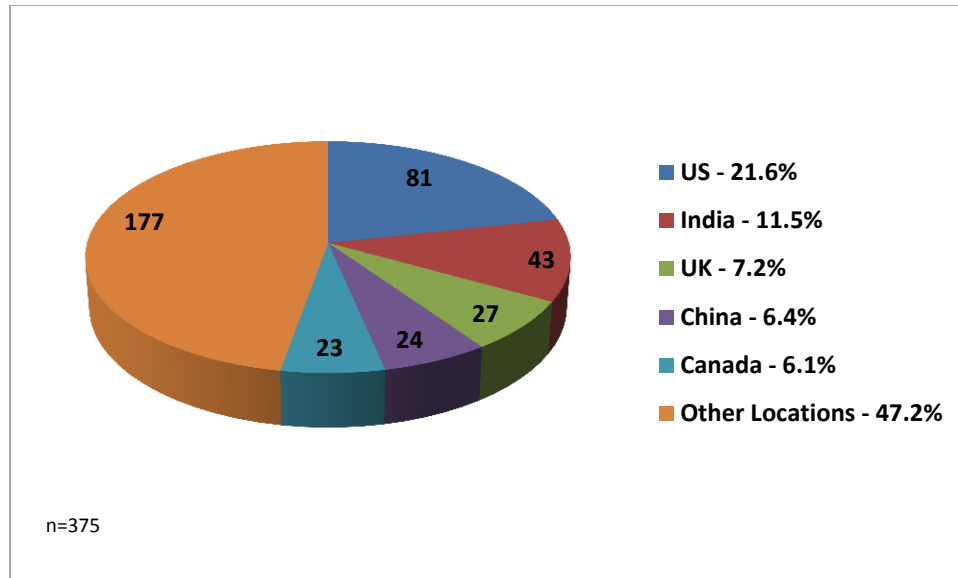
Source: Research Population

Figure 14: Top Five R&D Locations, Distribution
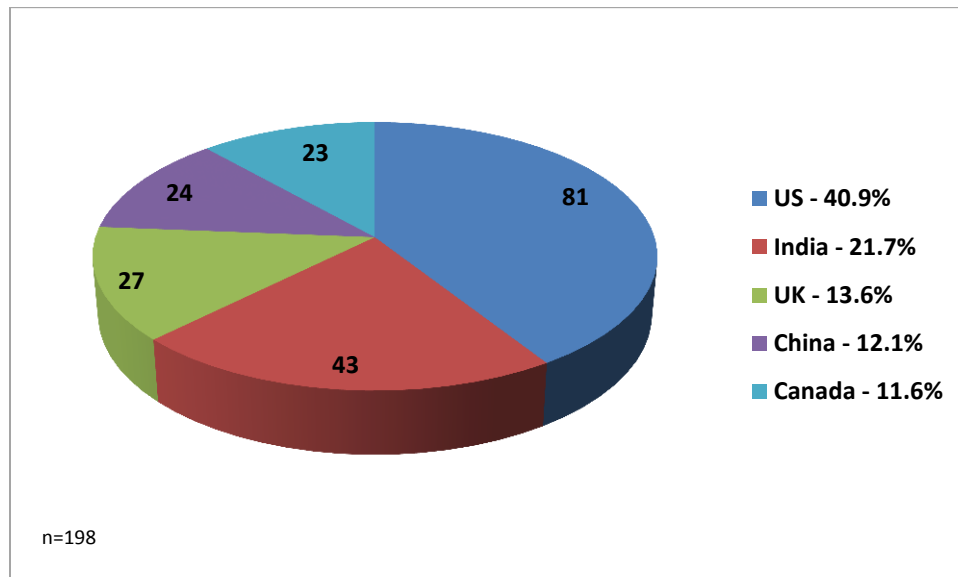
Source: Research Population

Figure 15: Top Five and Other R&D Emerging Region Locations, All Firms
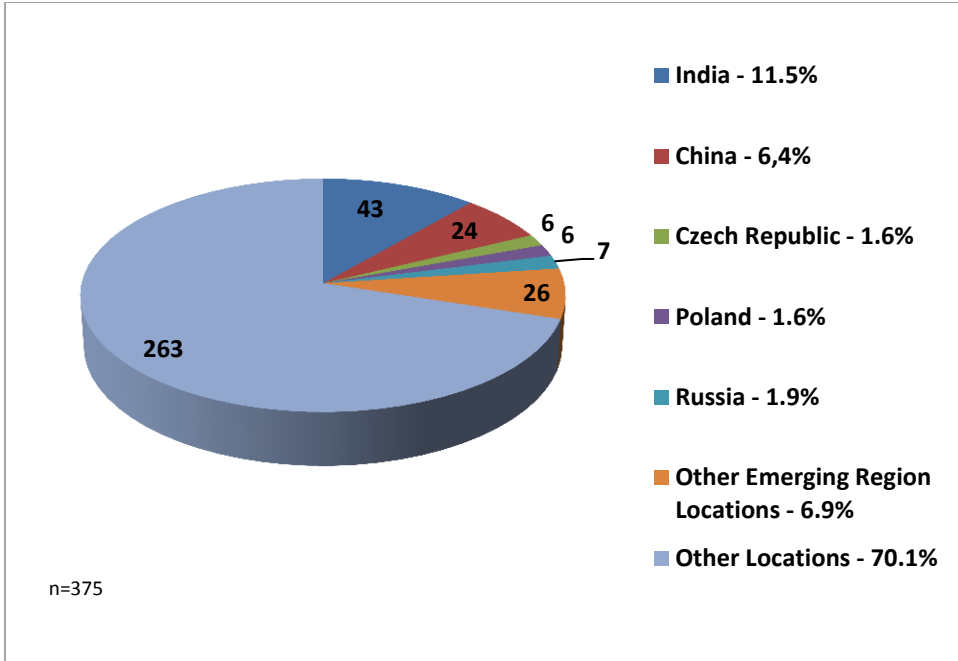
Source: Research Population

Figure 16: Top Five Emerging Region R&D Distribution, Emerging Region Locations
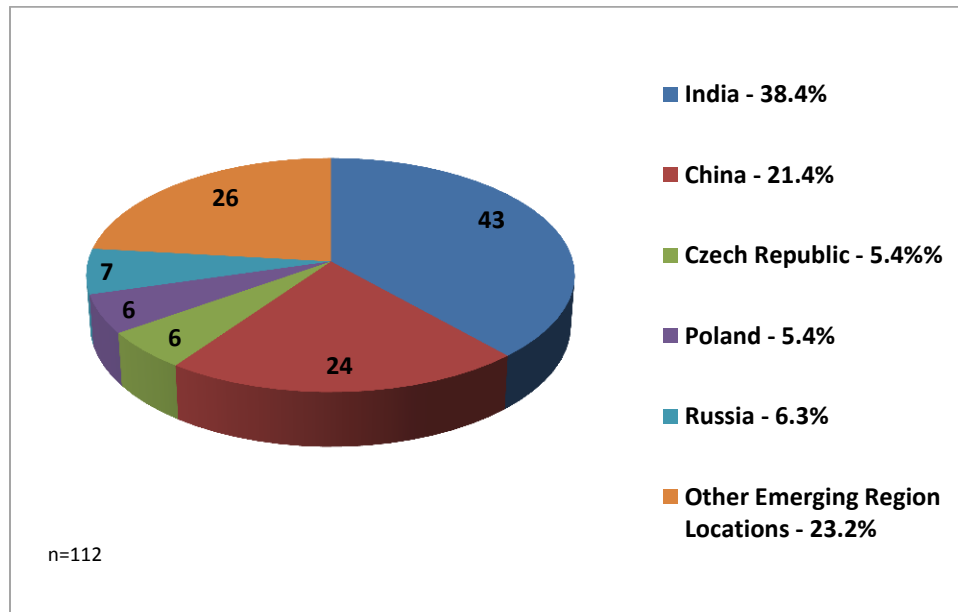
Source: Research Population

Firm Profitability Ratios

Two firm profitability ratios were used in the analysis, R&D expense/revenue,

and net profit margin. The average R&D investment in 2010 for the 64 firms analyzed

was 15.6% as a percentage of sales, slightly higher than previous research[133] but based on

a larger number of firms. Only 34.4% of the firms analyzed exceeded the average R&D

investment. Firms which did not exceed the average were often larger firms, such as

IBM and Microsoft, firms later in the maturity cycle, such as CA Technologies, or firms

which have shifted from a more product-based strategy to services, such as HP. Only

three of the firms with over $1B USD in total software revenues exceeded the average

R&D investment ratio: Adobe, Citrix Systems, and VMware, Inc. These three are

relatively recent market entrants compared with the other large incumbents, which may in

part account for their higher levels of investment.

Profit margins were aggregated and averaged for 66 vendors. Of these, 53% were

over the 2010 firm profit margin average of 9.34%. Just over 57% were firms both

exceeding the average profit margin for the total emerging region firms and the aggregate

emerging region growth rate of 17.7%.

Hypothesis Testing and Outcomes

Summary of Outcomes

The null hypotheses in all seven cases assumed no difference in probability of

outcome. All hypotheses were tested using the 1-sided Fisher's exact test[134] distribution,

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[133] Ibid.
[134] Fisher's exact test is a statistical significance test used in the analysis of contingency tables.
http://en.wikipedia.org/wiki/Fisher's_exact_test

and none of the null hypotheses could be rejected using a 95% significance level. The

alternative hypotheses are summarized in Table 3 below.

Table 3: Summary of Outcomes and Alternative Hypotheses

Hypothesis	95% Confidence Level	Odds Ratio	Alternative Hypothesis
H_0: All Hypotheses - no difference in probability			
Firm Strategy		**Direction**	
H1 - Overall Product Strategy	cannot reject H0	>1. association in direction of Ha	Software firms which develop and market both hardware and software products are less likely to exceed aggregate market growth in emerging regions than vendors who only develop and market software products.
H2 - Software Product Strategy	cannot reject H0	<1. association in direction opposite of Ha	Software firms which develop and market both infrastructure and application software are less likely to exceed aggregate market growth in emerging regions than software firms which only develop and market either infrastructure or application software.
H3 - Channel Strategy	cannot reject H0	>1. association in direction of Ha	Software firms which market and sell through multiple channels are less likely to exceed aggregate market growth in emerging regions than software firms which only offer software through a single sales channel.
H4 - Delivery Model	cannot reject H0	>1. association in direction of Ha	Software firms which develop and market software using a single delivery model are less likely to exceed aggregate market growth rates in emerging regions than software firms which offer software through multiple delivery models
H5 - R&D Emerging Region Locations	cannot reject H0	<1. association in direction opposite of Ha	Software firms which make R&D investments in emerging regions are less likely to exceed aggregate market growth rates in emerging regions than software firms which do not make R&D investments in emerging regions.
Firm Profitability			
H6 - R&D Investments	cannot reject H0	<1. association in direction opposite of Ha	Multi-national software firms with higher than average investments in R&D as a percentage of sales are less likely to exceed aggregate market growth rates in emerging regions.
H7 - Firm Profitability	cannot reject H0	<1. association in direction opposite of Ha	Software firms with higher than average profit margins are less likely to exceed aggregate market growth rates in emerging regions.

The data set for each hypothesis was based upon an analysis of firm data using 102

firms for Hypotheses 1-5, 64 firms for Hypothesis 6, and 66 firms for Hypothesis 7. For

three of the hypotheses (H1: product strategy; H3, channel strategy; and H4, delivery

model strategy), the odds ratio[135] showed the association between the predictor variable and the dependent variable (emerging market growth level) was in the direction hypothesized. The odds ratio for all other results was in the direction opposite of those hypotheses. Test output for all hypotheses is given in Appendix 3.

Results overall may be impacted by factors such as:

- The size of the population, particularly for hypotheses 1, 3, and 4, which exhibited an association in the direction of the alternative hypothesis.

- The lower percentage of firms which actually exceeded growth. The criteria used to select the firms (see Chapter 4, Research Methodology) allowed a wide range of firm size, product and market strategies, R&D location investments, and subsequently profitability ratios. Emerging region growth rates for firms ranged from a low of -73.6% to 311.4% in 2010, with R&D/revenue ratios from 2.35% to 25.36% and profit margins from -25.16% to 33.1%. The relationship of the variables among firms was not analyzed but may reveal other outcomes and is a potential consideration for future research.

- The position of firms within the industry life cycle and technology maturity curve, affecting strategic choices and resulting performance. Results could be confounded by the fact that firm positions in the industry life cycle are not the same.

- The concentration or fragmentation of firms by submarket, and the demand characteristics and adoption potential of product features in emerging regions.

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[135] The odds ratio is a measure of association between and exposure and an outcome, representing the odds that an outcome will occur given a particular exposure compared to the odds of the outcome occurring in the absence of the exposure. http://en.wikipedia.org/wiki/Odds-ratio.

- The potentially more relevant qualitative aspects of firm growth, such as internal resources and capabilities, relationships with emerging market government institutions, or the relative importance of firm vertical market concentration within emerging markets.

Detail Analysis

The Impact of Product Strategy and Go-to-Market Strategies

How do firm-level decisions concerning product and go-to-market strategies impact firm and market growth in emerging regions?

Hypothesis 1:

- H_0: There is no difference in the probability of exceeding aggregate market growth in emerging regions between software firms which develop and market both hardware and software and those that only develop and market software products.

- H_a: Software firms which develop and market both hardware and software products are less likely to exceed aggregate market growth in emerging regions than vendors who only develop and market software products.

In this case, the odds ratio showed the association between the predictor variable and the dependent variable (emerging market growth level) was in the direction hypothesized, with a value of 1.19. This indicates that the odds of firms which develop and market both hardware and software products are less likely to exceed aggregate market growth in emerging regions has a 19% greater probability than vendors who only develop and

market software products. This direction is not unexpected, as the majority of the

software firms developing and marketing both hardware and software had total software

revenues exceeding $1B USD, with lower growth rates relative to the entire population.

These firms also represented a smaller percentage of the total, impacting the outcome.

Firms offering only software represented the majority of the population (87%), comprised

of a wider range of company size and product market focus, with an average growth rate

of 23.7% within emerging regions.

Hypothesis 2:

- H_0: There is no difference in the probability of exceeding market growth in emerging
  regions between software firms which develop and market both infrastructure and
  application software and those that only develop and market either infrastructure or
  application software.

- H_a: Software firms which develop and market both infrastructure and application
  software are less likely to exceed aggregate market growth in emerging regions than
  software firms which only develop and market either infrastructure or application
  software.

For hypothesis 2, the odds ratio showed the association between the predictor variable

and the dependent variable was not in the direction hypothesized, with a value of 0.77.

This indicates that the probability of software firms which develop and market both

infrastructure and application software are less likely to exceed aggregate market growth

in emerging regions is only 77% as likely to occur than firms which only develop and

market software in a single macromarket. Though the results are inconclusive, the

outcomes may be due in part to the importance of infrastructure software in emerging regions (higher share), which, when developed and marketed as a complementary with applications from the same firm, is a more attractive solution for buyers and contributes to higher growth rates. It is interesting to note, however, that nearly 87% of the firms developing and marketing software in a single macromarket were below $500 million in total software revenues, whereas over 74% of the firms providing both applications and infrastructure products were above $500M in total software revenues. This suggests opportunities for further research focused on company size in the context of firm and market dynamics.

Hypothesis 3:

- H_0: There is no difference in the probability of exceeding aggregate market growth in emerging regions between software firms which market and sell through multiple channels and those which market and sell through a single channel.

- H_a: Software firms which market and sell through multiple channels are less likely to exceed aggregate market growth in emerging regions than software firms which only offer software through a single sales channel

The odds ratio for hypothesis 3 showed the association between the predictor variable and the dependent variable was in the direction hypothesized, with a value of 1.54. This indicates that the odds of software firms which market and sell through multiple channels are less likely to exceed aggregate market growth in emerging regions is 54% more likely to occur than firms which only offer software through a single sales channel. Approximately 75% of the firms adopted a multi-channel strategy. The direction is a

somewhat unexpected result, given the importance of indirect channel strategies in

emerging regions, and research which shows that it has become more common for larger

firms to also maintain a direct sales presence in emerging markets.[136] The costs of

maintaining both a direct and indirect sales force, however, can be prohibitive, especially

when emerging region channel partners demand as high as 31% of the deal[137], leaving

firms unable to justify a multi-channel strategy from a business perspective. Results may

also have been confounded by the number of smaller firms with higher growth rates using

a single-channel strategy, where 92% of all single-channel firms had estimated total

software revenues of under $500 million.

The Choice of Delivery Models

Do firm-level decisions on product and solution delivery models impact firm and

market growth in emerging regions?

Hypothesis 4:

- H_0: There is no difference in the probability of exceeding aggregate market growth in

  emerging regions between software firms which develop and market software using a

  single delivery model and those which develop and market through multiple delivery

  models.

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[136] Anavitarte, Luis, Wm. L. Hahn, Tiffani Bova, Federico Da Silva Leon, Lillian M. Alvardo, Samina
Malik, Naveen Mishra, April Adams, Donna Taylor, Fabrizio Biscotti, Yanna Dharmasthira, and Ian
Marriott, "Market Trends: Unveiling IT Trends in Emerging Regions." Gartner, Inc., G00154092,
December 18, 2007.
[137] Kornfield, Dan, "FT beyondbrics Feature – EM distribution: try DIY?".
http://blog.frontierstrategygroup.com/tag/channel-management/, January 24, 2013.

- H$_a$: Software firms which develop and market software using a single delivery model are less likely to exceed aggregate market growth rates in emerging regions than software firms which offer software through multiple delivery models.

The odds ratio for hypothesis 4 also showed the association between the predictor variable and the dependent variable was in the direction hypothesized, with a value of 1.24. This indicates that the odds of software firms which develop and market software using a single delivery model are less likely to exceed aggregate market growth rates in emerging regions is 24% more likely to occur as firms which offer software through multiple delivery models. This direction is not unexpected given the growing buyer demand for cloud services, lower price points which are attractive in emerging regions, digital infrastructure initiatives by governments,[138] and the market opportunity presented by the large emerging markets in Asia. Those firms offering only a single delivery model include both older incumbents, offering only on-premises software, and the SaaS pure-play vendors, the largest of which are based in North America and which need to overcome issues such as localization and the data privacy regulations associated with foreign markets, as well as more-extensive sales coverage challenges. In contrast, vendors offering both delivery models are often the larger, well established firms, with an established international presence, deeper knowledge of local markets, broader sales coverage models, well-established global technology structures, and the investment resource to develop recurring revenue streams. In addition, market consolidation has

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[138] Vasquez, Raphael; Luis Anavitarte, Alfonso Velosa, Derry N. Finkeldey, Cassio Dreyfuss, Tiffani Bova, Anthony Kros, Federico De Silva, Daniel O'Connell, Elia San Miguel, Sharon A. Mertz, Kiyomi Yamada, and Chad Eschinger, "Emerging Market Analysis: IT, Chile, 2010 and Beyond". Gartner, Inc., G0017135, October 16, 2009.

collapsed many of the small-to-medium pure-play SaaS vendors into the structures of the larger firms, increasing the number of vendors capable of providing multiple delivery options.

The Effect of Firm Innovative Activity

How does the degree of firm innovative activity affect the structure and growth of firms and software markets in emerging regions?

Hypothesis 5:

- H_0: There is no difference in the probability of exceeding aggregate market growth in emerging regions between software firms which make R&D investments in emerging regions and those that do not make R&D investments in emerging regions.

- H_a: Software firms which make R&D investments in emerging regions are less likely to exceed aggregate market growth rates in emerging regions

For hypothesis 5, the odds ratio showed the association between the predictor variable and the dependent variable was not in the direction hypothesized, with a value of 0.81. This indicates that the odds of software firms which make R&D investments in emerging regions are less likely to exceed aggregate market growth rates in emerging regions is only 81% as likely to occur as those which do not make R&D investments in emerging regions. Of the original 102 firms, just below 63% (64 firms) made emerging region R&D investments. Of those, half exceeded the aggregate emerging market growth rate. The results are inconclusive, but may have been confounded by company size distribution or maturity of the firm in the life cycle.

The Impact of Firm Profitability

Is the level of firm profitability an indicator of software market growth in emerging regions?

Hypothesis 6:

- H_0: There is no difference in the probability of exceeding aggregate market growth in emerging regions between multinational software firms with higher than average investments in R&D as a percentage of sales and those with lower than average investments in R&D as a percentage of sales.

- H_a: Multinational software firms with higher than average investments in R&D as a percentage of sales are less likely to exceed aggregate market growth rates in emerging regions.

For hypothesis 6, the odds ratio showed the association between the predictor variable and the dependent variable was not in the direction hypothesized, with a value of 0.41. This indicates that the odds of multinational software firms with higher than average investments in R&D as a percentage of sales are less likely to exceed aggregate market growth rates in emerging regions is only 41% as likely to occur as those with lower than average investments as a percentage of sales. Firms which invest in emerging region R&D to optimize costs and meet profitability targets, acquire new talent pools, or achieve benefits of localization expertise may be better positioned to deliver enhanced product portfolios and outperform market growth. Once again, company size may have been a confounding variable given the allocation of investments in the different size bands as defined.

Hypothesis 7:

- H_0: There is no difference in the probability of exceeding aggregate market growth in emerging regions between software firms with higher than average profit margins and those with lower than average profit margins.

- H_a: Software firms with higher than average profit margins are less likely to exceed aggregate market growth rates in emerging regions.

For hypothesis 7, the odds ratio showed the association between the predictor variable and the dependent variable was not in the direction hypothesized, with a value of 0.70. This indicates that the odds of software firms with higher than average profit margins are less likely to exceed aggregate market growth rates in emerging regions is only 70% as likely to occur than those with lower than average profit margins. Over 55% of the firms with profit margins over the average of 9.34% exhibited higher than average emerging market growth. Firms can sustain higher profit margins due to their product strategy, revenue mix, or more-effective operational management. Though statistically inconclusive, results could be confounded due to firm maturity, firm size, or position within the industry and product lifecycle.

Chapter 6 – Case Analysis Summaries and Firm Profiles

Case Analyses

The leading four vendors in the worldwide software markets – Microsoft, IBM, Oracle, and SAP – have been extensively researched by independent research firms, financial analysts, and other prominent market experts. Together these large incumbents comprise the majority of the market share in emerging regions, as well as in the worldwide markets, representing just under 72% of the total software revenues in emerging regions, and 48% at the worldwide level. A summary of each firm in the context of the current research follows.

Microsoft

Microsoft is the world's largest software vendor with estimated software revenues of approximately $54.7 billion worldwide in 2010. Incorporated in 1981, Microsoft has expanded its enterprise software product strategy to include operating systems, database management systems, development tools, IT operations software, collaboration software, and enterprise applications software, along with other peripheral markets. Microsoft conducts business in over 100 countries[139]. It is one of most sound and profitable companies in the technology sector, where the majority of profits are generated by the

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[139] Morningstar Document Research, Microsoft Corp – MSFT, Form 10K. July 28, 2011.

Microsoft Office and the operating system.[140] Its entry into the enterprise business

applications markets has been fairly recent, and has been initiated both through

acquisitions of companies such as Great Plains, as well as in-house development of

offerings such as its Microsoft Dynamics CRM products. Microsoft's go-to-market

strategy is through the indirect channel, where it has a vast network of resellers,

distributors, and systems integrators, many of which provide vertical solutions and

specialized services. The Microsoft customer base has traditionally been small to

medium businesses, but the company has more recently been pursuing deals in larger

enterprises, enabled through capacity and performance enhancements in their

infrastructure and applications products and the underlying hardware platform. Microsoft

has been aggressively pursuing SaaS and Cloud computing opportunities through the

Azure family of platform and database services and a number of application solutions in

the Cloud, as well as through their internet search engine.

Microsoft makes significant investments in R&D, ranging from 12.9%-15.4% of

revenues during the past five years. In 2010, the baseline of the study, these investments

totaled approximately $8.7 billion globally. Microsoft also maintains strong profit

margins, ranging from 24.9% to 33.1% for its fiscal year periods 2006-2011.

IBM

IBM, incorporated in 1911, is the most mature of all firms profiled. IBM claims

its solutions "typically create value by reducing a client's operational costs or by enabling

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[140] MacDonald, Neil, et.al., "Vendor Rating: Microsoft".   Gartner, Inc., G00166708, August 3, 2009.

new capabilities that generate revenue",[141] indicating a focus on the enterprise business buyer. From its beginnings as a computing-tabulating-recording company,[142] IBM has since successfully transitioned through several product strategy evolutions from a focus on mainframe and midrange hardware, to personal computers, then to services and a robust outsourcing business. Currently IBM has placed a growing product emphasis on software, both acquired and as a result of internally funded initiatives. The company has acquired over 100 other firms during the past decade.[143] IBM has a sophisticated sales coverage model which includes an extensive direct global sales force and a large partner ecosystem, operates in 170 countries, and is placing increased emphasis on emerging markets. The firm also makes substantial investments in R&D in multiple global locations, investing approximately $6 billion annually, from which it gains approximately $1 billion in IP income.[144] Profit margins ranged between 10-14% for each year during 2006-2009.

Oracle

Oracle is one of the world's largest software firms and offers an extensive range of infrastructure and application technologies including database management systems, middleware, and applications software. In early 2010, Oracle entered the hardware arena though the acquisition of Sun Microsystems, but the majority of revenues are still derived from software products. Though Oracle invested $4.5 billion in R&D during its fiscal 2011,[145] the company is known to be highly acquisitive, adding to its product portfolio on

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[141] Morningstar Document Research, International Business Machines Corp. – IBM, Form 10K. February 22, 2011.
[142] Ibid.
[143] Ibid.
[144] Ibid.
[145] Morningstar Document Research, Oracle – ORCL, Form 10K. June 28, 2011.

a consistent basis. Oracle has a growing business in both the public and private Cloud, levering its expertise in managed services into a 21st century cloud computing environment. The company began to more actively develop SaaS solutions following its acquisition of Siebel in 2006, as the demand for SaaS increased rapidly and Oracle faced competitive pressures from new market entrants. Oracle has a multi-channel sales strategy with business partners globally through the Oracle Partner Network, but focuses most of its direct sales efforts on large enterprises, and offers vertical-specific solutions in many industries include manufacturing, life sciences, communications, the public sector, transportation and utilities. The company achieved net profit margins of between 23-24% from 2006-2011.

SAP

SAP AG, incorporated in 1972, is based in Walldorf, Germany. The company develops and markets a wide array of infrastructure and application software products globally, also offering vertical-specific solutions supporting 24 industries with business process specific functionality. SAP has historically been well known for its enterprise software suite, developed to support the business computing needs of large global enterprises. More recently, SAP has developed solutions for smaller to mid-range businesses, but is still primarily focused on large accounts with a relationship selling model serviced by a direct sales force. The company has a well-developed partner ecosystem globally, including systems integrators, value-added resellers, and ISVs.

SAP traditionally broadened its product portfolio through both organic growth and small, targeted acquisitions, but began acquiring larger firms with its acquisition of

Business Objects in early 2008, and Sybase in the third quarter of 2010. The company

experienced many painful false starts in developing and delivery SaaS solutions, but is

now beginning to gain traction through the acquisition of SaaS pure-plays, and

deployment of its on-demand suite, Business ByDesign, targeted at smaller firms. SAP

prides itself on its international development facilities, and invested 13.9-14.9% of sales

in R&D for each year through 2006-2010. The company's net profit margins were 14.5%

in 2010, down from 20% in 2006.

Firm Profile Summary

Table 4 provides a summary of these firms, aligned to the seven hypotheses, and

also includes data on growth rates, market share, and some of the key attributes which

distinguish these firms from others in the marketplace. Discussion of the firms in relation

to the seven hypotheses follows.

**Table 4: Firm Profiles, Leading Vendors, Emerging Region Enterprise Software
Markets, 2010**

Strategy & Performance Indicators	Hypothesis	Firms			
		Microsoft	IBM	Oracle	SAP
Hardware & Software Product Strategy	H1	Software	Hardware & Software	Hardware & Software	Software
Software Product Strategy	H2	Infrastructure & Applications	Infrastructure & Applications	Infrastructure & Applications	Infrastructure & Applications
Channel Strategy	H3	Multi-channel	Multi-channel	Multi-channel	Multi-channel
Delivery Models	H4	Multiple	Multiple	Multiple	Multiple
R&D Strategy	H5	Emerging Region Locations	Emerging Region Locations	Emerging Region Locations	Emerging Region Locations
R&D Investment/Sales	H6	13.95%	6.08%	12.13%	13.87%
Profit Margin	H7	6.95%	14.02%	23.99%	14.53%
Aggregate Emerging Market Growth Rate		20.0%	10.8%	23.2%	20.6%
Aggregate Emerging Market Share		31.0%	17.7%	15.3%	7.7%
Key Attributes		- Expertise in channel strategy/channel management	- Leading technology incumbent, established over 100 years ago	- Highly acquisitive, successful growth by acquisition strategy	software vendor with multiple market leadership positions
		- Worldwide leadership and reach in office suites & other technologies	- Broad range of hardware and software technologies and solutions	- Breadth of software solutions due to acquisitions and internal development	-Integrated global enterprise software platform and applications
		- Significant investments in R&D and role-based soultions	- High global R&D investments;multi-year industry leadership in patent production	- Consistently high profit margins due in part to nature of acquisitions	- Expertise in solutions adapted to verticals and microverticals
		- Aggressive development of SaaS & Cloud delivery models and platforms	- Highly developed global sales and marketing organization	-Relationships primarily with mid-higher end market customer base	- Targeted acquisitions enhance product portfolio and expand reach down-market

Source: Author

Hypothesis 1 – Product Strategy, Hardware and Software

Among the four leading firms, IBM and Oracle offer both hardware and software, though Oracle's entry into the hardware market only occurred in January, 2010, with the acquisition of Sun Microsystems. IBM maintains the lowest growth rate among all four, supporting the first set of data comparisons for hypothesis 1 that indicates vendors providing hardware and software are likely to have lower growth rates in emerging regions than firms providing software only. This result is not entirely unexpected, given the size of IBM, but the growth is overshadowed by the other three largest firms which primarily develop and market software products. In addition, IBM has a lower concentration of traditionally higher-performing application offerings than its rivals, reflecting the lower growth rate.

Hypothesis 2 – Product Strategy, Software

All four of the leading firms develop and market both infrastructure and applications software. Microsoft and IBM compete in the largest market, operating systems, though Microsoft is the clear leader with just below 79% of the market share. All firms compete in database management systems, with Oracle leading at 18.6% of the market share, IBM at 9.9%, and Microsoft at 8.1%. SAP has a fractional, but immaterial share of the market. Many opportunities for coopetition exist among these vendors with reseller agreements and a variety of interoperability products, as buyers demand levels of integration for their diverse computing environments.

Hypothesis 3 – Go-to-market (channel) Strategy

All four firms adopt a multi-channel delivery strategy, but revenue allocations between direct and indirect sales can vary widely between firms. Microsoft conducts the majority of its business through the indirect channel, and is the undisputed leader industry-wide for its extensive and well-developed global channel partner program. The firm initiated a partner restructuring program in 2010, consolidating tens of thousands of partners into a more structured and focused channel program, and has positioned it to better prepare for increasing opportunities in the cloud computing arena. IBM, Oracle, and SAP all have robust partner ecosystems, but are more focused on serving the large enterprise buyer, and conduct the majority of their business through a direct sales force. Their sales coverage model is due in part to their product portfolios, consisting of comparatively more-complex, and often vertical specific, industry solutions developed for use by larger firms. The size of the firms enables investment in multichannel sales

strategies within emerging markets, in addition to decades of expertise developed by a direct presence in both mature and emerging economies.

Hypothesis 4 – Choice of Delivery Model

All firms provide multiple delivery models, though SaaS/Cloud product offerings represent different software markets, different architectures, and different levels of development, and depend upon more-specific firm product strategy decisions. Though IBM and Oracle have considerable expertise and business investment in outsourcing and managed services, they are relatively recent entrants in the SaaS arena, gaining a foothold through acquisitions in addition to internal development. Microsoft developed its SaaS offerings internally, then embarked on an aggressive course of marketing and delivering SaaS solutions both directly and through the channel globally. SAP, traditionally focused on the large enterprise and relationship selling, made several attempts at developing and bringing SaaS solutions to the market, before pursuing a strategy of both internal development and acquisition, with varying degrees of success. The top four firms are expected to continue investments in cloud computing environments as technologies evolve, country-level delivery infrastructures improve, and buyers become more familiar with the model, increasing adoption in both mature and emerging economies. International examples include Microsoft, who launched their Microsoft Dynamics CRM Online initiative in January, 2011, supporting 41 languages in 40 countries, and SAP, whose partnership with China Telecom is focused on providing cloud-based services to SAP's Business ByDesign.

Hypothesis 5 – R&D Emerging Region Investment

All four firms have R&D investments in emerging regions, though none exceed the average R&D investment as a percentage of revenue ratio of the overall population. This is due to firm size and R&D investment strategy as evidenced in previous research cited. The large vendors invest in worldwide R&D both organically and through acquisition, and have been more aggressive in growing development facilities in large emerging nations such as the BRIC economies.

Hypothesis 6 – Profitability: R&D/Sales

All four firms show lower than average R&D investment as a percentage of revenues, but are starting from a much larger base. Historically these firms have made substantial investments in research both internally, as described above, and by aligning with academic institutions and other external research organizations. IBM claims leadership for the past 20 years in patent production, with 5,896 patents in 2010.

Hypothesis 7 – Profitability: Profit Margin

Corporate profit margins for the four vendors all readily exceed the 9.34% population average, ranging from a low of 14% (IBM) to a high of 30% (Microsoft). Among the four, only SAP experienced declines in profit margin during the period 2006-2010. All four firms experienced positive double digit software growth in emerging regions emerging regions in 2010.

Chapter 7 – Conclusions, Findings, and Opportunities for Further Research

Conclusions & Findings

The premise of the research linked firm strategic choices regarding products, go-to-market initiatives, R&D location investments, and related profitability metrics to the growth of the firm in emerging regions, subsequently driving software market growth in these geographies. The structure of the analysis accounted for previous scholarly and applied research theories and results, but also included an analysis of a data set based on market share data and other firm-specific publicly available data sources, constructed to inform the hypotheses and research assumptions. Firm strategy and profitability criteria used within the hypothesis structure and analysis were either at a corporate or functional level, whereas further analysis may benefit from finer levels of granularity to examine strategies and performance within primary firm markets, applicability to a specific emerging region or country, or a focus on other elements contributing to firm growth such as a deeper examination of channel strategies or partner networks.

The inferential statistics suggest that:

- The decision on whether to offer complementaries, such as hardware and software, is important to firm product strategy formulation. While not statistically significant, Hypotheses 1 suggests directionally that offering these complementaries are not as likely to contribute to emerging market growth. This also introduces the question of share versus growth as

corporate objectives, as most of the larger firms offering both options enjoy higher share and greater market penetration rates. Smaller, less mature firms in the lifecycle or mid-size firms evaluating product portfolio choices may choose to focus on a single market rather than allocating resources among diversified market options within emerging regions.

- Sales channel strategy is an important determinant in firm emerging market growth. Hypothesis 3 findings indicate a 54% higher probability that firms selling through multiple channels are less likely to exceed aggregate market growth in emerging regions. This implies clear choices for firm decisions on resource allocation and sales coverage models when entering emerging regions.

- Delivery model strategies play an important role in emerging market strategy decisions. Alternative delivery models, such as Cloud and SaaS, present potentially higher future growth opportunities for firms in emerging markets, but also demand that firms inexperienced in this mode of delivery adapt their product architectures, change their sales structure, coverage, and compensation models, and make additional organizational investments. Hypothesis 4 shows the association is in the direction hypothesized, indicating that firms offering only a single delivery model need to revisit their product strategies when pursuing growth opportunities in emerging markets.

Firm size was not a specific focus of the research initiative, but additional analysis conducted to inform the results of the other hypotheses suggests that firm size is an

important subject for additional research in the context of strategy and profitability impacting firm and market growth. Firms are compelled to take different decisions on product strategies and delivery models, channel strategies, and R&D investments depending on size and lifecycle position. These elements could well impact outcomes of the same research focus if firm size were examined in the context of emerging region growth.

Research findings also produced some unanticipated results, such as:

- A lower percentage of firms in the population than expected which actually exceeded emerging market growth. Given the larger number of small and mid-size firms, and the larger number of application providers, a higher percentage of firms exceeding emerging market growth was anticipated. This affected the outcomes but provided new insights on the actual firm and market composition.

- The number of mid-range firms ($100-500M in total software revenues) in the population and their potential impact on the analysis and outcomes. The additional analysis cited above revealed that nearly 68% of firms in this band had both an R&D presence in emerging regions and exceeded the emerging region growth rates, higher than the aggregate population results. This is a further confirmation that a company size focus offers a fruitful area for further research.

- The number of firms offering multiple delivery models, and the impact on analysis outcomes. The broader applied research focus often confines SaaS and Cloud coverage on pure-play SaaS vendors or large infrastructure Cloud

providers, nearly ignoring the mid-market firms which provide an element of both, however small in relation to overall product portfolios and strategies. This suggests an area which has been overlooked by researchers, but also suggests that multiple models are of growing importance for firm strategies and that sufficient demand exists for firms to continue investments in multiple delivery strategies. This also presents opportunities for future research endeavors.

- The number of very large firms (over $1B in total software revenues) which exhibit double-digit growth rates (between 12.5-41.3%) in emerging regions. Of the 21 very large firms, 11 fall into this category. This suggests that the large firms will continue to drive growth in emerging regions. However, considering the size, emerging region presence, and performance of the broader mid-market, it also suggests a strong competitive environment and that firm decisions on strategies and investment in emerging markets will play a larger role in both firm and emerging market growth in the future.

- The lack of statistical significance on any of the hypotheses. This suggests that the granularity of the variables used may be too coarse, or that the real differentiator for firms actually lies in less quantitative elements which are more difficult to capture and measure, such as firm resources and capabilities, competencies from firm organizational learning based on years of experience and tacit knowledge, firm maturity, or firm position in the lifecycle. These aspects also suggest future research directions.

Opportunities for Further Research

Outcomes of the data collection and analysis suggest a wealth of research possibilities that could not be explored within the confines of the current research focus, as well as an evaluation of topics peripheral to the research, but of growing importance to firms within the global enterprise software markets. These include:

- Comparative analysis of indirect channel strategies and partner networks for leading firms within emerging regions in general, or in a specific region or country

- Analysis of firm size in relation to product strategy, go-to-market strategy, and R&D investment, and the impact on growth

- Evaluation of firm strategy, growth, and profitability within the context of firm maturity and primary market lifecycles

- A more granular examination of firm strategy choices and profitability within a specific emerging region or country

- The impact of firm strategies and profitability on demand factors such as adoption rates, technology absorption, and buyer demand within emerging regions

- The impact of increasing returns on more widely adopted technologies and solutions within enterprise software markets in emerging regions/countries, and the effect of open source strategies on firm growth and performance

- Product strategies, firm performance, and the acceleration of 21st century solutions and technologies within emerging regions and their market impact

- A comparison of other knowledge-intensive industries such as biotechnologies using a similar research construct.

Appendices

Appendix 1 -Software Market Definitions

Appendix 1 – Software Market Definitions

All definitions are sourced from "Market Definitions: Software." Gartner: G00209728, December 22, 2010.

Infrastructure Software:

Application Development: The AD software market comprises tools that represent each phase of the software development life cycle (application life cycle management [ALM], design, construction, automated software quality and other AD software).

Application Infrastructure and Middleware: Integration middleware is software that enables independently designed applications, software components or services to work together, by supporting data consistency, composite application and multistep process styles of integration. Gartner defines platform middleware as system software that provides the runtime hosting environment (a container) for application program logic.

Business Intelligence: BI is an umbrella term that includes the applications, infrastructure and tools, and best practices that enable access to and analysis of information to improve and optimize decisions and performance.

Data Integration Tools and Data Quality Tools: The discipline of data integration comprises the practices, architectural techniques and tools for achieving the consistent access and delivery of data across the spectrum of data subject areas and data structure types in the enterprise to meet the data consumption requirements of all applications and business processes. The data quality tool market comprises vendors that offer stand-alone software products for addressing the core functional requirements of the data quality discipline.

Database Management Systems: A DBMS is a product used for the storage and organization of data that typically has defined formats and structures. DBMSs are categorized by their basic structures and, to some extent, by their use or deployment.

IT Operations: IT operations management (ITOM) software is intended to represent all the tools needed to manage the provisioning, capacity, performance and availability of the computing, networking and application environment.

Operating Systems: An OS is software that, after being loaded into the computer by an initial boot program, manages a computer's resources, controlling the flow of information into and from a main processor. OSs perform complex tasks, such as memory management, control of displays and other input/output peripheral devices, networking and file management, and other resource allocation functions between software and system components. The OS provides the foundation on which applications, middleware and other infrastructure components function. An OS usually provides user interfaces, such as command-line shell and GUI, for interaction between user and computer.

Other Infrastructure Software: Other infrastructure software includes, but is not limited to, clustering and remote-control software, directory servers, OS tools, Java license fees, mainframe infrastructure, and mobile and wireless infrastructure, as well as other infrastructure software that is reported in vendors' income statements but is not reported in our Market Share publications.

Storage Management: The storage management software market includes all software products that are sold as value added options to run on a server, storage network device or storage device to aid in managing the device or managing and protecting the data.

Security: This category comprises centrally managed suites of endpoint security products, including antivirus, anti-spyware, personal firewalls and HIPSs. Endpoint protection platform suites are being extended with new capabilities, such as disk file encryption, network access control and data loss prevention.

Virtualization Infrastructure Software: Server virtualization infrastructure includes the hypervisor, VM and virtual machine monitors (VMMs) for the x86 market. The key to "virtualizing" a server is the hypervisor. A hypervisor is a layer of software (the term "software" can mean preloaded software that runs in a protected area or microcode/firmware, depending on the implementation) that runs directly on hardware and allows the definition of fixed partitions with predefined priorities for accessing hardware resources.

Enterprise Applications Software:

Customer Relationship Management: CRM technologies should enable greater customer insight, increased customer access, more-effective customer interactions, and integration throughout all customer channels and back-office enterprise functions. CRM is a business strategy, the outcome of which optimizes profitability, revenue and customer satisfaction by organizing around customer segments, fostering customer-satisfying behaviors and implementing customer-centric processes.

Digital Content Creation: DCC software is used for creating or altering visual digital content. The digital content can either be computer-generated or transformed from analog means, such as photographs or videos.

Enterprise Content Management: ECM suites consist of applications that interoperate but that can also be sold and used separately. Some vendors have added extended technology components, such as digital asset management, for handling rich media, electronic forms and document composition for high-volume generation of customized documents.

Enterprise Resource Planning: ERP is an application strategy focused on several distinct enterprise application suite markets. ERP is typically referred to as a back-office application set, but ERP applications typically automate and support more than

administrative processes and include the support of production and inventory processes, as well as the asset management aspects of an enterprise.

Office Suites: Office productivity suites are generally collections of basic productivity applications for tasks such as word processing, spreadsheet manipulation and presentation graphics. Traditionally, suites such as Microsoft Office, Corel WordPerfect, IBM SmartSuites and OpenOffice.org are fat-client applications that need to have millions of bytes of code installed and maintained on users' PCs.

Other Application Software: Other application software includes, but is not limited to, commerce applications; e-discovery; e-learning; engineering applications; enterprise search; enterprise social software; geographic information systems; governance, risk and compliance; media and entertainment; mobile and wireless applications; PLM; and other application software that is reported in vendors' income statements but is not reported in our Market Share publications.

Product and Portfolio Management: PPM applications support an integrated view across the portfolio of resource effort, including both project and nonproject work. PPM applications also support integrated planning of multiple, dependent projects in programs, with a view of cross-project dependencies, program-level budgets, costs, schedules and resource plans, and with flexible reporting of project and program data. They also allow for logging project problems and issues, as well as analyzing the impact of proposed changes.

Supply Chain Planning: SCP is the forward-looking process of coordinating assets to optimize the delivery of goods, services and information from supplier to customer, balancing supply and demand. An SCP suite sits on top of a transactional system to provide planning, what-if scenario analysis capabilities and real-time demand commitments, considering constraints.

Web Conferencing and Team Collaboration: Web conferencing represents one form of real-time collaboration and consists of real-time electronic meeting and content delivery, desktop and application sharing, text chat, and group document markup with electronic whiteboarding, augmented by audio, data and video, security (encrypted data transfer, password protection), and remote control (a participant can control applications of the desktop of another system). More-advanced features include integrated voice over IP audio, file sharing, videoconferencing, content archiving, media streaming, feedback and polling.

Appendix 2 – **Country Taxonomy**

Advanced Economies [32]	Emerging Markets [54]	Developing Countries [118]	
Australia	Argentina	Aruba	Kosovo
Austria	Bahrain	Afghanistan	Laos
Belgium	Bangladesh	Angola	Liberia
Canada	Botswana	Anguilla	Libya
Cyprus	Brazil	Albania	St Lucia
Denmark	Bulgaria	Andorra	Lesotho
Finland	Chile	Netherlands Antilles	Macau
France	China	Armenia	Moldova
Germany	Colombia	American Samoa	Madagascar
Greece	Cote d Ivoire	Antigua and Barbuda	Maldives
Hong Kong	Croatia	Azerbaijan	Macedonia
Iceland	Czech Republic	Burundi	Mali
Ireland	Ecuador	Benin	Myanmar
Israel	Egypt	Burkina Faso	Montenegro
Italy	Estonia	Bahamas	Mongolia
Japan	Ghana	Bosnia and Herzegovina	Mozambique
Liechtenstein	Hungary	Belarus	Mauritania
Luxembourg	India	Belize	Martinique
Malta	Indonesia	Bermuda	Malawi
Netherlands	Jamaica	Bolivia	Niger
New Zealand	Jordan	Barbados	Nicaragua
Norway	Kazakhstan	Brunei	Nepal
Portugal	Kenya	Bhutan	Papua New Guinea
Singapore	Kuwait	Central African Republic	Puerto Rico
Slovenia	Latvia	Cameroon	North Korea
South Korea	Lebanon	Congo	Paraguay
Spain	Lithuania	Comoros	Reunion
Sweden	Malaysia	Cape Verde	Rwanda
Switzerland	Mauritius	Costa Rica	Sudan
Taiwan	Mexico	Cuba	Senegal
United Kingdom	Morocco	Cayman Islands	Solomon Islands
United States	Namibia	Djibouti	Sierra Leone
	Nigeria	Dominica	El Salvador
	Oman	Dominican Republic	Somalia
	Pakistan	Democratic Republic of the Congo	Serbia
	Panama	Algeria	Sao Tome and Principe
	Peru	Eritrea	Suriname
	Philippines	Ethiopia	Swaziland
	Poland	Fiji	Seychelles
	Qatar	Micronesia	Syria
	Romania	Gabon	Chad
	Russia	Georgia	Togo
	Saudi Arabia	Guinea	Tajikistan
	Slovakia	Gambia	Turkmenistan
	South Africa	Guinea-Bissau	East Timor
	Sri Lanka	Equatorial Guinea	Tonga
	Thailand	Grenada	Tuvalu
	Trinidad and Tobago	Guatemala	Tanzania
	Tunisia	French Guiana	Uganda
	Turkey	Guam	Uruguay
	Ukraine	Guyana	Uzbekistan
	United Arab Emirates	Honduras	St Vincent and the Grenadines
	Venezuela	Haiti	US Virgin Islands
	Vietnam	Iran	Vanuatu
		Iraq	Palestinian Authority
		Kyrgyzstan	Samoa
		Cambodia	Yemen
		Kiribati	Zambia
		St Kitts and Nevis	Zimbabwe

Source: Gartner, October, 2011

Appendix 3 – Hypothesis Testing: Output

Hypothesis 1
H0: No difference in probability of exceeding aggregate market growth in emerging regions
between SW firms which develop and market both hardware and software and those that only
develop and market software products
Ha: Software firms which develop and market both hardware and software products are less likely
to exceed aggregate market growth in emerging regions

The FREQ Procedure

Frequency	Table of develop by Growth_level			
Percent		Growth_level		
Row Pct				
Col Pct	develop	Under	xOver	Total
	HW_and_SW	7	6	13
		6.86	5.88	12.75
		53.85	46.15	
		13.73	11.76	
	SW_Only	44	45	89
		43.14	44.12	87.25
		49.44	50.56	
		86.27	88.24	
	Total	51	51	102
		50.00	50.00	100.00

Statistics for Table of develop by Growth_level

Statistic	DF	Value	Prob
Chi-Square	1	0.0882	0.7665
Likelihood Ratio Chi-Square	1	0.0882	0.7664
Continuity Adj. Chi-Square	1	0.0000	1.0000
Mantel-Haenszel Chi-Square	1	0.0873	0.7676
Phi Coefficient		0.0294	.
Contingency Coefficient		0.0294	
Cramer's V		0.0294	

Fisher's Exact Test	
Cell (1,1) Frequency (F)	7
Left-sided Pr <= F	0.7229
Right-sided Pr >= F	0.5000
Table Probability (P)	0.2229
Two-sided Pr <= P	1.0000

Estimates of the Relative Risk (Row1/Row2)			
Type of Study	Value	95% Confidence Limits	
Case-Control (Odds Ratio)	1.1932	0.3715	3.8326
Cohort (Col1 Risk)	1.0892	0.6313	1.8791
Cohort (Col2 Risk)	0.9128	0.4900	1.7004

Sample Size = 102

Hypothesis 2

H0: No difference in probability of exceeding aggregate market growth in emerging regions
between SW firms which develop and market both infrastructure and application software and those
that only develop and market either infrastructure or application software
Ha: Software firms which develop and market both infrastructure and application software are less
likely
to exceed aggregate market growth in emerging regions

The FREQ Procedure

Frequency Percent Row Pct Col Pct	Table of develop by Growth_level		
		Growth_level	
develop	Under	xOver	Total
Both	16	19	35
	15.69	18.63	34.31
	45.71	54.29	
	31.37	37.25	
Single_Macromkt	35	32	67
	34.31	31.37	65.69
	52.24	47.76	
	68.63	62.75	
Total	51	51	102
	50.00	50.00	100.00

Statistics for Table of develop by Growth_level

Statistic	DF	Value	Prob
Chi-Square	1	0.3915	0.5315
Likelihood Ratio Chi-Square	1	0.3918	0.5313
Continuity Adj. Chi-Square	1	0.1740	0.6766
Mantel-Haenszel Chi-Square	1	0.3876	0.5335
Phi Coefficient		-0.0620	
Contingency Coefficient		0.0618	
Cramer's V		-0.0620	

Fisher's Exact Test	
Cell (1,1) Frequency (F)	16
Left-sided Pr <= F	0.3385
Right-sided Pr >= F	0.7978
Table Probability (P)	0.1363
Two-sided Pr <= P	0.6769

Estimates of the Relative Risk (Row1/Row2)			
Type of Study	Value	95% Confidence Limits	
Case-Control (Odds Ratio)	0.7699	0.3392	1.7478

Cohort (Col1 Risk)	0.8751	0.5707	1.3419
Cohort (Col2 Risk)	1.1366	0.7666	1.6853

Sample Size = 102

Hypothesis 3
H0: No difference in probability of exceeding aggregate market growth in emerging regions
between SW firms which market and sell through mulitple channels and those which market
and sell through a single channel
Ha: Software firms which market and sell through mulitple channels are less likely
to exceed aggregate market growth in emerging regions

The FREQ Procedure

Frequency / Percent / Row Pct / Col Pct	Table of channel by Growth_level		
		Growth_level	
channel	Under	xOver	Total
Multi_Channel	39	38	77
	38.24	37.25	75.49
	50.65	49.35	
	79.59	71.70	
Single_Channe	10	15	25
	9.80	14.71	24.51
	40.00	60.00	
	20.41	28.30	
Total	49	53	102
	48.04	51.96	100.00

Statistics for Table of channel by Growth_level

Statistic	DF	Value	Prob
Chi-Square	1	0.8574	0.3545
Likelihood Ratio Chi-Square	1	0.8629	0.3529
Continuity Adj. Chi-Square	1	0.4839	0.4867
Mantel-Haenszel Chi-Square	1	0.8490	0.3568
Phi Coefficient		0.0917	
Contingency Coefficient		0.0913	
Cramer's V		0.0917	

Fisher's Exact Test	
Cell (1,1) Frequency (F)	39
Left-sided Pr <= F	0.8765
Right-sided Pr >= F	0.2439
Table Probability (P)	0.1203
Two-sided Pr <= P	0.3695

Estimates of the Relative Risk (Row1/Row2)			
Type of Study	Value	95% Confidence Limits	
Case-Control (Odds Ratio)	1.5395	0.6157	3.8492
Cohort (Col1 Risk)	1.2662	0.7466	2.1476

Cohort (Col2 Risk)	0.8225	0.5558	1.2172

Sample Size = 102

Hypothesis 4

H0: No difference in probability of exceeding aggregate market growth in emerging regions between SW firms which develop and market software using a single delivery model and those which develop and market through multiple delivery models

Ha: Software firms which develop and market software using a single delivery model are less likely to exceed aggregate market growth in emerging regions

The FREQ Procedure

Frequency Percent Row Pct Col Pct	Table of delivery by Growth_level		
	delivery	Growth_level		
		Under	xOver	Total
	Multiple_Models	33	28	61
		32.35	27.45	59.80
		54.10	45.90	
		62.26	57.14	
	Single_Model	20	21	41
		19.61	20.59	40.20
		48.78	51.22	
		37.74	42.86	
	Total	53	49	102
		51.96	48.04	100.00

Statistics for Table of delivery by Growth_level

Statistic	DF	Value	Prob
Chi-Square	1	0.2778	0.5982
Likelihood Ratio Chi-Square	1	0.2778	0.5982
Continuity Adj. Chi-Square	1	0.1056	0.7452
Mantel-Haenszel Chi-Square	1	0.2751	0.6000
Phi Coefficient		0.0522	
Contingency Coefficient		0.0521	
Cramer's V		0.0522	

Fisher's Exact Test	
Cell (1,1) Frequency (F)	33
Left-sided Pr <= F	0.7670
Right-sided Pr >= F	0.3725
Table Probability (P)	0.1396
Two-sided Pr <= P	0.6872

Estimates of the Relative Risk (Row1/Row2)			
Type of Study	Value	95% Confidence Limits	
Case-Control (Odds Ratio)	1.2375	0.5600	2.7345
Cohort (Col1 Risk)	1.1090	0.7511	1.6374

| Cohort (Col2 Risk) | 0.8962 | 0.5982 | 1.3427 |

Sample Size = 102

Hypothesis 5

H0: No difference in probability of exceeding aggregate market growth in emerging regions between SW firms which make R&D investments in emerging regions and those that do not make R&D investments in emerging regions

Ha: Software firms which make R&D investments in emerging regions are less likely to exceed aggregate market growth in emerging regions

The FREQ Procedure

Frequency Percent Row Pct Col Pct	Table of R_and_D_in_ER by Growth_level			
		Growth_level		
	R_and_D_in_ER	Under	xOver	Total
	R&D_in_ER	32	32	64
		31.37	31.37	62.75
		50.00	50.00	
		60.38	65.31	
	R&D_not_in_ER	21	17	38
		20.59	16.67	37.25
		55.26	44.74	
		39.62	34.69	
	Total	53	49	102
		51.96	48.04	100.00

Statistics for Table of R_and_D_in_ER by Growth_level

Statistic	DF	Value	Prob
Chi-Square	1	0.2646	0.6070
Likelihood Ratio Chi-Square	1	0.2649	0.6068
Continuity Adj. Chi-Square	1	0.0958	0.7570
Mantel-Haenszel Chi-Square	1	0.2620	0.6087
Phi Coefficient		-0.0509	
Contingency Coefficient		0.0509	
Cramer's V		-0.0509	

Fisher's Exact Test	
Cell (1,1) Frequency (F)	32
Left-sided Pr <= F	0.3789
Right-sided Pr >= F	0.7638
Table Probability (P)	0.1427
Two-sided Pr <= P	0.6837

Estimates of the Relative Risk (Row1/Row2)			
Type of Study	Value	95% Confidence Limits	
Case-Control (Odds Ratio)	0.8095	0.3617	1.8117
Cohort (Col1 Risk)	0.9048	0.6208	1.3186

| Cohort (Col2 Risk) | 1.1176 | 0.7270 | 1.7181 |

Sample Size = 102

Hypothesis 6

H0: No difference in probability of exceeding aggregate market growth in emerging regions between multinational SW firms with higher than average investments in R&D as a percentage of sales and those with lower than average investiments in R&D as a percentage of sales

Ha: Multinational software firms with higher than average investments in R&D as a percentage of sales are less likely to exceed aggregate market growth in emerging regions

The FREQ Procedure

Frequency Percent Row Pct Col Pct	Table of R_and_D_sample_avg by Growth_level			
		Growth_level		
	R_and_D_sample_avg	Under	xOver	Total
	R&D_over_sample_avg	6	16	22
		9.38	25.00	34.38
		27.27	72.73	
		23.08	42.11	
	R&D_under_sample_av	20	22	42
		31.25	34.38	65.63
		47.62	52.38	
		76.92	57.89	
	Total	26	38	64
		40.63	59.38	100.00

Statistics for Table of R_and_D_sample_avg by Growth_level

Statistic	DF	Value	Prob
Chi-Square	1	2.4778	0.1155
Likelihood Ratio Chi-Square	1	2.5485	0.1104
Continuity Adj. Chi-Square	1	1.7061	0.1915
Mantel-Haenszel Chi-Square	1	2.4391	0.1183
Phi Coefficient		-0.1968	
Contingency Coefficient		0.1931	
Cramer's V		-0.1968	

Fisher's Exact Test	
Cell (1,1) Frequency (F)	6
Left-sided Pr <= F	0.0948
Right-sided Pr >= F	0.9689
Table Probability (P)	0.0637
Two-sided Pr <= P	0.1800

Estimates of the Relative Risk (Row1/Row2)			
Type of Study	Value	95% Confidence Limits	
Case-Control (Odds Ratio)	0.4125	0.1350	1.2601
Cohort (Col1 Risk)	0.5727	0.2699	1.2155

Cohort (Col2 Risk)	1.3884	0.9443	2.0415

Sample Size = 64

Hypothesis 7

H0: No difference in probability of exceeding aggregate market growth in emerging regions between SW firms with higher than average profit margins and those with lower than average profit margins

Ha: Software firms with higher than profit margins are less likely to exceed aggregate market growth in emerging regions

The FREQ Procedure

Frequency Percent Row Pct Col Pct	Table of Profit_margin_sample_avg by Growth_level			
		Growth_level		
	Profit_margin_sample_avg	Under	xOver	Total
	Profit_Margin_over_sample_avg	16	20	36
		24.24	30.30	54.55
		44.44	55.56	
		50.00	58.82	
	Profit_Margin_under_sample_avg	16	14	30
		24.24	21.21	45.45
		53.33	46.67	
		50.00	41.18	
	Total	32	34	66
		48.48	51.52	100.00

Statistics for Table of Profit_margin_sample_avg by Growth_level

Statistic	DF	Value	Prob
Chi-Square	1	0.5176	0.4718
Likelihood Ratio Chi-Square	1	0.5182	0.4716
Continuity Adj. Chi-Square	1	0.2229	0.6368
Mantel-Haenszel Chi-Square	1	0.5098	0.4752
Phi Coefficient		-0.0886	
Contingency Coefficient		0.0882	
Cramer's V		-0.0886	

Fisher's Exact Test	
Cell (1,1) Frequency (F)	16
Left-sided Pr <= F	0.3185
Right-sided Pr >= F	0.8331
Table Probability (P)	0.1517
Two-sided Pr <= P	0.6213

Estimates of the Relative Risk (Row1/Row2)		
Type of Study	Value	95% Confidence Limits
Case-Control (Odds Ratio)	0.7000	0.2646	1.8520
Cohort (Col1 Risk)	0.8333	0.5078	1.3676

| Cohort (Col2 Risk) | 1.1905 | 0.7356 | 1.9265 |

Sample Size = 66

Appendix 4 –List of Companies by Size

Appendix 4 –List of Companies by Size

Firms by Company Size, Total Software Revenues Worldwide, 2010					
Total Population					
> $1B USD	**>$500M - $1B USD**	**>$100M-$500M USD**		**>$50M - $100M USD**	**<$50M USD**
Number of Firms: 21	**Number of Firms: 13**	**Number of Firms: 42**		**Number of Firms: 11**	**Number of Firms: 15**
Microsoft	Software AG	Totvs	Cegedim (TDV)	Basware	KingSoft
IBM	Google Inc	Progress Software	Cegid	IBS AB	DST Systems
Oracle	Autonomy	Avid Technology, Inc.	Axway	FalconStor	Pervasive Software
SAP	Teradata	Sybase	Deltek	Saba Software	Hubwoo
Symantec	Open Text	Micro Focus International	Pegasystems	Unica	Magic Software
EMC	Red Hat	JDA Software	Taleo	Descartes Systems Group	Magix
CA Technologies	Novell	Unit4	ATG	EasyLink Services Corporation	SciQuest
HP	Compuware	MicroStrategy	F-Secure	Technology One	Update
Adobe	Amdocs	Fico	IFS	Accelrys	Intershop
VMware, Inc.	Quest	Websense	NetSuite	Aldata	Broadvision
Apple	TIBCO	Nuance	SuccessFactors	Callidus	Tecsys
Fujitsu	Informatica	Pitney Bowes	QAD		Chordiant
BMC Software	Lawson Software	Blue Coat	Kingdee		Ramco Systems
McAfee		Concur Technologies	Kenexa		Barloworld Supply Chain Software
Sage		Epicor	SolarWinds		American Software
Salesforce.com		CommVault Systems	CDC Software		
Citrix Systems		NetScout Systems	RightNow Technologies		
NetApp		Ariba	Manhattan Associates		
Cisco		Iron Mountain	Brocade		
Hitachi		Blackbaud	Actuate		
Trend Micro		Check Point Software Technologies	OPNET		

Glossary of Terms

Glossary of Terms

AD - Application Development

AIM - Application Infrastructure and Middleware

BI – Business Intelligence

CRM – Customer Relationship Management

DCC – Digital Content Creation

DI/DQ – Data Integration and Data Quality Tools

DBMS – Database Management Systems

ECM – Enterprise Content Management

ERP – Enterprise Resource Planning

Expat – "expatriots" (professionals from the parent company who are sent abroad on an assignment as opposed to hiring local staff)

GDP – Gross Domestic Product

IaaS – Infrastructure as a Service

IP – Intellectual Property

ITOM – IT Operations Management

M&A – Merger and Acquisition

MNE – Multi National Enterprise

PaaS – Platform as a Service

PPM – Product and Portfolio Management

PPP – Purchasing Power Parity

R&D – Research and Development

SaaS – Software as a Service

SCM – Supply Chain Planning

TRIPS – Trade-related Aspects of Intellectual Property Rights

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