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Effects of telecom service providers' strategic investments on business performance

A comparative study of US-Korea

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Abstract

Purpose – The purpose of this paper is to identify the structure of strategic investments and the effect of each investment category on business performance in two leading information and communication technology (ICT) countries, the USA and South Korea.

Design/methodology/approach – This is a longitudinal comparative study of the relationship between strategic investments and organizational performance of major telecommunication service providers (TSPs) in the two leading ICT countries, the USA and South Korea.

Findings – The study found that a sufficient amount of strategic investments in technological innovations is the driving force for TSPs' business performance. However, strategic investment structures differ among TSPs, depending on their market position, whether the first mover in the market or a follower, and on their country's market characteristics. Moreover, even though both countries' TSP markets are oligopolistic in nature, the market is more saturated in Korea and thus competition appears to be fiercer there than in the USA. The stronger oligopolistic market in Korea has lead TSPs to compete primarily on their marketing strategies, while TSPs in the USA do so based on technological innovation.

Originality/value – The findings of the study shed new insights that can help both TSPs in developing their competitive strategies and government policy makers in assuring healthy competitive telecommunication markets in their countries.

Keywords Technological innovation, Business performance, Marketing strategy, Market convergence, Operating expenditure, Telecommunication service providers

Paper type Research paper

1. Introduction

The telecommunications market is fast approaching the saturation point in developed countries. As the market has few new customers, competition among telecommunication service providers (TSPs) is becoming fierce as they try to invade each other's customer base. Improving or sustaining their current market position is a real challenge for TSPs (Gnyawali *et al.*, 2010; Lee *et al.*, 2011; Knutson, 2014). For example, in 2014, Verizon Communications experienced a decrease in the number of wireless customers for the first time, as its rivals, T-Mobile, AT&T, and Sprint, attracted new subscribers by offering substantial payouts for switching to their services (Knutson and Rubin, 2014).

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Major communication companies are aggressively pursuing mergers and acquisitions (M&A) (e.g. in the USA: Comcast with Time Warner, AT&T with DirectTV, Sprint attempting to pair with T-Mobile, perhaps Verizon with Satellite TV, etc.) to compete by providing integrated phone and data services, and wired and wireless services in convenient, flexible, and cheaper packages. The communication industry is in the verge of big transformation: the convergence of broadband, telecom, and video services (Rugman and Verbeke, 2008; Knutson, 2014). New technologies are emerging from these convergences, such as providing the internet broadband service via wireless, mobile phone services via wi-fi, etc. The goal is to provide customers new bundled services and flexible options for entertainment and communication whenever, wherever, and however they choose.

As smartphones and other wireless devices are widely adopted, TSPs, content providers, device manufacturers (e.g. Apple, Samsung, Nokia, LG, Blackberry, etc.), and new heavy-weight tech entrants (Google, Apple, Amazon) are also in competition. Dimensions of competition for wireless TSPs – handset selection, network quality, and price – are collapsing (Taylor, 2013; Knutson, 2014). Handset selection does not vary much anymore among TSPs, neither the network quality, as the majority of TSPs have upgraded to long-term evolution (LTE or 4G) networks in the USA and LTE-advanced (5G) in South Korea. Competition differentiators now are the price of devices and services offered. The first movers, such as AT&T and Verizon in the USA, gained their market share by providing cheaper subsidized prices for devices to lock in customers for two-year contracts. T-Mobile, an increasingly successful follower (fourth largest in the USA), has shaken up this business model by financing customer purchase of devices, thus allowing customers to upgrade their phones as often as they want. The other differentiator, service fee, is also decreasing: T-Mobile's low monthly service fee has forced its rivals to lower their rates as well (Knutson and Rubin, 2014).

We are entering a new stage, the post-iPhone era: the cheap, smart, and ubiquitous telecom environment. This development presents new implications. E-commerce companies, health care providers, and governments are also already transforming their internet-based business models to new mobile platforms (Stephen and Toubia, 2009; Kenney and Pon, 2011; Winston Smith, 2014). In such an environment, TSPs are finding it increasingly difficult to perform well, or even survive in the volatile market. Business performance of TSPs has been shaped by investments for new innovative technologies in devices, smartphones, and tablets, and supporting wireless network technologies (e.g. LTE-A, 5G), and expenditures in marketing these technologies and services. Currently, TSPs are changing their investment strategies and expenditure structures. The compelling motivation of this study is to determine the right balance and amounts of investment in technological innovations, new and improved customer service, and marketing for TSPs. The impact of each of these investments on business performance is critically important to TSPs (Yang *et al.*, 2010; Zablah *et al.*, 2012; Gray, 2013).

The relationship between the major strategic investments and business performance of TSPs is of great interest among researchers, information and communication technology (ICT) firms, policy makers in governments, and investors. Since the ICT industry is currently at a juncture and possibly at the starting point of a "big bang", it is crucial for TSPs to measure the effectiveness of their investments, particularly for innovations, on their business performance (Lam and Shiu, 2010). Previous studies on the ICT industry have been conducted mainly from the micro perspective (i.e. an individual's intention for technology adoption) rather than the macro perspective (i.e. examining an entire sector of the ICT industry). In this study, we

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focus on TSPs, a major segment of the ICT industry, from a macro perspective, by exploring the following research questions:

RQ1. How do TSPs' investments in innovative technologies affect their business performance?

RQ2. What should TSPs' strategies be concerning investments to gain competitive advantage? Do these strategies differ based on the firm's market position?

RQ3. Are there country differences in the answers to the above questions, and if so, why?

We collected strategic investment data from TSPs of two leading ICT countries in terms of the advanced technology penetration rate (e.g. LTE) and market size, the USA and South Korea on: investments for innovative services and products (SP); investments in selling, general and administrative (GA); investment in depreciation and amortization (DA); and operating revenues (OR). We first identified the structure of strategic investments and the effect of each investment category on business performance. Then we performed a comparative analysis to identify the differences among TSPs based on their market position and on their country's market characteristics. The rest of this paper is organized as follows: in Section 2 we present a review of relevant literature that supports the research; Section 3 discusses the development of research hypotheses and methods used in the study; Section 4 provides findings of the study; and Section 5 concludes the study by presenting the results and their implications, limitations, and future research needs.

2. Literary reviews

2.1 ICT industry studies

As the impact of the ICT industry on the global economy has grown steadily, so has the interest in the ICT industry economics (Hacklin *et al.*, 2009; Xing *et al.*, 2011; García-Villaverde *et al.*, 2012). All nations around the world endeavor for robust economic growth and better quality of life for their citizens through job creation, and the ICT industry is deemed a critical enabler of such development (Wang *et al.*, 2010; Katz and Koutroumpis, 2012). The ICT industry has considerable impact on job creation, improved productivity, green management, etc. in other industries as well, especially knowledge-intensive industries. Thus, the ICT industry's direct/indirect effects on the economy are strategic (Dimelis and Papaioannou, 2011). Consequently, investigating the economic impact of the ICT industry has been the focus of many studies. Table I and Figure 1 provide a summary of relevant publications in the top three MIS journals, *Management Information Systems Quarterly*, *Information Systems Research*, and *Journal of Management Information Systems*, during the six-year period of 2007-2012.

As can be seen in Figure 1, the largest proportion of ICT studies has been on technology and management, which means that the main focus of ICT-related studies dealt with utilization and innovation of ICT, and productivity enhancement from ICT

Table I. ICT-related studies in top three MIS journals: 2007-2012 period

Journal	No. of papers
Information Systems Research	271
Journal of Management Information Systems	261
Management Information Systems Quarterly	280

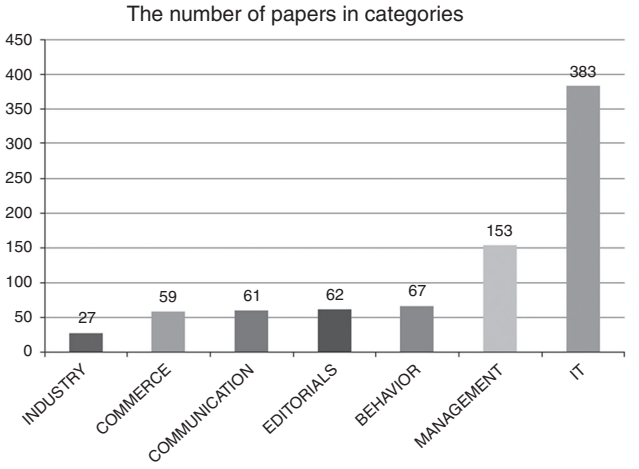

Figure 1.
ICT economic impact publications (in number)

applications. There have been only few studies on the direct/indirect impact and role of the ICT industry on the economy. As the ICT industry is growing at an accelerated rate, both in significance and size, there is the need for the industry-level studies, from a macro perspective, especially in different leading ICT countries. This study investigates the relationship of strategic investments and firm performance from a macro perspective of the ICT industry: focusing on TSPs.

2.2 TSPs in the USA and Korea

The US telecommunications service market saw a dramatic change with the breakup of AT&T in 1984. Since the adoption of The Communications Act in 1996, the US telecommunications service market has been growing rapidly in both size and competition (Holt and Jamison, 2009; Goto, 2010). By 2003, the 3G network standard was adopted, soon followed by the 4G era. As the use of smartphones has become the main stay of communication, providers constantly offer a large number of new types of devices and services and conduct major marketing campaigns targeted at post-adopters to steal each other's customers in this saturated market (Hadden, 2009; Yang, 2010). The competition is fierce and is dominated by very few large companies: for example, the wireless US market is dominated by four TSPs: Verizon Wireless, AT&T, Sprint, and T-Mobile, where the two largest (Verizon Wireless and AT&T) control more than 75 per cent of the US wireless market (Taylor and Hammond, 2014). In South Korea, wireless market is dominated by three large providers: SK Telecom (SKT), Korea Telecom (KT), and LGU+.

Currently, major TSPs offer a combination of voice and broadband, landline, and wireless. However, a big transformation is emerging. The providers of phone, internet, and video, and other new tech giants are converging and entering into each other's territory. They are offering new technologies, services, and packages; whenever, wherever, whatever, and however customers may choose. The TSP market structure is changing drastically as a number of M&A activities has and is taking place. For example, AT&T, a cellphone and internet provider, bought satellite TV company DirectTV, which, if approved, will produce a megatelecom firm and will expand AT&T's market into pay-TV, competing with cable companies such as Comcast. DirectTV, on the other hand, needs AT&T's fiber broadband network as its satellite

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network's speed is slow. Comcast, a cable and internet provider, bought Time Warner Cable, to not only expand its current market to become the largest content (TV) and broadband provider, but also to broaden the market by providing cable-wi-fi-enabled phone and data network services. Sprint, the third largest wireless provider, which was acquired by Japan's SoftBank, wants to strengthen its current position by becoming an equal competitor in size with the top two wireless providers, Verizon and AT&T. Sprint is pursuing to buy T-Mobile, which is the fourth largest cellphone provider (earlier merged with the fifth-largest provider, MetroPCs).

T-Mobile added 1.3 million wireless postpaid customers in the first quarter of 2014 alone, the result of an aggressive and expensive marketing campaign and deals to pay early termination fees to new customers who would switch from other providers. Sprint is also looking into buying satellite TV company Dish Network, which owns a large spectrum, as it is pushing to beam a high-speed home internet over wireless (Gottfried, 2014; Knutson, 2014). New players, including such giant tech companies as Google and Amazon, have also entered the telecom market to provide a faster broadband fiber internet and wireless internet through solar-powered drones and balloons to rural and undeveloped areas, etc.

South Korea is the world leader in the high-speed internet and wireless telecom adoption (Lee *et al.*, 2013). The Korean telecommunication market is more saturated than the US market, and therefore, the competition among ICT firms is extremely intense (Lee *et al.*, 2011; Shin *et al.*, 2011). The Korean ICT market, also characterized by oligopoly, has been dominated by three companies since 2009: SKT, the first mover, which has kept the largest market share (around 50 per cent) since 2001; KT, a fast follower, which expanded its share (to about 30 per cent) by acquiring Hansol PCS Inc. in 2001; and LGU+, a late comer and a rising contender. In Korea, each TSP is part of a large conglomerate, which offers a variety of products/services (e.g. internet, IPTV, wireless telecom, wired telecom, credit card, and so on). Thus, they can offer bundled packages to customers. TSPs are in control of the wireless devices sale rather than device manufacturers (e.g. Samsung, LG) also. Moreover, TSPs can set the price of wireless devices, which provides them the ability to offer mobile device subsidies to attract new customers. For this reason, there is cut-throat competition among TSPs in Korea. Recently, the Korean government ordered each TSP to suspend its mobile device subsidies over the allowed amount for 45 days in 2014. Thus, each TSP could not attract new customers during the suspension period (as shown in Table II).

Table II.
Numbers of mobile phone subscribers in the USA and South Korea

Year	Mobile phone subscriptions		Mobile phone subscriptions per 100 inhabitants	
	USA	Korea	USA	Korea
2006	229,600,000	40,197,115	76.29	85.00
2007	249,300,000	44,369,165	82.06	93.27
2008	261,300,000	45,606,984	85.21	95.28
2009	274,283,000	47,944,222	88.62	99.54
2010	285,118,000	50,767,241	91.31	104.77
2011	297,404,000	52,506,793	94.44	107.74
2012	304,838,000	53,624,427	96.01	109.43
2013	310,698,000	54,680,840	97.08	111.00
2014	317,443,800	57,207,957	98.41	115.54

Source: ITU world telecommunication

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2.3 Strategic investments and business performance

The effect of strategic investments on business performance has been examined by many studies (Lee *et al.*, 2009; Corrado and Hulten, 2010; Cusumano, 2013). These studies indicated that each major category of strategic investment classified as: SP; marketing, education/training, and administrative, general administrative (GA); and DA could have either positive or negative effects on business performance. In addition, because of globalization, technology advancement, and market saturation of the telecom industry, the significance of the impact of intangible assets on business performance, *vis-à-vis* tangible assets, has increased.

The SP category, represents technology innovation-related investments for new products and services. This category has showed positive effects on performance in some studies (Callen and Morel, 2005; Tubbs, 2007), but negative effects in others (Coombs and Bierly, 2006). Several studies found a positive effect of strategic investment in GA (marketing, education/training, and administrative expenditures) on business performance, depending on the industry or a specific company (Auh and Merlo, 2011; Morgan, 2012). These investments are in support of the innovative products/services that the firm provides in the market. Other studies did not find any significant level of contribution of marketing investment to performance (Bublitz and Ettredge, 1989). As for education and training, a significant percentage of previous studies (even though there were not as many studies as in the first two categories) found that they do have a positive effect on business performance (Contractor and Mudambi, 2008; Fleisher *et al.*, 2010; Bouillon *et al.*, 2011). Previous studies have indicated that DA (investments in property, plant, and equipment to support the firm's products/services) had a mixed impact on business performance. Some of these studies showed that an increase in DA investment in had positive effects on the business performance (Miller and Modigliani, 1961; McConnell and Muscarella, 1985). However, other studies found that the effect of DA on business performance was relatively minor as compared to the effect of R&D in the form of SP (Kothari *et al.*, 2002).

3. Hypotheses development and research method

3.1 TSPs' investment structure

The telecommunication service market in advanced economies is already saturated. Thus, many previous studies have shown that TSPs in these countries constantly invest for advanced new technologies so they can be the first to enter the market with new innovative products (Jakopin and Klein, 2012; Lee *et al.*, 2012; Haro-de-Rosario *et al.*, 2014; Parker *et al.*, 2014). Depending on their market positions, TSPs strive to explore new strategies to at least keep or, better yet, expand their market base (Scammell, 2006; Lee *et al.*, 2010; Ghezzi *et al.*, 2015). Once a TSP becomes the first mover, it tends to implement marketing strategies that would help retain its customers and avoid customer churn to follower companies. For example, in the USA, the two largest wireless providers, Verizon and AT&T, were the first movers and leaders in the smartphone market, as they invested heavily upfront in subsidizing new subscribers (e.g. customers who sign a two-year contract would pay $199 for a $699 iPhone). This investment strategy has enhanced their business performance, as they were able to create a great customer base and brand reputation, therefore not needing to invest heavily in marketing.

The follower companies in a saturated market, on the other hand, have no choice but to use strategies that would attract customers away from the first mover. For example, as discussed earlier, T-Mobile in the USA used a strategy of aggressive marketing and expensive deals to pay new customers for their early contract-termination fees, when

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switching from other providers. The strategy was very successful: in the first quarter of 2014, T-Mobile had the highest rate of subscriber increase (while Verizon lost customers for the first time) and its revenue increased by 47 per cent (Gryta and Rubin, 2014). However, gaining the network externality power through only marketing strategies would be for a short term and very expensive (Fernandez and Usero, 2009; Lee *et al.*, 2012). In the first quarter of 2014, T-Mobile ended with a huge loss of $151 million, compared to $107 million profit one year earlier (Gryta and Rubin, 2014). Consequently, the followers would be better off in making major investments in new and innovative products/services to attract customers. In sum, TSPs have different investment structures and strategies depending on their market positions. To explore the possible effect of TSPs' market position differences on their investment structure and strategies, we propose the following hypothesis:

H1a. TSPs' structure of strategic investments (SP, GA, and DA) differs depending on their market positions.

As observed earlier, TSPs in the USA are striving to improve their market positions through M&A and/or investments for innovative products and services (Yang, 2010; Prasad and Srivastava, 2012). The Korean TSPs market, on the other hand, is highly oligopolistic as it has been dominated by the same three providers for more than ten years (Ahn *et al.*, 2006; Lee *et al.*, 2012). These firms generally focus more on creative marketing strategies, such as bundled service packages and differential fee structures based on usage, rather than on M&A or product/services innovations. This shows that the telecom market, competitive strategies, and therefore, the investment structures of TSPs vary in different countries (Palcic and Reeves, 2010). Several previous studies have indicated how an oligopolistic market condition affects TSPs' investment ratios of SP, GA, and DA (Remneland-Wikhamn *et al.*, 2011; Schneiderman, 2012). In an oligopolistic market, TSPs are more concerned about maintaining the status quo of their market positions, and therefore tend to grow complacent and invest in marketing strategies rather than in product/service innovations. Thus, the following hypothesis is suggested:

H1b. TSPs' structure of strategic investments (SP, GA, and DA) differs depending on their country's market characteristics.

3.2 Effects of strategic investments on OR

TSPs invest in developing new products and services because it contributes to both short-term returns (e.g. a shorter product life cycle and new services contribute to OR) and long-term benefit for market sustainability and survival (Tishler and Milstein, 2009; Bigliardi *et al.*, 2012). Investing in new products and services, while increasing SP expenditures, may immediately affect business performance, which in turn affects the firm's share price almost instantaneously (Luo *et al.*, 2010; Oliveira *et al.*, 2010). It also affects the investor's long-term view of the firm's competitiveness, which determines the firm's market value.

Selling, marketing, and GA cost to support innovative products/services also have both short-term and long-term effects, depending on the firm's brand/reputation and the characteristics of the industry. As previously discussed, the telecommunications market, both in the USA and in Korea, during the past decade has been dominated by few service providers (Song, 2009). These TSPs, having "secure" market positions, search ways to improve their business performance through greater efficiencies in selling, GA, and investment in facilities (DA). For the followers, being in a saturated

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market, to attract new customers, they need to invest a great deal in promotion and marketing (as T-Mobile did). Thus, the effect of each type of strategic investment on business performance differs depending on the TSP's market position. We propose the following hypothesis:

H2a. The effect of each type of strategic investments (SP, GA, and DA) on the OR differs depending on the firm's market position.

Based on Hofstede's (1991) classification of country cultures, the USA and Canada belong to Type 1 culture – individualistic/low-power distance/weak-uncertainty avoidance. Korea, along with other countries such as Chile and Mexico, belongs to Type 2 culture – collectivistic/high power distance/strong uncertainty avoidance. As previous studies indicated, the pattern of technology adoption differs depending on the type of national culture (Alexander, 2012; Lee *et al.*, 2012). Investments strategies for TSPs in each country and their effect on business performance would be different as customers' acquisition and retention would be based on ICT adoption patterns, which depend on customers' national culture. Therefore, the following hypothesis is suggested:

H2b. The effect of each type of strategic investments (SP, GA, and DA) on the OR differs across countries due to their national culture type.

A summary of hypotheses to be tested in this study is provided in Table III.

3.3 Methodology

The research procedure used in this study is provided in Figure 2. Data on OR and strategic investments (for SP, selling, GA, and DA) were collected for the time period: first quarter, 2006 to second quarter, 2013. For the three US TSPs – Verizon, Sprint, and T-mobile – data were collected from the investor relations (IR). AT&T was excluded because it did not disclose the data for that time period. For the three Korean TSPs – SKT, KT, and LGU+ – data were collected from the IR (Table IV).

First, to identify the differences in the strategic investments structure among TSPs in each country, and the differences between the two countries, we examined the descriptive statistics of data (Table V). Then, for investment structures, we performed a *t*-test for each country (Table VI) and an ANOVA test for each of US TSPs (Table VII) and Korean TSPs (Table VIII). Because this study used cross-sectional and time-wise connected data, we used the panel data analysis method to integrate the data (Matyas and Sevestre, 1996). To verify the effectiveness of the variables by time and the model appropriateness, we used the Lagrange multiplier test on the data (Table X). Then, to test the hypotheses, we used the Hausman test for idiosyncratic error terms (Table X).

4. Results and discussion

4.1 Descriptive statistics

The means and standard deviations of investments for SP, selling, GA, and DA and the OR are shown in Table V. As the table shows, the differences in average values

	Firm's market position	Country characteristics	
Structure of strategic investments	*H1a*	*H1b*	*H1*
Effect of investments on operating revenue	*H2a*	*H2b*	*H2*

Table III. A summary of hypotheses

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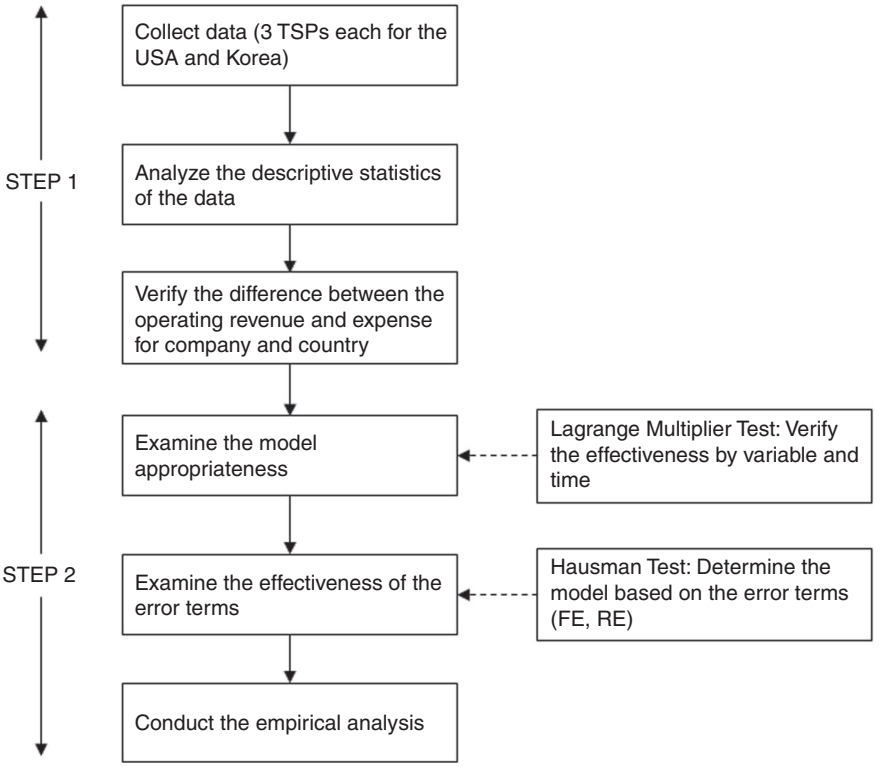

Figure 2.
The research procedure

Group	USA (second quarter, 2013) Sprint Nextel	Verizon	T-mobile	Korea (second quarter, 2013) SKT	KT	LGU+
OR	88.770	297.860	47.560	32.091	43.590	27.634
SP	50.450	110.330	19.360	2.912	12.860	10.408
GA	30.740	80.470	10.280	18.537	21.170	12.528
DA	16.320	41.510	8.880	5.319	7.620	3.250

Table IV.
Example of sample USA and Korea TSPs

Notes: Unit: millions $. OR, operating revenue; SP, investment in services and products; GA, investment in selling, general and administrative; DA, investment in depreciation and amortization

Group	OR	SP	GA	DA
US total	133.155 ± 92.395	52.968 ± 40.113	37.496 ± 31.606	21.607 ± 13.695
Sprint Nextel	89.454 ± 8.072	44.803 ± 4.286	26.691 ± 3.563	18.742 ± 4.272
Verizon	260.030 ± 24.544	104.863 ± 11.491	77.334 ± 20.899	39.224 ± 2.493
T-mobile	49.981 ± 4.259	9.239 ± 2.193	8.465 ± 0.870	6.855 ± 1.425
Korea total	29.351 ± 11.998	7.628 ± 4.996	13.939 ± 5.826	4.537 ± 2.137
SKT	29.846 ± 1.820	3.596 ± 0.3992	16.143 ± 2.496	4.880 ± 0.690
KT	40.673 ± 10.625	12.515 ± 5.050	17.962 ± 5.085	6.648 ± 1.233
LGU+	17.535 ± 6.903	6.774 ± 2.894	7.711 ± 3.149	2.084 ± 1.057

Table V.
Descriptive statistics for strategic investments and operating revenue, 2006-2013

Note: Unit: millions $

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between US and Korean service providers in OR (USA: $133.155 million, Korea: $29.351 million), SP (USA: $52.968 million, Korea: $7.628 million), GA (USA: $37.496 million, Korea: $13.939 millions), and DA (USA: $21.607 million Korea: $4.537 million) were quite significant, indicating the much larger US TSP market than Korea's.

4.2 Strategic investment structure (H1)

The analysis of differences in the OR and strategic investments between US and Korean service providers showed that overall US companies had both significantly higher OR and strategic investments (Table VI), indicative of the larger scale of the US telecommunications service market as compared to that of Korea.

When running the ANOVA test to see the differences among TSPs in each country, we found significant differences in the structure of investments between US TSPs and Korean ones. The *post hoc* test (Sheffe) revealed that statistically all US companies invested the most in SP and the least in DA, which implies that US TSPs generally compete based on their product/service innovations (Table VII).

All Korean providers invested more on GA and least on SP, which means that in the oligopolistic Korean telecom market the competitive efforts are mainly focused on keeping their current market positions, therefore firms spend more on marketing and sales (Table VIII). It is noteworthy that LGU+, a follower and smallest provider in the

Table VI. Countries' difference (*t*-test) in strategic investments (million $)

	Group	*n*	Mean	Std.	*t*	df	Sig.
OR	USA	90	133.155	92.913	10.511	178	0.000***
(US > KR)	Korea	90	29.351	12.066			
SP	USA	90	52.968	40.338	10.581	178	0.000***
(US > KR)	Korea	90	7.629	5.024			
GA	USA	90	37.496	31.783	6.915	178	0.000***
(US > KR)	Korea	90	13.932	5.859			
DA	USA	90	21.607	13.771	11.618	178	0.000***
(US > KR)	Korea	90	4.537	2.149			

Notes: Million $. ***$p < 0.001$

Table VII. US service providers' strategic investments

Telecommunications service provider (Sig.)	*Post hoc* test (Sheffe)
Sprint Nextel (0.000)***	DA < GA < SP
Verizon (0.000)***	DA < GA < SP
T-mobile (0.000)***	DA < GA, SP

Notes: ANOVA test. ***$p < 0.001$

Table VIII. Korean service providers' strategic investments (ANOVA test)

Telecommunications service provider (Sig.)	*Post hoc* test (Sheffe)
SK Telecom (0.000)***	SP < DA < GA
Korea Telecom (0.000)***	SP < DA < GA
LGU+ (0.000)***	DA < SP, GA

Notes: ANOVA test. ***$p < 0.001$

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market, spent relatively much more on SP than the two larger competitors, SKT (the largest) and KT (second largest). As a matter of fact, LGU+ introduced LTE (4G) and now LTE-Advanced (5G) services first time in the world. This is an indicator of the investment strategy of a follower or a newcomer: the only way to survive in a saturated market is by introducing new products and services to become the leader or the first mover in the new market.

These results support *H1a* (there were differences in the investment structure depending on a TSP's market position) and *H1b* (there were differences in investments depending on a TSP's country).

4.3 Effect of strategic investments on business performance (H2)

To examine the effect of the strategic investments on business performance, we developed a model for the OR, as one of the main indicators of business performance. This model not only included the three categories (SP, GA, and DA) of strategic investments, but also considered the possible existence of individual-specific effect (μ_i), time-specific effect (τ_t), and residual error (ε_{it}). That is, we divided the specific effect into the individual-specific effect in terms of cross-sectional and the time-specific effect (in terms of time series) so that we could determine the proper method to use if there existed a time-specific effect in the following equation:

$$OR_{it} = \alpha + \left(\beta_1 SP_{it} + \beta_2 GA_{it} + \beta_3 DA_{it}\right) + \mu_i + \tau_t + \varepsilon_{it} \quad (1)$$

where i is firm; t is time; and β_i is coefficient for each strategic investment category. To analyze the data, we first checked whether the time-specific effect existed in the model. To verify the time-specific effect, the null hypothesis was set at ($H_0: \sigma_\mu^2 = \sigma_\tau^2 = 0$). First, if the null hypothesis is accepted, then the time-specific effect does not exist. Then, the proper method to use for testing the operating costs effect would be ordinary least squares (OLS). Second, if the null hypothesis is not accepted, meaning that the time-specific effect with the error term exists, then the Lagrange multiplier test (LMT) needs to be used to verify its effect. Thus, we used LMT to see if a time-specific effect existed in the data of both countries. In addition, we classified firms by their market position: the first movers are Verizon in the USA and SKT in Korea, the followers are T-mobile in the USA and LGU+ in Korea. Thus, we used LMT to see if a time-specific effect exists according to their market position (Table IX).

As shown in Table IX, the results of the LMT analysis on US and Korean data showed that there indeed was time-specific effects (in the correlation between OR and SP, GA, and DA) for US firms, but not for Korean TSPs. In addition, the results of the LMT analysis showed that there indeed was time-specific effects (in the correlation

	USA		Korea		First mover		Follower	
	Var	Sqrt (Var)	Var	Sqrt (Var)	Var	Sqrt (Var)	Var	Sqrt (Var)
OR	8,632.875	92.913	145.593	12.066	13,778.710	117.382	301.101	17.352
e	69.100	8.312	1.864	1.365	57.592	7.588	7.246	2.691
p	0.000***		0.166		0.313		0.000***	
Result	Time-specific effect exists		Time-specific effect does not exist		Time-specific effect does not exist		Time-specific effect exists	

Note: ***$p < 0.001$

Table IX. Lagrange multiplier test

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between OR and SP, GA, and DA) for the follower, but not for the first mover TSP. This means that for the Korean data and first mover, we can use OLS, but not for the US data and follower. For US firms and the follower, we need to examine time-specific effects when measuring the effect of SP, GA and DA on OR.

First, for the USA and follower data, we needed to check whether the time-specific effect is fixed or is subject to a probabilistic/random change, using the Hausman Test. In the Hausman test, when the null hypothesis $E(\mu_i/X_{it}) = 0$ is accepted, the generalized least squares (GLS) estimates (the random effects model) can secure consistency and efficiency, and thus it would be an ideal choice. If the null hypothesis is not accepted, however, the GLS estimate would be inconsistent, and thus, the fixed effects model would be the choice. Based on the result of the Hausman Test (Table X), for the USA and follower data, the null hypothesis was not accepted. Therefore, the coefficient estimation by the fixed effect model would be more appropriate.

4.4 Analysis of the effects of strategic investments on OR

Based on the above discussion, we analyzed the effect of strategic investments on OR using different models as shown in Table XI. To analyze the effect of each investment category on the OR based on the market position of TSPs, we used OLS for the first movers and the fixed effects model for the follower TSPs. For the first mover TSPs, both SP ([1]0.831) and DA ([9]4.031) showed significant positive effects on OR, while GA showed no significant effect. For the follower TSPs, only GA ([6]2.190) showed a significant positive effect on OR, while SP and DA had no significant effects. These results supported *H2a*.

When we did a comparative analysis between the USA and Korea, the degree of the effect of SP on OR was greater for US TSPs ([3]1.234) than it was for Korean TSPs ([4]0.724). In addition, the investment in selling, GA had a significant positive effect on OR for Korean TSPs ([8]0.937) but no effect in US TSPs. As for the investment in DA, its effect on OR was positive in both countries, the USA ([11]1.931) and Korea ([12]1.966). These results supported *H2b*.

Difference (SE)	SP	GA	DA	*p*
USA	0.212 (0.269)	−0.510 (0.101)	−0.302 (0.386)	0.000***
Follower	−0.259 (0.037)	1.902 (0.273)	−5.789 (0.831)	0.000***

Note: ***$p < 0.001$

Table X. Hausman test result for the USA and follower data

	First mover OR	Follower OR	USA OR	Korea OR
Model	Ordinary least squares (OLS) model	Fixed effects model	Fixed effects model	Ordinary least squares (OLS) model
SP	[1]0.831 (2.950)***	[2]0.153 (0.650)	[3]1.234 (7.750)***	[4]0.724 (14.060)***
GA	[5]0.127 (1.320)	[6]2.190 (8.270)***	[7]0.134 (1.400)	[8]0.937 (12.150)***
DA	[9]4.031 (5.500)***	[10]−0.364 (−1.040)	[11]1.931 (6.180)***	[12]1.966 (8.720)***
Cons	4.996 (1.280)	16.441 (11.580)***	20.981 (2.390)	1.832 (3.410)***
R^2	0.996	0.105	0.956	0.974

Notes: *$p < 0.1$; **$p < 0.05$; ***$p < 0.001$

Table XI. Panel analysis: operating cost effect on operating revenue

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In sum, hypotheses tests (Table XII) showed that the strategic investments structures varied depending on TSPs' market positions (*H1a*) and the country's market characteristics (*H1b*); the TSP's strategic investments (SP, GA, and DA) affected the OR in varying degrees, with SP having the greatest effect. However, there were differences in the effect investment type on OR, depending on a TSP's market position (*H2b*) and the country's market characteristics (*H2b*) – SP had the most significant positive influence on the OR in the USA, while in Korea GA and DA were the most significant.

5. Conclusion

5.1 Summary and implications

The survival of TSPs has become very challenging as the telecom market is now very saturated and on the verge of big changes in developed economies. To survive, TSPs must implement strategies that would not only leverage their core competencies and market positions but also that would fit their country's competitive environments and national culture. The average revenue per subscriber – a key industry metric – has fallen for the first time in three years (Taylor, 2014). TSPs must focus their financial resources wisely on the type of strategic investment that will have the greatest impact on business performance, specifically, the operation revenue. Firms need to find what would be the right balance among strategic investments (for new products and services, sales and general administration, and DA) that would result in the best return on their investment. Research on the strategic investments and their relationships with OR, at the macro industry-level and cross-country comparative studies, has been limited. This study examined this much needed topic, by comparing the largest TSPs in the two leading ICT countries (based on the advanced ICT penetration rate and size of the market), the USA and Korea. This study examined the unique TSPs market situation, both the firm's market position and each country's market characteristics, using actual data of strategic investments and OR, rather than survey data as most previous studies did.

The study revealed several important findings. First, there was a time-specific effect for US TSPs, but no such effect was evident among Korean providers. This could imply that US TSPs have changed their investment strategies as they continued to compete against each other over time, but Korean companies did not make major changes in strategies as they already have the world leading technologies (e.g. LTE-A 5G). Which means that, the US market is more dynamic as compared to Korea: market shares among the three Korean TSPs remained relatively stable, indicating that the Korean market continued to be saturated as an oligopoly. Second, the most significant positive influencer in the increase of OR was the increased strategic investment in new products and services (SP). While this was the case for both countries' TSPs, the effect was more significant for US companies: the efforts of US TSPs to enhance the OR via products/

Table XII. Summary of the hypotheses test

Hypotheses	Market position (main effect)	Country characteristics (main effect)	
H1a	Different	na	Supported
H1b	na	Different	Supported
H2a	First mover: SP, DA Follower: GA	na	Supported
H2b	na	USA: SP, DA Korea: SP, GA, DA	Supported SP: USA > Korea GA: USA < Korea

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services innovations were greater and their effects on OR were more significant. This result might also mean that, in the USA, companies that have a competitive technology can enter the TSP market relatively easily, as the recent M&A activities indicate. The US TSPs that do have strategic technology and invest heavily in innovations tend to be more competitive, while it is not in the saturated Korean market which is shared by three TSPs. For example, AT&T and Verizon were very successful in expending their market base by being first to introduce iPhones; now they offer all kinds (price, function, and brand) of smartphones and tablets. Since all of US TSPs offer a variety of devices, the attention is turned to offering new services: several M&As in the US telecom market are going on right now to merge broadband, video, and phone to offer new services and bundled packages to customers (e.g. AT&T & DirectTV – wireless, high speed, paid TV; Comcast & Time Warner – combine wi-fi with broadband; Sprint & Dish – wireless broadband through satellite; etc.).

This study found that strategic investment in selling and GA had a positive effect on the OR in both the USA and Korea, but with a much greater degree in Korea. This result accentuates the reasoning that in the small, saturated, and oligopolistic Korean market, telecommunication companies focus mostly on advertising and product/service sales packages to attract each other's customers and strive to sustain their market positions. In such a market, the competition based on technological innovations could be dampened when the market is not very open because of oligopoly.

From the results discussed above, we can deduce the following for OR improvement for TSPs: first, US TSPs' key competitive strategy should be on the development of new products/services through continuous technological innovations; Korean firms on the other hand, given their current market situation, should invest in creative marketing for expanding their competitive position. Even though one would think that government interventions (e.g. new regulations) to vitalize the market and ameliorate the oligopolistic dominance could help encourage constructive competition among companies based on technological innovations.

The results of the study can shed important implications to both the ICT research community at large and practicing managers of TSPs in particular. The telecom market in most developed countries has either already reached or is fast approaching saturation. Thus, the competition is extremely fierce and strategies to attract new customers have been diverse – from product/service innovations, M&A activities, marketing with numerous bundled service packages, and outright customer churn attempts from other TSPs. However, such strategies are not universally effective as the market position of a TSP and the country's market characteristics have direct and indirect impact on such strategies. Thus, an in-depth comparative research of the unique conditions of TSPs and the country based on empirical data should be undertaken. This study provides valid theoretical conclusions about effectiveness of various strategic investments of TSPs with the varying market positions and competitive environments.

For practicing TSP managers, this study also provides useful implications. First, investment in products/service innovations is an imperative to remain competitor in the dynamic telecom market. The strategic investment in SP is undoubtedly the single most important item for firm performance in terms of OR. Nevertheless, GA and DA also offer many opportunities to improve OR through various marketing, service bundling and new content packages at appropriate intervals to support the firm's products and services. However, as long as oligopolistic type market conditions persist, eventually TSPs must introduce SP innovations to sustain or expand their market share. For example, KT in Korea recently announced $4 billion investment in new

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technological products/services, such as the fastest internet in the world (three to ten times faster than Korea's world leading internet) and converged new services including smart energy, integrated security, next generation media, health care, and intelligent transportation systems.

5.2 Limitations and future research needs

This study examined the effects of strategic investments on business performance of TSPs in the USA and Korea. However, the strategic investments are segmented, which makes this study subject to the following limitations. First, categorizing strategic investments into only three main areas – SP, selling, GA, and DA – presents limitations to perform a more detailed analysis. Thus, a greater segmentation of the strategic investments is needed. Second, the research was limited to only two leading ICT countries, the USA and Korea. Therefore, the results of this study cannot be generalized because other relevant factors that affect the OR in other TSP markets might not have been included. In future studies, more countries should be included for a comparative analysis including: ICT leaders, emerging economies, and under-developed nations. The aforementioned limitations should provide opportunities for future research.

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