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Task Environment and Resource Deployment: Their Impact on the Performance of Telecommunications Firms in Asia-Pacific Countries

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This research combines both the positioning school and the Resource-Based View models in an analysis of telecommunications firms operating in Asia-Pacific countries. From a strategic management viewpoint, it provides an analysis of the task environment as an external factor, as well as changes in resource deployment as internal factors, to these firms. Thereafter, it examines the influence of a task environment, which has experienced enormous changes resulting from market deregulation and rapid technological advancement, and resource deployment on firm performance. Our findings support the notion that changes in task environment, which correspond to a decrease in market concentration and an increase in task ambiguity lead to a lower profitability rate among firms. In addition, this study also indicates that a firm's ability to respond to changes in the task environment is reflected in changes in resource deployment. Finally, a considerable change in resource deployment is also associated with a higher level of performance. Notably, this study offers some insights on issues of heterogeneity among firms within the telecommunications industry, suggesting that they are uniquely different in term of their objectives and strategic resources.
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Introduction and Objectives of the Study

The conceptual idea for this research originates from the increasing importance of transformation in the telecommunications industry, coupled with the argument in the strategy literature on the relative influence of industry forces

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and firm factors on overall performance. The industry and firm effect issues fall on the boundary of the industrial organization (IO) or positioning school and strategic management fields. The idea from the positioning school is that industry structure is the central determinant of firm performance and, in the field of strategy, strategic management scholars argue that a firm's profitability depends on the resources and distinctive capabilities of each firm relative to its rivals, rather than to industry forces.[1]

This research combines both the positioning school and the Resource-Based View (RBV) in a strategic analysis of the telecommunications industry. Preceding studies[2] of the telecommunications industry, covering such topics as privatization of incumbents and market liberalization issues, have been addressed primarily by economic scholars and aimed largely at other economists and policymakers. However, this research tries to examine the most significant forces in the industry from a strategic management approach which aims at broader audiences — including strategic planning scholars — to provide a deeper understanding of performance determinants in telecommunications firms.

The telecommunications industry in the Asia-Pacific region has undergone significant changes in its structure and has transformed from a monopolized market to a competitive environment. At the same time, it has recorded significant development and a higher growth rate compared to those in other regions. Among other factors that have resulted in the industry transition and the significant growth of telecommunications services, changes in market regulation and technological development accompanied by growth in consumer demand are common themes in each country in the Asia-Pacific region. The net effect of deregulation policy and technological development have led to a decrease in market concentration and an increase of task ambiguity in the telecommunications industry under study.

The main objectives of this study are, first of all, to provide an in-depth analysis of the task environment and its impact on changes in resource deployment and performance, and second, to investigate the influence of changes in resource deployment on the performance of telecommunications firms in Asia-Pacific countries. Figure 1 shows the research framework of this study, which takes three main concepts into consideration: task environment, resource deployment and performance. It further examines relationships between task environment and performance, as well as the relationship between task environment and changes in resource deployment, and finally the relationship between changes in resource deployment and performance across two types of firm, incumbents and entrants. Incumbents are those state-owned firms which monopolized the market until the era of deregulation policy, while entrants are newcomers entering the industry after the liberalization of the telecommunications market.

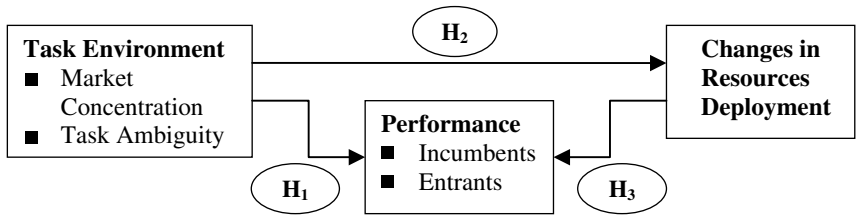

Figure 1 Research framework.

Our analysis focuses on the changes in task environment influenced by the interaction between PEST factors and industry forces. We then incorporate the internal environment, which includes factors inside firms, such as resource deployment, to explain intra-industry performance heterogeneity in the case of the telecommunications industry in Asia-Pacific countries.

The subsequent section offers the definition of constructs and their relationships.

Literature Review and Theoretical Background

Theoretically, a firm's performance depends jointly on internal factors, such as core resources and strategies, coupled with external factors such as industry-wide forces or the market structure in which it competes. This is consistent with the theory of the Structure-Conduct-Performance (SCP) model, which states that industry structure drives a firm's conduct and, in turn, performance. The thrust of any external factors analysis is to identify the most significant forces outside the firm which influence its conduct and performance (Fahey and Narayanan, 1986).

Basically, firms and their task environment are linked together within the context of the macro-environment. In this study, macro-environmental forces are also seen as having a direct influence on firm performance through their impact on task environment. In the case of telecommunications, there are three significant macro-environmental forces — deregulation policy, technological changes and growth in consumer demand — which fall in the Political, Economic, Socio-cultural and Technology (PEST) analysis.

The dynamic changes in the telecommunications industry call for a clear explanation of mechanisms, or how liberalization policies, technological change and rapid consumer demand have affected industry performance. Apparently, these exogenous factors deriving from PEST analysis affect the changes in industry forces and in turn create concentration and market

uncertainty. In the early stages of telecommunications, regulatory and large technological scale made it difficult for new firms to enter the industry. Conversely, changes in technology and market deregulation have reduced market concentration and led to higher competition. From the viewpoint of an industry, we can consider the extent to which uncertainty exists with regard to accompanying technologies used in producing and operating the telecommunications services in understanding the concept of task ambiguity.

Porter (1980) illustrates the Five Forces framework for industry analysis, which consists of the threat of new entrants, the bargaining power of buyers, the bargaining power of suppliers, the threat of substitutes and the intensity of rivalry or industry competitors. His framework is used for the identification of key forces affecting performance and the determination of how changes in industry environment may affect firm performance. However, the Five Forces framework pays little attention to macro-environmental factors such as changing consumer demand, government policy and technology innovation. Most importantly, the model is also qualitative and the analysis of industry structure may suggest that buyer power or the threat of new entry is either high or low, but does not show how to estimate and quantify each force.

In the context of the telecommunications industry, regulatory and technological factors have been the most influential forces and have resulted in turbulent changes in market concentration and task ambiguity. In view of the evolution of increased competition and government intervention in the technologically driven telecommunications industry, a sounder approach to defining the relevant industry forces could provide a better understanding of the mechanism of how the task environment might affect changes in resource deployment and performance. In this study, we attempt to illustrate how market deregulation and rapid technological advancement of telecommunications products and services influence the concentration of market and task ambiguity in understanding the overall climate in the industry.

Butler and Carney (1986) developed a conceptual framework of market concentration and task ambiguity, which is used to illustrate the British telecommunications industry. They argue that a firm's strategy should take into account both task ambiguity and the concentration of the market. In other words, strategy should be matched to environmental conditions as defined by task ambiguity and market concentration. From the viewpoint of industry, Butler and Carney (1986) considered task ambiguity as the lack of clarity or ambiguity of the end/means relationship in the knowledge of producing goods and services, whereas a highly concentrated market is when the output of an industry is concentrated in the hands of a monopoly firm. This conceptual framework may be applied to an industry or to a specific firm environment and be particularly suitable for the analysis of highly regulated and technology-oriented industries.

Diverging from the conventional definition of market concentration, which only focuses on competitor concentration, this study includes the most significant industry-wide forces of the telecommunications market, adapting both Butler and Carney's concept, and Porter's five forces framework of industry analysis. We specifically emphasize three main variables of market concentration — competitor concentration, buying power and complementary products — which are viewed as the most influential industry forces resulting from changes in deregulation policy and technological innovation. Hence, the conceptual definition of market concentration in this study focuses on the most influential industry forces or specific task environment for telecommunications firms, which not only emphasizes competitor concentration, but also takes other forces into consideration, such as buying power and complementary products.

Furthermore, since the telecommunications industry is characterized as highly capital-intensive and technologically oriented, firms would do better to think of themselves as 'complementor' and competitor, as it would seem more reasonable to increase the size of the pie rather than compete over the slices. This parallels the concepts of 'Co-opetition'.[3] In the realm of telecommunications, competitive and cooperative elements coexist with regard to the convergence industry between telecommunications and other Information Technology (IT) products. Therefore, it is important to include the contribution of complementary products from other emerging sub-sectors in analyzing the competitive environment in the telecommunications industry. In this research, we incorporate the influences of other sub-sectors, which have strong linkages with the telecommunications industry, such as the internet and personal computer sectors.

Despite the market deregulation factor, technological changes have also been an important contributing factor to changes in task ambiguity or market uncertainty in the telecommunications industry. Task ambiguity can also be influenced by the development of communications system technology from the specialized group of R&D-intensive equipment manufacturers, such as Nokia, Lucent, Fujitsu, etc. In addition, an increase in demand for capacity from both incumbents and new entrants has stimulated the process of technical change, which also could lead to higher task ambiguity. In part, how firms respond and adapt to new technology through strategic investment could also determine the degree of task ambiguity.

Furthermore, an analysis of each component of the competitive environment leads inevitably to the evaluation of a firm's behavior and intrinsic resources. As Shaw (2000, 2001) has pointed out, in the changing landscape of telecommunications, where firms are characterized as capital-intensive and technologically oriented, it is important to examine each firm's critical resources, such as available capital, labor, technology, R&D and productive

capabilities, since each of these resources is directly linked to the firm's profitability.

Teece *et al.* (1997) developed an integrative approach called 'dynamic capabilities'. Their approach focuses on specific ways in which capabilities are renewed as responses to changes in environmental forces. While the industry forces are built upon the assumption that five forces determine industry competition and potential rent generation, there should also be a reciprocal relationship between internal factors to the firms and their performance outcomes. In this context, the analysis of environmental forces could be seen as 'opportunities & threats' components in a conventional analysis Strengths, Weaknesses, Opportunities and Threats (SWOT), while resource deployment reflects some aspects of 'strengths and weaknesses', or the internal factors of the firms.

For the concept of firm performance, there are numerous indicators often used to measure performance, but relatively little agreement about which indicator is best for an accurate measurement of firm performance. In the end, there is no single measure of performance without flaws, so multiple approaches can be extremely useful in the actual strategic performance analysis. The task environment may have a direct impact on performance or can even have an impact on changes in resource deployment or firms' strategic response.

Key Concepts Construct and Their Relationships

The focal point of our analysis was on changes in the task environment, which includes the market concentration and task ambiguity dimensions of the telecommunications industry. In short, from the standpoint of strategic management, following the main idea of SCP model, we examined the direct influence of the task environment, as derived from the interaction between PEST factors and industry forces in the external environment, on firm performance in the telecommunications industry. Complementary to the analysis of external factors, to provide some aspect of internal factors to the firms we incorporated RBV theory, which is path-dependent in explaining their performance heterogeneity.

In this study, task environment is viewed as the most influential force in the telecommunications industry. It is conceptualized as having two dimensions — market concentration and task ambiguity. *Market concentration* includes the most significant forces of the telecommunications industry, with particular emphasis on the number of competitors, buyer power and products, or services complementary to telecommunications, such as computers and the internet. *Task ambiguity* refers to the degree of uncertainty in the market environment

resulting from rapid changes in telecommunications technology and convergence issues with other communication-related sectors. Measuring task ambiguity or market uncertainty is not an easy task, especially with the pace of technological innovation in telecommunications. Therefore, variables were assigned in this study reflecting the reality of the telecommunications industry in addition to key issues affecting market uncertainty. We have attempted to operationalize task ambiguity concepts by employing variables such as telecom investment, based on the argument that a higher level of telecom investment indicates a firm's strategic response to market uncertainty, thus lowering task ambiguity. Further, the research also employs variables such as the privatization effect and the level of telecommunications technology in each case.

As mentioned earlier, changes in task environment may affect a firm's behavior and accumulation of resources. A firm's *resource deployment* reflects its ability to respond effectively to changes in external forces. In the case of telecommunications, which are capital-intensive and technology-oriented, the evolution of core resources internal to the firm is crucial in examining their ability to respond to changes in the task environment. This research analyzes a firm's critical resources and employs variables such as changes in capital expenditures, employment structure and strategic assets, since each of these resources are linked to the firm's prospective growth and profitability.

For the analysis of performance, we have employed three measures of a firm's performance, namely growth, profitability and efficiency. These indicators are often used in the performance analysis of telecommunications operators, reflecting telecom revenue, net income and firm's operating efficiency. We aimed to examine the influences of the task environment on changes in resource deployment and performance outcomes across two groups of firms, incumbents and new entrants, in the telecommunications industry in relevant countries.[4]

Hypothesized relationships

H_1: Increased competition resulting from a decrease in market concentration and an increase in task ambiguity will lead to lower profitability rates for both incumbents and entrants competing within the same industry.

H_2: A firm's ability to respond to changes in the task environment will be reflected in changes in resource deployment. Thus, increased changes in task environment dimensions, market concentration and task ambiguity will lead to increased changes in resource deployment.

H_3: Increased changes in resource deployment reflect the greater ability of a firm to respond to changes in the task environment and in turn will lead

to higher level of performance. Thus, a higher accumulation of resources will lead to a higher level of performance.

Empirical Analysis

For the analysis of the task environment, we performed a calculation of the index for market concentration (INDEXMC) and task ambiguity (INDEXTA). Prior to calculating the index, we consider the variables that determine INDEXMC and INDEXTA. The section on Indexation of task environment contains a detailed description of the indexation procedures.

Key concepts, variables, data set constructs, and standardized indicators

Our selection of constructs reflects key concepts and the reality of the telecommunications industry, considering inputs provided by industry experts with regard to the specific nature of telecommunications. As shown in Table 1, proxies for our variables are derived from the most significant environmental forces, as already stated: deregulation policy, technology and economic factors. The key concept of this study, the task environment, is divided into market concentration and task ambiguity.

Proxies for market concentration consist of buyer power, competitor concentration and complementary products. Task ambiguity indicators include the privatization effect, telecom investment and level of digital technology. Indicators of task environment variables consider 15 Asia-Pacific countries for the period 1991–2000. As for resource deployment, variables consist of changes in capital intensity, intrinsic assets and total employment. For a firm's performance, the research employs growth, efficiency and profitability measures of performance. Indicators of resource deployment and performance consist of 38 telecommunications firms (16 incumbents and 22 entrants) for the period 1993–2000 in the relevant Asian countries.

Indexations of task environment

In order to determine whether market concentration and task ambiguity are high or low, first we have to calculate the INDEX for market concentration (INDEXMC) and task ambiguity (INDEXTA), adapting the methodology of Wagner *et al.* (2002). We employed indexation of indicators for the following reasons.

First, we sought to identify the most significant forces causing change in the environment of the telecommunications market. For each key concept, there is more than one variable representing them, for example, market concentration,

Table 1 Key concepts, variables, and standardized indicators

Concepts	*Variables*	*Standardized indicators*	*Denotes*	*Source*
Task environment factors	Number of competitors	Number of service providers per million population	C1, SERPROV	Data file of Asia-Pacific Telecommunication (CIT, various issues)
Market concentration	Liberalization effect	Dummy after (before) first new entrant (one for after liberalization and 0 for before liberalization)	C2	
Competitor concentration	Effect from emerging competition treat	Dummy for new entrants (0,1)	C3	
Buyer concentration	GDP	Per capita income constant price (US$)	B1, PCAPI	International Financial Statistics (IFS) (IMF, 2001)
	GDP growth rate	GDP growth rate	B2	
Complementary Products	Internet subscribers	Internet users per 100 population (ITU estimates)	S1, INTUS	Yearbook of Statistics: Telecommunication Services (ITU, 2001)
	PC owner	Personal computers per 100 population (ITU estimates)	S2, PC	
	Main line availability	Main line penetration rate (per 100 inhabitants)	S3	
Task ambiguity	Privatizations effect	Dummy after (before) privatizations (one for after privatizations and 0 for before privatizations)	TA1	Data file of Asia-Pacific Telecommunications (CIT, various issues)
	Telecom investment	Telecom investment to telecom revenue	TA2, TELEINV	
	Level of technology	Percentage of digital network	TA3	

Table 1 Continued

Concepts	*Variables*	*Standardized indicators*	*Denotes*	*Source*
Resource deployment	Employment	Number of employees (persons)	EMP	Data file of Asia-Pacific Telecommunications (CIT, various issues) and various company reports
		Growth rate of number of employees (% from previous year)	GEMP	
	Assets	Assets (million US$)	ASS	
		Growth rate of assets (% from previous year)	GASS	
	Capital expenditure	Capital expenditure (million US$)	CAPEX	
		Growth rate of capital expenditure (% from previous year)	GCAPEX	
Firm performance				
Growth	Telecom revenue	Telecom revenue growth	REVG	Data file of Asia-Pacific Telecommunications (CIT, various issues) and various company reports
Profitability	Net profit	Profit margin (ratio of net profit to telecom revenue)	PROMAR	
Efficiency	Revenue to no. of employees		REVTEM	
	Revenue to asset		REVTASS	

which covers competitor concentration, buyer power and complementary products. Second, preceding studies had shown developments of indices that aim to assess and aggregate certain indicators to represent one concept or construct. Leading examples are *The Global Competitiveness Report* and *The World Competitiveness Yearbook*. These reports cover about 50 countries worldwide. For instance, one aspect of the report, the assessment of telecommunications competitiveness, employed such measures as the cost of three-minute telephone calls to the US, number of fixed telephone lines *per capita* (fixed-lined teledensity), number of internet hosts *per capita* (internet teledensity), etc. Another example is the index development conducted by the *Center for Telemedia Strategy* (1998, 1999 and 2000), which aimed to assess the national telecommunications competitiveness of Asia-Pacific countries.

Indexation of each indicator representing market concentration

Before calculating the INDEX for market concentration and task ambiguity, we had to consider the concepts and variables determining them. As mentioned in the previous section, the determination of market concentration is based on three main variables; competitor concentration (C), buyer power (B) and complementary product availability (S).

As shown in Table 1, there is more than one indicator representing each concept. We therefore also have to index them. Although we did not separate task ambiguity into sub-sections, there are various indicators to determine INDEXTA, and accurate weights have to be accorded.

In assigning weights, we considered the significance of each force, taking into account the reality in the telecommunications market, which was driven by deregulation policies and rapid technological change. For example, in calculating the competitor concentration index (INDEXC), we assigned a weight of two for the number of competitors, since deregulation led to a direct effect on competitor concentration through changes in the number of competitors. We further assigned one for each of the other indicators of competitor concentration, due to the effect of market deregulation on the two factors being lesser, compared to the indicator of number of competitors. The given weights for the calculation of each index are defined in the following section.

We begin with the procedures to calculate INDEXMC as follows:

Competitor concentration (C): INDEXC: Starting with the index for competitor concentration (INDEXC), assuming that it will be calculated for k different individual indicators (in the context of this paper, $k = 3$):

Let, therefore, the indicator k, describing competitor concentration for case i (in our case, a specific total of $n = 150$ cases, 15 Asian Countries over a 10-year period of analysis), be C_i^k. Based on this, the mean value for this variable is

identified over the whole set of countries

$$Mean\ C^k = E(C_i^k | i \in 1, 2, \ldots, n) \tag{1}$$

Subsequently, for each case, a new variable, which is the score given to each case, SC_i^k is defined according to the following equation:

$$SC_i^k = [C_i^k - Mean\ C^k]/Mean\ C^k \tag{2}$$

The value taken by this ratio ranges from a negative to a positive value. We then transform the negative value into a positive value by finding out the minimum value for SC^k, and subtract it from SC_i^k, to get a positive score PSC_i^k for each indicator.

$$SC_{\min}^k = min_i(SC_i^k | i \in 1, 2, \ldots, n) \tag{3}$$

$$PSC_i^k = SC_i^k - SC_{\min}^k \tag{4}$$

Prior to calculating the index of competitor concentration (*INDEX C*) for each case, it is necessary to adjust the contribution PSC^k for heterogeneities in the individual variables. Otherwise, some variables are mistakenly given a much higher weight than others. In order to adjust for differences in the skew of distributions, adjustment factors are calculated according to the following equation:

$$Adj\ C^k = \mathrm{Max}_{j=1..k}[Median(PSC^k)]_j / PSC^k \geq 1 \tag{5}$$

For the calculation of INDEXC, the PSC_i^k for each case i is then multiplied with the corresponding $AdjC^k$, and the intended weight (wC^k), which is shown as follows:

$$wC^k = \left\{ \begin{array}{l} 2 \text{ for } wC^1, \text{ or } k = 1 \\ 1 \text{ for } wC^1, \text{ or } k = 1 \\ 1 \text{ for } wC^1, \text{ or } k = 1 \end{array} \right\} \tag{6}$$

Finally, the INDEXC is calculated for each case according to Equation (7).

$$INDEXC_i = \left[\sum_{i=1}^{k} PSC_i^k\ Adj\ C^k\ wC^k \right] \Big/ \left[\sum_{i=1}^{k} Adj\ C^k\ wC^k \right] \tag{7}$$

Buyer Power (B): *INDEXB*: We then proceed to calculate the index for buyer power (*INDEX* B_i), following the same process used for calculating *INDEX* C_i. However, since the number of indicators for each index and weight varies, we assume that the index for buyer power will be calculated for m different individual indicators (in the context of this paper, $m = 2$). The weights given in

calculating the $INDEX\,B_i$ are as follows:

$$wB^m = \begin{cases} 1 \text{ for } wB^1, \text{ or } m = 1 \\ 2 \text{ for } wB^2, \text{ or } m = 2 \end{cases} \quad (8)$$

For buyer power, we argue that growth rate of GDP, which represents the economic growth of a country, is more important in estimating the rise of consumer demand than the GDP itself, which represents the size of the economy. We therefore assign 1 and 2 for GDP and its growth rate, respectively.

Complementary product availability (S): INDEXS: We can also calculate the index for complementary product availability ($INDEX\,S_i$) by following the same process used to calculate $INDEX\,C_i$. The index for complementary product availability is calculated for p different individual indicators (in the context of this paper, $p = 3$). The weights given in calculating the $INDEX\,S_i$ are as follows:

$$wS^p = \begin{cases} 1 \text{ for } wS^1, \text{ or } p = 1 \\ 2 \text{ for } wS^2, \text{or } p = 2 \\ 5 \text{ for } wS^3, \text{ or } p = 3 \end{cases} \quad (9)$$

In assigning weight for complementary products in mobile telecommunications services, we give 1, 2 and 5 for internet users per 100 population, personal computers (PC) per 100 population and mainline penetration rate, respectively. The weight of five for mainline penetration is due to its strong linkage with mobile communications services, where, in most countries under study, it is argued that the two are complementary to each other. Note that higher weight is given to PC per 100 population as compared to internet users per 100 population, since the number of PC owners directly reflects an increase in IT users, whereas, for instance, one can access the internet without owning a PC, since an increasing number of internet or cyber cafés, IT facilities, etc, exist.

Indexation of market concentration (INDEXMC) and task ambiguity (INDEXTA)

Now, let MC_i^q represent the indicator q describing market concentration for case i for $q = 1,\ldots,q$. In the context of this paper, $q = 3$, which are competitor concentration, buyer power, and complementary product availability. Therefore, we derive:

$$MC_i^q = \begin{cases} INDEX\ C_i \text{ for } q = 1 \\ INDEX\ B_i \text{ for } q = 2 \\ INDEX\ S_i \text{ for } q = 3 \end{cases} \quad (10)$$

Then, the index for market concentration ($INDEXMC_i$) can be calculated following the procedures from Equations (5)–(7), without the necessity of assigning a score to MC_i^q. We give the same weight to competitor concentration, buyer power, and complementary product availability ($wMC^q = 1$).

Finally, the index for task ambiguity ($INDEXTA_i$) can also be calculated by following the procedures from Equations (1)–(7). In the context of this study, let TA_i^r represent the indicator r, describing task ambiguity for case i for $r = 1,\ldots,r$; and that $r = 3$. Note that the weight -3 is assigned to telecom investment (TA^2), based on the argument that the higher the telecom investment value, the lower the task ambiguity. For the privatization effect and level of technology, TA^1 and TA^3, respectively, we assign two and one. Accordingly, weights are given as follows:

$$wTA^r = \begin{cases} 2 & \text{for } TA^1, \text{ or } r = 1 \\ -3 & \text{for } TA^2, \text{ or } r = 2 \\ 1 & \text{for } TA^3, \text{ or } r = 3 \end{cases} \tag{11}$$

In order to determine whether market concentration and task ambiguity are high or low, we calculated the mean values of $INDEXMC$ and $INDEXTA$ and used them as the cut-off points.

The indexes of market concentration ($INDEXMC$) and task ambiguity ($INDEXTA$) are presented in the upper parts of Tables 2 and 3, respectively. In addition, the classification of market concentration and task ambiguity into higher and lower levels are presented in the bottom parts of Tables 2 and 3, respectively.

In Table 2, the higher values of the market concentration index ($INDEXMC$) represent lower market concentration (higher competition). In some countries, market concentrations are considered to be lower or higher throughout the whole period, while in others, market concentrations vary. For example, in the case of Malaysia, the liberalization process started in 1993, which resulted in an increasing number of players; consequently, market concentration became low. Following the Asian Crisis, the acquisition of weaker telecommunications firms by an incumbent took place, which once more resulted in higher market concentration.

In Table 3, the higher value of the task ambiguity index ($INDEXTA$) represents higher task ambiguity. We note that task ambiguity is high throughout almost the whole period in countries with more developed economies (eg Australia, Hong Kong, New Zealand, Japan and Singapore). At the same time, in developing countries, task ambiguity rose after the introduction of new technological developments, for example, the introduction of second-generation (2G) digital mobile technology by the mid-1990s in most developing Asian countries.

Table 2 Indexation of market concentration *(INDEX MC)*

Index for market concentration (INDEX MC)										
Country	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*	*2000*
Australia	1.57	1.59	1.6	1.65	1.7	1.74	1.8	2.06	1.67	1.91
China	n.a.	n.a.	0.28	0.28	0.31	0.28	0.2	0.23	0.92	0.93
Hong Kong	2.22	2.19	3.1	3.08	4.3	5.08	5.13	5.21	1.3	1.43
India	n.a.	0.24	0.29	0.3	0.34	0.37	0.3	n.a.	0.22	n.a.
Indonesia	n.a.	n.a.	n.a.	0.38	0.33	0.2	0.23	0.26	0.35	0.42
Japan	1.1	1.21	1.25	1.26	1.28	1.41	1.43	1.53	1.63	1.76
Korea	0.58	0.63	0.73	0.75	0.92	0.84	0.94	0.98	1.29	1.62
Malaysia	n.a.	0.78	1.47	1.43	1.4	1.29	1.33	1.05	0.84	0.95
New Zealand	n.a.	0.97	0.99	1.06	1.11	1.17	1.24	1.34	0.93	1.08
Pakistan	n.a.	n.a.	n.a.	n.a.	0.25	0.27	0.19	0.21	0.15	0.23
Philippines	n.a.	n.a.	n.a.	0.44	0.43	0.5	0.49	0.55	1.28	1.27
Singapore	1.63	1.6	1.6	1.64	2.39	2.56	2.54	3.37	1.55	1.72
Taiwan	0.62	0.65	0.75	0.94	1.36	1.64	1.64	1.79	1.11	1.23
Thailand	0.4	0.53	0.51	0.57	0.53	0.58	0.58	0.58	0.28	0.4
Vietnam	n.a.	n.a.	n.a.	n.a.	n.a.	0.34	n.a.	n.a.	n.a.	n.a.

Mean = 1.17

Classification of market concentration

Australia	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low
China	High	High	High	High	High	High	High	High	High	High
Hong Kong	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low
India	High	High	High	High	High	High	High	High	High	High
Indonesia	High	High	High	High	High	High	High	High	High	High
Japan	High	Low	Low	Low	Low	Low	Low	Low	Low	Low
Korea	High	High	High	High	High	High	High	High	Low	Low
Malaysia	High	High	Low	Low	Low	Low	Low	High	High	High
New Zealand	High	High	High	High	High	High	Low	Low	High	High
Pakistan	High	High	High	High	High	High	High	High	High	High
Philippines	High	High	High	High	High	High	High	High	Low	Low
Singapore	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low
Taiwan	High	High	High	High	Low	Low	Low	Low	High	Low
Thailand	High	High	High	High	High	High	High	High	High	High
Vietnam	High	High	High	High	High	High	High	High	High	High

The relationship between task environment and firm performance

In order to observe the relationship between the task environment dimensions and a firm's performance, we begin by classifying *INDEX MC* and *INDEX TA* as high or low, as described in the previous section.

Further, we have calculated the mean values of the performance indicators classified by types of firm (Incumbents *vs* Entrants) and indicators for task

Table 3 Indexation of task ambiguity (INDEX TA)

Index for task ambiguity (INDEX TA) *Country*	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*	*2000*
Australia	−0.14	−0.08	0.11	0.15	0.11	0.11	0.37	0.48	0.44	0.43
China	−0.43	−0.55	−0.87	−0.72	−0.4	−0.19	−0.05	−0.04	0.01	−0.03
Hong Kong	0.18	0.14	0.33	0.3	0.22	0.15	0.44	0.41	0.52	n.a.
India	n.a.	n.a.	−0.43	−0.39	−0.36	−0.08	−0.03	0.03	−0.1	n.a.
Indonesia	−0.21	−0.42	−0.29	0.02	−0.16	−0.32	0.1	0.24	0.52	0.36
Japan	−0.16	−0.14	−0.11	0.07	0.06	0.05	0.33	0.36	0.41	0.41
Korea	−0.34	−0.25	−0.21	−0.21	−0.18	−0.18	0.01	0.2	0.18	0.26
Malaysia	−0.16	−0.27	−0.2	−0.42	−0.22	−0.13	0.02	0.19	0.4	0.45
New Zealand	0.04	0.09	0.28	0.29	0.25	0.22	0.5	0.51	0.53	0.56
Pakistan	−0.24	−0.15	−0.37	−0.4	−0.08	0.03	0.34	0.41	0.45	0.44
Philippines	−0.3	−0.35	−0.26	−0.45	−0.49	−0.63	−0.23	0.02	0.21	0.18
Singapore	−0.28	0.19	0.22	0.28	0.28	0.31	0.43	0.47	0.49	0.49
Taiwan	−0.46	−0.25	−0.15	−0.03	0.01	0.01	0.4	0.34	0.29	−0.29
Thailand	−0.14	0.01	−0.09	−0.4	−0.15	−0.28	−0.1	0.4	0.41	0.41
Vietnam	n.a.	−1.12	n.a.	n.a.	n.a.	n.a.	0.12	0.18	0.19	n.a.

Mean = 0.02

Classification of task ambiguity

Australia	Low	Low	High	High	High	High	High	High	High	High
China	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low
Hong Kong	High	High	High	High	High	High	High	High	High	High
India	Low	Low	Low	Low	Low	Low	Low	High	High	High
Indonesia	Low	Low	Low	Low	Low	Low	High	High	High	High
Japan	Low	Low	Low	High	High	High	High	High	High	High
Korea	Low	Low	Low	Low	Low	Low	Low	High	High	High
Malaysia	Low	Low	Low	Low	Low	Low	Low	High	High	High
New Zealand	High	High	High	High	High	High	High	High	High	High
Pakistan	Low	Low	Low	Low	Low	High	High	High	High	High
Philippines	Low	Low	Low	Low	Low	Low	Low	Low	High	High
Singapore	Low	High	High	High	High	High	High	High	High	High
Taiwan	Low	Low	Low	Low	Low	Low	High	High	High	Low
Thailand	Low	Low	Low	Low	Low	Low	Low	High	High	High
Vietnam	Low	Low	Low	Low	Low	Low	High	High	High	High

environment (high or low *INDEX MC* and *INDEX TA*). The performance indicators used in the analysis are telecom revenue growth (*REVG*), profit margin (*PROMAR*), telecom revenue to number of employees (*REVTEM*), and telecom revenue to assets (*REVTASS*). The reason for doing this is to compare the mean value of the performance indicators to the high and low task environment indicators.

Market concentration index and firm performance. From the upper part of Table 4, comparing both types of firm, it seems that incumbents have higher growth and profit margins when market concentration is high (low competition), while entrants have higher growth and profit margins when market concentration is low (high competition).

Table 4 Mean values of performance indicators classified by type of firm and task environment indicators

Indicator of industry factor	*Type of firm*	*Classification of industry factor indicators*		*Performance indicators*			
				REVG	*PROMAR*	*REVTEM*	*REVTASS*
INDEX MC	Incumbents	Low	Mean	10.32%	13.83%	30.95%	75.32%
			N	35	38	37	24
		High	Mean	12.52%	22.70%	17.83%	59.62%
			N	48	52	53	26
		Total	Mean	11.59%	18.96%	23.22%	67.16%
			N	83	90	90	50
		Low	Mean	121.05%	6.65%	104.69%	65.56%
			N	48	51	36	29
	Entrants	High	Mean	40.13%	2.35%	11.28%	69.62%
			N	46	53	35	67.22%
		Total	Mean	81.45%	4.46%	58.64%	20
			N	94	104	71	49
		Low	Mean	74.35%	9.72%	67.32%	69.98%
			N	83	89	73	53
	Total	High	Mean	26.03%	12.43%	15.22%	63.97%
			N	94	105	88	46
		Total	Mean	48.69%	11.19%	38.84%	67.19%
			N	177	194	161	99
		Low	Mean	12.92%	24.05%	19.98%	61.61%
			N	37	40	45	13
INDEX TA	Incumbents	High	Mean	11.36%	15.19%	26.13%	69.10%
			N	47	51	47	37
		Total	Mean	12.05%	19.08%	23.12%	67.16%
			N	84	91	92	50
		Low	Mean	44.91%	11.86%	31.90%	81.91%
			N	35	39	32	10
	Entrants	High	Mean	23.60%	1.74%	77.08%	66.08%
			N	59	65	41	37
		Total	Mean	31.54%	5.54%	57.27%	69.45%
			N	94	104	73	47
		Low	Mean	28.47%	18.03%	24.93%	70.44%
			N	72	79	77	23
	Total	High	Mean	18.18%	7.65%	49.87%	67.59%
			N	106	116	88	74
		Total	Mean	22.34%	11.86%	38.23%	68.26%
			N	178	195	165	97

As for efficiency, both incumbents and entrants seem to perform at a higher level when there is more competition. Interestingly, entrants have remarkably higher efficiency (revenue to total employment) compared to incumbents. A decrease in market concentration is significantly related to higher efficiency in both incumbents and entrants. Our interpretation is that in the face of intense competition, both incumbents and entrants need to ensure their survival by increasing both productivity and operating efficiency.

To support our argument, we have further analyzed the relationship between a firm's performance and each indicator of market concentration. For example, the number of service providers per million population, *per capita* income, internet users per 100 population and PCs per 100 population.[5]

Furthermore, as shown in Table 4, the compare means analysis shows that a decrease in market concentration is associated with a decrease in revenue growth and profitability in incumbents, but an increase of revenue growth and profitability in entrants.

From Figure 2(b), we note that the effect of a decline in market concentration is a greater decline in profitability for incumbents as compared to entrants. This could be due to the fact that as government-owned firms, incumbents are not flexible in strategic decision-making because of their complex structure and legacy technology. Most importantly, as state-owned firms, they also have a social obligation to remain balanced between industry advocacy and pursuing individual business objectives in order to ensure industry growth and survival.

In addition, we have also performed a box-plot for different levels of market concentration and task ambiguity against the non-categorized firms' performance indicators, as shown in Figures 2 and 3.

Task ambiguity index and firm performance. The lower part of Table 4 shows the compare means analysis. Figure 3(a)–(c) show the box-plot for different levels of task ambiguity against non-categorized firms' performance indicators. It seems that revenue growths and profit margins of both incumbents and entrants decrease as task ambiguity increases, while both incumbents and entrants gain efficiency as task ambiguity increases. In general, entrants seem to have higher revenue growth, and revenue-to-employment is high compared to incumbents. Our interpretation is that the existence of financial support from capital markets for entrants to set up their initial investment of the latest infrastructure and communication network has allowed them to acquire the latest technology from equipment manufacturers like Lucent, Nokia, Alcatel, NEC and Fujitsu; and that, in turn, has led to lower technological barriers for new entrants. Therefore, compared to incumbents, new entrants were able to

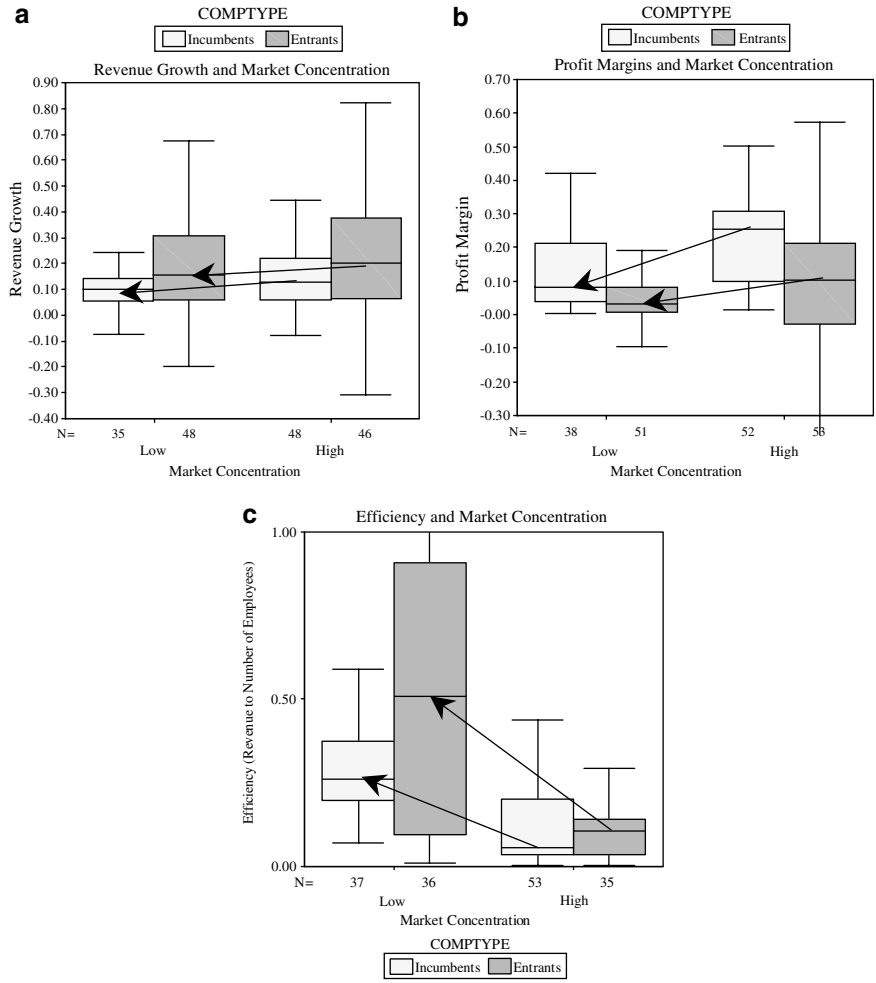

Figure 2 Performance *vs* market concentration. (a) Revenue growth and market concentration, (b) profit margins and market concentration and (c) efficiency and market concentration.

take advantage of the latest technology in telecommunications equipment and construct entirely new networks based on that new technology, hence minimizing their uncertainty or technological ambiguity.

To summarize, the analysis of the relationship between both market concentration and task ambiguity with incumbents and entrants' performance points to some distinct characteristics. Notably, the mean values of revenue

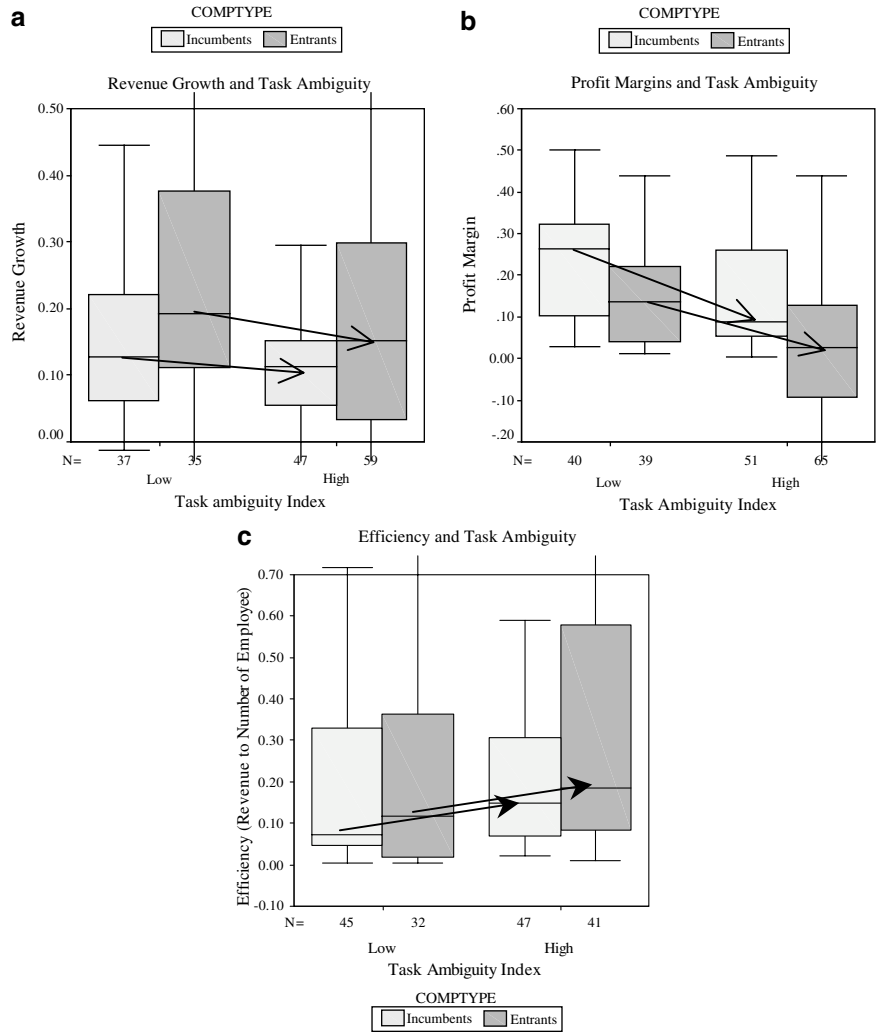

Figure 3 Task ambiguity *vs* performance. (a) Revenue growth and task ambiguity, (b) profit margins and task ambiguity, (c) efficiency and task ambiguity.

growth and revenue to total employment are higher for entrants than incumbents. On the other hand, the mean values of profit margins for incumbents are higher than those of entrants. The mean values of revenue to total assets are quite similar for both groups.

The relationships between task environment and resources deployment

We have performed the box-plot of the non-categorized firms' resource deployment indicators with the categorized market concentration and task ambiguity index. The non-categorized firms' resource deployment indicators are the growth rates of employment,[6] growth rates of assets, and growth rates of capital expenditure.[7]

The results of the analysis between market concentration and changes in resource deployment and those of the analysis between task ambiguity and changes in resource deployment are shown in Figure 3(a)–(d). The results can be summarized as follows:

First, entrants seem to have more significant overall changes in resource deployment compared to incumbents. Second, both incumbents and entrants seem to react to a decline in market concentration by increasing their resource deployment growth rate. Finally, both incumbents and entrants further seem to react to an increase in task ambiguity by reducing their resource deployment growth rates. The final section offers detailed interpretations of these findings.

The relationship between resource deployment and firm performance

First, we start by classifying the different indicators for resource deployment into low, moderate, and high. Due to the skewed nature of the data set, we performed a K-means cluster analysis, starting by classifying the performance variables into 10 clusters, then dividing them into three clusters at appropriate points. We classify the indicators by giving thresholds for cut-off points as follows:

For employment, the thresholds are 20,000 and 50,000 persons. The thresholds for assets are 5 billion US$ and 20 billion US$. The thresholds for capital expenditures are 1 billion US$ and 2.5 billion US$.

$$EMPhl_i = \begin{cases} \text{high; } EMP_i \geq 50,000 \\ \text{moderate; } 20,000 \leq EMP_i < 50,000 \\ \text{low; } EMP_i < 20,000 \end{cases} \tag{12}$$

$$ASSThl_i = \begin{cases} \text{high; } ASST_i \geq 20,000 \\ \text{moderate; } 5,000 \leq ASST_i < 20,000 \\ \text{low; } ASST_i < 5,000 \end{cases} \tag{13}$$

$$CAPEXhl_i = \begin{cases} \text{high; } CAPEX_i \geq 2,500 \\ \text{moderate; } 1,000 \leq CAPEX_i < 2,500 \\ \text{low; } CAPEX_i < 1,000 \end{cases} \tag{14}$$

Finally, we performed a box-plot for each different level of a firm's resource deployment against non-categorized performance indicators (Figure 4).

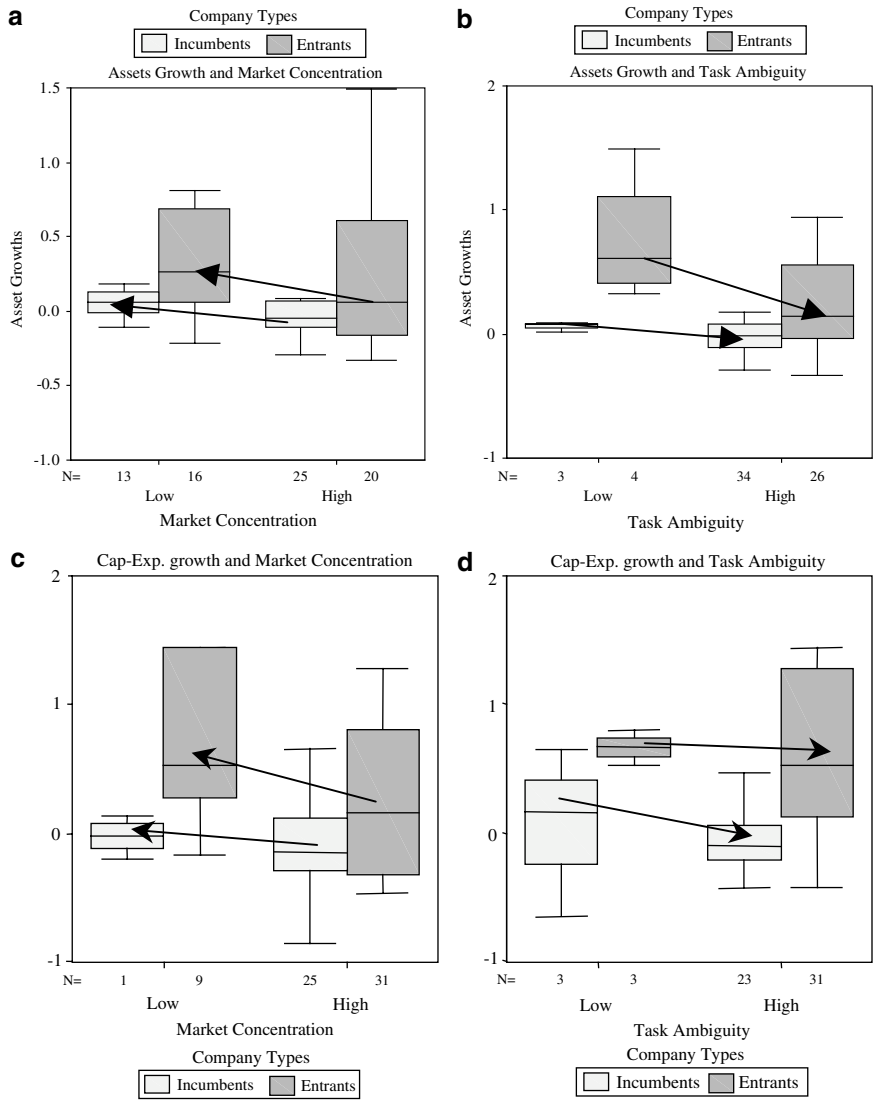

Figure 4 Task environment and changes in resource deployment. (a) Assets growth and market concentration, (b) assets growth and task ambiguity, (c) Cap-Exp. growth and market concentration and (d) Cap-Exp. growth and task ambiguity.

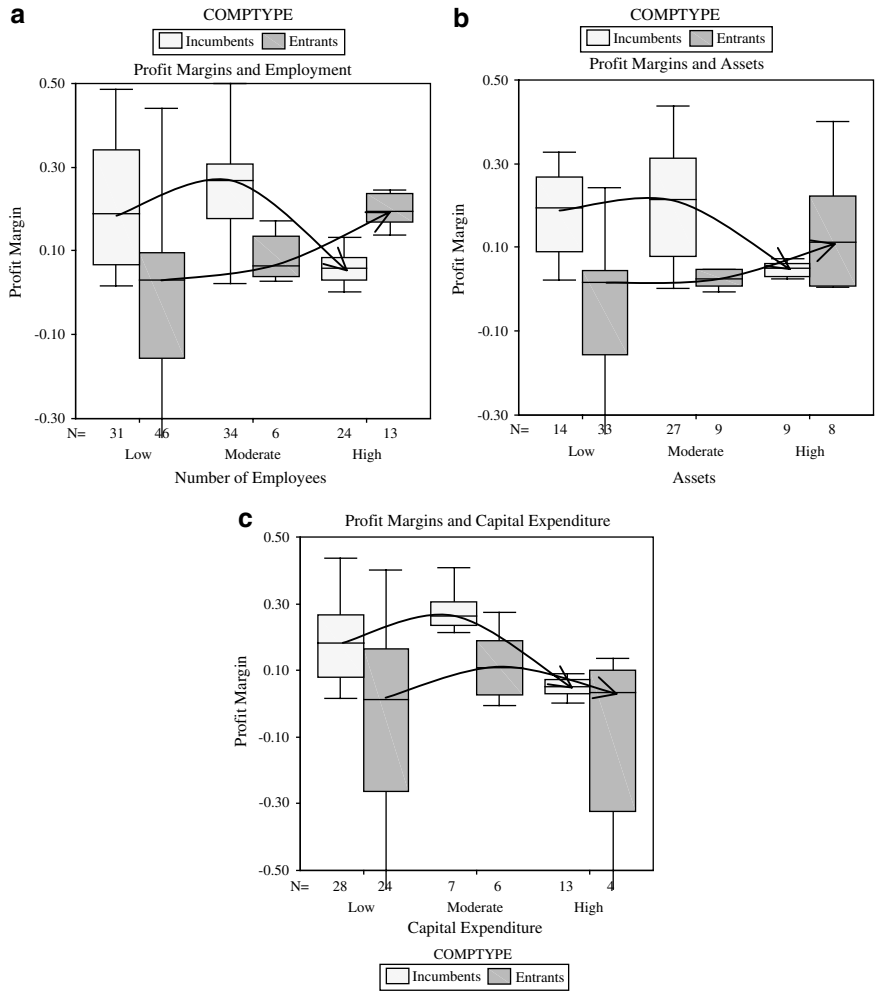

Figure 5 Resource deployment and profitability. (a) Profit margins and employment, (b) Profit margins and assets and (c) profit margins and capital expenditure.

As shown in Figures 5(a)–(c) and 6(a),(b), the impact of changes in resource deployment on performance indicators varies between incumbents and entrants. For changes in physical resources, such as total employment and strategic assets *vs* profitability, the results are quite clear in the case of entrants. On the contrary, in the case of incumbents, profitability fell when changes in all resource deployment indicators shifted from moderate to high. Our

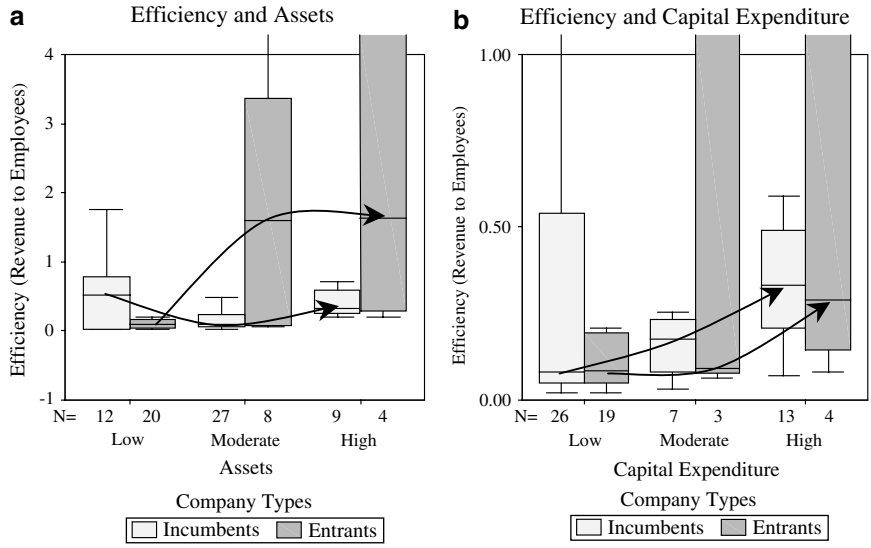

Figure 6 Resource deployment and efficiency. (a) Efficiency and assets and (b) Efficiency and capital expenditure.

interpretation is that an increase in total employment or size of incumbents from medium to large leads to lower profitability. This indicates that large incumbents do not perform as well as medium-size incumbents, while large entrants perform better than medium and small-size entrants.

This is due to heterogeneity characteristics between the two groups of firms. Entrants might benefit more from economies of scale than incumbents, because of the fact that incumbents are highly influenced by government in their internal strategic decision-making and have more social obligations. They also seem to have more complex internal structures. While entrants are pursuing individual objectives, being privately owned and driven by competitive behavior, they suffer less external intervention, and therefore can benefit from economies of scale.

Discussion of Findings and Conclusions

For an analysis of the relationship between the task environment (which includes both market concentration and task ambiguity) with incumbent and entrant performance, the overall result shows that the profitability rates of incumbents and entrants reduce as market concentration declines or

competition level rises. However, it also indicates some distinct characteristics across the different performance indicators of growth, profitability and efficiency.

Regarding the relationship between market concentration and the first two indicators of firm performance, when comparing both types of firms, incumbents seem to have higher growth and profit margins when market concentration is high, while entrants have higher growth and profit margins when market concentration is low. As for efficiency, both incumbents and entrants seem to perform better when there is heightened competition.

Our results also show that both incumbents and entrants perform at a higher level when task ambiguity is low. However, compared to incumbents, entrants seem to have higher growth and efficiency when task ambiguity is high. This could be due to the fact that the existing infrastructure of entrants is more receptive to the latest infrastructure and communication networks compared to that of incumbents.

On the other hand, incumbents have a higher profit margin than entrants. Our interpretation is that entrants are basically newcomers to the industry, putting more emphasis on investment in infrastructure and telecommunications networking. After market liberalization, changes in consumer demand required entrants to pay particular attention to consumer preferences in telecommunications services in order to compete with incumbents who had already established their brand advantages. As for incumbents, firms needed to adapt organizational structures following privatization and prior to market liberalization; and at the same time, they needed to respond to changes in market competition. We can observe that lower growth in telecom revenue for incumbents is due to competition with entrants and structural changes in employment following the divestment of privatized firms.

With regard to the result of the analysis between task environment and changes in resource deployment, our findings show that the overall changes in resource deployment for entrants seem to be higher than for incumbents. Since entrants are basically newcomers to the industry, they need to compete and catch up with the incumbents who have already established their position in the market; therefore, compared to incumbents, entrants put more emphasis on investment for the accumulation of the physical aspects of their core resources.

Subsequently, the results also show that both incumbents and entrants seem to react to a decrease in market concentration by increasing their resource deployment growth rate. Our interpretation is that rising competition in the telecommunications market led both incumbents and entrants to substantially increase investment in infrastructure and networking. The higher capacity of their telecommunications networking indicates a higher telecommunications service quality which is vital for growth and survival. Most importantly,

intense competition also necessitates incumbents to sustain their market share and requires entrants to penetrate new markets.

Finally, the results show that both incumbents and entrants seem to react to an increase in task ambiguity by reducing their resource deployment growth rates. Our interpretation is that when there is rising uncertainty, firms tend not to increase resource deployment. As far as IT industries such as the telecommunications industry are concerned, technology advance, especially from equipment suppliers, is rapid, and the value of investment in infrastructure and networks diminishes substantially. Therefore, firms need to reconsider the value of their investment in technological advancement in order to sustain competitive advantage.

Note that all the indicators employed in the analysis of resource deployment focus only on the physical aspect of resources. One might argue that the three indicators employed in this study also reflect the size of the firms. Therefore, it can be interpreted that both incumbents and entrants grew in size when market concentration dropped, but not when the pace of technological change or task ambiguity increased.

As for the final part of the analysis, we find that higher changes in resource deployment are associated with higher levels of firm performance, especially in the case of entrants; in the case of incumbents, the results show that changes in resource deployment from low to moderate lead to an increase in profitability, although changes in resource deployment from moderate to high tend towards a decrease in profitability. Although incumbents elevated their deployment of physical resources from moderate to high, we can say that increasing resource deployment by incumbents did not lead to higher profitability. This may reflect the inability of large incumbents to operate at their maximum potential due to their complexity and bureaucratic structure.

Heterogeneity among firms within the telecommunications industry suggests that incumbents and entrants are unique in terms of their objectives, strategic resources and capabilities. The latter requires a detailed analysis of their resource accumulation and the intangible aspects of firm's resources, which is beyond the scope of this study.

In conclusion, at the firm level of analysis, our findings support the notion that a greater intensity of market competition reduces the profitability rate among firms, which is a matter at the center of discussions in strategic management studies. This is essential for business practitioners — to consider the desirable outcomes of the effect of task environments on firms' strategic changes and variation in performance.

Furthermore, for firm or strategist, identifying significant changes in an industry environment is valuable for further strategic planning, particularly in the formulation of strategic options at the firm level in responding to changes in task environment. It would also provide insights for potential investors to

choose more profitable telecommunications-related investment, given certain conditions of the business environment.

To this end, the focal point of our contributions are the identification, operationalization and quantification of each of the industry forces, which were often left as abstracts in previous literature. Further, complementary to the analysis of external factors, and to provide some aspect of internal factors to the firms, we incorporated RBV theory, which is path-dependent in explaining their performance heterogeneity. Our model could be seen as a step towards identifying important implications for how firms should compete and respond to the continuous changes in the telecommunications landscape.

Our findings also indicate that following changes in the task environment, a thorough analysis of a firm's resource requires intra-firm indicators. These indicators should also reflect the firm's ability to utilize resources such as its dynamic capabilities. This study only focused on changes in resource deployment or capacity expansion of core resources; total employment, assets and capital expenditure or the accumulation of resources. Therefore, a generalization of conceptualized resource deployment in this study should be carefully interpreted, since firm resources also include other aspects, such as intangible assets, as well as dynamic capabilities.

Notably, this research bridges the gap between industry and firm-level analysis by combining the industrial organization approach and the resource-based perspective; it explicitly operationalizes the strategic dimensions of performance determinants for the analysis of telecommunications firms. Further analysis on the detailed process of resource accumulation and how well each resource is utilized at an intra-firm level would provide fruitful discussions on the importance of the resource-based view for the telecommunications industry.

Notes

1 See, among others, Chang and Singh (2000), McGahan and Porter (1997), Roquebert *et al.* (1996), Rumelt (1991), Schmalensee (1985), etc.
2 See Bortolotti *et al.* (2001), Bruno (2002), Noll (2000), etc.
3 See Nalebuff and Brandenburger (1996).
4 The study on the influences of task environment on industry performance in the telecommunications industry of Asia-Pacific countries can be found in Ahmad and Mokudai (2003).
5 Although the results are not reported here, they can be obtained from the author.
6 Although not shown here, the box-plot of growth rates of employment in different task environment settings can be obtained from the authors.
7 We also performed an analysis of compare means for different resource deployment indicators in different task environment settings. Though not reported here, the results supported the argument derived from the illustration in the box-plots.

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