

KNOWLEDGE MANAGEMENT STRATEGIES IN THE DIGITAL GAME INDUSTRY: A CASE STUDY OF TAIWANESE FIRMS

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Abstract

Today knowledge and innovation have become critical core competencies for enterprises worldwide. Because of the importance of corporate knowledge in developing a digital economy, we selected 4 firms representing the online gaming industry. Through in-depth qualitative interviews, we investigated current developments in knowledge management strategies in the case firms, the results of which are summarized as follows. First, industry characteristics influence knowledge attributes. The corporate knowledge of digital content developers is usually tacit and is thus difficult to transfer. Second, knowledge management and creation approaches are influenced by the type of knowledge. Managing tacit knowledge tends to involve personalization and can be innovated through socialization and internalization. Third, knowledge creation is related to organizational scale and corporate value-creation processes. Knowledge creation is influenced by corporate value-creation processes, which differ considerably among firms—even those operating in the same industry. Finally, industry characteristics and corporate strategies influence knowledge management strategies. Most digital content developers have long-term oriented industrial consistency that improves their responsiveness to environmental change. Knowledge innovation is unique to the digital content industry. The types of knowledge management strategy correlated with the breadth, depth, diversification, and relevance of organization knowledge.

Keywords: Digital Content Industry, Game Industry, Knowledge Management Strategy, Knowledge Creation

INTRODUCTION

In the 21st century, knowledge economies are crucial. In “Post-Capitalist Society,” management expert Drucker predicted that knowledge would become the only meaningful economic resource in the future. He asserted that knowledge will radically transform existing economic systems and social patterns and become the new benchmark by which corporations assess competitive advantages. Stanford economist Romer (1999) defined knowledge as the only infinite resource in the world and a corporate asset that grows with use. Cadjonovic (2013) defined knowledge as highly valued information and the most vital asset of an organization. Satyendra and Andrew (2013) have reported that knowledge management has a profound influence on the competitiveness and sustainability of corporations. Knowledge management capabilities (KMCs) are factors that enable firms to maintain their competitive advantages (Hung, Chou, & Tzeng, 2011; Yingxin, Yanqiu, & Xiangyang, 2013).

Following the growing prevalence of broadband networks, the increasing number of Internet users, and growing trend of digitization and network applications, the digital content industry, which encompasses various businesses (e.g., gaming, animation, video communication, network services, digital content management, and e-learning), has become the primary focus in realizing the knowledge economy in Taiwan. Developing the digital content industry is anticipated to have a profound and permanent effect on Taiwan’s economy. Developing this industry would facilitate integrating the network creators in Taiwan, such as entrepreneurs, technicians, industry experts, governmental officials, scholars, and cultural and media knowledge workers, and enable firms to accumulate and strengthen their core competencies, thereby accelerating corporate globalization.

Recently, the number of studies focusing on knowledge management has increased, accelerating the development of knowledge management strategies in various industries. However, investigations into the knowledge-intensive strategies employed by digital content developers in industrial clusters are lacking. Apart from studies by Zack (1999) and Nonaka and Takeuchi (1995), no study has investigated corporate knowledge management and innovation from the strategic view of knowledge. Furthermore, previous studies on knowledge management have typically focused on organizational learning and intrinsic factors, and few scholars have explored other factors influencing knowledge management. In addition to intrinsic factors, extrinsic factors affecting knowledge management include strategies, industrial environments, organizational structures, and other external factors. In particular, organizations in emerging industries characterized by rapidly changing environments must develop adaptive and flexible strategies and knowledge operation models to respond to such changes. Most studies in this field have explored knowledge management from the perspective of intrinsic

factors, and only a few of them have considered the effect of corporate strategies. Therefore, this study examined the knowledge management strategies employed by gaming firms to investigate current developments in this area. The research objectives are summarized as follows:

1. To examine and compare the operational status of the development of knowledge management strategies among industry-leading gaming firms; specifically, digital content developers.
2. To understand the execution, selection, and development processes underlying the knowledge management strategies employed in Taiwan's digital content industry.
3. To conduct a case comparison and analysis and propose suggestions for developing the digital content industry. The findings may serve as a reference for industry experts, government officials, and scholars.

LITERATURE REVIEW

Previous studies on knowledge management strategies have explored various dimensions. In this study, we focused on the following four dimensions: knowledge type, knowledge management framework, knowledge innovation, and the strategic view of knowledge. These dimensions are briefly described in the following sections.

Knowledge Type

Knowledge is commonly categorized as explicit or tacit knowledge according to the form of expression (Polanyi, 1967; Nonaka & Takeuchi, 1995; Howells, 1996; David & Liam, 2000). Table 1 lists the connotations to facilitate comparing these two knowledge types. The concept was proposed first by Polanyi in 1967 and has since been applied in various fields. The concept is relatively simple and the two types of knowledge are easy to distinguish and observe in studies; moreover, it has become a critical model for investigating corporate knowledge-management mechanisms. Nonaka and Takeuchi (1995) applied this concept to explain knowledge creation theories. Borghoff and Pareschi (1998) maintained that tacit knowledge is practical knowledge and crucial for accomplishing tasks, and such knowledge is generally available only to organization members. By contrast, explicit knowledge refers to any ability or intellectual property possessed by an organization; unlike tacit knowledge, explicit knowledge is independent from organization members and necessary for organizations.

Table 1: Explicit Knowledge versus Tacit Knowledge

Type	Explicit knowledge	Tacit knowledge
Form	Descriptive	Heuristic
Characteristics	Improves the efficiency of management and innovation	Ensures effective management and innovation
Transfer Method	Direct and effective communication approaches	Direct, face-to-face interactions, sharing and transferring
Ownership	Can be protected by law and is transferrable	Owned by individuals and is difficult to duplicate and transfer
Traits	Rational knowledge: mental Continual knowledge Digital knowledge: theoretical	Experiential knowledge: substantial Synchronous knowledge Analog knowledge: practical
Connotation	Can be transferred through formal or institutionalized media or through language. Advantages include automatic reaction and require little time for contemplation.	Embedded in actions and commitments. Involves unique characteristics. Relatively difficult to transfer and establish as a cultural norm. Divided into cognitive and technological dimensions. The technological dimensions can be further divided into specific technologies, craft, and skills.
Examples	<ol style="list-style-type: none"> 1. Information technology 2. Operational plans 3. Organizational charts 4. Performance data sheets 5. Industry information 6. Operation manuals 7. Expert data banks 8. Education and training courses 	<ol style="list-style-type: none"> 1. Expertise 2. Experience and opinions 3. Professional advice 4. R&D support 5. Technology transfer 6. Corporate culture 7. Coordination skills for interorganizational culture 8. Innovative feedback 9. Customer attitudes toward products and expectations for future products

Source: Nonaka and Takeuchi (1995) and Howells (1996)

In addition to these two knowledge types, various other forms of knowledge have been classified by scholars with various objectives. However, in accordance with the objectives of the present study, only the most widely used classifications are discussed in this paper.

Knowledge Management Frameworks

Cadjenovic (2013) defined knowledge as highly valued information and the most vital asset of an organization. Firms must transform and update knowledge to continually innovate their products (Liao & Wu, 2010). Moreover, appropriately and effectively applying knowledge enhances an organization's competitiveness (Aujirapongpan et al., 2010). Foss (2007) and Satyendra and Andrew (2013) have reported that knowledge management has a profound influence on the competitiveness and sustainability of corporations. Organizations must

continually acquire knowledge to derive competitive advantages (Ciganek, Nicholls, & Srite, 2008; Lai & Lee, 2007). Knowledge management capabilities (KMCs) are factors that enable firms to maintain their competitive advantages (Hung, Chou, & Tzeng, 2011; Yingxin, Yanqiu, & Xiangyang, 2013). KMCs directly affect the organizational performance, which involves innovation, understanding of business opportunities, response to environmental change, and coordination of internal and external activities (Felin & Hesterly, 2007; Rao, 2008).

Different industries and companies cannot apply the same knowledge management approach. Similar to organisms, knowledge management is closely associated with the environment in which it exists. Approaches to knowledge management vary according to external competition, strategic resources, organizational characteristics, and national culture. An environment defines the nature, scope, and limit of processes specifically related to core knowledge. Accordingly, numerous scholars have established various knowledge-related theoretical frameworks for classifying knowledge management approaches according to the following three perspectives: the process perspective, the driving factor perspective, and social capital perspectives.

1. Process perspective: involves dividing knowledge management into activities into knowledge acquisition, knowledge creation, knowledge storage, and knowledge transfer, and then examining these activities separately (Bonora & Revang, 1991; Nonaka & Takeuchi, 1995; Grant, 1996; Davis, 1998; Bhatt, 2000; Shobha, 2008)
2. Driving factor perspective: focuses on environmental factors supporting knowledge management and *enablers* of knowledge management such as leadership, culture, organizational structure, and data systems (Bonora & Revang, 1991; Nonaka & Takeuchi, 1995; Grant, 1996; Bhatt, 2000; Shobha, 2008).
3. Social capital perspective: emphasizes knowledge as a form of social capital. Because knowledge management practices differ substantially, this perspective is also focused on managing knowledge according to practical considerations (Gates, 1999; Swan et al., 1999).

The generalized process and driving factor perspectives were adopted to analyze the knowledge management frameworks discussed in this study. In particular, the critical role of knowledge innovation in this framework was investigated.

Knowledge Innovation

Trott (2008) claimed that innovation is a management process that involves creating value from existing knowledge. A prerequisite for a firm to undertake innovation activities depends on the capacity to transform individual experiential knowledge into corporate knowledge (Helfat &

Peteraf, 2003). According to the resource-based perspective, knowledge is an essential strategic resource for firms; assessing the performance of products, processes, and management innovations enables firms to evaluate the effectiveness of its knowledge innovation processes (Kao, 2011; Liao & Wu, 2010).

Nonaka and Takeuchi (1995) divided knowledge management processes into the following five stages: (1) sharing tacit knowledge, (2) creating concepts, (3) justifying concepts, (4) constructing an archetype, and (5) cross-leveling knowledge. Knowledge creation is a crucial knowledge management process; regardless of which perspective is applied, knowledge cannot be circulated without first being created. The knowledge acquisition-based perspective posits that knowledge creation involves a firm developing internal knowledge, whereas knowledge leverage refers to acquiring extrinsic knowledge. Generally, outsourcing knowledge entails slightly higher information costs compared with insourcing knowledge, but it also enables faster knowledge acquisition. Table 2 depicts the relationship among knowledge acquisition, corporate strategies, and knowledge creation.

Table 2: Knowledge Acquisition and Knowledge Creation

Development Direction	Corporate development strategies	Knowledge acquisition approach	Knowledge attributes
External development (Outsourcing)	1. Mergers and acquisitions 2. Strategic alliances (equity or nonequity; e.g., technological development) 3. Long-term contracts	Knowledge leverage 1. Buyout acquisitions, mergers and acquisitions, technology transfer 2. Strategic alliances (joint ventures, cooperatives) 3. Contract research (outsourcing and innovation incubators are analogous to original equipment manufacturers)	Involves more explicit knowledge, such as technological management
Internal development (Insourcing)	1. Process improvement 2. Intrapreneurship 3. Diversification 4. Vertical integration	Knowledge creation 1. Benchmarking 2. Learning from customers 3. Talent recruitment 4. Experiential and experimental learning 5. Knowledge stocks	Involves more tacit knowledge. Diverse forms of knowledge with high specificity.

The Strategic View of Knowledge Management

To examine knowledge management strategies, the strategic attributes of knowledge management must first be understood. Porter (1980) classified competitive strategies according to factors such as market breadth, cost advantages, and differential advantages. However, few

studies have explored the strategic attributes of knowledge management. We thus organized the strategic attributes of knowledge management and related studies as follows:

- (a) Outsourcing–insourcing: indicates whether an organization researches, develops, creates, and generates knowledge internally or acquires knowledge externally (Loenard-Barton, 1995; Nonaka & Takeuchi, 1995; Freeman, 1987).
- (b) Knowledge expiry: specifies whether the effects of knowledge are long or short term (Nonaka & Takeuchi, 1995).
- (c) Intensification or integration: indicates whether an organization focuses on intensifying existing strategies or integrating new strategies in order to achieve diversity (Hedlund, 1994).
- (d) Collective activities: indicates the number of individuals, units, or functional units involved in knowledge-related affairs in an organization (Senge, 1990; Nonaka & Takeuchi, 1995).
- (e) Environmental stability: indicates whether knowledge-related affairs remain stable or change profoundly (Nonaka & Takeuchi, 1995).
- (f) Market–production: indicates whether an organization focuses on knowledge demand of market consumers and channels or overlooks market conditions and dedicates itself instead to its core knowledge of focus (Williamson, 1975).
- (g) Levels of knowledge bases: reveal the amount of accumulation, investment, and breadth of knowledge resources owned by an organization (Peters & Fufeld, 1982).
- (h) Intensity of resource investment: indicates the extent to which an organization is willing and able to invest intellectual resources into its organizational affairs (Peters & Fufeld, 1982; Nonaka & Takeuchi, 1995).
- (i) Knowledge characteristics: indicate the ease with which an organization documents the knowledge required or commonly applied (Peters & Fufeld, 1982; Loenard-Barton, 1995; Grant, 1996).
- (j) Periods of tolerance: indicates whether an organization is willing to invest continually and acquire new knowledge slowly or requires this knowledge immediately (Zack, 1999).

METHODOLOGY

Population and Sampling

The main purpose of this study was to examine the application of knowledge management strategies. Accordingly, digital content developers were recruited for this study because they present the greatest research values, and their knowledge innovation characteristics are most prominent. Among the subsectors of the numerous content developers, the game firms, which are listed by the Taiwan authority as targets for key counseling and exhibit vital market values,

were selected to represent the targets of study in the industry. Four game firms were selected for in-depth interviews because they were the leading firms that exhibited extraordinary representativeness in the gaming industry. Table 3 and the remainder of this chapter show the organized independent background information of these case firms, which are labeled as Firms A, B, C, and D.

Table 3: Basic Information of the Case Firms

Firm Item	Gaming Firms			
	Firm A	Firm B	Firm C	Firm D
Founding Year	2000	1989	1988	1995
Capital	NT\$409.8 million	NT\$370 million	NT\$470 million	NT\$1.08 billion
Listed in the Market	Yes	Yes	Yes	Yes
Number of Employees	300	180	250	580
Overseas Business Locations	United States, China	China, USA	China, Japan	China, Japan, South Korea, Europe, United States
Primary Businesses	TV games, online games, social network service game development	PC games, online games, multimedia for preschool education	PC games, online games, digital magazines, multimedia	Development, agency, and publication of PC and online games, merchandises, magazine media programs
Core Values	R&D Self-developed real-time 3D game-imaging engines and graphics production technology	R&D, publication Simultaneous capabilities for development and publication, Chinese-language gaming materials, other multimedia software	R&D, publication PC, online, and TV game R&D, video peripheral R&D, access publication advantage	Publication, services The first self-built server room, AVATAR game cross-platform integration technology, game engine technology R&D, service and marketing innovation

Research Approach

Through the use of the multiple-case study approach, the digital content developers who exhibited favorable knowledge innovation effectiveness were selected for open-field in-depth interviews. In accordance with the focal points in the established study structure and the constructed questionnaire and summary, qualitative in-depth interviews were conducted in order to understand the current circumstances regarding the implementation of knowledge innovation strategies in the case-study firms and other related problems. These data were consolidated and classified to aggregate the conclusion and devise recommendations in this study.

Regarding the interviewee requirements, midlevel and top-level managers involved in strategic-level decision-making were principally selected as the interviewees. The exceptional

firms were selected from the list of recommendations by the Industrial Development Bureau, Ministry of Economic Affairs. Contacts were then established with the firms to receive recommendations on suitable candidates for the interviews. Afterward, interview letters, questionnaires, and question outlines were faxed/ emailed to the case firms. In practice, a majority of digital content developers do not possess personnel specialized in knowledge management; responsibility over knowledge circulation and sharing is typically shared among managers overseeing the administration, information, and technology departments. This indicates that the role identification of knowledge management differs substantially in each firm.

CASE ANALYSIS

Knowledge Attributes

The knowledge attributes of the case firms in this study were divided into the following two types for analysis: core knowledge and tacit/explicit knowledge.

Core Knowledge

Core knowledge is a key factor enabling a firm to develop substantially, and acquire competitive advantages continually. In this study, core knowledge was analyzed using two viewpoints: (a) the functional value viewpoint, which involved using questionnaires to obtain information, as shown in Table 4; and (b) the knowledge-based asset viewpoint, which involved conducting in-depth interviews.

The Functional Value Viewpoint

Based on the concept of value chains proposed by Porter (1980), this viewpoint divides core knowledge into items such as R&D designs, marketing access, manufacturing, logistics financing administrations, human resource management, and others. Our analysis on the case firms is shown in Table 4.

Table 4: Core Knowledge of the Case Firms

Case Firms	Gaming firms			
	A	B	C	D
Core knowledge items				
R&D	⊙	⊙	⊙	⊙
Market access	⊙			
Manufacturing		⊙	⊙	
Logistics Financing Administrations				
Human Resource Management				
Customer–Supplier Relationship Management				

1. Importance of R&D in the gaming industry: All interviewees addressed R&D as the primary core knowledge for game firms. The innovation orientations and entertainment values of game story contents are the primary factors affecting game product sales. Possessing a long history of operations, Firms B and C had adopted vertical integration in their role as publishers; therefore, manufacturing was also a decisive value chain for Firms B and C.
2. Differences in product lifecycle: Lifecycles for gaming products comprise two types; those for games played locally on a PC, and those for games played online. PC games have shorter life cycles, which last from approximately 3–12 months. Online games have life cycles that can last for several years because of the considerable social adhesiveness and content development intensity online games display. The contents of game products must be recurrently updated to continually expand the markets for game products. Therefore, all the interviewees agreed that R&D designs are vital core knowledge that enables the case firms to operate sustainably and strengthen their core competitiveness continually.

The Knowledge-Based Asset View

The in-depth interviews revealed that a majority of the interviewees perceived the core knowledge of their firms as knowledge-based assets. The responses of these interviewees are hereby organized as follows:

- A. Knowledge on R&D technology is the common language and primary requirement for all digital content developers.
- B. R&D contents exhibit industry characteristics. Although knowledge on R&D technology is the primary requirement for digital content developers, the contents developed using the technology vary according to the types of industries. For game firms, R&D technology involves not only 3D technology, but also planning, scripts, arts, content materials, and music for game storylines, all of which require creative project producers to plan thoroughly. The interviewees from Firm D indicated that creative talents are more difficult to train than technological talents but are the core personnel in game development. The interviewees from Firm A maintained that technology is only a basic requirement, but the entertainment values provided by products is the true key aspect of the industry. Therefore, creative and technological developments are both required for integral R&D in the gaming industry.
- C. Corporate strategies generate differences within the industry. Firm A originally positioned itself as a professional TV game developer but is now involved in the online game market. The firm focuses on the international market and involves primarily foreign partners, and the technological requirements of the firm are high. Therefore, R&D technology and talents are the core assets for the firm. Firms B and C position their markets in China, Hong Kong, and

Taiwan and commit themselves fully in promoting Chinese-language games. Because of their long history of operation, these two firms have developed vertically integrated business models. Therefore, manufacturing and marketing accesses have become the two business know-hows for these two firms in addition to R&D technology. Firm D was established as an online game agency firm. Because satisfactory services and stable Internet connection must be provided to online game users, Firm D invested more than NT\$300 million to develop backend server room technology. Consequently, Firm D differs from other game firms, which typically only develop product technology and entrust server rooms to Internet service providers. Therefore, R&D technology with developmental service characteristics was one of the factors enabling the emergence of Firm D.

Tacit and Explicit Knowledge

Knowledge is one of the crucial resources for firms. We maintained that information tangibly and formally recorded in open corporate systems, as well as various documents, rules, records and data system information that enable employees to acquire and satisfy their job requirements, are corporate explicit knowledge. Conversely, those with none of the aforementioned characteristics are tacit knowledge. Accordingly, corporate knowledge can be divided into four types, namely highly tacit, highly explicit, highly tacit and explicit, and lowly tacit and explicit. The corporate knowledge in each of the case firms was categorized into one of these four types. The Likert scale was applied in the questionnaire assessment, which corresponds the answers strongly disagree, disagree, moderate, agree, and strongly agree to the scores of one, two, three, four, and five, respectively. Table 5 illustrates the knowledge attribute construction table for the case firms.

Table 5: Theoretical Constructs of the Corporate Knowledge Attributes

Operational Definition		A	B	C	D	Mean
Tacit Knowledge	V Employees typically must acquire job knowledge through informal learning and programs	4	4	4	3	3.75
	V Employees typically acquire job knowledge by accumulating personal experience	3	2	5	2	3
	V The job core knowledge must be taught through one-on-one approaches (mentorship)	2	4	2	2	2.5
	V During work, employees must acquire considerable core knowledge and experience outside written information	4	4	4	3	3.75
	V Pre-service training and learning in the job are time-consuming	5	5	5	3	4.5
Explicit Knowledge	V The job core knowledge is clearly articulated in text	3	4	2	3	3
	V The job core knowledge is easily preserved in written data	2	4	2	3	2.75

V Employees can acquire knowledge from standard written manuals to accomplish jobs	1	2	4	4	2.75	
V The core knowledge is structured, contextualized systematic knowledge	3	2	2	2	2.25	
V The job core knowledge is typically taught through group training	3	2	4	3	3	
Knowledge Attribute: Tacit Knowledge	Mean	3.6	3.8	4	2.6	3.5
Knowledge Attribute: Explicit Knowledge	Mean	2.4	2.8	2.8	3	2.75

Firms A–D are all game-developing firms. Different strategic positions in the industrial chain have caused a number of differences among the knowledge attributes of the firms. However, all the four firms stress R&D technology. This study implied that Firms A, B, and C exhibit higher levels of tacit knowledge and lower levels of explicit knowledge, as well as similar distribution areas. Only Firm D focuses on online games, which require higher maintenance costs than PC games. Therefore, Firm D emphasizes creating its own backend platform technology, differentiating itself from other firms, which typically partner with Internet service providers. Additionally, Firm D strongly stresses service innovation and actively engages with customer communities; conversely, PC game products do not facilitate interactions with customer communities. Consequently, unlike other firms, Firm D possesses nontechnical organizational knowledge, integral service codes, and more shared explicit knowledge; these render the knowledge attribute of Firm D different from those of the other three case firms. Firm C scored the highest on tacit knowledge. This can be attributed to the high proportion of R&D personnel in the firm (constituting more than half the total number of employees). Furthermore, because of its long operation history, Firm C has formed a fixed learning curve and accumulated a certain number of technical documents, and its employees stress experience accumulation. In summary, only Firm D emphasizes both types of knowledge equally, but the other case firms accentuate tacit knowledge solely.

Knowledge Management Model

This section presents a discussion on whether the case firms executed organizational changes according to knowledge management, and briefly details knowledge management approaches.

Organizations Promoting Knowledge Management

An overview of knowledge management promotion for the four case firms are organized and presented in Table 6.

Table 6: Case Firms Promoting Knowledge Management

Case Firm Question	Game Firms			
	A	B	C	D
1. Does the firm include specialized personnel in charge of promoting knowledge management?	N/A	Management information systems department	N/A (human resource department)	General administration (human resources department)
2. Does the firm promote substantive activities for knowledge management?	Yes	Yes	Yes	Yes
3. Participants in knowledge innovation	All personnel	All personnel	All personnel	All personnel
4. Additional investments in establishing knowledge management	N/A	NT\$5–\$10 million per year	NT\$1–\$5 million per year	N/A
5. What approaches have been adopted to motivate employees to promote knowledge management activities?	Rewards upon goal achievement	Rewards upon goal achievement	Rewards upon goal achievement, direct participation by managers	Direct participation by managers

Table 6 shows that all the interviewees agreed that knowledge management activities have been promoted in the case firms. However, plans for systemizing knowledge management remain lacking. Comparatively, Firms B, C, and D exhibited relatively clearer knowledge management organizational concepts. The interviewees from Firm B indicated that knowledge management activities are run by the Information Department in the firm. The interviewees from Firm C recounted that, although actual knowledge management activities have been conducted in the firm, the department in charge of these activities has not been specified; a majority of knowledge management activities are still run by the Personnel Department. Compared with the conventional organizational models of Firms B and C, the knowledge management activity strategies of Firm D involve reestablishing a virtual unit that resembles the general administration unit. This is attributed to the relatively flat organizational structure in Firm D, in which midlevel and top-level managers of the five core departments are designated as the points of contact in charge of integrating affairs regarding knowledge circulation and sharing. Regarding the question on the approaches used to motivate employees to promote knowledge management activities, the managers of the case firms typically presented two types of approaches: rewards upon goal achievement and direct participation by managers.

Knowledge Management Approaches

According to the strategic framework model on knowledge management used in Arthur Andersen Consulting and the study conducted by Hansen, Nohria, and Teirney (1999), two types of corporate knowledge management approaches (i.e., codification and personalization) were summarized. Face-to-face interviews were conducted in order to understand the knowledge management approaches the firms have employed. The results are summarized in Table 7.

Table 7: Knowledge Management Approaches Adopted by Case Firms

Operational definition		A	B	C	D	Mean
Codification	Primarily incorporates using information systems, documents, or technical manuals to solve problems	3	5	2	3	3.25
	Emphasizes developing information systems as well as classifying, storing, and transferring knowledge	3	5	4	4	4.00
	Involves a sizable investments in IT	5	5	4	4	4.50
	Typically involves hiring people who lack experience	3	1	2	3	2.25
	Encourages employees to use and accumulate documents in a database	4	5	4	4	4.25
Personalization	Primarily incorporates using personal and professional knowledge and experience to solve problems	3	5	4	3	3.75
	Knowledge acquired from solving work-related problems is typically case-specific	2	2	4	2	2.50
	Emphasizes developing staff networks and accumulating personal experience and professional knowledge from other workers	4	5	2	4	3.75
	Typically involves hiring experienced professionals who are knowledgeable in their field	4	5	4	4	4.25
	Encourages person-to-person communication and knowledge-sharing among employees	5	5	4	5	4.75
Knowledge management approach: Codification	Mean	3.6	4.2	3.2	3.6	3.65
Knowledge management approach: Personalization	Mean	3.6	4.4	3.6	3.6	3.80

Influence of Knowledge Attributes

The knowledge attribute analysis revealed that the digital content industry emphasizes the importance of accumulating tacit knowledge, which is consistent with the conditions of personalized knowledge management approaches reported by Hansen, Nohria, and Tierney (1999). Sharing and transferring personalized knowledge involves interpersonal networks, which foster person-to-person interactions through various means to enable tacit professional knowledge-sharing among employees. Regarding the question items on personalization, the item “encourages person-to-person communication and knowledge sharing among employees” received a score of 4.75, which was the highest among the items, whereas “incorporates primarily the use of personal professional knowledge and experience to solve problems”

received an equally significant score of 3.75. On codification, “typically involves hiring inexperienced novices” scored 2.25, the lowest among the question items, indicating that tacit knowledge is crucial for the industry. These are the primary causes contributing to the mean on personalization (3.8) being higher than that on codification (3.65).

Investment in IT Moderates the Effect on Knowledge Attributes

Although the mean score on personalization was slightly higher than that on codification, the difference between them was small. This was ascribed to the high score on IT investments, which reduced the difference between the mean scores. Among the codification items, “involves a sizable investment in IT” received a score of 4.5, which was attributed to the industry characteristics of the firms; unlike general cultural and media industries, the digital content industry involves combining innovation, technology, and the intensive use of brainpower to create knowledge-based products. Specifically, to continually acquire competitive advantages in the international market, Taiwan’s digital content industry requires persistent improvements in its manufacturing processes. Consequently, investments in IT have been substantial; for instance, Firm D has more than one-third of its capital expended into constructing its own server room.

The gaming industry typically applies codified and personalized knowledge management approaches equally. However, based on the nature of industry knowledge, the level of personalization is slightly higher than that of codification. Nevertheless, at the current stage, investment in information hardware is the primary indicator of codification.

Knowledge Creation

Knowledge-Creation Processes

The question items regarding the knowledge creation processes employed by the case firms are organized in Table 8.

Table 8: Knowledge Creation Processes Employed by the Case Firms

		Case Firm			
		A	B	C	D
Knowledge Creation Process Within the Organization	Top-down		⊙		⊙
	Bottom-up				
	Central and bottom-up	⊙		⊙	
	Central and top-down				

Note. “Top” represents top-level managers, “central” represents midlevel managers, and “bottom” represents low-level employees

In this study, knowledge creation processes were classified into four types: top-down, bottom-up, central and bottom-up, and central and top-down. The knowledge creation processes applied by the case firms were categorized into the following two types.

Top-Down

This type of process is employed by Firms B and D, both of which are large-scale multinational firms. Firm B has nearly 300 employees, including foreign R&D personnel; and Firm D comprises more than 700 employees worldwide. In these large-scale multinational firms, staffing and knowledge circulation must be uniformly planned and integrated effectively by top-level managers.

Central and Bottom-Up

This knowledge creation process was adopted by Firm A, which employs nearly 100 staff and encompasses the U.S. market, and Firm C, which has nearly 300 employees and operates in markets in China and Japan. Although these two firms exhibit different organizational scales and market positioning, they share identical R&D orientations, and approximately 50% of employees in each firm work in R&D. Firms that stress research and innovation generally provide employees with more developmental freedom. Therefore, the midlevel manager of each department is authorized to supervise knowledge creation processes; the resulting encouragement to employees is more effective than interventions from top-level managers.

Types of Knowledge Creation

During the knowledge creation process, each firm may focus on various types of knowledge. Table 9 displays the primary types of knowledge creation adopted in each firm, as well as the knowledge types considered difficult to create in each firm.

Table 9: Types of Knowledge Creation Employed by the Case Firms

Case Firm		A	B	C	D
Knowledge Creation Topic					
1. Types of knowledge created internally (◎)	R&D technology	◎	◎	◎	◎△
	New production equipment skills and process improvement	◎	◎		◎
2. Types of knowledge difficult to create (△)	Management skills	◎	△	◎	
	Product innovation	◎△	◎	◎△	◎△
	Market advertising			△	◎
	Customer services		△		◎

Major Types of In-House Knowledge Creation

As shown in Table 9, the major types of knowledge creation adopted by the four case firms are sequentially R&D technology, product innovation, and new production equipment skills and process improvement. Because all the case firms are digital content developers (content providers), basic technological R&D for digital products is the most critical type for these firms. In the gaming industry, technologies such as game engine development, platform integration development, and illustration technology, which define the quality, fluidity, and entertainment values of digital products, are the fundamental tools utilized for producing digital products. Therefore, innovative R&D technology is indubitably the primary requirement for digital content developers. Moreover, in addition to hardware development, product creativity is substantially imperative, for it is characterized by nontechnical knowledge innovation involved in product creation such as planning, scripts, and designs; product creativity is the key factor affecting product sales more directly than technology. In summary, because product innovation is easier to achieve than the other types of knowledge creation in the gaming industry, developing in-house gaming products has gradually become a novel business approach for game firms after the end of the foreign game agency trend.

The other types of knowledge creation employed vary according to the unique conditions of each case firm. Firms A and C emphasize R&D relatively more than do Firms B and D. During game product development processes in these firms, organizational changes occur considerably frequently; development teams are often disbanded when a project is complete, and the team personnel reinvest their knowledge in developing the next product. However, these team personnel explicitly value knowledge innovation involving organization management skills. Comparatively, Firms B and D exhibited relatively greater organizational stability because of their larger organizational scales.

Firm D is a game development and agency firm focusing on online games. Online games differ from offline games in that the long-term management of online game customer communities is considerably more critical. Therefore, Firm D differs from the other case firms in that it possesses more diverse types of knowledge creation, which include not only R&D technology but also other items such as market advertising and customer services. Specifically established in Firm D are a Core Media Department, which oversees the management of game magazines and media programs, and a Core Sales Department, tasked with planning and innovating marketing tactics. These reveal the firm's strong ambition to attract new customers and its aggressive approach to expanding its market share.

Types of Knowledge Considered Difficult to Create

Product innovation is typically regarded as the most difficult type of knowledge to create. The core values of product contents influence numerous dimensions regarding the products themselves. In addition, employees with prolific creativity are challenging to train, and finding entertainment materials that fulfill customer preferences and market trends is strenuous. Unlike technical knowledge, product innovation is a type of knowledge creation without clearly defined logics. Therefore, game firms that attempt to develop their own brands inevitably face problems regarding product innovation.

The interviewees from Firm B stated that the firm has not encountered any difficulties in product innovation, although this does not imply that their innovation attempts are negligible. This is ascribed to other resources enabling product innovation in the firm, including not only game software businesses but also businesses involving preschool multimedia and management training. Furthermore, the members of Firm B are currently planning to focus on developing games based on Chinese-language historical novels. Therefore, the product content resources for the firm are temporarily stable. Firms B and C were formed as offline game firms before expanding into online game development, in which managing online game communities is crucial. Therefore, the interviewees from both Firms B and C indicated that market advertising and customer services in the firms must currently be improved.

Approaches of Knowledge Creation

Knowledge creation activities in an organization can be classified into those involving cooperation with other organizations and those accomplished internally and independently. Table 10 lists the questionnaire items and results regarding the approaches of knowledge creation adopted by the case.

Table 10: Knowledge-Creation Approaches employed by in the Case Firms

Case Firm		A	B	C	D
Modes of Knowledge Acquisition					
Primary modes of internal knowledge creation	Experience-sharing among employees (e.g., hosting in-house seminars or business conferences)	⊙	⊙	⊙	⊙
	Describing experiences through metaphors, analogies, or concepts (e.g., encouraging creation and publishing research results)		⊙		
	Using videos to provide learning experiences or creating learning manuals to enable employees to accumulate knowledge creation values.	⊙		⊙	
	Through the use of seminars and implementation training, systematically introducing and converting external knowledge to in-house knowledge.	⊙	⊙		⊙

Nonaka and Takeuchi (1995) maintained that knowledge is created through interactions between tacit and explicit knowledge, from which four unique modes of knowledge creation are generated: socialization, externalization, combination, and internalization. Table 10 shows that the primary modes of knowledge creation employed by the case firms are socialization and internalization, which are described in the following subsections.

Experience-Sharing Among Employees (Socialization)

Socialization involves an individual acquiring tacit knowledge from other individuals without the use of language. For example, apprentices learn their craft from their masters through observation, imitation, and practicing, rather than through language. The same principle applies to businesses: tacit knowledge is obtained through workplace training. Accumulating experience is the key to acquiring tacit knowledge; without a certain form of common experience, a person cannot easily understand how other people think. Such is the meaning of socialization. As shown in Table 10, all four case firms have incorporated socialization and experience-sharing to generate knowledge. The mentioned knowledge attribute analysis results indicated that knowledge in the digital content industry is substantially tacit and difficult to transfer and generate through documentation, externalization, or combination. Therefore, experience-sharing among employees has become the primary mode of knowledge creation for digital content developers.

The Mechanism Involving Seminars and Implementation Training (Internalization)

Internalization is a process of converting explicit knowledge to tacit knowledge, and explicitly involves the process of learning by example. For instance, Hiroshi Watanabe, the project leader of urban car models in the Japanese Honda Automobiles, has continually encouraged his employees to internalize and broaden their experience, using the phrase, "Let's try it!" Practically, transferring knowledge using languages and stories or documenting it facilitates converting explicit knowledge to tacit knowledge. Documents enable individuals to internalize an experience; in addition, using documents or manuals promotes transferring explicit knowledge, thereby enabling a third party to partake in the experience of other people indirectly. Such is the concept of internalization.

Knowledge Creation Strategies

Knowledge Strategy Attributes

Introducing innovative knowledge and technology to a firm typically involves strategic considerations. In this study, knowledge strategy attributes were classified into 10 types,

including long- or short-term orientations. Knowledge was categorized using the continuum approach, and recorded using a 5-point semantic differential scale, with each item receiving a score from 1 to 5 (left to right). Table 11 shows the measurement of the knowledge strategy attributes applied in the case firms.

Table 11: Knowledge Strategy Attributes Employed by the Case Firms

Attribute Classification	Item	Game Firms				Note
		A	B	C	D	
Long- and short-term response orientations	Long-term consideration to short-term consideration	2	1	4	2	
	High—low investment	2	2	2	2	*
	Satisfactory—unsatisfactory basics	2	1	1	2	*
	Long—short lifespan	3	1	2	3	
	Abstract—specific knowledge	2	2	2	3	*
	Mean	2.2	1.4	2.2	2.4	
Externalization orientations	Joint intervention — expert-specific	2	4	4	2	
	Internal creation — external introduction	3	1	4	3	
	Mean	2.5	2.5	4	2.5	
Intensification orientations	Market- to firm-oriented	4	4	4	3	
	Integrated—intensified knowledge	2	3	2	3	
	Mean	3	3.5	3	3	
Environmental stability	Changing environment — Stable environment	1	2	2	2	*

Note: * indicates industry consistency.

Table 11 lists the orientations of the organizational knowledge strategies. This study analyzed the factors that exhibit industry consistency, revealing that corporate strategies are the primary factor affecting the individual performance of each firm. The factors are explained as follows.

Industry Consistency in Long-Term Response Orientations

High resource investment, R&D personnel with satisfactory basic skills, and abstract and difficult-to-document knowledge are the items all the case firms had a tendency to shift toward in emphasis. These items were categorized in long-term orientation for knowledge strategies. All the case firms are upstream digital content developers, the industry characteristics of which are the primary factors causing them to favor the mentioned orientations. According to the mentioned analysis on knowledge attributes, tacit knowledge is the most common knowledge attribute among the case firms. Because tacit knowledge must be identified from the learning experience of employees, the greatest assets for digital content developers are experienced employees. Therefore, firms must invest a considerable amount of resources into training and production.

Industry Consistency in Environmental Stability

All the interviewees maintained that the industry environment is changing rapidly and remains unpredictable. In addition, market demand in the entertainment industry is everchanging; digital content products are situated in the global market, in which rapid market responses directly influence the values of firm innovations. Therefore, in response to the global entertainment market, digital content developers must devise flexible development strategies to overcome cultural language barriers, understand local market demands quickly and accurately, utilize the timeliness of thematic materials effectively, improve production efficiency and reduce lead time, promote the regional adaptability of products, and strengthen global marketing.

Industry Characteristic Differences in Intensification Orientation

Intensification orientation indicates the level of knowledge innovation or technological development intensity in an organization. This orientation may be categorized under two topics: (a) the orientation of an organization regarding knowledge pursuit, which implies whether the organization focuses on acquiring commercially available knowledge or generating its own specialized knowledge; and (b) the types of knowledge accumulated in an organization, which may favor integrated knowledge of multiple fields, or fixed, nontransferable core knowledge. The case analysis in this study differed substantially from previous analyses on conventional industries. Analyses on conventional industries have indicated that each of the developmental orientations corresponded with one of the two respective topics. Specifically, firms that focused on market orientation all favored the integration orientation, and those that focused on their own expertise all preferred development involving fixed intensification. However, by investigating the case digital content developers, we found that the two topics regarding intensification were matched with opposing developmental orientations. Thus, the result of this analysis differed from those conducted on conventional industries, and revealed the differences in these industries.

Taiwanese gaming firms typically exhibit industrial directions combining firm orientations and integrated knowledge. Specifically, these game firms pursue firm knowledge intensively, because the contents of game firm knowledge are more diverse than those of market-oriented knowledge. Vertical integration involving all levels of overall product development and production processes is considerably prominent. During the integration process, game firms typically integrate knowledge that is both related and unrelated to their own professions in order to generate new knowledge patterns that are beneficial to apply, thereby promoting diverse, multiproduct-line strategic development. Moreover, game firms typically initiate market demand

creation. Therefore, accumulating and integrating diverse firm knowledge has become the most prominent operational approach of Taiwanese game firms.

The Externalization Orientations are Affected by Individual Corporate Strategies

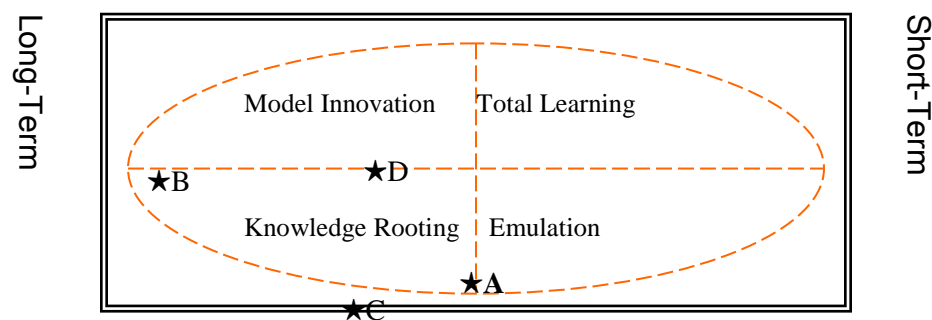
When engaging knowledge-based activities, the four case firms exhibited considerably diverse levels and approaches in introducing knowledge from the external environment, and vary according to the unique corporate strategies in each firm.

Types of Knowledge Strategies

For this study, we divided knowledge strategies into four types, as shown in Figure 1.

Diverse Integrated Knowledge Orientation (wide breath, low intensity)

Figure 1: Classification of Knowledge Attributes and Strategies



Firm-Specific Knowledge Orientation (narrow breath, high intensity)

Innovation Model Strategies

Firms that adopt this type of strategy specialize in innovating new knowledge, and produce industry or product models frequently. Therefore, this type of firm is known for its model innovation knowledge management strategies. Firms B and D are this type of firm. As mentioned, the knowledge attributes of nearly all the case firms are inclined toward long-term-oriented tacit knowledge. Therefore, all the case firms are positioned on the second and third quadrants in the figure. Firms B and D are positioned in the upper quadrant, thereby displaying their tendency toward knowledge integration approaches. In addition, both these firms display diversified business development. Specifically, Firm B is engaged in multiple businesses such as preschool software, downstream productions, and management training consultants; consequently, the knowledge in Firm B is substantially diverse and requires integration. Although Firm D focuses on online game platform development and agency, it has invested a

substantial amount of capital into small businesses involved with related technological development. Furthermore, of all the case firms, Firm D, which is involved in factors such as upstream in-house game development, a midstream publication agency and integrated platform establishment, and downstream access and customer services, stresses customer services most intensively. Thus, the in-house knowledge of this firm is substantially diverse, leading to the firm's preference to vertically integrate all levels of the industry. In summary, broader and more diverse in-house knowledge often leads to the formation of a multiservice organization. Furthermore, long-term, intensive resource investment in knowledge integration enables an organization to create new market knowledge and industry or product models. Therefore, this type of firm is known for model innovation knowledge management strategies.

Knowledge-Rooting Strategies

Firms employing this type of strategy generate knowledge that is intensive and difficult for competitors to acquire, similar to building barriers to entries. Therefore, these firms are known for their knowledge-rooting strategies. Unlike organizations that adopt model innovation strategies, those that employ knowledge-rooting strategies focus their own specialized in-house knowledge, and do not transfer their core knowledge readily. The in-house knowledge of this type of organization exhibits a narrower breadth, but greater intensity. Represented by Firm C, firms of this type typically possess more rigorous R&D departments and emphasize technical innovation.

Emulation Strategies

Firms that adopt this type of strategy are typically adopters of existing knowledge. Instead of applying a broad variety of knowledge, these firms only focus on following intensified knowledge. This type of knowledge management strategy is the most passive of the four types. However, although Firm A is classified as one such type of firm in this study, the firm is considerably close to the type involving knowledge-rooting strategies. Firm A is the leading firm in the Taiwanese console market, which exhibits higher technical requirements than do other types of games, and the major competitors to the firm are foreign. Therefore, following the mainstream international supplier demands and market changes is the primary knowledge management strategy of Firm A.

Total Learning Strategies

Firms adopting this type of strategy exhibit urgent requirements for knowledge, mediocre knowledge basics, a shorter knowledge lifespan, and negligible investments in long-term

knowledge resources. However, these firms also display intentions to acquire a wide variety of knowledge externally, and appropriately integrate the knowledge into knowledge patterns beneficial for the firms to apply. Therefore, these firms are known for their use of total learning knowledge management strategies. None of the case firms in this study have adopted this type of knowledge management strategy.

CONCLUSION

Four Taiwanese online game firms were sampled in this study, and in-depth interviews were conducted to analyze and compare the knowledge management strategy topics regarding these firms. Our conclusion is as follows:

- (a) Knowledge attributes are influenced by industry characteristics. Corporate knowledge possessed by digital content developers tends to be tacit and difficult to document.
- (b) Knowledge management and creation approaches are both affected by knowledge attributes. If certain knowledge tends to be more tacit, then the management of such knowledge is often more personalized, and the innovation of this knowledge is typically more socialized and internalized. Conversely, if certain knowledge is more explicit, then managing such knowledge tends to be more codified, and the innovation of this knowledge is more commonly combined and externalized.
- (c) Knowledge creation processes are related to organizational scales and corporate value creation processes (market positioning and product lines). Types of knowledge creation are influenced by corporate value creation processes (corporate strategies), which differ explicitly among firms.
- (d) Knowledge management strategies are defined by industry characteristics and corporate strategies. Regarding the four dimensions of knowledge management strategies analyzed in this study, industry consistency is displayed in long-term orientations and environmental changes in the digital content industry, industry uniqueness is exhibited in intensification orientations, and externalization orientations are affected by individual corporate strategies. In addition, regarding the four types of knowledge management strategies, the strategies employed by the four digital content developers in this study were classified as two of the types: model innovation and knowledge rooting strategies. This is related to the breadth, depth, and diversification levels of corporate knowledge.

In summary, systematic standards for knowledge management in current Taiwan online gaming industry are still lacking; this is ascribed to the industry characteristics and the small organizational structures of game firms. Therefore, research on understanding the effect of organizational scale is a valuable future research direction.

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