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"Gaming Industry in S&T Clusters: A Comparative Analysis of Osaka-Kobe-Kyoto and Tokyo-Yokohama"

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INTRODUCTION

The objective of this thesis is to examine production specializations in the gaming industries of Japan's science and technology clusters: Osaka-Kobe-Kyoto and Tokyo-Yokohama. According to Global Innovation Index (GII), Tokyo-Yokohama has consistently been recognized as the top S&T cluster worldwide for years, while Osaka-Kobe-Kyoto is positioned sixth in 2024. Concurrently, the gaming industry is regarded as a strategically crucial sector in Japan, which is one of the leading global markets in this field, alongside the United States and China. The analysis presented in this thesis employs the WIPO Patent Classification (IPC) for the cluster analysis of video games. This classification has been utilized in several research studies to facilitate insights into industry technologies and trends (Oguguo, 2024; Izushi & Aoyama, 2006; Cohendet et al., 2010).

The initial chapter provides an analysis of existing literature regarding industrial and innovation clusters, examining their key features and related advantages, specifically focusing on the ideas of knowledge spillovers, geographical concentration, and the capacity for innovation. Various pertinent theoretical frameworks are examined, including Porter's diamond model, Engel's Innovation Clusters Model, and the Triple Helix Model, which are beneficial for contextualizing the dynamics of cluster evolution and interrelation. The reviewed literature also encompasses studies focusing on gaming industry clusters, including the analysis of the Montreal cluster by Cohendet et al. (2010), which aids in comprehending the dynamics and unique aspects of gaming as an innovation sector. The second chapter seeks to provide a general overview of the two science and technology clusters, in accordance with the parameters delineated by the Global Innovation Index. Subsequently, an analysis is presented of the genesis of the video game industry in Japan, accompanied by an overview of its status and economic performance.

The third chapter is dedicated to the identification of any distinctive production specialisations in the two clusters. Through an analysis of the patents registered in the technology classes relevant to gaming, based on the Orbit database, a useful dataset was constructed to highlight the areas of technological specialisation of each cluster. An analysis of patents related to complementary sectors was also carried out to gain a broader understanding of industrial synergies. In support of these findings, a qualitative analysis of the largest companies active in the clusters was used to identify emerging technological trends and to outline the role and development directions of the clusters in the global competitive landscape. The study points out different yet complementary technological focuses in Japan's main gaming hubs. Tokyo-Yokohama demonstrates strong capabilities in connectivity, cloud technologies, and data security. This area is dedicated to improving infrastructure and network systems, playing a crucial role in the evolution of AR/VR interfaces and streaming technologies. On the other hand, the Osaka-Kobe-Kyoto region stands out in sensor technologies and immersive game controls, which showcase a highly focused corporate environment driven by Nintendo.

CHAPTER 1

1.1 DEFINITION AND CHARACTERISTICS OF CLUSTERS

Clustering is defined as the process of locating firms in similar sectors in close proximity to one another, without any form of political or legal obligation (Crouch & Farrell, 2001). In a cluster, companies, specialised suppliers, service providers and associated institutions are connected by shared characteristics and complementary features, forming a collaborative network that drives innovation and enhances productivity. These firms operate under the same market condition (Simmie & Sennett, 1999), which has the potential to result in the creation of synergies through geographical proximity, interdependency (Rosenfeld, 1997) and higher levels of cooperation. The relationship between these firms is not merely one of mutual support; rather, it is characterised by a complex interplay of competition and reinforcement, with the objective of generating added value (Roelandt & den Hertog, 1999).

According to Waxell and Malmberg (2007), four essential characteristics define and analyze clusters:

1. Geographical Concentration: Clusters exhibit a geographical concentration of similar or related economic activities, facilitating interaction and local resource exchange. The precise definition of geographical concentration can vary from an industrial estate to a broader region.
2. Interactions and Transactions: Clusters encompass a variety of interactions, transactions, and linkages between entities. These activities often revolve around a common set of knowledge and skills, frequently centered on a technological platform rather than a single industry.
3. Self-Recognition and Coordination: Participants in a cluster typically recognize themselves as part of the cluster and engage in coordination mechanisms. This self-awareness often manifests through policy programs and cluster initiatives, providing a governance-based definition of clusters.
4. Innovative Performance: Clusters are synonymous with competitive success and innovative performance. They are dynamic entities that drive innovation and maintain a competitive edge, achieving what distant rivals cannot match (Porter, 1998).

1.1.1 Geographical Proximity and Knowledge Spillovers

Each interaction and activity that facilitates the acquisition of knowledge occurs in a particular geographic location. These interactions are carried out by actors situated in a specific spatial setting, either individually or collectively. There are a number of reasons why knowledge generation processes are not aspatial or universal. Rather, they develop in ways that make geographic space an active participant (Waxell & Malmberg, 2007). In this context, cluster aims to generate knowledge-based competitiveness through a sequence of interconnected activities among systems of players gathered in an environment defined by spatial proximity. Numerous empirical studies have shown that the development of innovations is strongly associated with the concentration of knowledge inputs in specific geographical areas, particularly in the United States and Europe (Audretsch and Feldman, 1996). The degree of spatial clustering has been demonstrated to vary between industries, contingent on the stage of the industry lifecycle and the significance of tacit knowledge (Feldman and Audretsch, 1999). A cluster's constituent entities are frequently located close to one another, promoting effective coordination, communication, and cooperation. Proximity enables in-person interactions, which are vital for fostering rapport, exchanging tacit knowledge, and stimulating creativity (Porter, 1998; Ketels, 2013). This type of knowledge is described as 'sticky' due to its embeddedness in social relations and team dynamics, making it challenging to formalize (Tracey & Clark, 2003).

The strategic necessity of knowledge and the opportunities derived from knowledge spillovers provide further insight into the aggregative nature of innovative firms (Audretsch and Feldman, 2004). Technological spillovers represent a key example of such positive externalities that manifest in non-market interactions and that directly influence the utility of an individual or the production function of a firm (Fujita and Thisse, 1996). The significance of proximity in reducing the costs associated with the transfer of knowledge can be attributed to the inherent characteristics of the knowledge base that are pertinent to firms' innovative activities, particularly its complexity and its tacit nature. As a consequence of these characteristics, the transmission of knowledge is only possible through interpersonal contacts and the movement of workers between firms, both of which are facilitated by close geographical and cultural proximity (Breschi & Malerba, 2001). The incorporation of external knowledge into a firm's internal processes requires a clear alignment with the firm's core technological competencies (Cohen & Levinthal, 1990; Stuart, 1998). New businesses frequently locate themselves next to more established ones (Baum & Haveman, 1997), which links their innovation efforts to the technologies that are widely used in the area (Bresnahan et al., 2001; Niosi & Bas, 2001). The number of businesses having close access to technology rises while operating in an area with a high concentration of businesses involved in related innovative activities. This greater pool increases the likelihood that new businesses inside the cluster will absorb technological knowledge spillovers more successfully than businesses in areas with less concentration of industry (Rosenkopf & Nerkar, 2001). Although companies in less concentrated areas do experience spillovers, they often occur in smaller volumes and with less richness than in highly clustered areas (Jacobs, 1969). Component knowledge, or the particular information, abilities, and technologies associated with distinguishable components of an organisational system, is frequently shared throughout companies in clusters (Tallman et al., 2004). Within the cluster, this specialised expertise is essential for promoting innovation and preserving competitive advantages. Although the existing literature places considerable emphasis on knowledge spillovers as the primary driver of localised innovation, this exclusive focus may inadvertently obscure other crucial mechanisms of knowledge transfer, potentially leading to misguided policy implications. Breschi and Lissoni (2001) challenge the notion that firms in innovative clusters primarily benefit from publicly accessible, geographically confined tacit knowledge. Instead, they propose that tacitness is not an inherent attribute of knowledge but rather a characteristic of how knowledge is shared within an epistemic community. This perspective permits knowledge flows to occur even between geographically disparate agents (Audretsch, 1998; Breschi & Lissoni, 2001).

1.1.2 Geographical Concentration and Dimensions of Clusters

It is possible to differentiate between the vertical and horizontal dimensions of the cluster. The horizontal dimension of the cluster is constituted by firms engaged in similar activities, while the vertical dimension is comprised of firms providing related activities (Malmberg & Maskell, 2002). The horizontal dimension pertains to firms that are typically situated within the same industry, producing similar goods or services, and thus competing in the same market. Although competition is a defining feature, it also brings dynamic benefits that are frequently overlooked in conventional agglomeration analyses (Malmberg & Maskell, 2002; Porter, 1998). Marshall (1890) posited that firms benefit from the variations introduced by performing similar tasks, which in turn promote innovation. Each firm, with its unique interpretation of available information, generates a diverse range of solutions to similar challenges (von Hayek, 1937). Domestic rivalry encourages businesses to pursue innovation and constant development, which strengthens their competitive edge (Porter, 1990). Moreover, ongoing observation and comparison make it easier to recognise and implement effective techniques, which promotes an environment that encourages quick and iterative innovation (Schmitt, 2019).

The introduction of the vertical dimension, in which the division of labour and complementarity are of significance, permits a more comprehensive comprehension of cluster dynamics. This dimension entails the coordination of firms across disparate stages of production, whereby the output of one firm serves as input for another (Malmberg & Maskell, 2002). The concept of specialisation driving efficiency, as postulated by Adam Smith (1776), is extended here to encompass the collaboration between the pinhead maker and the pinpoint maker, which serves to avoid inefficiencies (List, 1841). Clusters frequently comprise firms that possess distinctive expertise, thereby augmenting productivity and stimulating innovation (Young, 1928). The success of the vertical dimension is contingent upon achieving an equilibrium between coordination and specialisation. While excessive specialisation may result in a reduction of knowledge production due to the limitation of variability, the co-location of firms facilitates communication and collaboration, thereby enabling the closure of knowledge gaps and the nurturing of creative potential (Loasby, 1999; Maskell, 1999).

1.1.3 The Interdependence of Economic Structure and Institutions in Clusters

At the level of the individual firm, an effective capacity to draw upon a body of localised knowledge and capabilities is contingent upon the ability to establish and maintain effective social links and lines of communication (Bathelt et al., 2004). At the collective level, the efficacy with which knowledge can be shared is contingent upon the presence of shared norms, conventions and codes for the exchange and interpretation of knowledge. In this context, geographical proximity frequently intersects with institutional, organisational and technical proximity, thereby facilitating processes of collective learning (Breschi & Malerba, 2001; Storper, 1997). This phenomenon may be attributed to the existence of 'untraded interdependencies' such as trust, shared norms and structures, and familiar values, which are more likely to exist between firms located in the same jurisdiction (Storper, 1997;Saxenian, 1994). Alternatively, it may be attributed to the importance of shared institutional and cultural contexts, which encourage interactive learning between actors (Lundvall, 1992; Malmberg, 1997; Asheim & Gertler, 2006).As a result, it is evident that the characteristic of successful high-tech clusters depends on the degree to which local businesses are deeply embedded in an extensive knowledge-sharing network, which is reinforced by close social interactions and by institutions that cultivate trust and encourage informal relations among actors (Breschi & Malerba, 2001;Maskell & Lorenzen, 2004). The institutions that comprise the cluster and its economic structure are inextricably linked and mutually reinforcing. The diversity of firms engaged in complementary activities within a cluster is reflective of the distinctive institutions that emerge within it. These institutions regulate learning processes, establishing norms and procedures that govern the manner in which firms engage in knowledge exchange and innovation (Lundvall & Maskel, 2000; Edquist, 2006). This reciprocal relationship implies that distinct clusters, defined by disparate activities, evolve distinctive institutional frameworks that either facilitate or impede the generation and dissemination of knowledge (Asheim & Coenen, 2005). The institutions that emerge within a cluster become highly specialised and vary significantly between clusters, which increases the cognitive distance between them (Maskell & Törnqvist, 1999). However, this cognitive distance can also act as an attractive proposition for external firms, given the specialized knowledge that clusters possess, which makes them appealing for collaboration (Malmberg & Maskell, 2002). Nevertheless, the inflexibility of institutional frameworks within clusters may present obstacles. When routines become deeply embedded, they may resist change even when external circumstances shift, rendering previously successful practices obsolete (Demesetz, 1988; Hedberg, 1981). This path dependence and institutional lock-in can impede the cluster's capacity to adapt to new technological or market developments, potentially leading to a decline in competitiveness (Grabher, 1993). Notwithstanding these challenges, clusters continue to represent a powerful framework for innovation. Although 'institutional fit' is not a sufficient explanation of cluster existence in isolation, it contributes to our understanding of the path-dependent development trajectories of clusters and the occasional lock-in scenarios they experience (Malmberg & Maskell, 2002; Imai et al., 1985)

1.1.4 Innovation Clusters

Innovation is identified as the primary driver of economic performance (Porter, 1998; Schumpeter, 1942), and is considered a crucial decision for companies looking to stay ahead in competitive markets (Teece, 2007). Schumpeterian understandings of innovation include new ways to organize production processes, unique strategies for entering different markets, and creating new or improved products and services that significantly improve customer satisfaction (Schumpeter, 1934). In recent years, economic geography has seen a rise in collaboration across social science disciplines, investigating firm competitiveness, learning, and innovation (Cooke, 1996). This interdisciplinary approach has been successful in uncovering how spatial clustering enhances firms' ability to learn and innovate. (Morgan, 1997; Asheim & Isaksen, 1997). Scholar have begun to employ analyses of the distinctive innovation systems exhibited by various countries (Lundvall, 1992) to demonstrate that, within a given nation, there are regional innovation systems that are partially linked to the existence of agglomerations of related firms and industries (Cooke, 1996; Morgan, 1997; Asheim & Isaksen, 1997). The concentration of specialised resources, professional networks and continuous knowledge exchange foster innovation through the formation of clusters (Saxenian, 1994). Companies may not always engage in direct business relationships, but they have the opportunity to collaborate and share technology to foster innovation (Rosenfeld, 1997). Clusters are particularly beneficial for industries like biotechnology, software, and medical equipment, as they help companies stay competitive by continually innovating. These sectors gain advantages from having concentrated professional connections, which help in spreading information about quickly changing technologies, ultimately strengthening the competitive edge offered by clustering (Bresnahan, 2001). Conversely, traditional industries may be less inclined to prioritise innovation, despite its acknowledged importance for competitiveness. For example, innovative small and medium-sized enterprises (SMEs) in Europe have extensive external networks involving other firms and institutions, such as universities and private research institutes, which provide support for their innovative activities (Cooke, 2002;Rothwell, 1991). Clusters that are closely connected to key sources of new technology, like research labs and equipment manufacturers, are typically the initial pioneers in innovation (Rosenfeld, 1997; M. Porter, 1998). Moreover, technology-driven clusters also gain advantages from common resources such as universities, public research facilities, and a qualified workforce, leading to decreased expenses and risks related to companies' innovation efforts (Breschi & Malerba, 2001; Cooke et al., 1997). Maskell (2001) has pointed out that having a proficient workforce and educated individuals from universities is crucial for the development of new clusters. The formation of clusters is contingent upon the localised mobility of workers, whether between firms or from universities and public research centres to new firms. This mobility leads to the ongoing exchange of knowledge and innovation (Breschi & Malerba, 2001;Saxenian, 1994). The migration of skilled individuals not only promotes innovation in the cluster but also strengthens its durability and competitiveness in the long run. Common characteristics of systemic innovation in a region include cooperative relationships, networking, trustful labor relations, and knowledge sharing. Collectively, these factors contribute to a high level of embeddedness, which is a defining feature of systemic innovation at the regional level (Cooke, 2001). Inventions and innovations, which embody both tacit and explicit knowledge, represent the outputs of the knowledge creation process (Fallah & Howe, 2004). As Babtista and Swann (1998) observe, the tacit nature of much technological knowledge – which cannot be codified through plans, instructions, or scientific articles – gives rise to the necessity for geographic concentration of innovators. The acquisition of knowledge from new technologies frequently necessitates repeated utilisation and informal personal interactions with innovators, particularly during the nascent stages of technological development. This is a principal rationale for the emergence of technological clusters, aligning with Pavitt's (1987) proposition that informal, uncodified new technological knowledge diffuses more readily at the local level than over vast distances. Corno et al. (1999) also emphasised the role of technological clusters in the transfer of tacit knowledge. They described industrial districts as "complex networks between firms" and analysed these systems from a geographic perspective, referring to them as "ba" (Japanese for place). Nonaka and Konno

(1998) adapted the concept of "ba" to elaborate on their model of knowledge creation, emphasising that "ba" provides a platform for advancing individual and collective knowledge, facilitating the exchange of tacit knowledge. Knowledge spillovers from regional clusters are said to be advantageous since they let businesses find out what technical paths other businesses are following and what new projects they may be working on. This makes it possible for receiving firms' initiatives to be effectively consistent with market trends (Brown & Duguid, 1998). Knowledge spillovers can assist businesses in lowering the level of uncertainty surrounding their innovation endeavours, particularly when they come from a variety of sources (Gilbert et al., 2008). Number of studies demonstrate that the innovation activities of nearby firms exert a significant influence on the innovative practices of other firms (Almeida, 1996;Frost, 2001; Jaffe et al., 1993). The value of spillovers of technological knowledge lies in their capacity to introduce new and potentially novel knowledge to the receiving firm (Gilbert et al., 2008). Through these spillovers, firms gain access to industry-specific knowledge, enabling them to understand the technological activities of others, their current pursuits, and the levels of success they have achieved in these endeavors (Brown & Duguid, 1998) themselves to utilise the latest technologies, thereby enabling them to compete in the most attractive markets. The capacity to foresee the technological trajectory of an industry allows entrepreneurs to adapt the technologies of their nascent firms to align with emerging trends and to enhance their innovation activities on an ongoing basis (Gilbert et al., 2008). In 2009, Engel and del-Palacio developed a global cluster of innovation framework, building on Porter's definition of industrial agglomeration. The framework defines business clusters based on the level of innovation and development of the cluster's members, rather than industry specialization (Engel, 2015).

1.2 PORTER’S DIAMOND MODEL AND REGIONAL ADVANTAGE

The Porter's Diamond Model offers a robust framework for understanding the comparative advantage of diverse countries and regions within specific industries (Porter, 1990). The model demonstrates how the interconnectivity of firms in a particular region can foster competitive advantages and regional growth, transforming geographic concentrations into economically resilient and prosperous economic powerhouses (Zonnenshain et al., 2020). It also highlights the interaction of different elements that lead to local economic development and industrial expansion.

Porter argued in his comparative study that a country's top exporters are not lone entrepreneurs but rather are members of prosperous clusters of competitors operating in connected sectors (Martin & Sunley, 2003), subject to the interactions of four sets of factors that make up a "competitive diamond": firm strategy, structure and rivalry; factor input conditions; demand conditions; and related and supporting industries (Figure 1). The mutual interactions between these elements give rise to the dynamic characteristics of the system. These interactions are not uniformly distributed across the economy; rather, they are concentrated in specific industries that have achieved a high level of competitiveness and productivity (Neven & Dröge, 2001). This concept elucidates why certain locations are more conducive to specific economic activities and why some businesses in those regions flourish as more innovative and competitive entities.

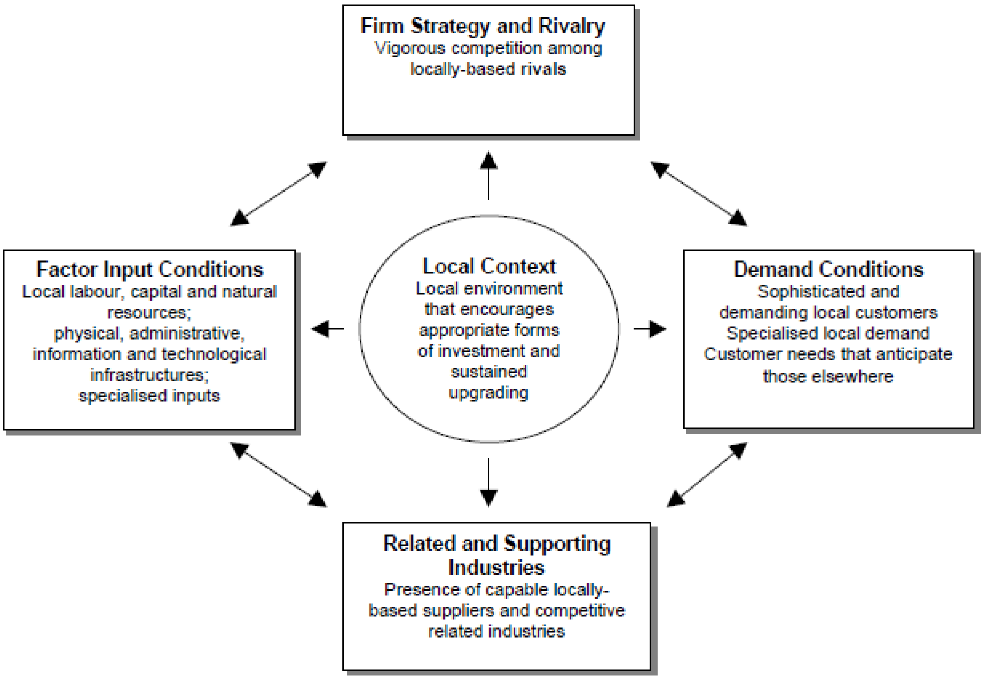

Figure 1. Porter's Competitive Diamond of Local Industrial Clustering. Based on Porter (1998, Ch. 10). From "Deconstructing clusters: chaotic concept or policy panacea?" by Ron Martin and Peter Sunley, Journal of Economic Geography, 2003, p.9

1.2.1 Factor Conditions

The conditions that affect an organisation have a significant impact on its productivity and long-term success. Porter (1998) posits that these determinants are shaped not only by inheritance but also by investments in research, technology, and education. Factor conditions can be classified into two categories: basic factors (tangible resources) and advanced factors (intangible resources), which include skilled labour and technology (Zhou & Li, 2020). The interplay of these conditions exerts a significant influence on the strategic choices and competitive advantage of firms. The basic factors inherited can be grouped into the following categories: climate, location, accessibility of minerals, natural resources, agricultural development, forest resources and the availability of skilled and unskilled labour (Oz, 2002; Jin & Moon, 2006; Lin & Wu, 2014). Conversely, advanced factors are specialised elements, such as highly qualified labour or cutting-edge research facilities, that are primarily produced with the objective of gaining a competitive advantage or that are affected by human labour (Kharub & Sharma, 2017).

Porter's (1990) definition of competitiveness places greater emphasis on wealth generated through economic activity than on wealth inherited through the exploitation of resources. He asserts that an organisation's authentic, intrinsic competitiveness may be constrained by an overreliance on inherited assets. Indeed, in order to foster a competitive advantage and prevent imitative behaviour, it is essential to focus on the specialisation of factors that align with the specific requirements of an industry. Concurrently, selective disadvantages in the most basic elements might promote innovation and upgrading within a company. For example, Japan's shortage of natural resources has encouraged competitive innovation since it has had to innovate and modernise to stay competitive.

1.2.2 Demand Conditions

The second broad factor of national competitive advantage pertains to the characteristics of the domestic market. Porter considered demand conditions in terms of the size of the home market, sophistication and demanding buyers (Kharub & Sharma, 2017). The significance of domestic demand has not decreased despite the globalisation of competition; it still affects how businesses perceive, understand, and address the demands of their customers. Businesses will have a greater competitive advantage over competitors if house demand offers a more precise or early image of emerging buyer needs (Porter, 1990). The character of the domestic consumer is another crucial factor. When domestic consumers are sophisticated and demanding, they provide an insight into the latest customer demands and put pressure on companies to maintain high standards, innovate and modernise. At the same time, they can provide early warning signs of global market trends. Stonehouse and Snowdon (2007) and Ahn et al. (2012) argue that rising demands are forcing companies to modernise their technology, achieve higher standards and improve the performance and quality of their products. Porter adds another perspective by focusing explicitly on the quality of local demand: the specific needs of customers in a particular location can provide firms with a unique opportunity to learn how to meet those needs with targeted products and services (Cairncross, 2001). If local customers need to anticipate the actions of customers in other markets, firms that have operated locally are likely to have a competitive advantage when entering the new market.

1.2.3 Relating and Supporting Industries

The geographical concentration of firms and other institutions operating in a particular economic sector is important for competitiveness because it is associated with higher levels of productivity and innovation (Porter, 2003). Related industries are those in which an organisation can organise or allocate activities in the value chain when competing, or those that produce component goods (Tasevska, 2006). Internationally competitive domestic suppliers create downstream advantages in several ways. They provide the lowest cost inputs efficiently, early and quickly. At the same time, suppliers and end users located close to each other can take advantage of short lines of communication, a fast and constant flow of information, and a continuous exchange of ideas and innovations. Companies can influence their suppliers' technical efforts and can serve as test sites for R&D work, accelerating the pace of innovation (Porter, 1990). Domestic firms benefit most when their suppliers are global competitors, providing benefits such as innovation, improved information flows, and shared technology development through firm alliances to create advantages in downstream industries (Woods and Hecker, 2011; Gupta and Nanda, 2015). Potential suppliers not only reduce delivery time, but also invest in research and innovation activities and create a knowledge base like upstream firms (Porter and Ketels, 2003).

1.2.4 Firm Strategy, Structure and Rivalry

Firm strategy, structure, and rivalry not only influence the way companies are created and managed but also shape the nature of domestic competition within a given industry (Porter, 1990). Porter (2008) asserts that there is no universally appropriate managerial system. Rather, the competitiveness of a specific industry is contingent upon the management practices that are favoured within that country and the source of competitive advantage within the industry. The characteristic that controls these variables is unique to each country and changes depending on how people live, how they view authority both individually and collectively, and how these aspects shape the organisational culture (Cho et al., 2008; Esen and Uyar, 2012). Furthermore, the objectives pursued by companies and individuals in different countries reflect the characteristics of the national capital market and compensation practices (Hall & Soskice, 2001). Porter (1990) identifies domestic rivalry as a key aspect of the diamond model, arguing that it has an influential role in stimulating the other elements and exerting pressure on companies to innovate and enhance their performance. Local competitors drive each other to reduce costs, improve quality and services, and introduce new products and processes, while also competing for human resources, technical excellence, and prestige. Indeed, the competitive dynamic between domestic firms frequently extends beyond a mere price war. Instead, it encompasses a push for enhanced quality and services, as well as innovation, which often manifests as the introduction of new products and processes (Wilson, 2016). Furthermore, geographic concentration intensifies the impact of domestic rivalry, suggesting that the more localised the competition, the greater its influence (Crescenzi et al., 2023).

1.3 ENGELS' CLUSTERS OF INNOVATION

To enhance the comprehension of the insights derived from Porter's framework, it is essential to extend its scope to encompass the formation of novel, specialised clusters. Indeed, Engel and De Palacio (2009) argue that the model proposed by Porter fails to account for the emergence of new and seemingly unrelated industries in pre-existing clusters, as for instance the advent of a biotechnology cluster in Silicon Valley. Furthermore, the model does not account for the rapid emergence of new technology clusters in "indigenous environments" (Engel & del-Palacio, 2009). The objective of the Clusters of Innovation theory is to establish a link between Porter's model and the capacity of specific regions to foster the emergence of new clusters and enterprises, regardless of the existing industrial orientation within the area (Engel & del-Palacio, 2009). Engel (2015) defines clusters of innovation (COIs) as: "*Global economic "hot spots" where new technologies germinate at an astounding rate and where pools of capital, expertise, and talent foster the development of new industries and new ways of doing business"*. They are a set of interconnected entities, including start-ups, companies that provide support for their development, and mature companies. The success of these ecosystems hinges on the flexibility of resources, including people, capital, and knowledge, and the rapid exchange of these resources driven by the relentless pursuit of opportunities, staggered funding, and the tendency for business models to evolve rapidly (Engel & del-Palacio, 2009). The Clusters of Innovation (COI) framework posits that the benefit derived from agglomeration is not primarily attributable to the specialisation of the industry, but rather to the level of development and innovation (Engel & del-Palacio, 2009). The concept of innovation is based on the notion of resource mobility, whereby assets such as capital, human capital, information and intellectual property transcend regional boundaries to facilitate international collaboration and innovation. This enables the formation of start-ups that are immediately global in their perspective, growing by leveraging international markets and shared resources (Malecki, 2010). A key distinction between COIs and more traditional clusters is their emphasis on the global interconnectedness of local clusters (D. Audretsch & Link, 2018). This approach highlights how such clusters can drive rapid, sustained innovation, facilitated by a high degree of resource mobility and strategic alignments among key players. COIs facilitate the advancement of new technologies, the commercialisation of innovations, and global competitiveness by capitalising on the proximity of relevant actors. These clusters are dynamic systems, wherein the continuous learning, adaptation, and collaboration of their constituent actors create an environment conducive to high levels of entrepreneurial activity (Bresnahan, 2001).

To develop a framework for the identification of the central elements in the genesis of a new technology cluster, Engel and De Palacio (2009) concentrated their attention on the clusters that emerged in Silicon Valley. They proceeded to delineate the key components that define these clusters (Figure 2), which they identified as entrepreneurs, venture capital investors, mature corporations and strategic investors, universities, government, R&D centres, and specialised service providers and management (Braunerhjelm & Feldman, 2008).

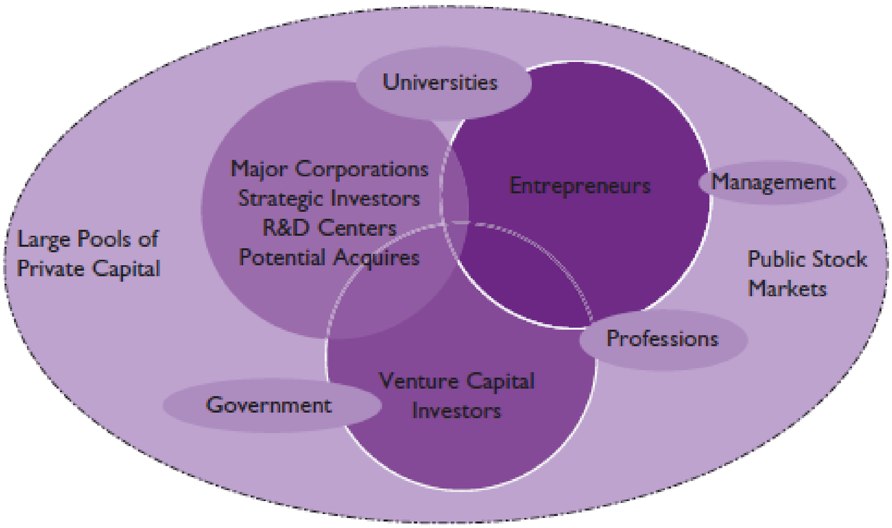

Figure 2. The Innovation Engine of Clusters of Innovation. From Engel (2014). From Global Clusters of Innovation: Entrepreneurial Engines of Economic Growth around the World by J.S. Engel, 2014, p. 38, Edward Elgar Publishing Inc

In addition, the key behaviours adopted by these agents to facilitate the creation and growth of COI were identified. These behaviours included the mobility of resources, an entrepreneurial process, a global strategic perspective, the alignment of interests and the formation of global ties and bonds (Engel, 2015).

1.3.1 Key Components

Leading research universities serve as vital sources of new technologies and inventions, offering educational programs that foster entrepreneurialism, as well as providing incubators and seed funding. Institutions such as Stanford and Berkeley have been pivotal in the formation of Silicon Valley's start-ups through the transfer of technology, thereby fostering the growth of the local entrepreneurial ecosystem (Engel, 2015). MIT, along with other universities, has played an important part in shaping the regional innovation ecosystem (Etzkowitz, 2002a). The government has a crucial role in promoting environments conducive to innovation. This is accomplished by establishing clear legal guidelines, providing funding for R&D, and implementing policies that support the commercialization of technology (Mowery & Sampat, 2006). Moreover, they invest in education and infrastructure, which are essential for maintaining innovation clusters. Entrepreneurs are the driving force behind innovation within clusters, assumsing the risk inherent in the creation of new businesses. In locations such as Silicon Valley, a considerable proportion of individuals reinvest their financial success in the establishment of new start-up businesses, thereby generating a continuous cycle of innovation and economic growth (Engel, 2015). This entrepreneurial recycling of talent and capital is a defining feature of dynamic clusters (Kenney & Patton, 2009). Venture capitalists provide crucial financial and expert support to nascent businesses. They perform a pivotal function in governance, recruitment, and the acceleration of start-up growth, aligning the interests of stakeholders to foster value creation (Gompers & Lerner, 2001).Venture capital ecosystems are especially well-developed in regions such as Silicon Valley, where networks of investors and start-ups mutually reinforce one another's success (Sorenson & Stuart, 2001). Large companies within clusters engage in active collaboration with start-ups, investing in or acquiring them with the objective of integrating innovative solutions. Such an openness to innovation serves to maintain the dynamism and competitiveness of these ecosystems (Chesbrough, 2003). Clustered corporations frequently derive benefit from external sources of innovation and partnerships with start-up organisations, which can facilitate the acceleration of new product development and commercialisation (Rothwell, 1991). Research centres, both corporate and governmental, are instrumental in driving technological advances and providing the technical talent and innovations that often give rise to new business ventures (Wessner & Wolff, 2012). The formation of public-private partnerships between research centres and industry represents a crucial mechanism for the translation of research into marketable products (Rothaermel et al., 2007).

1.3.2 Key Behaviors

The entities within these ecosystems are additionally associated with displaying key behaviors that contribute to the development of innovation clusters. These include a high level of mobility of resources, primarily involving people, capital, and information, including intellectual property (Malecki, 2010). There is also an entrepreneurial process, which involves the relentless pursuit of opportunities without consideration of resource limitations (Shane & Venkataraman, 2000). Additionally, the business development velocity increases, and there is a strategic global perspective, along with a culture of aligning interests and transaction structures (Stam, 2015).

Furthermore, incentives and goals are in place that lead to an affinity for collaboration, and global ties and bonds are formed. The collaborative and networking behaviours exhibited by entities within innovation clusters are fundamental to the generation of innovative outputs. In order to share best practices, technology, and expertise, companies within clusters often participate in cooperative efforts such as partnerships, joint ventures, and informal networks (Engel, 2015; Powell et al., 1996). Such a collaborative culture facilitates the innovation process, resulting in the creation of more sophisticated and competitive products and services (Ketchen et al., 2007). In accordance with Breschi and Malerba (2005), collaborative linkages within clusters facilitate the expeditious and effective innovation process, enabling the exchange of knowledge and resources.

Mobility of Resources

To identify the most significant resources, Engel utilises a definition initially put forth by Timmons (1994). This definition encompasses three key areas: people, money and technology. However, it should be noted that in a COI, these resources are not necessarily held exclusively by individual companies. Instead, there is a focus on facilitating the mobility and rapid redeployment of resources within and between high-potential entrepreneurial companies. This approach is designed to promote a continuous and rapid innovation process within a COI (Freeman & Engel, 2007; Engel & del-Palacio, 2009).

Entrepreneurial Process

The entrepreneurial process facilitates ongoing and quick invention, technology commercialisation, testing out different business models, and the creation of new markets in a COI. A dense cluster of venture capital and the associated infrastructure for the formation of well-connected, well-funded companies enhance this process. Startups can benefit significantly from the proximity of other businesses, suppliers, and service providers who are either compatible with or specialise in entrepreneurship. This can lead to beneficial collaboration and knowledge sharing (Engel & del-Palacio, 2009). Entrepreneurs play a crucial role in business by providing essential guidance and insight into the complex process of starting and growing a commercial venture. Their deep understanding of the complexities of business operations and the specificities of their industries allows them to skilfully overcome challenges, make wise decisions, and take advantage of potential opportunities. Expertise enables entrepreneurs to construct and capitalise on valuable networks, attract investors and gain access to essential resources. Furthermore, this experience lends credibility to their ventures, which can facilitate faster growth and potentially reduce costs by streamlining access to necessary support and resources. In conclusion, entrepreneurial expertise has been demonstrated to significantly enhance the probability of a venture's success and its capacity to innovate and compete in the market (Engel & del-Palacio, 2009).

Born Global

The strategic advantages derived by born global companies, which utilise international resources and markets from their inception, contribute to their success and growth. Due to their global orientation from initial stages, born global companies are able to access foreign markets and resources early in their growth(Knight & Cavusgil, 1996; McDougall-Covin et al., 2003;Oviatt & McDougall, 2005; Phillips McDougall et al., 1994). These businesses can compete globally, adjust to changing market demands, and take advantage of opportunities that may not present themselves domestically thanks to their early international engagement. These businesses benefit from the global resource mobility that enables them to optimise their operations through international subcontracting and the adoption of economical solutions like software development or overseas manufacturing (Saxenian, 2008). This feature helps to save operating expenses while also improving the ability to distribute resources effectively. Global organisations that are born with a diverse and competent staff benefit from the immigration of skilled individuals from around the world, such as engineers, scientists, managers, and entrepreneurs (Saxenian, 2008). Because different teams can bring new viewpoints and ideas, this multicultural atmosphere encourages creativity, enthusiasm, and ongoing innovation (Florida, 2002). It is easier to create new networks spanning many industries, cultures, and languages when there is diversity in the workforce. These networks can make it easier to collaborate with clients, organisations, and research institutes located abroad (Castells, 1997). These international ties are helpful in gaining understanding of other markets and forming worthwhile alliances. Born-global businesses can have an extensive understanding of global markets and prospects by assembling a global staff from the beginning. This wide-ranging viewpoint makes it easier to recognise and take advantage of worldwide opportunities, as well as to acquire essential resources, suppliers, and clients on a national and worldwide scale (Saxenian, 2008).

Alignment of Interests

The conventional obstacles to cooperation are frequently less evident in a Cluster of Innovation (COI), which promotes a strong culture of cooperation both within and between businesses. The primary factor fostering this cooperative atmosphere is the congruence of interests, which is reinforced by special equity pay schemes specific to COIs (Engel & del-Palacio, 2009). Broad equity participation through stock option schemes promotes alignment of interests within a company. By linking compensation to the company's overall success, these plans help decrease the conventional gap between owners and employees and promote alignment of goals among investors, managers, employees, and founders (Freeman & Engel, 2007). This practice is prevalent in high-growth environments such as Silicon Valley, where the promotion of innovation and risk-taking is facilitated by the presence of shared equity (Kaplan & Stromberg, 2004). COIs collaborate with a wide range of stakeholders in their external activities, including suppliers, customers, and even rival companies. In the face of established market norms, this cooperation—sometimes called "co-opetition"—appears out of the necessity to reach critical mass, set standards, and provide feasible consumer solutions(Kenney, 2000); Florida & Kenney, 1988). These exchanges are based on a common interest in innovation, which enables opposing companies to build profitable alliances with one another (Engel & del-Palacio, 2009). Such collaborative endeavours are also evident in the biotechnology and technology sectors, where organisations join forces to gain access to complementary capabilities and shared knowledge (W. Powell, 1989). The practice of co-investment and deal flow sharing among investors is indicative of an alignment of interests within the venture capital industry (Engel & del-Palacio, 2009). The way investments are arranged fosters a dynamic atmosphere where entrepreneurs are constantly pushed to reach goals. If this isn't done, investors might look for other possibilities (Sahlman, 1990). This arrangement fosters a creative tension that motivates business owners to aim for higher value and more successful liquidity results (Hellmann & Puri, 2002). Through the implementation of creative compensation plans and cooperative practices, COIs effectively stimulate collaboration and align the interests of many stakeholders, thereby enhancing value creation and achieving successful outcomes for their member firms. (Gompers & Lerner, 2001).

1.4 TRIPLE HELIX MODEL

The role of government has changed in response to industry's growing reliance on academic research to propel technical innovation and economic growth (Etzkowitz, 1993). In this context, Henry Etzkowitz and Loet Leydesdorff developed the Triple Helix Model of Innovation, which has proven to be a crucial framework for comprehending how businesses, governments, and academic institutions interact to promote innovation (Leydesdorff & Etzkowitz, 1995). This model captures the transition from a prevailing industry-government dyad to a more integrated triadic relationship, where universities play a key role alongside industries and governments in driving knowledge-based economies (Ranga & Etzkowitz, 2013). Etzkowitz and Leydesdorff employed Georg Simmel's sociological concept of triads to elucidate the qualitative shift that occurs when a dyad becomes a triad (Cai, 2022). As postulated by Simmel, the introduction of a third actor modifies the nature of interactions, thereby creating a third sense of space

(Leydesdorff & Lawton Smith, 2022; Cai, 2022). Etzkowitz and Leydesdorff expanded Simmel's micro-level analysis of dyads and triads to the meso-level of organizational relationships, showing how the inclusion of a third actor (the university) significantly alters the dynamics of innovation (Cai & Etzkowitz, 2020 Cai, 2022).

In this triad, the government provides contractual relationships that ensure stable interactions and exchanges; the university serves as a source of new knowledge and technology, embodying the generative principle of knowledge; and the industry serves as the main centre of production (Etzkowitz, 2003). The theory proposes that innovation in the knowledge society is contingent upon the formation of novel institutional structures and the convergence of functions from industry, government, and academia. According to Ranga and Etzkowitz (2013), this contact makes it easier to produce, share, and use knowledge, which in turn promotes economic progress. According to Cai and Etzkowitz (2020) , the Triple Helix model is an effective tool for fostering entrepreneurship and enhancing regional economic development while also serving as a theoretical construct. Over the past two decades, extensive theoretical and practical studies have progressed the Triple Helix model, offering policymakers at various levels a complete instrument to examine intricate innovation processes (Ranga & Etzkowitz, 2013). Different interpretations can be applied to the core of the Triple Helix framework. Etzkowitz takes on a neo-institutional viewpoint, emphasizing the development of new institutional structures and strategies to promote cooperation among the three parties (Ranga & Etzkowitz, 2013). Leydesdorff, on the other hand, highlights a neo-evolutionary viewpoint, seeing the interactions as fluid and adjustable, with ongoing feedback loops molding the innovation process throughout the years (Leydesdorff, 2012).

1.4.1 Neo-institutional Perspectives

The institutional perspective examines the interrelations between universities, industry, and government (Cai, 2022). It proposes three primary configurations for positioning the three institutional spheres in relation to each other (Ranga & Etzkowitz, 2013). These configurations illustrate varying degrees of interaction, collaboration, and control among the three actors, contingent on the broader socio-political and economic contexts (Figure 3).

In a statist model, the government assumes a dominant role, assuming responsibility for driving innovation and directing the activities of both universities and industry (Ranga & Etzkowitz, 2013). This approach is typical of contexts in which the government exerts considerable control over the economy and research Such contexts can be observed in select countries in Latin America, Eastern Europe, and China (Ranga & Etzkowitz, 2013). In such instances, the relationships between universities and industry are frequently shaped by governmental policies, with incentives aligned towards the realisation of national objectives. Typically, the government assumes responsibility for allocating funding for research and regulating industry participation (Etzkowitz & Leydesdorff, 2000).

In contrast, the laissez-faire configuration views industry as the primary driver of innovation (Ranga & Etzkowitz, 2013) with the three agents operating as distinct and independent entities (Cai & Etzkowitz, 2020). The university and the government adopt a more passive role, allowing market mechanisms to operate without significant state intervention China (Ranga & Etzkowitz, 2013). This configuration is frequently associated with free-market economies, wherein competitiveness and private initiative are strongly encouraged. In this configuration, industry is the primary driver of innovation, while the government imposes limited intervention in the economy, acting as a regulator of social and economic mechanisms. The government provides basic infrastructure but refrains from direct intervention in innovation processes, while universities provide skilled human capital (Etzkowitz, 2003).

In conclusion, a balanced configuration represents a more synergistic approach to collaboration between universities, industry, and government actors (Etzkowitz & Zhou, 2017). In this model, each of the three parties makes a substantial contribution to the innovation ecosystem, achieved through an acknowledgement of the value of collaboration and knowledge sharing. The equilibrium configuration encourages the formation of public-private partnerships, the emergence of university spin-offs, and the expansion of technological clusters. This is described as a "more flexible and overlapping system, with each taking the role of the other" (Etzkowitz, 2002b).

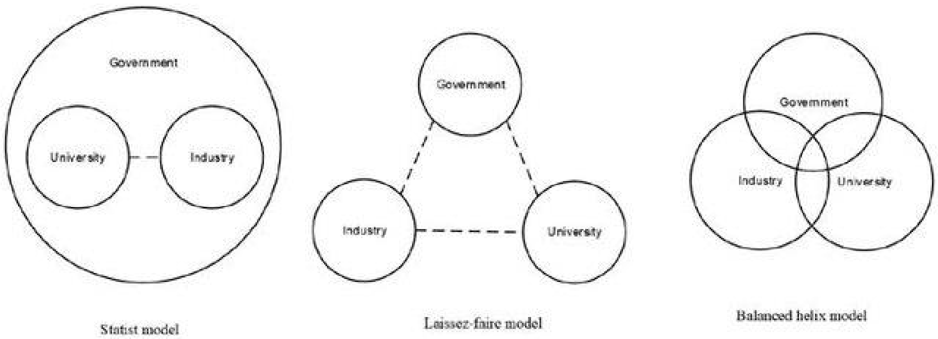

Figure 3. Triple Helix Model. from "Theorizing the Triple Helix model: Past, present, and future" (Etzkowitz & Zhou, 2020). From Triple Helix Journal, 6(1), p 12

1.4.2 Neo-Evolutionary Perspectives

The neoevolutionary perspective, as articulated by Leydesdorff, conceptualises the triple helix as an analytical model for the investigation of innovation in knowledge-intensive economies (Leydesdorff, 2010). In contrast to the prevailing emphasis on the static relationships between universities, industry and government, Leydesdorff highlights the co-evolutionary dynamics and self-organising processes that drive innovation in knowledge-based economies (Ranga & Etzkowitz, 2013). The three helices have been identified as selection mechanisms (Leydesdorff & Meyer, 2006; Cai, 2022) that asymmetrically influence one another, and such mutual selections have the potential to shape a trajectory in a coevolutionary process (Leydesdorff, 2012). These three selection mechanisms pertain to the functions of wealth creation, knowledge production and normative control. These latter three functions constitute the principal functions of UIG (Leydesdorff, 2012; Leydesdorff & Lawton Smith, 2022). This perspective emphasises the dynamic and coevolutive nature of interactions between the three actors, whereby each helix functions as a selection mechanism that influences and models the others (Cai, 2022). The relationships between universities, industry and government are not static; rather, they evolve over time through complex processes of mutual adaptation and learning (Galvao et al., 2019; Cai, 2022). This dynamic perspective acknowledges that the innovation trajectory is shaped by a multitude of factors, including scientific and technological advancements, shifts in market demand, and changes in the political and social environment (Ranga & Etzkowitz, 2013). Moreover, it emphasises the significance of contingency and emergency in the innovation process (Leydesdorff & Etzkowitz, 1998).

1.4.3 Triple Helix Innovation Systems

Etzkowitz and Ranga developed the Triple Helix Systems framework by building upon the Triple Helix model for understanding innovation systems (Ranga & Etzkowitz, 2013). They rely on the concept of innovation systems to explore how knowledge and innovation drive economic growth, a framework that has been utilized since the 1980s. Institutions and learning processes play a crucial part in these systems, functioning as essential analytical units that examine how particular institutional configurations can foster interactions among economic actors in market contexts or knowledge transfer (Cai & Etzkowitz, 2020).

Innovation systems can be analyzed from different angles, such as technological, sectoral, national, or regional. Ranga and Etzkowitz (2013) categorize these systems into three basic types: (1) the components of the system; (2) the connections between these components; and (3) the functions of the system. This method is consistent with previous views on innovation systems highlighting the interconnectedness of actors, knowledge circulation, and institutional structures (Lundvall, 1992). Following Ranga and Etzkowitz's (2013) perspectives, system frameworks consist of three key elements: system components, relationships among components, and system functions. The components of the system encompass various individuals participating in the innovation process. These entities encompass individuals, enterprises, governmental bodies, academic establishments, and other entities forming the necessary institutional structure for innovation. This point of view aligns with the National Innovation System (NIS) framework, emphasizing the importance of institutions and networks in shaping technological progress (Nelson, 1993; C. Freeman, 1987).The relationships among innovation players might result in the generation of new knowledge through internal efforts or by utilising technology transfer from outside sources. Connections between innovation actors can lead to the creation of new knowledge either internally or through technology transfer from external sources. The actors' ability to recognize, absorb, and apply external knowledge, known as absorptive capacity, influences the outcomes of these interactions (Cohen & Levinthal, 1990). The idea of absorptive capacity has been a main point of interest in studies on innovation, showing how companies and areas can benefit from external knowledge exchanges (Zahra & George, 2002). The system's functions are capabilities of each component that affect the system's overall performance. The main objectives of an innovation system are the development, diffusion, and utilization of technology (Ranga & Etzkowitz, 2013). In order to perform this function, the system relies on four distinct types of capabilities: (a) organisational capability, which involves coordinating and overseeing the contributions of various participants; (b) technical or functional ability, which comprises the necessary knowledge and skills for technological advancement; (c) technical or functional ability; and (d) learning or adaptive ability, which involves the ability to evolve and adjust through continuous learning procedures (Ranga & Etzkowitz, 2013). This is similar to frameworks like the Regional Innovation System (RIS), where local companies, universities, and government entities collaborate on learning and innovation (Asheim & Gertler, 2006). Etzkowitz and Ranga (2013) outlined three distinct spaces: the consensus space, the knowledge space, and the innovation space. Every one of these areas plays a major role in supporting communication and collaboration among the Triple Helix participants like universities, industry, and government (Leydesdorff, 2012). The domain of knowledge space involves creating, sharing, and using knowledge among the Triple Helix players, aiming to avoid fragmentation and reduce redundancy in research efforts (Ranga & Etzkowitz, 2013). This aligns with the idea of open innovation, which involves incorporating external knowledge sources into a company's internal research and development activities (Chesbrough, 2003).

The innovation space highlights the skills of hybrid organizations and entrepreneurial individuals in the Triple Helix system. The primary goal is to support the development of creative local companies, draw in talented individuals, and boost the intellectual and entrepreneurial strengths of the area or nation (Ranga & Etzkowitz, 2013). In this scenario, innovation is seen as going beyond typical business activities to include public entrepreneurship, recognized as crucial for developing institutional systems (Ranga & Etzkowitz, 2013). This viewpoint aligns with the idea of "entrepreneurial ecosystems," where individuals work together to support the advancement of startups and enhance regional competitiveness (Stam, 2015). The consensus space is where scholars, businessmen, and government leaders meet to engage in forward-looking discussions and evaluate ideas that advance the knowledge-based society. According to Ranga and Etzkowitz (2013), trust-based interactions occur in this setting, enabling the negotiation of shared goals and the development of new identities and collaborations Creating consensus is crucial for aligning resources and interests effectively. The involvement of both governmental and non-governmental entities is crucial for this process, as it is driven by interactions between various societal and governmental entities, rather than being solely influenced by state entities (Kuhlmann, 2001)

1.4.4 The Quadruple and Quintuple Helix Models

Expanding on the Triple Helix Model, Carayannis and Campbell (2009) introduced the Quadruple Helix, by incorporating civil society as a fourth component. The Quadruple Helix concept highlights the impact of media, culture, and societal discourse on innovation. The model recognizes the important role that societal needs and preferences play in the innovation process and states that successful innovation ecosystems must involve civil society to ensure that new technologies and solutions align with societal values and expectations. The integration of civil society indicates a shift towards innovation processes that are more inclusive and participatory, involving citizens and communities in creating solutions to societal issues (Carayannis & Campbell, 2009). The Quintuple Helix Model, also proposed by Carayannis and Campbell (2010), extends the framework by including the environment as the fifth element. This model incorporates ecological perspectives into innovation systems, thereby acknowledging the vital role of sustainable development and environmental considerations in ensuring long-term innovation success. The Quintuple Helix Model is aligned with the growing emphasis on green innovation and the circular economy, which emphasise the necessity of balancing technological progress with environmental sustainability.

1.4.5 Cluster Studies in the Gaming Industry

The video game sector has seen significant expansion due to the creation of regional hubs, where dense connections of businesses, talented professionals, and beneficial organizations promote both economic and creative benefits. Notable clusters in urban areas such as Montreal, San Francisco, Tokyo, and London have transformed into vital hubs of innovation, providing avenues for knowledge exchange, teamwork, and swift product advancement (Cohendet et al., 2010; Johns, 2006). As described by Cohendet et al. (2010) in their research on Montreal, a flourishing gaming ecosystem is typically facilitated by the coordination of different local players, such as governmental agencies, educational establishments, and industry groups, which collectively foster a supportive atmosphere for game creation. The Montreal cluster, through its policy incentives and vast talent reservoir, has drawn both significant studios and independent developers, positioning itself as a world leader in gaming (Pilon & Tremblay, 2013). Clusters like these not only enhance efficiency but also aid in maintaining the intricate balance between organized production methods and the creative liberty that is crucial in game design (Tschang, 2007). This is particularly clear in creative centers such as San Francisco and Los Angeles, where businesses gain from being close to digital media sectors and entertainment, facilitating considerable cross-sector skill exchange (Vang & Tschang, 2008). Tschang (2007) emphasizes that gaming clusters frequently navigate the balance between the necessity for efficient, streamlined production and the intense requirements of creativity—a process made easier by the informal networks and closeness of creative talent in these areas. Universities also play an essential role in gaming clusters by acting as incubators for new talent and innovative studios. Tschang and Vang (2008) observe that although numerous startups are established by experienced professionals, universities nurture budding developers who either become entrepreneurs or work at local studios, contributing to the cluster's development. In Boston, the gaming industry developed in part because of its student demographic, with studios such as Looking Glass, established by MIT graduates, showcasing how academic entities contribute to a skilled workforce. Moreover, the growth of the industry has been influenced by the transfer of skills across different sectors, a process significantly affected by the distinct economic, social, and cultural elements of every region. Izushi and Aoyama (2006) contend that the development of skills is profoundly influenced by local social environments, affecting the industry's path in distinct ways across different nations. For example, Japan's gaming industry developed via corporate sponsorships in arcade games, toys, and electronics, incorporating knowledge from animation and comics—popular entertainment mediums in Japan. In the United States, the industry began in university computer labs and later grew into arcade games, capitalizing on connections to the rising personal computer market. The integration of skills relies not just on financial motivations but also on cultural acceptance, social legitimacy, and technological progress, which all influence how developing industries draw talent from different sectors (Izushi & Aoyama, 2006). The clustering occurrence in the gaming sector is additionally bolstered by robust governmental and policy support in various areas, which draws investment and fosters a competitive advantage. Montreal, for example, has utilized tax breaks and various types of institutional backing, which have been vital in building its status as an important contender in the worldwide gaming industry (Pilon & Tremblay, 2013). Likewise, policy structures in the United Kingdom have supported game development in cities such as London, boosting the resilience and growth opportunities of the local gaming industry (Kerr, 2011). These incentives provide not only economic advantages but also create a reinforcing effect, as businesses are attracted to areas where resources, infrastructure, and talent are easily accessible (Zackariasson & Wilson, 2010). Clusters facilitate greater specialization among workers and the cultivation of distinctive skills vital to the competitive edge of these areas (Izushi & Aoyama, 2006). In Japan, cities such as Tokyo and Osaka serve as hubs of innovation in gaming technology and narrative development, partly owing to the exchange of ideas with other creative sectors, including animation and manga. This singular ecosystem fosters a unique cultural and artistic perspective that impacts the worldwide attraction of Japanese games, mirroring the collective values and cultural stories within the area (Kerr, 2011; Zackariasson & Wilson, 2010) .The prosperity of these clusters is clear in their financial impact and cultural importance. The games developed in these hubs frequently reflect local cultural traits, enriching the worldwide gaming scene with varied stories and artistic styles (Vang & Tschang, 2008; Johns, 2006). The gathering of resources, concepts, and skills in gaming clusters turns them into hubs of cultural creation, where innovation holds both economic worth and enhances the wider cultural landscape (Gibson et al., 2010). This combined effect—economic and cultural—demonstrates the significant influence of clusters in determining the future of the gaming sector, rendering them essential to both local economies and the worldwide creative environment.

CHAPTER 2

2.1 OVERVIEW OF THE TOKYO YOKOHAMA INNOVATION CLUSTER

In the 2024 Global Innovation Index (GII) Tokyo-Yokohama is highlighted as the leading science and technology (S&T) centre, for consecutive years now. This recognition underscores the importance of technological hubs in driving innovation across top economies globally (WIPO, 2024; WIPO, 2023). Tokyo is home to more than 680,000 companies, mostly small-medium sized enterprises (SMEs) (*Tokyo Metropolis | EU-Japan*, n.d.). Approximately 70% of the city's working-age population works in SMEs, contributing to the city's innovative capacity and economic dynamism (Tokyo | Regional Information - Investing in Japan, n.d.; Tokyo Metropolis | EU-Japan, n.d.).The industrial sector in Tokyo is of considerable importance, particularly in areas such as transportation machinery and information and communication technology equipment (Odagiri & Goto 1996). However, the city's service sector is particularly noteworthy, employing approximately 80% of the workforce (*Tokyo Metropolis | EU-Japan*, n.d.). Tokyo boasts a well-developed innovation infrastructure, comprising networks between businesses and academic institutions that are reinforced by collaborative research projects involving government, business, and academia (*Tokyo Metropolis | EU-Japan*, n.d.). Tokyo is a major center for both national and international innovation, due to its collaborative atmosphere and status as a hub for foreign businesses. Indeed, 75% of Japan's foreign companies have their headquarters in Tokyo (Tokyo | Regional Information - Investing in Japan, n.d.).

Parallelly, with a population of 3.7 million, Yokohama is the second-largest city in Japan (Japan External Trade Organization, 2023). The city offers specialized clusters in high-tech industries, including semiconductors, IT, and life sciences, which enhance Tokyo's innovation environment (Ministry of Internal Affairs and Communications, 2020). By facilitating connections between businesses, academic institutions, and research centers, programs such as the IoT Open Innovation Partners (ITOP Yokohama) and the Yokohama Life Innovation Platform (LIP Yokohama) foster innovation and support small and medium-sized enterprises (SMEs) in their R&D endeavours and commercialization strategies (*Yokohama City | Regional Information - Investing in Japan*, n.d.) Mentioning the Keihin Industrial Zone is also important as it enhances the industrial collaboration between Tokyo and Yokohama. Throughout history, the area has been known for its multiple steel mills, petrochemical complexes, and shipyards, which together serve as the center of Japan's heavy industry (Ministry of Internal Affairs and Communications, 2020).

2.1.1 Overview of Global Innovation Index Indicators

Science and Technology Metrics

The GII uses two main metrics to evaluate the performance of S&T clusters globally. The initial measure focuses on global patent applications made via the Patent Cooperation Treaty (PCT), acting as an indication of the area's technological productivity. The second measure takes into account the quantity of scientific papers released, demonstrating the level of research and academic engagement (WIPO, 2024). In the year 2024, the Tokyo-Yokohama region filed 3,712 PCT applications per million inhabitants and published 3,231 scientific articles during the same period. This result serves to confirm the region's position as the largest global S&T cluster, thereby underscoring its role in innovation not only within Japan but also on an international scale. In terms of intensity, the ratio of innovation output to population density places the region 15th globally, which serves to indicate its efficiency despite the size of its population (WIPO, 2024). The innovation performance of Tokyo-Yokohama has remained consistently high, with 3,520 PCT applications filed and published 3,178 scientific articles in 2023. While its status as the largest cluster remained unchanged from 2023 to 2024, the cluster demonstrated an improvement in intensity, advancing from the 18th position in 2023 to the 15th in 2024. This improvement suggests that, in comparison to its population, Tokyo-Yokohama is becoming increasingly efficient in generating innovative results (WIPO, 2024). In total, 87,457 patents were granted to companies based in Tokyo or Yokohama between 2017 and 2023 (Orbit, 2024).

Tokyo-Yokohama S&T Cluster	
Position as GII S&T Cluster (2024)	1
Position as GII S&T cluster by intensity (relative to population density) (2024)	15
Position as GII S&T cluster by intensity (relative to population density) (2023)	18
Number of patent applications (2024)	3712
Number of patent applications (2023)	3520
Number of published scientific articles (2024)	3231
Number of published scientific articles (2023)	3178

Table 1. Tokyo-Yokohama S&T Cluster's results. Personal elaboration from WIPO, 2024; WIPO, 2023

Key technological fields

A review of PCT applications submitted in 2024 reveals the following main technology sectors (WIPO, 2024):

- Information Technology (9%)
- Electrical Machinery (8%)
- Digital Communications (5%)
- Measurement Technology (5%)
- Audiovisual Technology (5%)
- Medical Technology (5%)
- Optics (5%)

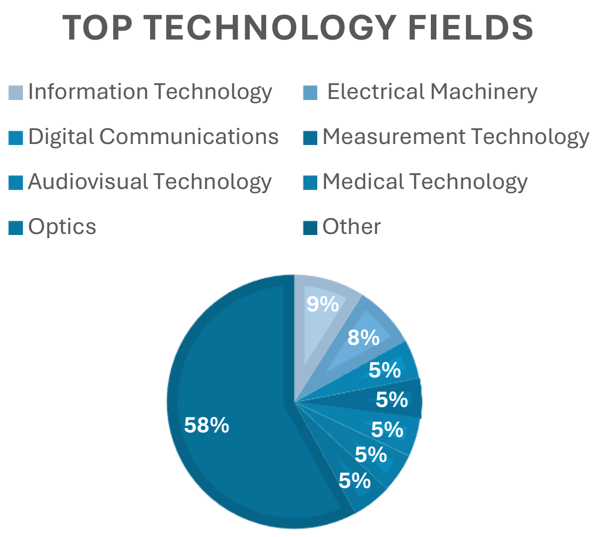

Figure 4. Top Technology fields in Tokyo Yokohama Cluster. Source: WIPO, 2024

A more comprehensive analysis of the IPC classification system indicates that the three technology domains with the highest number of granted patents between 2017 and 2023 are computer technology, optics, and electrical machinery, respectively (Orbit, 2024).

On the other hand, the distribution of scientific publications in the cluster reveals focus in both fundamental research and applied sciences. Physics and Mathematics account for 11% of publications, Technology for 10%, Clinical Medicine for 10%, Engineering for 9%, Surgery for 8%, and Biochemistry and Biotechnology for 8%. Such diversification ensures that the region contributes to a wide range of scientific disciplines, thereby establishing Tokyo-Yokohama as a versatile and comprehensive innovation hub (WIPO, 2024).

Top PCT Applicants and Top publishing organizations

According to GII 2024, the leading applicants in the field of international patent applications (PCTs) in the Tokyo-Yokohama region in 2024 are Mitsubishi Electric, NTT, and Sony. In fact, in 2024, Mitsubishi Electric filed 11,894 PCT patent applications, NTT filed 7,201 PCT patent applications and Sony filed 6,399 PCT applications (WIPO, 2024). A more comprehensive examination by IPC indicates that the three leading companies in terms of patent families granted between 2017 and 2023 are Canon, Seiko Epson and Honda (Orbit, 2024), as shown in Figure 5.

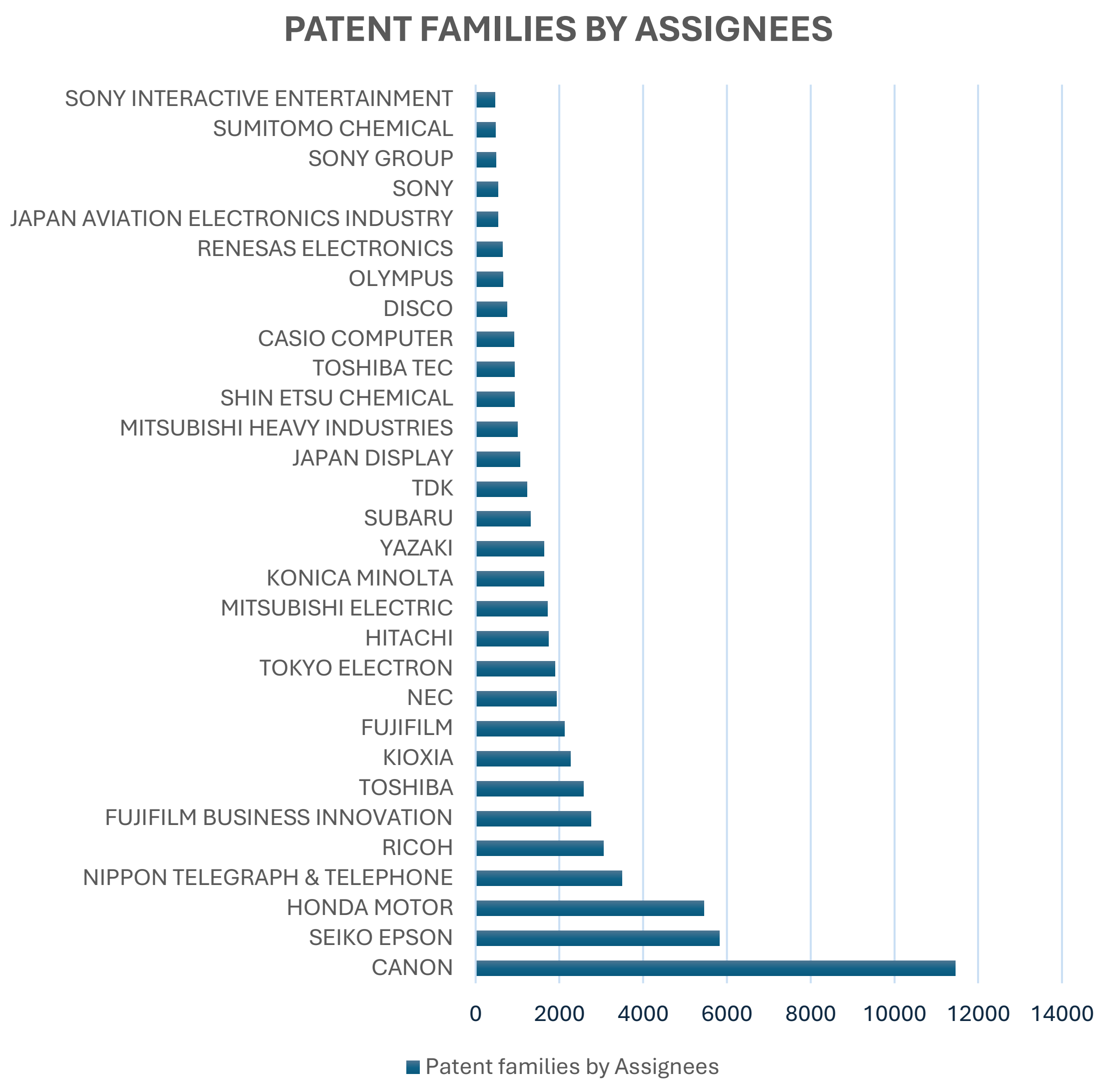

Figure 5. Patent Families by Assignee in Tokyo-Yokohama Cluster. Personal elaboration from Orbit data

In the field of scientific research, the University of Tokyo, Tokyo Institute of Technology and Keio University have been identified by GII 2024 as the leading institutions in terms of the number of scientific articles published in 2023. The University of Tokyo published 17,036 scientific articles in 2024, representing 14% of the total number of publications in the cluster. In 2024, the Tokyo Institute of Technology published 5,432 articles, representing a 5% share of the regional total, while Keio University published 4,420 articles, representing 4% of the total.

Furthermore, the University of Tokyo has a notable history of fostering entrepreneurial activity, with 237 start-ups emerging from its various departments as of 2015 (Hasegawa & Sugawara, 2017). Start-ups are distinguished by their engagement with faculty (44%), their relationship with students (37%) and their relationship with patents (26%) (Hasegawa & Sugawara, 2017). The University of Tokyo provides funding for over 100 joint research projects on an annual basis and maintains almost 200 collaborative relationships with domestic and international companies. In 2004, the University of Tokyo established the venture capital affiliate, University of Tokyo Edge Capital Partners (UTEC), which focuses on early-stage companies, particularly those with a robust academic foundation (FIRM PROFILE｜UTEC-The University of Tokyo Edge Capital Partners Co., Ltd., n.d.).

Condition		Number	%
(i)	Patent-Based relationship	64	27 %
(ii)	Knowhow-based relationship	62	26 %
(iii)	Faculty engagement relationship	104	44 %
(iv)	Student relationship	87	37 %
(v)	Education-based relationship	49	21 %
(vi)	Incubation facility relationship	59	25 %

Table 2. University of Tokyo's companies. Source: Hasegawa & Sugawara, 2017.

2.2 OVERVIEW OF THE OSAKA-KOBE-KYOTO INNOVATION CLUSTER

According to the 2024 Global Innovation Index (GII), the Osaka-Kobe-Kyoto Cluster ranks as the 7th largest science and technology (S&T) cluster worldwide, maintaining the same position as in 2023 (WIPO, 2024a; WIPO, 2023a).

Osaka is specialized in manufacturing sector, with numerous small and medium-sized enterprises (SMEs) specializing in electronics, pharmaceuticals, machinery, and other industries (Ministry of Internal Affairs and Communications, 2020). The city is a major economic hub in Japan, accounting for around 3.8% of the country's gross domestic product in 2019 (Osaka City | Regional Information - Investing in Japan, n.d.). The city is also a significant contributor to the environmental and new energy sectors, with clusters of businesses concentrated in the bay area (Osaka Prefecture | EU-Japan, n.d.). Additionally, Osaka showcases a sophisticated bio-cluster, a regional gathering of government, business, and academic efforts designed to expedite progress in biotechnology, pharmaceuticals, and medical research. Due to its transit network and lower business costs comparing to Tokyo, Osaka is an ideal location for various sectors, including logistics and biotechnology (Osaka City | Regional

Information - Investing in Japan, n.d.). Conversely, Kyoto stands out for its traditional city layout, with a mix of artisanal craft businesses and advanced industrial activities, totaling 118,716 establishment (Kyoto | Regional Information - Investing in Japan, n.d.). Many highly regarded companies such as Shimadzu, Kyocera, and Nintendo are based in Kyoto, along with cutting-edge research in the areas of information and communication technology (ICT) and biotechnology(Kyoto Prefecture | EU-Japan, n.d.). In Kyoto, the manufacturing industry is famous for its advanced technology companies, which represented a large portion of the area's manufacturing exports in 2013. These consist of electronics, transportation machinery, and the beverage sector (Kyoto Prefecture | EU-Japan, n.d.). Parallelly, Kobe boasts 69,736 establishments, serving as a pivotal node for a multitude of heavy industries, including shipbuilding, steel, and precision machinery (Hyogo Prefecture | EU-Japan, n.d.). In recent years, the city has also witnessed a notable expansion of its biomedical industry, representing one of the most significant biomedical research hubs in Japan (Kobe City | Regional Information - Investing in Japan, n.d.). As a result of this initiative, Kobe has become a prominent city in medical R&D, attracting both domestic and foreign medical-related enterprises (Hyogo Prefecture | EU-Japan, n.d.)). Moreover, Kobe is recognized as a hub for leading technical research, encompassing institutions such as the SPring-8 synchrotron radiation facility, which engages in advanced research on nanotechnology (Hyogo Prefecture | EU-Japan, n.d.).

2.2.1 Overview of Global Innovation Index Indicators

Science and Technology Metrics

In 2024, the Osaka-Kobe-Kyoto region filed 2,435 patent applications under the Patent Cooperation Treaty (PCT) and published 3,341 scientific articles per million inhabitants. This sustained output has maintained the region's position as the seventh largest science and technology cluster globally (WIPO; 2024). However, when considered in terms of intensity relative to population density, the region ranked 29th. The data indicates that the figures remained almost stable in comparison to the previous year, with 2,446 PCT applications and 3,308 scientific articles published during 2023 (WIPO; 2024; WIPO, 2023). A total of 20,423 patents were granted to companies based in Osaka, Kobe or Kyoto between 2017 and 2023 (Orbit, 2024).

Osaka-Kobe-Kyoto S&T Cluster	
Position as GII S&T Cluster (2024)	7

Position as GII S&T cluster by intensity (relative to population density) (2024)	29
Position as GII S&T cluster by intensity (relative to population density) (2023)	30
Number of patent applications (2024)	2435
Number of patent applications (2023)	2446
Number of published scientific articles (2024)	3341
Number of published scientific articles (2023)	3208

Table 3. Osaka-Kobe-Kyoto S&T Cluster's results. Personal elaboration from WIPO, 2024; WIPO, 2023

Key Technological Fields

Osaka-Kobe-Kyoto demonstrates excellence across various technology sectors. The PCT applications filed in 2024 reveal a concentration in the following fields:

- Electrical machinery: 13%
- Measurement: 7%
- Semiconductors: 6%
- Medical technology: 5%
- Audio-visual technologies: 4%
- Optics: 4%
- Other machinery: 4%

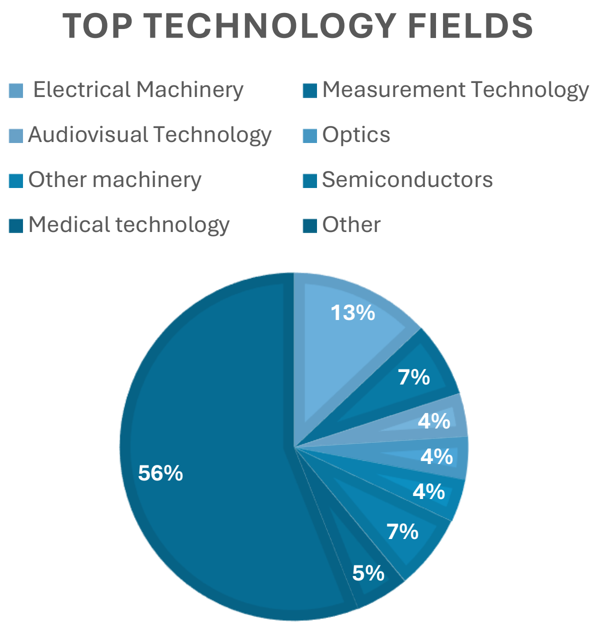

Figure 6. Top technology fields in Osaka-Kobe-Kyoto's Cluster. Personal elaboration from WIPO data

A more comprehensive analysis of the IPC classification system reveals that the three technology domains with the highest number of granted patents between 2017 and 2023 were electrical machinery, computer technology and optics, respectively (Orbit, 2024).

In the context of scientific publications, the Osaka-Kobe-Kyoto region demonstrates a robust presence in both fundamental and applied research. In the field of chemistry, the region accounts for 18% of publications. In the fields of physics and mathematics, the region accounts for 12%. A further 9% of publications are in the field of technology, followed by biochemistry and biotechnology, surgery, engineering, and clinical medicine (WIPO, 2023).

Top PCT Applicants and Top Publishing Organizations

Murata Manufacturing leads with 3,999 patent applications, accounting for 10% of the total. In 2024, Kyocera submitted 2,567 patent applications, accounting for 7% of all applications filed. In 2024, Nitto Denko submitted 2,053 PCT patent applications, retaining a 5% share (WIPO, 2024). IPC's further analysis shows that Panasonic, Kyocera, and Sumitomo are the top three companies in terms of patented families granted from 2017 to 2023 (Orbit, 2024), as shown in Figure 7.

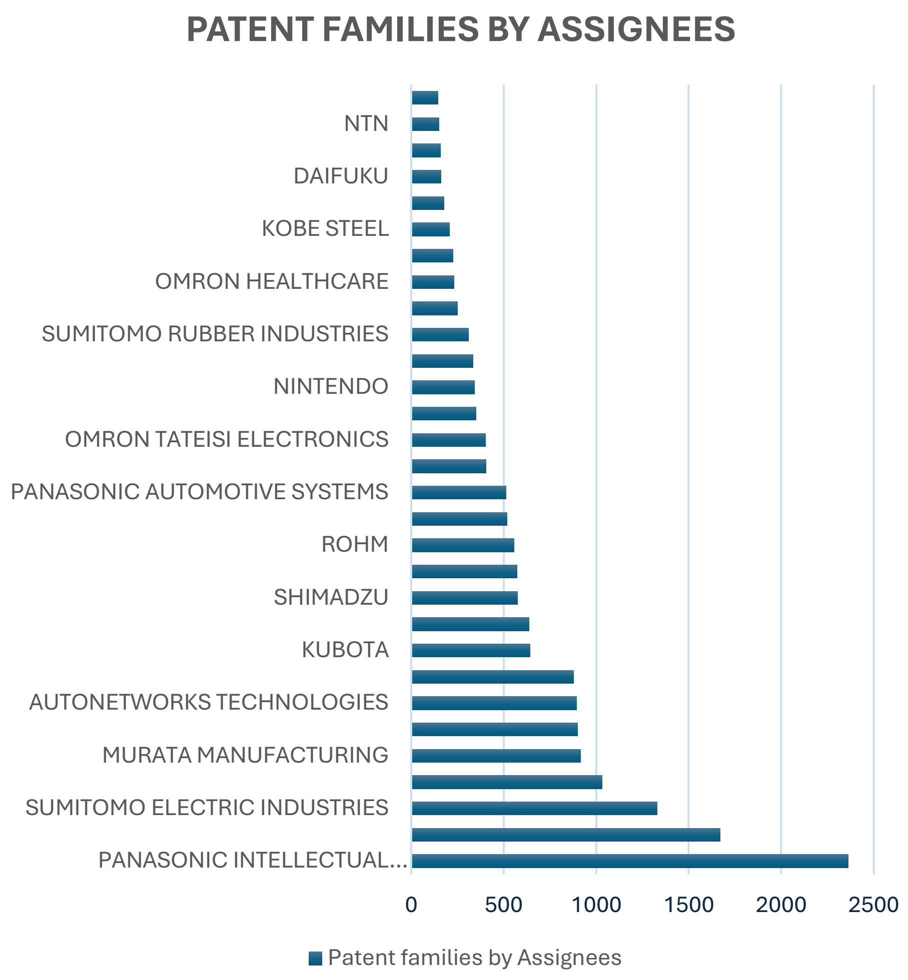

Figure 7. Patent families by Assignees in Osaka-Kobe-Kyoto Cluster. Personal Elaboration from Orbit data

In terms of scientific publications, the principal institutions are Kyoto University, Osaka University and Kobe University. In the year 2024, Kyoto University published a total of 12,226 articles, representing 23% of the total number of publications within the cluster. In contrast, Osaka University published 9,894 articles, representing 19% of the total. Consequently, Kobe

University contributed 7% of the total, having published 3,533 articles in 2024 (WIPO, 2024). In 2016, Osaka University made a commitment to combine academic research with business by allocating ¥25.7 billion to UIC initiatives (Ogawa, 2017). Its office for University-Industry Co-Creation has the objective of strengthening the university's commitment to regional and national development, and it has become a major hub for innovation, coordinating initiatives across all areas (Ranga et al., 2017).

2.3 RISE OF GAMING INDUSTRY IN JAPAN

The Japanese video game industry has its origins in the importation of models from the United States, which were then rapidly adapted and enhanced by Japanese companies, giving rise to a distinctive Japanese style (Koyama, 2023). Japanese entertainment industries and import/export companies played a significant role in the emergence of this industry (Picard, 2013). Concurrently, the economic and cultural context of Japan in the 1970s, characterised by robust economic growth and the expansion of the electronics industry, constituted an important factor in the evolution of the digital games industry (Kohama, 2007). During this period, Japanese companies-initiated investments in advanced technologies and products, relocating a portion of their production to overseas markets to enhance domestic competitiveness and innovation (Masai et al., 2024).

2.3.1 Early Development: Arcade Games and the Impact of Space Invader

The Japanese video game industry has its origins in the late 1970s, coinciding with the emergence of global electronic entertainment, a phenomenon that had already manifested in the United States (Koyama, 2023). The release of Pong by Atari, Inc. in 1972 can be considered the point of origin of a new trend in Japanese game production (Kent, 2001). Subsequently, companies such as Taito and Namco, which initially distributed American games, commenced the development of their own titles, frequently replicating those that had demonstrated commercial success (Picard, 2013). Consequently, Japan witnessed the advent of a proliferation of clones and reproductions of games exhibiting only slight deviations from the originals. As the concept of intellectual property rights was not yet firmly established within the gaming industry, there were no legal ramifications for the replication of games produced by other companies (Koyama, 2023). However, games such as Taito's Speed Race and Western Gun, distributed in the US in 1974, demonstrate that the Japanese industry not only imitated but also developed new concepts that achieved success both domestically and internationally (Kohler, 2004). During this period, Nintendo first entered the video game market as a result of a collaborative venture with an American company. This involved the latter supplying components for the inaugural home console, the Magnavox Odyssey, in 1971 (Picard, 2013).

The 1973 oil crisis, which compelled the company to temporarily withdraw from the amusement machine sector, and the phenomenal success of Space Invaders were the determining factors in Nintendo's decision to refocus on arcade video games (Georges, 2011). To oversee this new venture, Nintendo established an entertainment subsidiary, Nintendo Leisure System, and initiated the development of derivative versions of existing games (Nintendo Co., Ltd. : Corporate Information, n.d.). The launch of the company's inaugural Japanese console, the Color TV Game, in 1977, in collaboration with Mitsubishi Electronics, enabled it to assume a dominant position within the industry, particularly due to the affordable price point of 9,800 and 15,000 yen, respectively, despite the inclusion of colour screens. This constituted a significant competitive advantage over other game machines, which had monochromatic screens and cost upwards of 20,000 yen. Moreover, the company's previous collaborations with American organisations afforded it direct access to the North American market (Georges, 2011).

Significant gameplay innovations, such as the ability for players to interact with enemies, the goal of achieving high scores, and the option to save players' scores, were introduced with Tomohiro Nishikado's Space Invaders (July 1978) for Taito, increasing player involvement and loyalty (Picard, 2013). The so-called 'golden age' of arcade video games began with Space Invaders, the first Japanese arcade game to achieve mass phenomenon status (Kent, 2001). Gaming centres could recoup their initial expenditure of 460,000 yen in less than a month thanks to the game's potential to produce 20,000–30,000 yen in a single day (Koyama, 2023). By the end of 1978, the firm was forced by the economic success of Space Invaders to license production to other Japanese game companies, which was unusual in the industry as licensing was usually exclusively given to foreign companies (Koyama, 2023). imilar to many other popular games of the time, Space Invaders generated an extensive number of copycats, such as Pac-Man (1980) and Galaxian (1979). These were created by Namco and helped the arcade sector grow even more (Kent, 2001). By the beginning of the 1980s, the arcade game industry was worth $8 billion, which equates to approximately $26.8 billion in 2023 (Kent, 2001). During the late 1970s and early 1980s, several Japanese companies were also successful in entering the arcade market, including Konami, Data East, Irem, SNK, Nichibutsu, Sunsoft, Jaleco, Tecmo and Capcom (Picard, 2013).

Key Milestone	Details	Date

Entry of Imported Models	Japanese companies adapted and localized American game models, capitalizing on early successes in global markets.	1970s
Atari's Pong	Pioneered a new trend in Japan's game production, creating demand for arcades and electronic entertainment.	1972
Entry of Nintendo	Collaboration for Magnavox Odyssey, shift to arcade focus	1971, 1973
First Japanese Console	The Color TV Game series was priced competitively (9,800–15,000 yen) to penetrate the domestic market.	1977
Success of Space Invaders	Space Invaders generated significant revenue per unit (20,000–30,000 yen/day) and initiated mass licensing to competitors.	1978
Arcade Industry Value	Japanese arcade market reached $8 billion in value, showcasing its dominance in the global market.	Early 1980s

Table 4. Summary of Early Developments of Gaming Industry in Japan. Personal elaboration

2.3.2 The Rise of Home Consoles: Nintendo's Family Computer (Famicom)

Nintendo distinguished itself from its competitors by its decision to design a console that was technologically advanced while maintaining lower production costs (Koyama, 2023; Aoyama & Izushi, 2003). In contrast with the conventional approach of developing the hardware and then adapting the software, Nintendo adopted a strategy of reversing the process, allowing the software to determine the technical specifications of the console (Georges, 2011). From a commercial standpoint, Nintendo adopted a business model predicated on the low-cost sale of hardware, with profits concentrated on software (Consalvo, 2006). The company devised a comprehensive production and consumption ecosystem, entered into licensing agreements with third-party developers, and formulated targeted marketing strategies. Promotional initiatives included the implementation of dedicated in-store displays, the organisation of gaming competitions, the establishment of commercial partnerships, and the creation of a network of fan clubs, with the objective of further enhancing audience loyalty (Sheff, 1994; Choo, 2013) . Furthermore, Nintendo has developed a reputation for providing amusement for people of all ages (Kline et al., 2003; Amano & Rockwell, 2021), in great part because of a marketing approach focused on family entertainment. Nintendo's Game & Watch, which was created with a more adult audience in mind, was released in 1980 as proof of this. Incorporating a watch function to overcome the psychological barrier associated with purchasing a toy (Picard, 2013). Nintendo collaborated with Sharp to implement the watch function, creating a low-power device capable of always being on, a beneficial feature for gaming as it allowed the highest score to always be saved (Koyama, 2023). A change from the post-war era's emphasis on unrelenting work to a growing interest in leisure and amusement can be observed in Nintendo's 1983 release of the Family Computer (Famicom) (Kline et al., 2003; (Sheff & Eddy, 1999). At the same time, the interdependence of technology, culture, and marketing tactics—all of which have played a crucial role in the development of the video game industry—is best illustrated by Famicom's success (Kline et al., 2003;Altice, 2015). A combination of technical, strategic, and content-related factors led to Famicom's higher sales than rival platforms like SEGA, as shown in Figure 8. Although technically superior, the subsequent Mark III (1985) was unable to compete with Nintendo's strong market position, while SEGA's SG-1000, which was released in the same year as the Famicom (1983), provided worse performance (Koyama, 2023). This was because Famicom offered affordable hardware and concentrated profits on software, supported by an extensive network of third-party developers (Koyama, 2023; Kent, 2001). From the outset, Nintendo attracted several companies wishing to develop and sell games for Famicom due to the establishment of a system of licensing agreements with third parties of two distinct varieties. The first were royalty agreements, which required manufacturers to pay a percentage of their earnings to Nintendo (Koyama, 2023). The second were OEM agreements, which permitted companies to create games for the Famicom under the Nintendo brand name. This system facilitated the development of a diverse and extensive library of titles, enabling the Famicom to establish cultural relevance across global markets (Aoyama & Izushi, 2003; Consalvo, 2006). In contrast, SEGA encountered difficulty in generating the same level of interest among external companies, with only Salio entering the market as a third-party developer for the Mark III, leading to a smaller selection of available games for the console (Aoyama & Izushi, 2003; Johns, 2006).

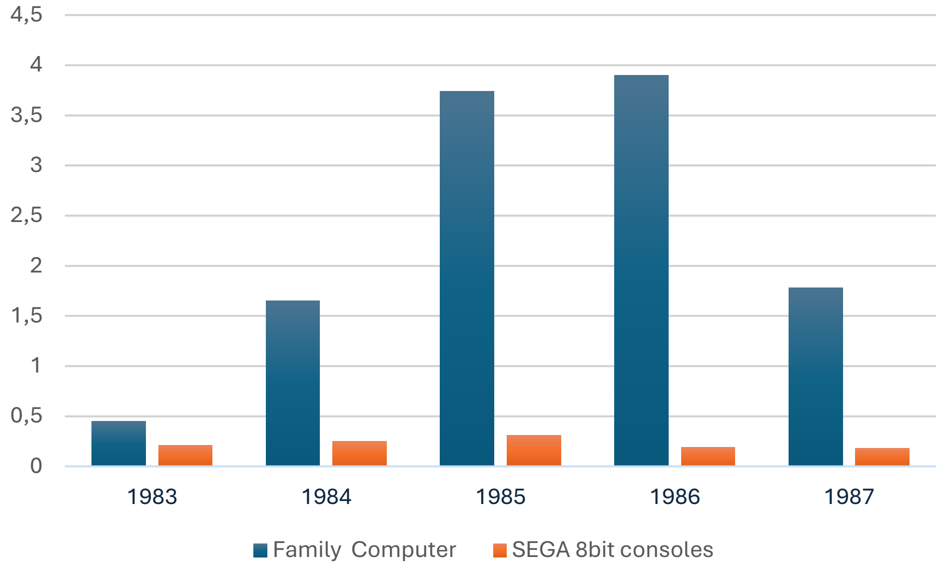

Figure 8. Rise of Famicom in Japan. Personal elaboration from Family Computer: Jouhou Media Hakusyo (Information Media White Paper), 2000 edition. Sega 8-bit consoles (total of SG-1000 and MARK III): Yanagawa and Kuwayama (1999).

The expansion of the Famicom market was accompanied by a notable increase in the number of consumers and a proliferation of available games, which in turn gave rise to a substantial demand for information on new titles, content and release dates (Koyama, 2023). Moreover, a considerable number of players encountered obstacles in completing the games, thereby generating a demand for strategy guides. This resulted in the advent of periodicals dedicated to video games, such as Beep and Family Computer Magazine (Georges, 2011), which contributed to the consolidation of the association between video games and popular culture.

The PC Engine, which was created by Hudson and debuted by NEC in 1987, was a major technological leap in the field of home video game consoles after the release of Famicom in 1983 (Koyama, 2023; Kent, 2001). This was due to the integration of the CD-ROM as an optional peripheral. This enabled the integration of new features, including character dubbing, high-quality soundtracks, and sophisticated graphic presentations, which encompassed full-screen static images and animated scenes (Altice, 2015). Nevertheless, despite the innovations introduced by the PC Engine, the console failed to achieve the same level of sales as the Super Famicom, Nintendo's subsequent console launched in 1990 (Nintendo Co., Ltd. : Corporate Information, n.d.). Koyama (2023) claims that the Super Famicom and the PC Engine had about identical cumulative sales in the first several months after their releases. However, in terms of total sales, the Super Famicom greatly outperformed its rivals starting in 1991, as shown in Figure 9. The Super Famicom continued to show steady growth, peaking in 1993, while the PC Engine and SEGA's Mega Drive reached their best sales statistics in 1990. The overall number of units sold by Nintendo at the end of the console's life cycle was far more than the combined sales of the PC Engine and Mega Drive.

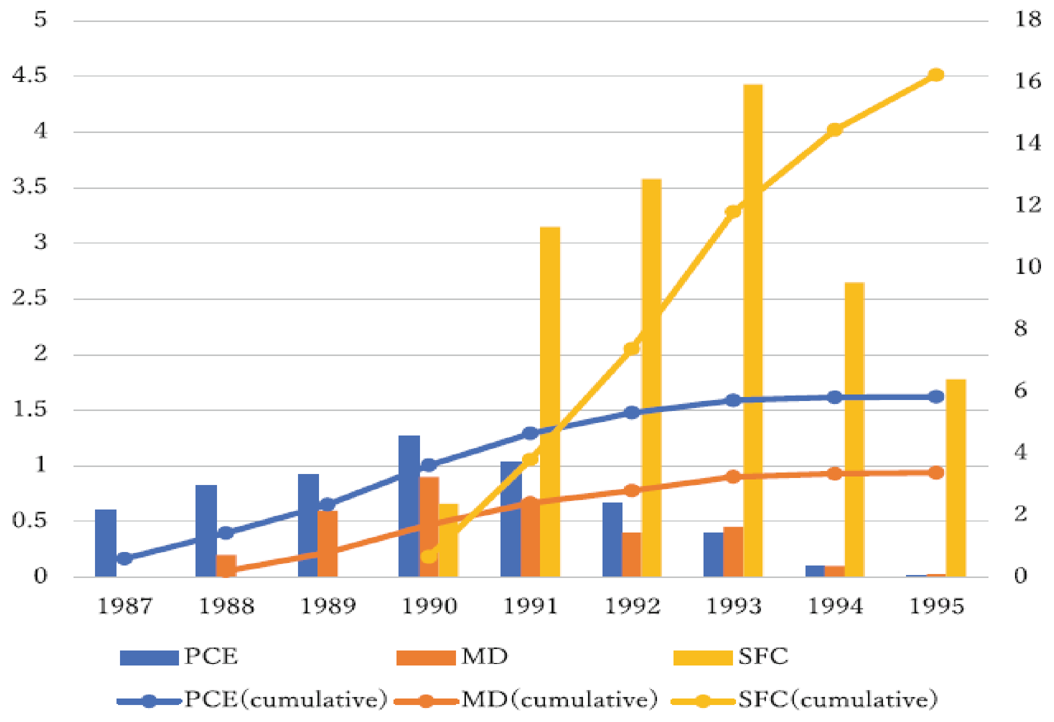

Figure 9. Sales of Consoles in Japan 1987-1995. Source: Koyama, 2023

Key Milestone	**Details**	**Date**
Launch of Game & Watch	Designed for a mature audience; collaborated with Sharp to incorporate a watch function. Addressed the psychological barrier of purchasing "toys" (Picard, 2013; Koyama, 2023)..	1980
Release of Family Computer (Famicom) by Nintendo	Technologically advanced and low-cost console. Established a licensing model with royalty and OEM agreements.	1983
SEGA SG-1000 and SEGA Mark III launch	Less successful in attracting third-party developers, leading to a smaller game library	1983, 1985
Launch of NEC's PC Engine	Introduced CD-ROM for better audio, graphics, and animation.	1987

Release of Super Famicom	Quickly surpassed PC Engine and SEGA's Mega Drive in sales post-1991	1990

Table 5. Summary of the Rise of Home Consoles. Personal elaboration

2.3.3 Transformation of the Video Game Market in the 1990s

According to Koyama (2023), the market peaked during this decade at a value of over 600 billion yen, roughly three times that of 2020. The decrease in game prices, which made them more affordable for a larger audience, is one of the main reasons for this growth (Sheff & Eddy, 1999; Altice, 2015). Some of the titles were priced at over 10,000 yen towards the end of the Super Famicom era; however, the advent of CD-ROMs, utilised by the PlayStation and Saturn, saw a reduction in the price of games to approximately 5800-6800 yen, while maintaining a high standard of quality (Koyama, 2023; Picard, 2013). A second crucial factor was the substantial increase in profitability for video game companies (Koyama, 2023). Despite a reduction in selling price by half, the production costs for CD-ROM titles were found to be considerably lower than those for cartridges, allowing companies to maintain consistent profit margins. These businesses had a significant increase in total revenue as sales volumes rose (Johns, 2006; Koyama, 2023). With their unique technical and strategic features and wide selection of games, the three main consoles of the 1990s—the PlayStation, Saturn, and Nintendo 64—grew the gaming market and established game consoles as a major force behind technological advancement (Kent, 2001; Consalvo, 2006). Console manufacturers made significant financial investments in the creation of hardware improvements to outperform their rivals. This was due to the fact that more powerful consoles would let developers to produce more graphically appealing and expressive games, which would draw in more players and grow the industry (Kline et al., 2003). However, a more difficult era for home consoles began with the turn of the millennium. The industry was forced to reevaluate its strategy because of a number of problems, including growing development costs, market saturation, and changing consumer behaviour (Kline et al., 2003; Johns, 2006). While the North American and European markets experienced considerable expansion during the mid-2000s, Japan's market demonstrated only marginal growth (Aoyama & Izushi, 2003; Consalvo, 2006), as shown in Figure 10. On an international scale, the market continued to expand, but the rising complexity of each new console generation led to a dramatic increase in R&D and production costs, which made it challenging for companies to maintain profitability (Altice, 2015; Kent, 2001).

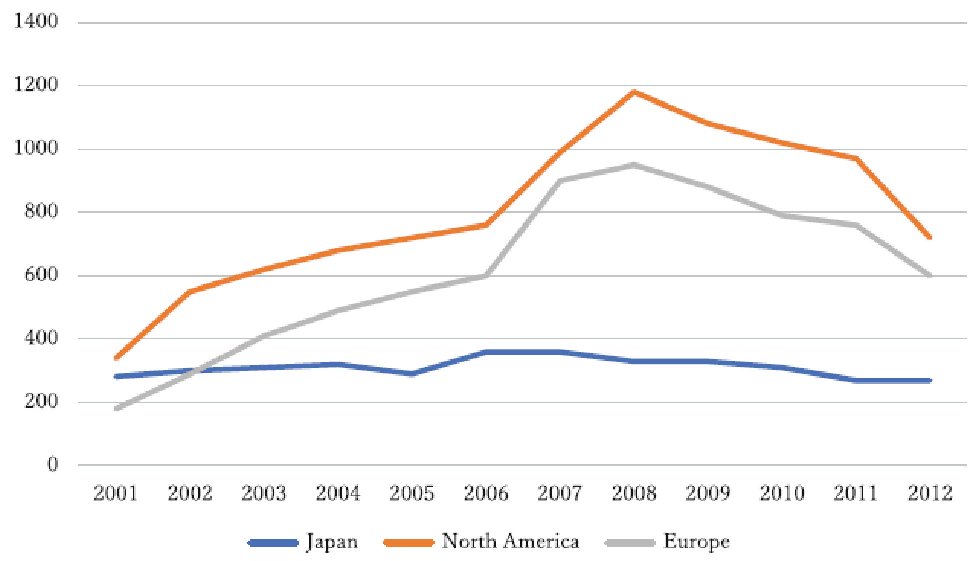

Figure 10. Sales of Home Consoles in North America, EU and Japan 2001-2012. Source: Famitsu Game White Paper

A significant challenge was the phenomenon of "reverse spread," in which the cost of manufacturing each console exceeded its retail price. To illustrate, the PS3 exhibited a reverse spread of 30,000 yen, indicating that Sony sustained a loss of this amount on each unit sold. It was anticipated that these losses would be compensated for by software sales over the lifespan of the console (Koyama, 2023). However, the extent of this reverse spread was so considerable that it would be necessary to sell 30 games per console to achieve a break-even point (Sheff & Eddy, 1999). Furthermore, customers did not react significantly at first to the development of gaming console technology, especially regarding high-definition (HD) visuals. Although HD televisions were intended to be fully utilized by the PS3 and Xbox 360, their adoption was slow, especially in Japan, where they weren't widely available until about 2010 (Picard, 2013; Altice, 2015). On the other hand, Nintendo's Wii, which debuted in 2006, completely avoided the reverse spread issue and instead focused more on creative gaming using motion controllers. This was because it sought to appeal to a wider range of consumers and its hardware was less expensive to produce (Koyama, 2023). Nonetheless, the Japanese home video game software market was beginning to exhibit signs of a downturn.

Key Milestone	Details	Date
Market Peak	Gaming market reached 600-billion-yen, triple that of 2020.	1990s
Higher Profit Margins	Lower production costs of CD-ROMs maintained profitability despite lower prices.	Mid-1990s

Console Innovation	PlayStation, Saturn, and N64 diversified the market and pushed tech advancements.	1990s
Global Market Growth of home consoles	North American and European markets expanded significantly; Japan's growth slowed.	Mid-1990s
Reverse Spread phenomenon	PS3's manufacturing cost exceeded retail price by 30,000 yen per unit	2006
Nintendo Wii Success	Wii achieved profitability with motion controls and lower production costs.	2006

Table 6. Summary of Transformation of the Video Game Market in the 1990s. Personal elaboration

2.3.4 Shift from Home Consoles to Handheld Devices

It has historically been the case that handheld consoles have played a secondary and complementary role in home consoles, primarily serving niche markets or younger demographics. Nevertheless, the introduction of the Nintendo DS and PlayStation Portable (PSP) in 2004 led to a significant shift in the market, with these new consoles gaining larger market shares and surpassing sales in terms of hardware and software, respectively, in 2005 and 2006. The Nintendo DS and PSP introduced novel forms of gaming that were more focused on mobility, accessibility, and creative gameplay experiences (Koyama, 2018). The principal factors responsible for this shift in market demand are demographic and strategic in nature. A review of population data from 2006 reveals that game consumption rates among the 25-34 and 35-44 age groups are comparable to those observed among younger demographics. The advent of portable gaming consoles has enabled individuals who have grown up with video games to engage in gaming during commutes or in brief periods during their limited free time. Secondly, the elevated costs of developing home consoles have made it challenging for small and medium-sized enterprises (SMEs) to remain competitive and for smaller companies to enter the market. In contrast, portable consoles have lower development costs, which allow smaller studios to flourish in a more accessible market (Koyama, 2018; Shankar, 2016). Furthermore, in the wake of the global financial crisis of 2008, consumers have become increasingly price conscious. The accessibility of portable gaming consoles, coupled with their portability and diverse game libraries, has rendered them a compelling alternative to more costly home gaming systems (Marchand & Hennig-Thurau, 2013).

Key Milestone	**Details**	**Date**

Rise of Handheld Consoles	Nintendo DS and PSP shifted handheld consoles from a secondary to a primary market, surpassing home consoles in sales.	2004-2006
Wider Demographic Reach	Portable gaming attracted older demographics with on-the-go gaming options	2006
Lower Development Costs	Portable consoles had lower costs, allowing small and medium-sized enterprises to enter and compete	2000s

Table 7. Summary of Shift to Handheld consoles. Personal elaboration

2.3.5 Rise of Smartphones and Social Games

With a comparatively modest market share and little potential for company revenue, the mobile gaming industry was still in its earliest stages in the early 2000s. This market was considered secondary, and its small profits were referred to as "pocket money" (Koyama, 2023). From 2007 onwards, the market for mobile games began to expand. This can be attributed to the increased popularity of mobile phones, but at the same time also to the introduction of phone games referred to as 'social games'. These are games in which competition, cooperation, and interaction with other players are central to the enjoyment of the game (Koyama, 2023). In order to market these games, companies adopted a 'free-to-play' business model, whereby the game is made available for free to download and play but offers users the option of making in-game purchases or microtransactions (Costes & Bonnaire, 2022).This enables developers to monetise the game without requiring an initial payment by capitalising on the potential for upgrades or the acquisition of additional lives to resume gameplay in the event of a loss. The technological evolution of smartphones, particularly with the release of the iPhone 3G, enabled these devices to achieve performance levels that were on par with, and subsequently surpassed, those of handheld gaming consoles (Costes & Bonnaire, 2022). With the release of the Nintendo 3DS and PS Vita in 2011, smartphones had surpassed handheld consoles in terms of performance, making them the most popular platform for handheld gaming (Koyama, 2023; Consalvo, 2006). With a 50% global market share in 2002, the Japanese video game industry continued to dominate the market. However, it saw a sharp fall in the years that followed, dropping to a mere 10% of the global market in 2010. The primary reasons for this decline were the economic downturn in Japan (Capcom Investor Relations, 2011) and the disparity in tastes between Western and Japanese audiences (Cieslak, 2010). Concurrently, Japanese companies were slow to develop and release new games for home video game consoles, resulting in global consumer dissatisfaction (Why Do Japanese Developers Keep Us Waiting? - The Japan Times, n.d.).

Key Milestone	Details	Date
Emergence of Mobile Gaming	Mobile gaming was initially a small market but grew with the popularity of mobile phones and social games.	Early 2000s-2007
Free-to-Play Model	Companies adopted a free-to-play model with in-game purchases (microtransactions) to monetize games.	From 2007
Technological Advancements in Smartphones	Performance parity between smartphones and handheld consoles led to smartphone dominance in handheld gaming.	2011

Table 8. Summary of Rise of Smartphones and social games. Personal elaboration

2.4 OVERVIEW OF THE GAMING INDUSTRY

The video game industry comprises several key stakeholders, including developers, publishers, distributors (both digital and physical), retailers, hardware manufacturers, game creation tool providers, and consumers; collectively, these entities engage in a range of economic activities related to the creation, promotion, and monetisation of video games (Oguguo, 2024). Over the past ten years, the worldwide video game market has grown at an exponential rate, making it one of the most lucrative segments of the entertainment industry. The global revenue from video games is expected to reach €41.18 billion in 2024, according to Statista (2024). Through 2029, the market is anticipated to reach an estimated volume of €57.45 billion, representing a compound annual growth rate (CAGR) of 6.89%. With a projected value of EUR 119.6 billion in 2024, the Chinese market is predicted to overtake all others in terms of revenue creation worldwide (Video Games - China | Statista Market Forecast, 2024). This is followed by the US and Japan (Video Games - Japan | Statista Market Forecast, 2024;Video Games - United States | Statista Market Forecast, 2024). By 2029, there are expected to be 66 million users worldwide, with market penetration rising from 48.5% in 2024 to 55.3% in the same year. Additionally, it is anticipated that the average revenue per user (ARPU) would reach €1,551 in 2024, highlighting consumers' increasing propensity to spend money on subscriptions, microtransactions, and premium content inside the gaming ecosystem (Statista, 2024).

2.4.1 Japanese Gaming Industry

According to Statista, since 2017, Japan follows China and US in the gaming industry, based on revenue comparison (Figure 11). With €25,970 million in revenue in 2024, Japan will rank third in the world's gaming marketplaces, after the US ($73,340.00 million) and China ($87,620.00 million). Forecasts for the Japanese market indicate that revenue will reach €25.97 billion in 2024, with a compound annual growth rate of 7.03%. By 2027, the market will have grown to a total size of €31.84 billion. The Japanese video game market is expected to have 26.7 million players by 2027, with a user penetration rate of 19.7% in 2024 and 21.8% in 2027. Japan's ARPU, estimated at € 1,057 per user in 2024, remains among the highest globally, indicating that Japanese consumers are willing to invest significantly in high-quality gaming experiences.

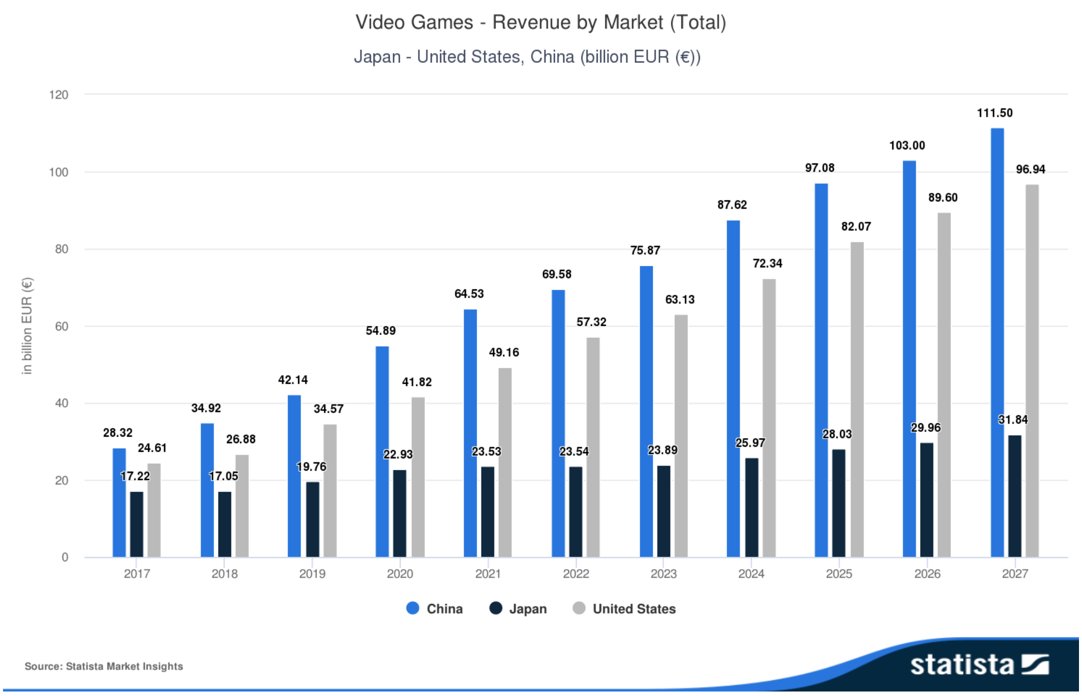

Figure 11. Video Games' Revenue in China, Japan and US. Source: Statista, 2024

2.4.2 Mobile Gaming Dominance in Japan

As the largest contributor to the gaming industry's revenue, mobile games continue to hold an influential position in the Japanese market (Statista, 2024). It is projected that revenues generated by mobile games in Japan will reach €15.55 billion in 2024 (Figure 12), accounting for approximately 59.9% of the total market, which is estimated to be €26 billion. This dominance has been consolidated over the years, with mobile games accounting for €12.15

billion, or approximately 70.5% of the total market, which was valued at €17.2 billion in 2017. Although the market share of mobile games has experienced a slight decline in percentage terms, the growth in absolute value has remained steady and significant. By 2027, revenues generated by mobile games are projected to reach € 18.62 billion, representing 58.5% of the total projected revenues for that year (€ 31.84 billion).

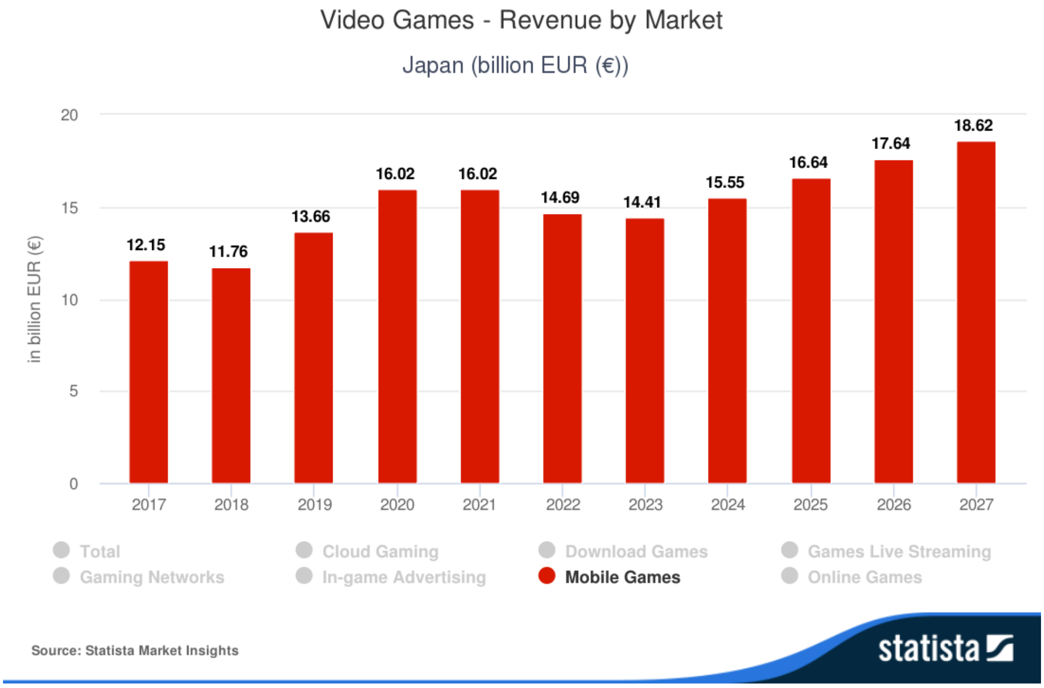

Figure 12. Mobile Games' Revenues in Japan. Source: Statista, 2024

2.4.3 Growth of other market segment in Japan

At the same time, other emerging market sectors are expanding more quickly, although from a smaller starting point (Figure 13). For example, it is anticipated that in-game advertising would triple its earnings by 2027, rising from less than one billion euros in 2017 to € 3.35 billion (Statista, 2024). This will account for approximately 10.5% of the total market. Even though it is still a small market, the cloud gaming industry is expanding at the fastest rate. Cloud gaming is predicted to grow from a very small € 0.04 billion in 2017 (less than 1% of the market) to € 1.34 billion in 2027 (4.2%) of the market. In 2017, the download of games generated €1.46 billion, representing approximately 8.5% of the total market. By 2027, it is projected that this figure will reach €2.45 billion, maintaining a market share of 7.7%. The online games segment also maintains a stable share of total revenues. In 2017, online games generated €2.28 billion, accounting for 13.3% of the total market. By 2027, revenue from this segment is projected to reach €4.13 billion, accounting for 13% of the total market.

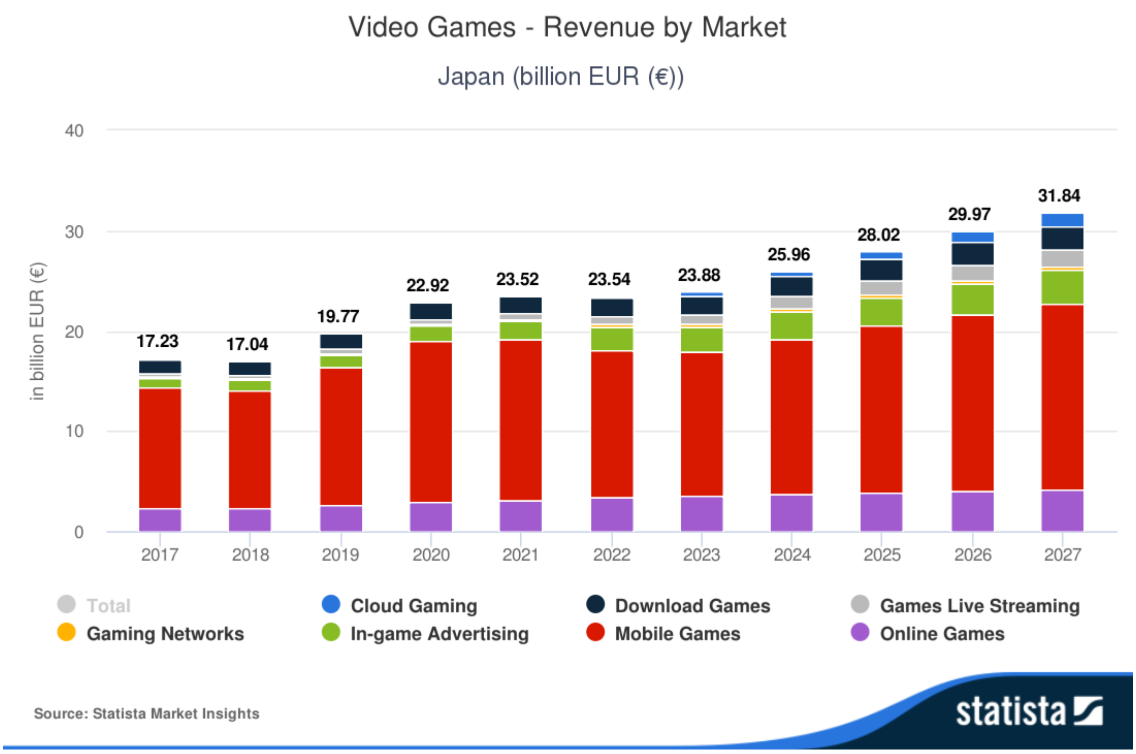

Figure 13. Video Games' Revenue by Market in Japan. Source: Statista, 2024

The growth of cloud gaming has been marked by an initial period of rapid expansion, with a peak growth rate of 76.7% in 2022, followed by a subsequent period of gradual deceleration (Statista, 2024). The projected growth for 2024 is +55.1%, while in 2027 it is estimated to fall to +26.6%. This indicates that the sector is entering a phase of maturation following a period of rapid expansion. Downloadable games demonstrate a more stable growth trajectory, with an anticipated growth rate of 7.5% in 2024 and a gradual deceleration to 5.9% in 2027. Similarly, the online games sector is projected to expand by 5.2% in 2024 and then decelerate to 3.7% in 2027. Live game streaming demonstrated considerable initial growth, with an increase of 42.5% in 2022. However, projections for 2024 indicate a growth rate of 20.0%, followed by a further deceleration to 5.8% by 2027. Following a downturn in 2022, with a decline of -8.3%, the mobile games market is demonstrating signs of recovery. It is anticipated that growth in 2024 will reach +7.9%. However, by 2027 this is projected to decline to +5.6%. This suggests that this particular sector is also entering a period of stabilisation following a more volatile growth cycle. In-game advertising, which is becoming an increasingly significant source of revenue, is projected to grow by 8.3% in 2024 and reach 7.3% in 2027. This growth trajectory is consistent with the expansion of digital advertising in gaming, exhibiting a steady but moderate increase (Statista, 2024).

2.4.4 Comparison with Global Trends

The dominance of mobile games is not a global phenomenon. In 2017, mobile games generated € 48.68 billion out of € 100.6 billion total, representing approximately 48% of global revenue (Statista, 2024). By 2027, mobile games revenue is projected to reach € 111 billion out of € 339.2 billion total, maintaining a share of around 32%. Despite this growth, the percentage impact of mobile games globally is expected to decline relative to other segments. In contrast, in-game advertising represents the largest segment of the global market, with a growth trajectory that commenced at €21.69 billion in 2017 and is projected to reach €135.9 billion by 2027. The sector already accounted for 21.5% of global revenue in 2017, but in-game advertising is expected to reach approximately 40% of the total. In general, the Japanese market is characterised by a relatively low level of market diversification, with a notable concentration of revenue derived from mobile games and downloads. In 2027, these two sectors still constituted a substantial proportion of total revenue. In contrast to the Japanese market, the global market is more balanced, with expansion occurring across a range of segments, including cloud gaming, in-game advertising, live streaming, and online games (Statista, 2024).

2.4.5 Market users and penetration rates

According to Statista (2024), the number of individuals utilising cloud gaming has increased considerably, from 1.7 million in 2017 to an estimated 24.6 million in 2027 (Figure 14). In accordance with this, the penetration rate is projected to increase from 1.3% in 2017 to an estimated 20.1% by 2027. The number of users increased from 12.5 million in 2017 to 57.7 million in 2027, while the penetration rate rose from 9.8% to 47.0%. Consequently, live streaming was another rapidly expanding market. The market for download games exhibited a gradual increase between 2017 and 2027, with the number of users rising from 40.1 million to 42.5 million. Nevertheless, the penetration rate exhibited minimal variation, oscillating between 31.5% and 34.6%. This suggests the existence of a well-established yet relatively slow-growing industry. Similarly, the number of users of mobile games increased from 32.5 million to 38.2 million, while the penetration rate rose from 25.5% to 31.1%. This indicates a moderate rate of growth for the mobile gaming industry.

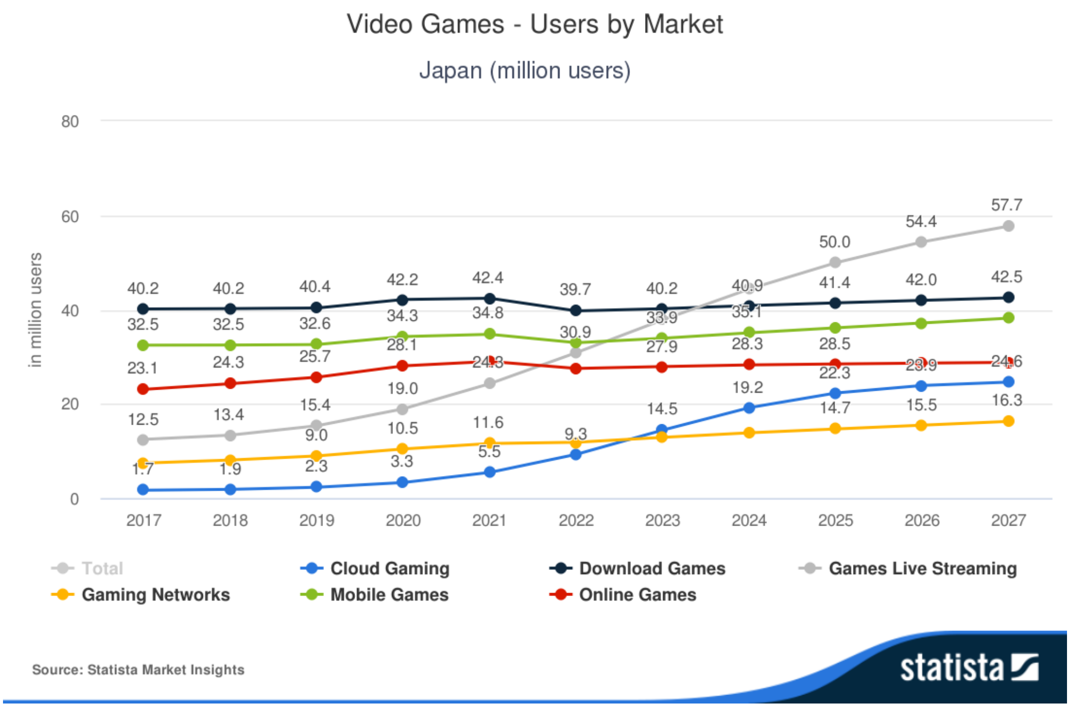

Figure 14. Video Games' Users by Market in Japan. Source: Statista, 2024

2.4.6 Average Revenue per User (ARPU) Comparison

A comparative analysis of average revenue per user by market reveals that mobile games are significantly more profitable than other market segments (Figure 15). In 2024, they are estimated to generate revenue of €443.1, representing a gap of €313 from the revenue per user of online (€129.9). In contrast, the other market segments generate revenue between €20 and €60 per user (Statista, 2024).

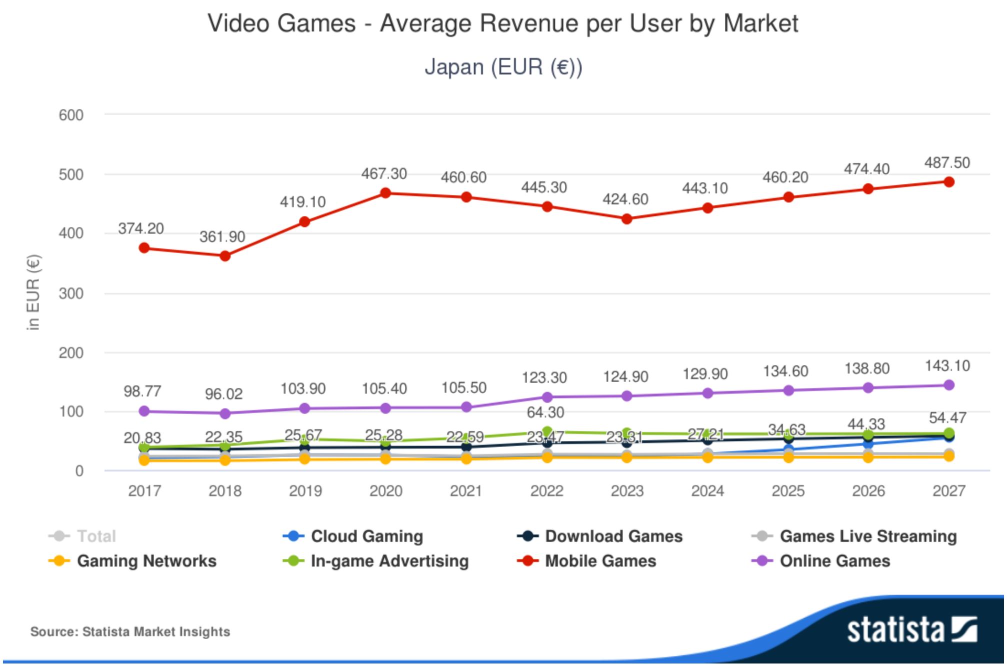

Figure 15. Video Games' Average Revenue per User by Market in Japan. Source: Statista, 2024

A comparison of the Japanese average revenue per user with the global average revenue per user for mobile games reveals a significant discrepancy. The average revenue per user (ARPU) for mobile games was €374.20 in 2017, rising to €487.50 in 2027. In contrast, the global ARPU for mobile games was €41.35 in 2017, increasing to €60.02 in 2027. Consequently, in 2017, the ARPU for mobile games in Japan was 804.96% higher than that of the global market. By 2027, the disparity in percentage remains considerable, with Japan exhibiting an ARPU that is 712.23% higher than the global average. In general, Japan exhibits a markedly higher ARPU across most segments when compared to the global average. This indicates that Japanese gamers typically spend a greater amount of money on average than average global gamers, which may be attributed to a higher propensity among Japanese gamers to invest more financially for a premium gaming experience (Statista, 2024). When the other two main markets, China and the United States, are incorporated into the comparative analysis, Japan's ARPU for mobile gaming remains notably higher (Figure 16).

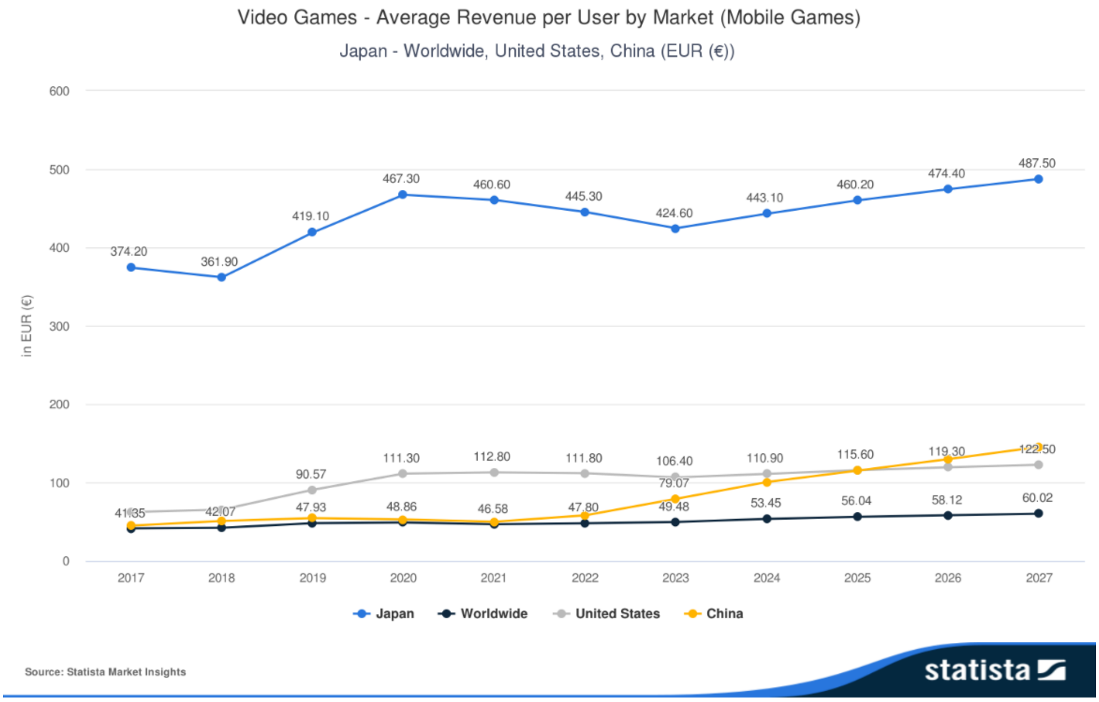

Figure 16. Mobile Games' Average Revenue per User in Japan, US, China and Worldwide. Source: Statista, 2024

This trend persists when the analysis is expanded to encompass download and online games (Figure 17). In contrast, Japan does not perform as well as its competitors in the domain of gaming networks, the only sector where China also exhibits a dominant position relative to the United States. In this market, Japan is even above the worldwide average.

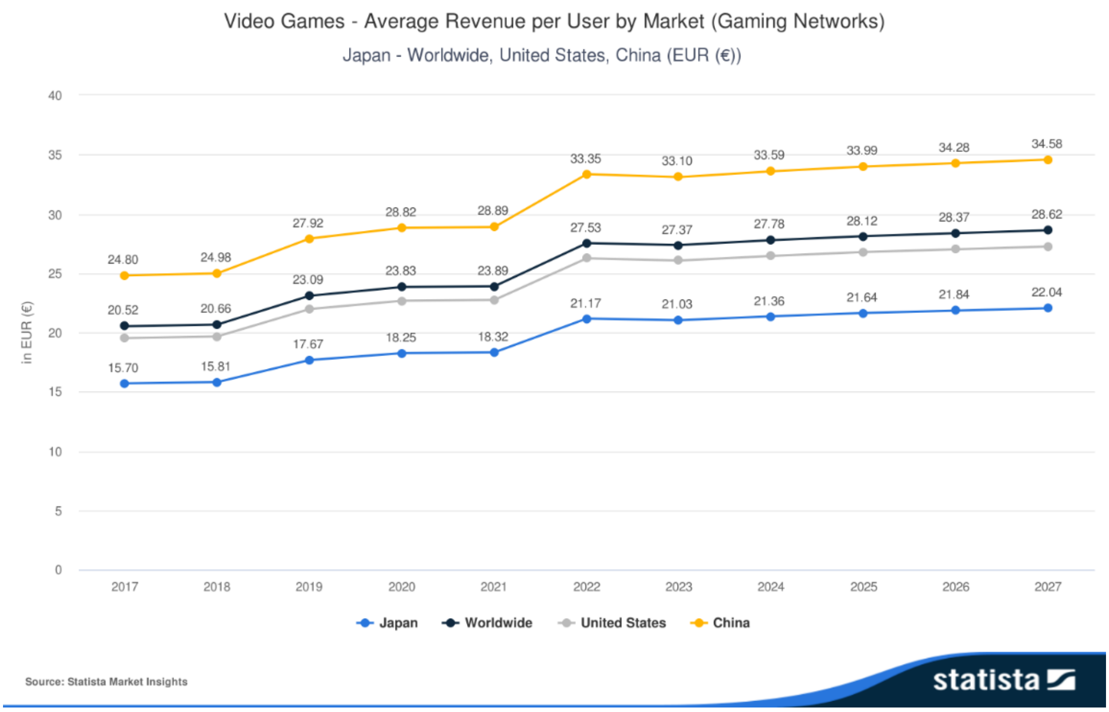

Figure 17. Gaming Networks' Average Revenue per User in Japan, US, China and Worldwide. Source: Statista, 2024

Regarding in-game advertising, the ARPU in Japan is projected to remain stable, while in the United States there is an emerging upward trajectory, culminating in a predicted surpassing of Japan's ARPU by 2025.

2.4.7 Profitability and Market Efficiency

To evaluate the profitability of each market with respect to its user base, the ARPU of the overall market may be used as a reference point in conjunction with the number of users (Figure 18). The country with the highest ARPU-to-user ratio is Japan, with values ranging from 3.29% in 2018 to 4.46% in 2027 (Statista, 2024). This high percentage indicates that, despite the smaller size of the Japanese market in comparison to larger markets such as the United States or China, each user makes a substantial financial contribution. The average percentage for Japan over the examined period is 4.06%, which serves to illustrate the market's resilience in terms of profitability per user. In the United States, there has been a increase in the proportion of users, with a significant rise from 0.56% in 2017 to 1.18% in 2027. This positive trend reflects a continuous expansion of the mobile market, whereby the average revenue per user (ARPU) is increasing at a faster rate than the number of users. Finally, China exhibits the lowest proportions of ARPU relative to the number of users, with figures ranging from 0.05% to 0.07% over the analysed period. This is consistent with the observation that, despite having a significantly larger user base than Japan and the US, each user's contribution to overall revenue is relatively low.

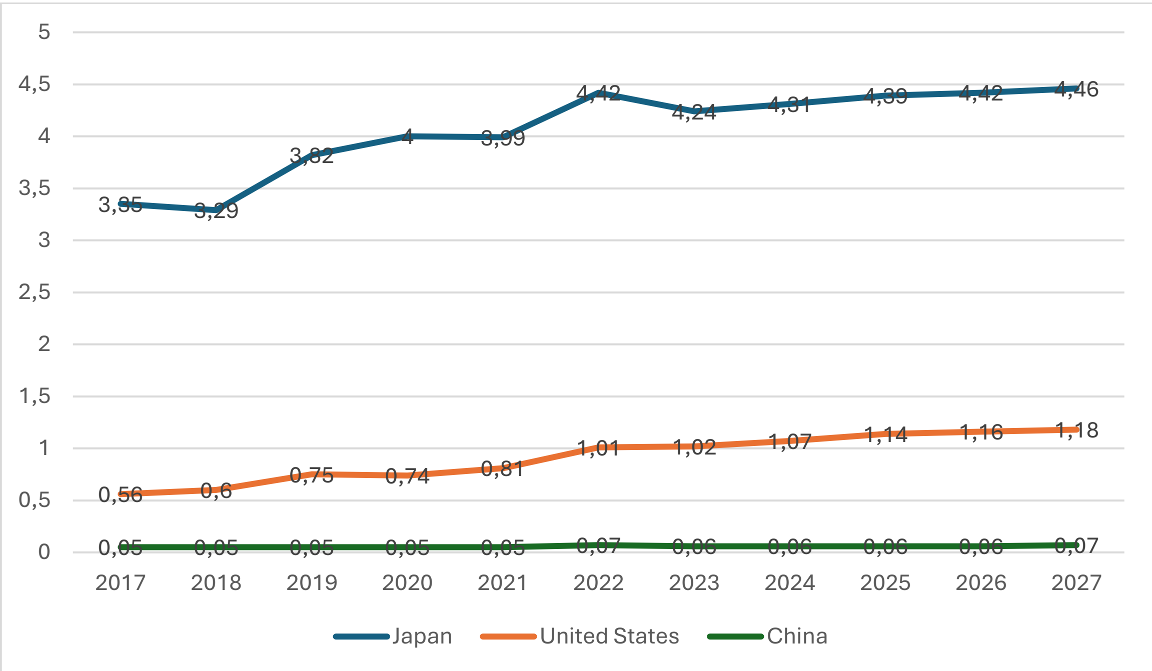

Figure 18. ARPU to User Ratio in Japan, US and China. Personal Elaboration from Statista data

2.4.8 Industry Trends

As reported by WIPO (2023), advancements in hardware, software, and the continuous digital revolution have had a profound impact on the global video game industry. The methods through which video games are distributed, played, and monetised have undergone a substantial transformation because of the digital transition that has occurred within industry (WIPO, 2023). The transition from physical to digital platforms has enabled game creators to reach a wider audience and reduce distribution costs (Marchand & Hennig-Thurau, 2013). The principal avenues for purchasing video games are now console-specific platforms and internet stores (Entertainment Software Association, 2021). This enables game creators to reach a global audience at a relatively low cost (Aoyama & Izushi, 2003). It is also expected that cloud gaming, which provides high-quality online gaming experiences, will facilitate wider access to gaming, particularly in regions where access to advanced gaming equipment is limited (Carrascosa & Bellalta, 2022). The advent of digital distribution has also given rise to the emergence of "games as a service" (GaaS) models, that encompass games that are updated with new content on a regular basis and are eventually monetised through microtransactions, season passes, and subscription services (Davidovici, 2014). The digital transformation and the development of console systems with PC-like processors have also enabled the expansion of cross-platform gaming (Apperley & Jayemane, 2012). The cross-platform feature is regarded as a crucial factor in maintaining a substantial player base for an extended period following the game's initial release (Bangash et al., 2024).

The advent of new software has made it easier for developers to create sophisticated and engaging game environments, thanks largely to the growth of game engines and artificial intelligence (AI) technologies (WIPO, 2023). As stated by GP Bullhound (2023), three principal trends will emerge with the utilisation of AI: hyper-personalisation, prototype acceleration and predictive analysis. The industry will benefit from AI in terms of more targeted content, accelerated development periods and enhanced data analysis. The utilisation of AI has enabled content providers to automate processes, reduce expenditure, enhance precision and curate superior user experiences, optimising development practices and creating scalable content (GP. Bullhound, 2023). A survey conducted by Cint™ (2023) revealed that gaming development studies are employing AI in various aspects of content creation. The most prevalent applications of AI in this context are in character animation (46%), code writing and optimization (37%), artwork and game level generation (36%), narrative design and writing (36%), automated play testing (36%), adaptive difficulty adjustment (35%), and in-game text and voice chat moderation (33%). The advancement of AI-driven analytics tools has facilitated a more profound comprehension of consumer dynamics and behaviour. The utilisation of a data-driven approach by developers enables the production of more engaging games that align with player preferences, thereby enhancing player retention and revenue (Yannakakis & Togelius, 2018).

Another emerging trend is the use of virtual reality (VR) headsets and augmented reality (AR) systems, which facilitate more immersive and interactive experiences (Jerald, 2015). As indicated by Statista (2024), the B2C augmented reality (AR) industry is projected to expand from $24.5 billion in 2024 to $28.4 billion in 2025, representing a notable surge in the subsequent years. Statista forecasts that the B2C AR industry will be valued at $37.8 billion by 2029. Prior to its widespread acceptance, the market continues to confront certain obstacles, including the affordability and expense of AR and VR devices, the protection of data and the security of users (GP.Bullhound, 2023). Concurrently, global revenues for virtual reality headsets are projected to expand by approximately 17% between 2024 and 2029, reaching an estimated USD 11.63 billion in 2029 (Statista, 2024). In the gaming sector, it is projected that the market for augmented reality (AR) and virtual reality (VR) will reach $11 billion by 2026, representing a compound annual growth rate (CAGR) of 18.5% between 2021 and 2026 (Industry Arc, 2024)

The industry's aspiration for continuous technological advancement is exemplified by the growing trend of intellectual property protection in the hardware sector, which has witnessed a notable surge in recent years, as illustrated in the Figure 19 (Oguguo, 2024).In the context of video games, two principal categories of relevant patents can be identified, namely those pertaining to hardware and those relating to software. Hardware is typically afforded the same protection as other electronic devices. In the case of software, the level of protection afforded by legislation is less straightforward, as it is contingent upon the software being implemented in a manner that creates a technical effect (Dimita, 2023).

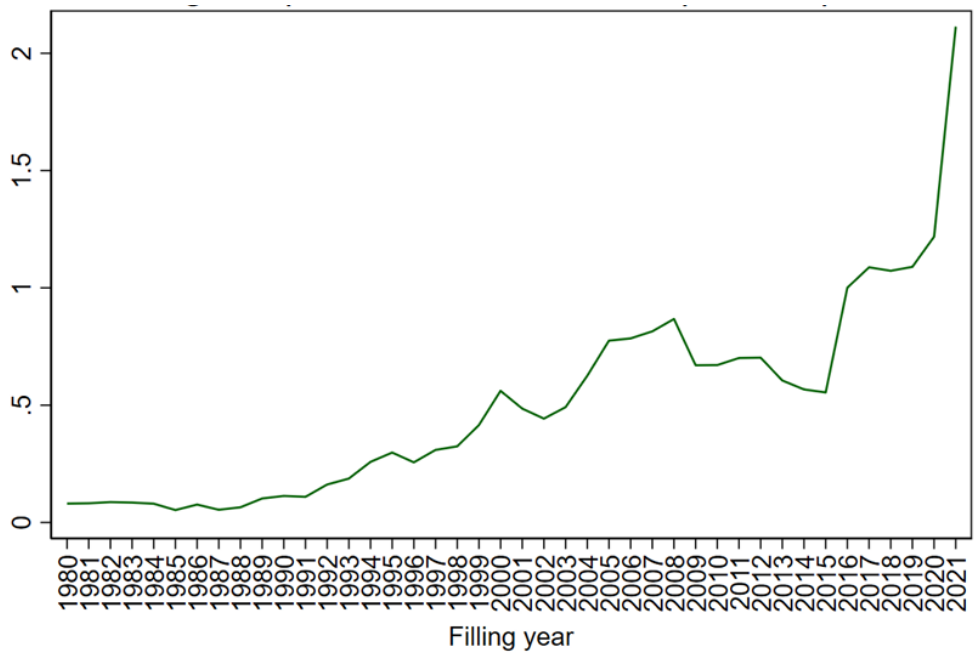

Figure 19. Video Game Patents as a Share of All Patents (%). Source: WIPO, 2024

In line with this trend, the Cint™ (2023) survey found that 53% of the gaming companies surveyed said they faced economic uncertainty in expanding their business into new markets by leveraging their existing IP, highlighting the importance of IP protection in the sector.

2.4.9 Studies on Japanese Gaming Cluster

In the research conducted by Izushi and Aoyama in 2006, they recognized Nintendo as a crucial participant in the expansion of Japan's video game industry. They portray the industry in Japan as a vertically integrated structure that includes both large hardware producers and many smaller software creators. Aoyama and Izushi's examination emphasize the artistic influences that have molded Japan's gaming industry, especially the role of manga and animated films, which they claim offered crucial skills and knowledge in character and graphic design. This foundation was crucial in creating captivating game scenarios and storylines. The elevated salaries in the video game industry drew a movement of talented designers and illustrators from similar fields, while marketing tactics further linked to the video game, manga, and animated film industries, collectively enhancing sales among these sectors. Johns (2006) expands on this by highlighting the impact of manga on Japan's gaming culture, pointing out that certain major companies in Japan, like Nintendo and Bandai, started in the toy sector, while others, including Capcom and Namco, grew out of arcade gaming. Johns points out the distinct preferences of Japanese and Western markets in terms of game genres and hardware sales, noting that consoles usually perform best in their native regions. For example, in Japan in 2003, PlayStation sales on a weekly basis greatly exceeded those of the Xbox. Japan's gaming sector is well-regarded for its cultural influence, with various studies connecting Japan's games to a boost in the nation's "soft power" on a global scale. McGray (2002) introduced the phrase "Gross National Cool" to describe Japan’s cultural impact via exports such as video games, which have gained worldwide popularity due to unique stories and visuals deeply embedded in Japanese culture. Consalvo (2006) expands on this topic by exploring how localization influences the adaptation of Japanese games for Western audiences, making certain that cultural references and humor appeal to various markets. Hasegawa et al. (2012) in their research of the gaming cluster in Japan charted the Japanese console gaming market, highlighting the crucial influence of console makers in developing this industry. The authors recognized the electronic cluster as an additional influence, enhancing the technological abilities of console makers, who chose to subcontract component manufacturing. This study emphasizes the significant links between Japan’s gaming sector and associated industries, such as animation, comics, and character merchandise, which together create a strong content ecosystem. The rivalry between leading firms like Nintendo, Sony, and Sega encouraged a swift cycle of innovation in hardware creation. The research additionally investigates the social gaming sector, where platforms such as GREE and DeNa facilitate third-party game publishing and foster player interactions. In contrast to conventional gaming, social games don't depend on specialized hardware, rendering the electronic cluster less significant. Özalp (2024) also points out that Tokyo, Osaka, and Kyoto are the main centers of the industry, with Tokyo being the most prominent hub. He underscores the importance of consumer electronics companies and the manga and animation sectors as vital elements contributing to the industry’s success in Japan.

CHAPTER 3

3.1 METHODOLOGY

The objective of this study is to analyze the patent landscape within the video gaming sector in Japan, with a particular emphasis on the regional distribution of patent registrations. To achieve this, the study examines patents registered within two key industrial clusters: the Tokyo-Yokohama area and the Osaka-Kobe-Kyoto region. The patent data was collated using the FAMPAT database, which is the default and most comprehensive database for patent analysis within Orbit. FAMPAT compiles world patents, including full text and bibliographic data, and groups them by invention-based families, with data shown at the family level. Each record in FAMPAT represents a unique patent family, consolidating all patent equivalents related to a single invention as published in various countries. The data collection process involved the definition of search parameters within the Orbit database, with the objective of capturing patents explicitly related to the video gaming sector. To guarantee that only patents pertinent to video gaming were taken into consideration, the search was confined to those registered under the International Patent Classification (IPC) subclass A63F, which encompasses a range of gaming formats. The analysis was specifically focused on two groups within the subclass, A63F-13 and A63F-09, which pertain to electronic gaming:

- Group A63F-13 encompasses the term "video games," which is defined as "games using an electronically generated display having two or more dimensions."
- Group A63F-09 covers "games not otherwise provided for," including unique aspects of games that use electronically generated displays with multi-dimensional representations related to gameplay.

This classification framework, derived from the World Intellectual Property Organization (WIPO), ensures that the patents examined are an accurate reflection of the gaming industry. This is also indicated in Oguguo (2024), which maps the video game industry patents with a strategy based on this combination of keywords CPC and IPC codes. The search parameters were further refined by setting the protection country to Japan, thereby ensuring that only patents filed for protection within Japan were included. Two distinct searches were conducted based on the assignee city field, one for Tokyo and Yokohama, and another for Osaka, Kobe and Kyoto. To obtain aggregate data at the national level, an additional search was conducted with the Assignee Country set to Japan. This enabled a more extensive comparison between regional clusters and national trends, thus providing a comprehensive overview of patenting activity within Japan's gaming industry. The earliest patents recorded in Orbit for both clusters date back to 2004. Consequently, the temporal range of study was set from 2004 to 2024. It is important to note that the data on patents for the year 2022 and subsequent years may be incomplete due to the time lag between the submission of a patent application and its subsequent publication (Orbit). This has resulted in a decrease in the number of patents recorded in recent years. The dataset collected for analysis consists of:

- 3,399 patent families registered by 165 corporations in the Tokyo-Yokohama cluster
- 1,270 patent families registered by 30 corporations in the Osaka-Kobe-Kyoto cluster,
- 5,723 patent families registered by 386 corporations across Japan.

To facilitate a more in-depth analysis, two distinct datasets were constructed based on the aforementioned data.

- The Subclass Group Filtered Dataset was created by filtering the original database by subclass group. This allowed for the examination of the presence of other subclasses within patents registered under A63F, thereby providing insights into additional technologies linked to gaming patents.
- The Group A63F-13 Filtered Dataset was created with the specific focus on patents within group A63F-13. This allowed for an analysis of specific IPC codes and, consequently, the technologies represented within this group.

3.2 SUBCLASS ANALYSIS

3.2.1 Subclass Metrics

To facilitate a comparative analysis of patent activity across the Tokyo-Yokohama and Osaka-Kobe-Kyoto clusters, a series of specific metrics were developed. The following metrics were calculated with a view to assessing the distribution and intensity of patents within the IPC subclass groups, starting from the number of patents registered in an IPC group by each cluster.

1. Patent Intensity per Million People: $\frac{Number\ of\ patents\ registered\ in\ an\ IPC\ group}{Population\ of\ city} \times 1000000$

   This metric quantifies the density of patents within an IPC group per million residents in a given city, thereby providing a population-normalised perspective on the extent of patent activity in each region.
2. Share of A63F Patents (cluster): $\frac{Number\ of\ patents\ registered\ in\ an\ IPC\ group}{Total\ number\ of\ patents\ registered\ in\ A63F} \times 100$

This metric represents the proportion of patents within a specific IPC subclass relative to the total patents in subclass A63F, thereby providing insight into the concentration of other subclasses within the A63F patents.

3. Share of A63F Patents (national): $\frac{Number\ of\ patents\ registered\ in\ an\ IPC\ group}{Total\ number\ of\ patents\ registered\ in\ A63F\ in\ Japan} \times 100$

   This metric demonstrates the proportion of patents within an IPC group in comparison to the total number of patents in subclass A63F registered nationally. This allows for an evaluation of the regional contributions to the national gaming patent landscape.

4. Corporate Patent Density (cluster): $\frac{Number\ onf\ patents\ registered\ in\ an\ IPC\ group}{Number\ of\ corporations\ that\ registered\ patents\ in\ A63F\ in\ the\ cluster}$

   This metric calculates the mean number of patents held by each company operating in the video game industry in a specific city or regional cluster. It is employed to gauge the average intensity of patenting activities of companies in that region.

5. Corporate Patent Density (national): $\frac{Number\ onf\ patents\ registered\ in\ an\ IPC\ group}{Number\ of\ corporations\ that\ registered\ patents\ in\ A63F\ in\ Japan}$

   The formula provides a national average, indicating the mean number of patents filed by each company in the country.

3.2.2 Tokyo-Yokohama A63F Subclass Analysis

A total of 3,399 patent families were identified under subclass A63F, with assignees located in the Tokyo-Yokohama cluster. The patent intensity per million inhabitants for the Tokyo-Yokohama area is 190.70 patents per million people. The Tokyo-Yokohama region accounts for 59% of all A63F patents registered in Japan, which serves to illustrate its dominant role in the country's gaming patent landscape. The corporate patent density in Tokyo-Yokohama is calculated by dividing the total number of patents (3,399) by the number of corporations active in this subclass within the cluster (165). This yields an average of 20,60 patents per corporation, suggesting that companies headquartered in the Tokyo-Yokohama cluster collectively hold approximately 20,60 patents each in the gaming sector. When the analysis is extended to encompass all 386 corporations active in this subclass at the national level, the corporate patent density for Tokyo-Yokohama declines to an average of 8.81 patents per corporation. This indicates that, when considering the broader pool of national corporations, the average number of patents held by each company in this sector is approximately nine. Moreover, the analysis examined the prevalence of additional subclasses that are frequently associated with patents filed under A63F (Figure 20). 41% of patents within this subclass also include subclass G06F

(Electrical Data Processing). An additional 20% of patents are classified under G06T (Image Data Processing or Generation), while 12% are associated with H04N (Pictorial Communication), and 9% include G06Q (Data Processing Systems or Methods adapted for administrative, commercial, financial, managerial, supervisory, or forecasting purposes). Further subclasses appear with smaller percentages, ranging from 8% to 1% of patents registered under A63F.

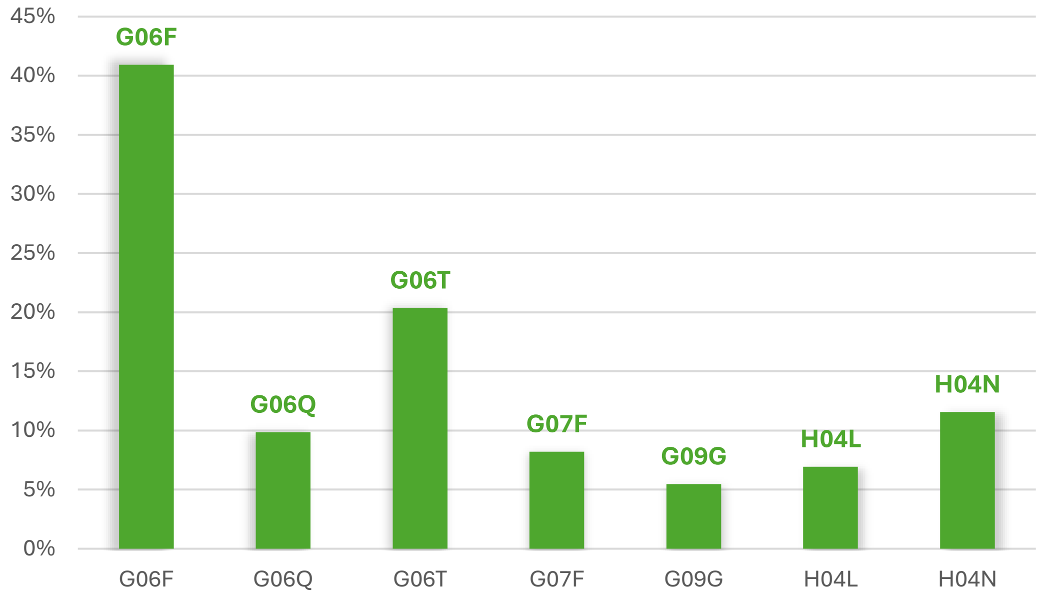

Figure 20. Related A63F Patent Codes in Tokyo Yokohama. Personal elaboration from Orbit data

G06F: Electrical Data Processing G06Q (Data Processing Systems or Methods

G06T: Image data processing or generation

G07F: Coin-freed or like apparatus

G09G: Arrangements or circuits for control of indicating device

H04L: Transmission of digital information

H04N: Pictorial communication

3.2.3 Osaka-Kobe-Kyoto A63F Subclass Analysis

A total of 1,270 patent families were identified under subclass A63F, with assignees located in the Osaka-Kobe-Kyoto cluster. The patent intensity per million inhabitants for the cluster area is 185.27 patents per million people. The Osaka-Kobe-Kyoto region accounts for 22% of all A63F patents registered in Japan. The corporate patent density in the Osaka-Kobe-Kyoto cluster is calculated by dividing the total number of patents (1270) by the number of corporations active in this subclass within the cluster (30). This yields an average of 42,33 patents per corporation, which suggests that companies headquartered in the cluster hold approximately 42 patents each in the gaming sector. Upon extending the analysis to encompass all 386 corporations active in this subclass at the national level, the corporate patent density for Osaka-Kobe-Kyoto declines to an average of 3.29 patents per corporation. This suggests that, when considering the broader pool of national corporations, the average number of patents held by each company in this sector is approximately three. Furthermore, the analysis examined the prevalence of additional subclasses that are frequently associated with patents filed under A63F (Figure 21). Furthermore, 49% of patents within this subclass also include subclass G06F (Electrical Data Processing). Additionally, 21% of patents are classified under G06T (Image Data Processing or Generation), while 9% is classified under G09G (Arrangements or circuits for control of indicating devices using static means to present variable information) and 8% under H04N (Pictorial communication).

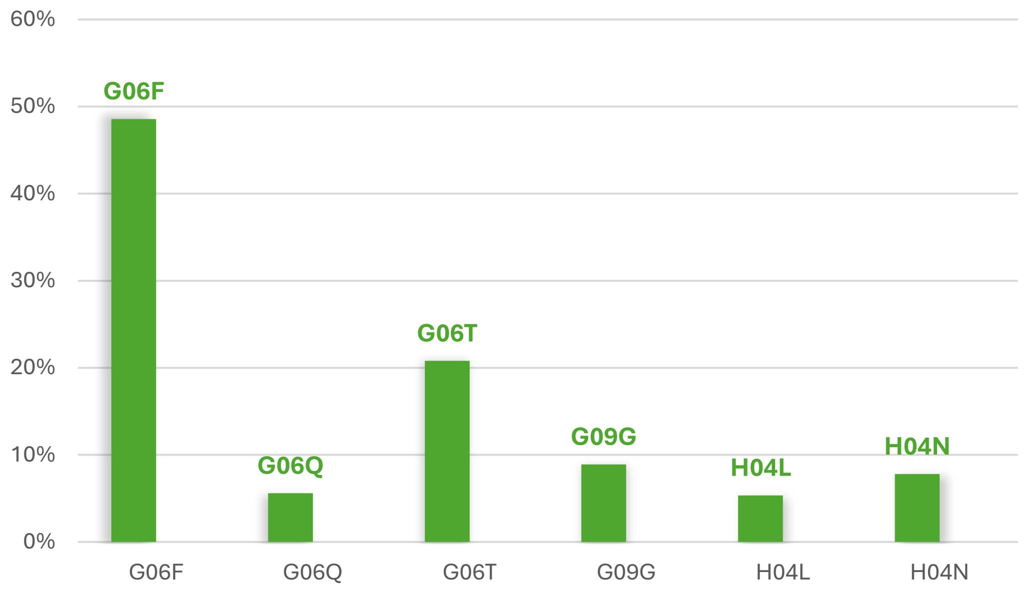

Figure 21. Related A63F Patent Codes in Osaka-Kobe-Kyoto. Personal elaboration from Orbit data

G06F: Electrical Data Processing G06Q (Data Processing Systems or Methods
G06Q: Data processing systems or method
G06T: Image data processing or generation
G09G: Arrangements or circuits for control of indicating device
H04L: Transmission of digital information
H04N: Pictorial communication

3.2.4 Subclass Clusters' Comparison

Tokyo-Yokohama leads the world in patents, with 3,399, while Osaka-Kobe-Kyoto has 1,270. The greater output of Tokyo in comparison to Osaka-Kobe-Kyoto has resulted in the former holding 59% of Japan's national gaming patent pool, in contrast to the latter's 22%. The combined total of patents held by these two cities represents approximately 81% of Japan's entire gaming-related patent portfolio, thereby underscoring their pivotal roles in propelling innovation within this domain (Figure 22).

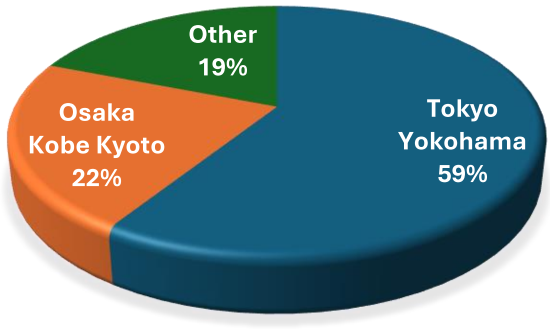

Figure 22. Share of A63F patents in Clusters. Personal elaboration from Orbit data

Both cities exhibit comparable patent intensity per capita, with Tokyo-Yokohama registering 190.70 patents per million people and Osaka-Kobe-Kyoto 185.27. This indicates comparable innovation rates in relation to their populations, despite Tokyo-Yokohama having a higher number of patents. Indeed, both clusters have a significantly higher patent intensity than the national average of 46.33 patents per million people (Figure 23).

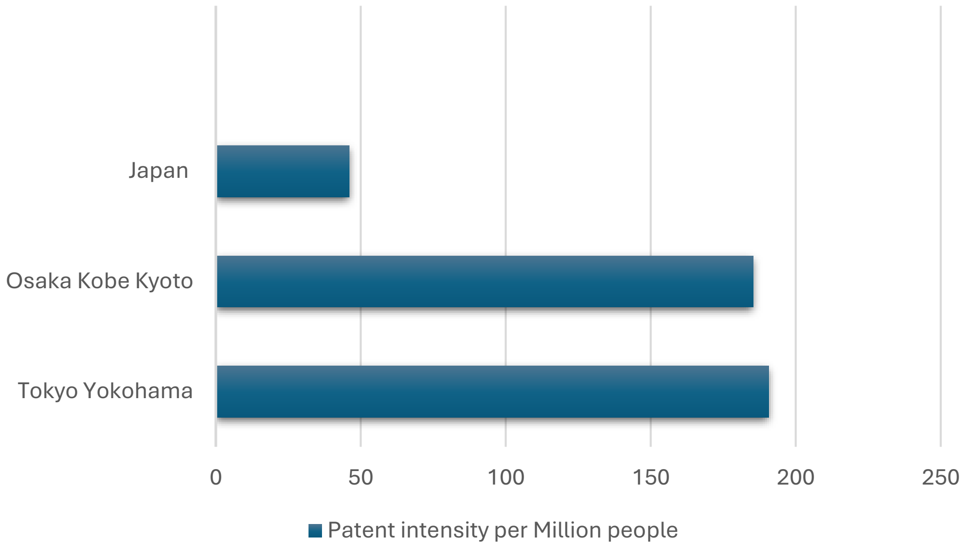

Figure 23. Patent Intensity per Million People. Personal elaboration from Orbit data

The number of patents per organization in each cluster, or corporate patent density, exhibits considerable variation. The corporate patent density of Osaka-Kobe-Kyoto is 42.33, which is markedly higher than that of Tokyo-Yokohama, which stands at 20.60. This indicates that Osaka cluster's patenting activity is concentrated in a smaller number of firms that produce a considerable number of patents (Figure 24). While the corporate ecosystem in Tokyo-Yokohama is more diverse, on average, there are fewer patents per company. Furthermore, Tokyo-Yokohama and Osaka-Kobe-Kyoto are highly above the national average of 14.83 patents per firm. This indicates that companies with headquarters in the two clusters, particularly those in Osaka Kobe and Kyoto, contribute to patent activity more frequently than the typical Japanese company. Tokyo-Yokohama exhibits a markedly superior performance in terms of national corporate patent density (8,81 compared to 3.29 of the other cluster). This observation suggests that, in general, the patents of Tokyo-Yokohama-based companies exert a more pronounced influence on Japan's patent environment.

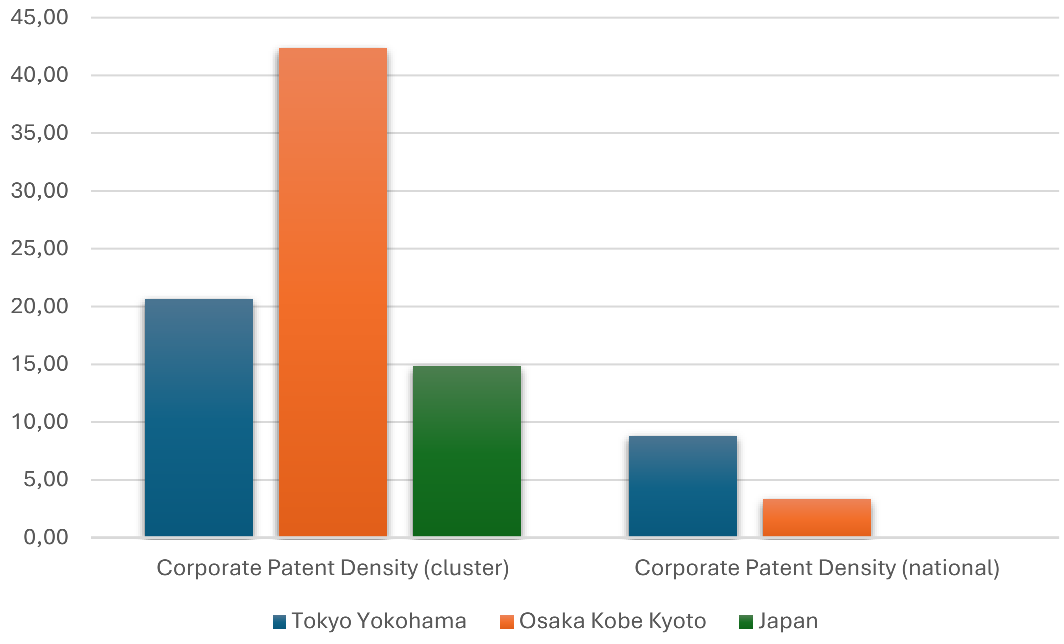

Figure 24. Patent Density per Company. Personal elaboration from Orbit data

The observed period revealed notable differences in the growth and intensity of trends in gaming-related patent registrations in Tokyo-Yokohama and Osaka-Kobe-Kyoto (Figure 25). Tokyo-Yokohama consistently demonstrates a higher rate of patent registrations than Osaka-Kobe-Kyoto, indicating a more concentrated development of gaming technologies within the Tokyo-Yokohama cluster. Both regions exhibited a consistent increase in patent filings until approximately 2012, with Tokyo-Yokohama reaching its peak in 2012 at 288 patents and maintaining elevated levels of activity throughout the 2010s. In contrast, Osaka-Kobe-Kyoto's patent activity is lower overall, with a peak in 2011 at 115 patents, followed by fluctuations in the following years. The decline that both clusters experience from 2022 onwards is attributable to the patent publication lag rather than an actual reduction in innovative activity, since recent filings may still be pending publication.

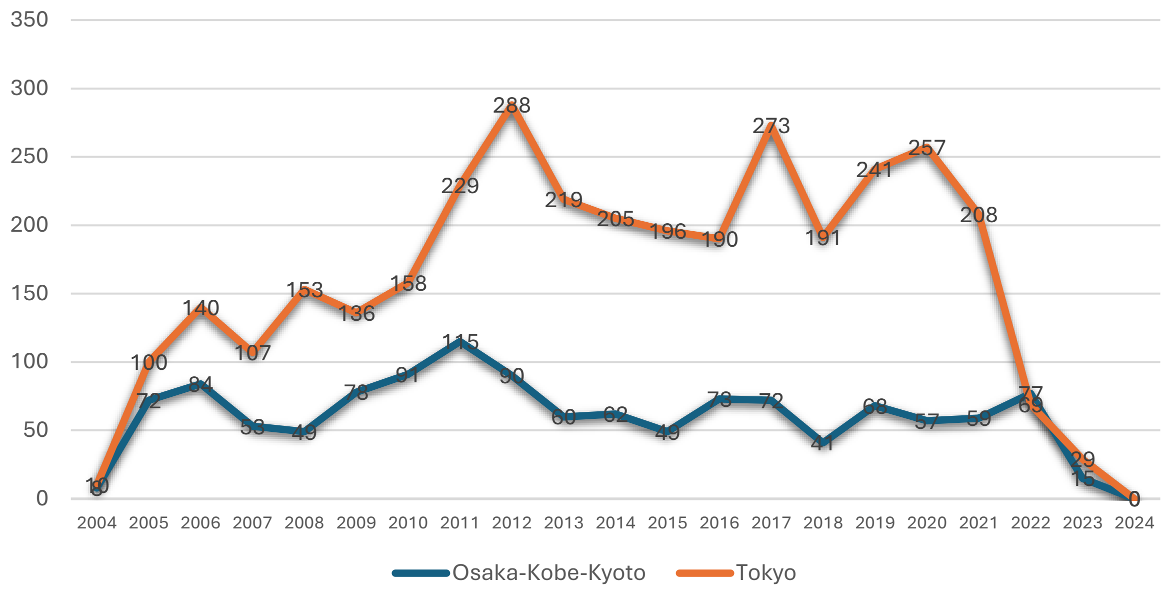

Figure 25. Patent's trends 2004-2024 in Clusters. Personal elaboration from Orbit data

The groups most frequently registered in conjunction with A63F code are G06F (electric digital data processing) and G06T (image data processing or generation), for both clusters, which serve to illustrate the complementarity of the technologies in the gaming industry. With regard to the patent intensity per million residents, Osaka-Kobe-Kyoto exhibits a higher level of innovation in the G06F category (90.01) than Tokyo-Yokohama (78.04). This indicates that there is a notable concentration of innovation in this technical area in relation to population and a reversal of the trends observed for A63F, which could suggest that Osaka-Kobe-Kyoto possesses distinctive competitiveness in digital processes despite the continued leadership position held by Tokyo-Yokohama in terms of overall performance. Furthermore, the Osaka-Kobe-Kyoto cluster displays a slightly elevated mean number of patents per corporation (20.57 to 8.43 in Tokyo-Yokohama), which indicates a less diversified ecosystem but is characterised by highly specialised businesses in this field. Notwithstanding the aforementioned, the total number of patents in G06F registered in Tokyo-Yokohama is greater, resulting in Tokyo-Yokohama accounting for 24% of the A63F patents registered nationwide, in comparison to Osaka-Kobe-Kyoto's 11%. This reinforces Tokyo-Yokohama's status as the preeminent hub of innovation, although Osaka-Kobe-Kyoto exhibits a notable degree of patent intensity, particularly within specific domains. Regarding the G06T (image data processing) group, the number of patents held by Tokyo-Yokohama is greater than that held by Osaka-Kobe-Kyoto (692 vs. 264). This accounts for 12% of the A63F patents registered nationwide, compared to 5% in Osaka-Kobe-Kyoto. However, other metrics, such as patent intensity per million population and patent density per corporation, indicate a similar distribution of innovation capacity between the two clusters.

The analysis of the IPC groups G06Q (data processing systems for administrative and commercial purposes), G09G (display devices using static media to present variable information) and H04N (visual communication, e.g. television) reveals that Osaka-Kobe-Kyoto demonstrates a competitive advantage also in these specific sectors, despite Tokyo-Yokohama's dominance in terms of patent volume. Indeed, although Tokyo-Yokohama has a higher overall number of patents in all groups, Osaka-Kobe-Kyoto demonstrates a slightly higher corporate patent intensity in G09G and H04N, which suggests a targeted and specialized approach by local companies. The data indicates that, while Tokyo-Yokohama is the overall leader in patenting, Osaka-Kobe-Kyoto has strengths in specific areas of innovation, reflecting a focused and competitive strategy.

3.2.5 Companies in the Gaming Clusters

In the dataset obtained from Orbit, there are 165 companies based in the Tokyo-Yokohama region. Among these, 80 have registered more than one patent in the gaming sector. The key players in this field, along with the number of patents they have registered, are as follows:

- Konami Digital Entertainment: 781 patents
- SONY Interactive Entertainment: 701 patents
- Square Enix: 240 patents
- GREE: 177 patents
- Bandai Namco Entertainment: 157 patents

The major corporate groups in this region include:

- Bandai Namco
- Nintendo
- Koei Tecmo
- Konami
- NEC
- NTT
- Sega Sammy
- Sony
- Tencent
- Square Enix

In contrast, the Osaka-Kobe-Kyoto region hosts 30 companies in the dataset, of which 12 have registered more than one patent in the gaming industry. The leading companies in this sector are:

- Nintendo: 1,152 patents
- Capcom: 39 patents
- Omron: 22 patents

The major corporate groups in the Osaka-Kobe-Kyoto region are:

- Nintendo
- Capcom
- Panasonic

Firms in the Tokyo-Yokohama and Osaka-Kobe-Kyoto clusters entered the video game industry through various pathways, which showcased their unique technological skills and strategic directions. In the Tokyo-Yokohama cluster, Sony started off in 1955 in the consumer electronics industry. Its offerings comprised radios, televisions, and the well-known Walkman. Sony did not enter the video game market until 1993, when they released the first PlayStation. Sony's focus on advanced accessories and connectivity with other devices was influenced by their cross-disciplinary technological knowledge. On the other hand, Konami focused on arcade games at first. Square Enix, established as a merger of Square (videogames developer) and Enix (games publisher), is known for developing complex narrative-driven games. Gree, an online media company, ventured into the gaming sector by utilizing its knowledge in mobile platforms. Bandai Namco has always centered its attention on the video game industry since the beginning. On the other hand, in the Osaka-Kobe-Kyoto cluster, Nintendo, which started out creating basic toys, has established a solid reputation focused on family-friendly games and easy-to-access entertainment. Capcom started with arcade games and has become known for creating innovative games focused on excitement and action. Panasonic and Omron, although not manufacturers of video games themselves, provide crucial knowledge with their different products: Panasonic in home electronics and Omron in electrical parts, which are important for gaming equipment. The companies' differing technological expertise, based on their sector of origin, leads to distinct orientation. Companies like Sony, known for their strong base in sophisticated electronics, focus on innovative technologies like VR/AR. On the other hand, Nintendo, originating from traditional gaming, prefers creating intuitive experiences tailored for a family-friendly audience.

3.3 ANALYSIS OF SPECIFIC TECHNOLOGIES IN A63F-013 CODES

3.3.1 A63F-013 Analysis Metrics

The A63F-013 group represents the set of IPC codes that pertain to video games and associated technologies. According to WIPO's classification, this group encompasses a comprehensive range of technical and functional aspects pertaining to game devices and interfaces. It includes diverse subgroups pertaining to input and output structures, interconnections between devices, game control management, and content generation.

To examine the two selected clusters, a series of key metrics were employed, calculated on the basis of patent data for the A63F-013 cluster. The variables employed in the calculation of the metrics are outlined in the following section.

- $N_{\text{A63F}-013/\text{n, Cluster}}$: Number of patents registered in group A63F-013/n within the cluster.
- $N_{\text{A63F, Cluster}}$: Total number of patents registered in the A63F group in the cluster.
- $N_{\text{A63F}-013/\text{n, Japan}}$: Number of patents registered in the A63F-013/n cluster in Japan.
- $N_{\text{A63F, Japan}}$: Total number of registered patents in the video game industry in Japan.
- $N_{\text{Companies, Cluster}}$: Number of companies in the cluster.

The following metrics were calculated with a view to assessing the distribution and intensity of patents within the IPC A63F-013 group, starting from the number of patents registered in the specific IPC A63F-013 group from the cluster.

1. Share of A63F Gaming Patents Registered in the Cluster: $\frac{N_{\text{A63F}-013/\text{n, Cluster}}}{N_{\text{A63F, Cluster}}}$

   This metric represents the proportion of A63F-013/n patents to the total number of A63F patents registered in the cluster. It functions as an indicator of the extent of innovation and patenting activity within a cluster in relation to specific industries' technologies.

2. Share of Japan Gaming Patents: $\frac{N_{\text{A63F}-013/\text{n, Cluster}}}{N_{\text{A63F, Japan}}}$

   This metric indicates the share of A63F-013/n patents in the cluster compared to total patents in the gaming industry in Japan. It signifies the cluster's contribution to the Japanese gaming industry in terms of patent output with regard to particular technologies.

3. Share of Japan A63F-013 Gaming Patents: $\frac{N_{\text{A63F}-013/\text{n, Cluster}}}{N_{\text{A63F}-013/\text{n, Japan}}}$

This metric represents the share of A63F-013/n patents registered in the cluster compared to total A63F-013/n patents in Japan. It offers insight into the cluster's position in the development of specific technologies in relation to the national trend.

4. Average Number of Patents per Company: $\frac{N_{\text{A63F}-013/\text{n, Cluster}}}{N_{\text{Companies, Cluster}}}$

This metric calculates the average number of A63F-013 patents per company in the cluster. It functions as an indicator of the extent of innovation and patenting activity among companies in the cluster with regard to specific industries' technologies.

3.3.2 National Trends in A63F-013

The following section presents the most significant trends in the key innovation areas of the game, based on an analysis of the top five national registrations under A63F-013, as indicated by the number of patent families.

IPC Code	Description	Count of Patent families	Share of total gaming patents in Japan	Average Number of Patents per Company
A63F-013/55	Controlling game characters or game objects based on the game progress	1223	21%	3,17
A63F-013/79	Game security or game management aspects involving player-related data	1098	19%	2,84
A63F-013/52	Controlling the output signals based on the game progress involving aspects of the displayed game scene	1090	19%	2,82
A63F-013/45	Controlling the progress of the video game	1076	19%	2,79
A63F-013/69	Generating or modifying game content before or while executing the game program, by enabling or updating specific game elements	1048	18%	2,72

Table 9. A63F-013 trends in Japan. Personal elaboration from Orbit data

3.3.3 A63F-013 in Tokyo-Yokohama Cluster

The following section presents the most significant trends in the key innovation areas of the game, based on an analysis of the top five cluster's registrations under A63F-013, as indicated by the number of patent families.

IPC Code	Description	Count of Patent families in Cluster	Count of Patent families in Japan	Share of total gaming patents in Japan	Average Number of Patents per Company
A63F-013/35	Interconnection arrangements between game servers and game devices; Details of game servers	783	1002	23%	4,75
A63F-013/45	Controlling the progress of the video game	750	1076	22%	4,55
A63F-013/79	Game security or game management aspects involving player-related data	728	1098	21%	4,41
A63F-013/55	Controlling game characters or game objects based on the game progress	703	1223	21%	4,26
A63F-013/52	Controlling the output signals based on the game progress involving aspects of the displayed game scene	679	1090	20%	4,12

Table 10. A63F-013 trends in Tokyo-Yokohama Cluster. Personal elaboration from Orbit data

3.3.4 A63F-013 in Osaka-Kobe-Kyoto Cluster

The following section presents the most significant trends in the key innovation areas of the game, based on an analysis of the top five cluster's registrations under A63F-013, as indicated by the number of patent families.

IPC Code	Description	Count of Patent families in Cluster	Count of Patent families in Japan	Share of total gaming patents in Japan	Average Number of Patents per Company
A63F-013/55	Controlling game characters or game objects based on the game progress	402	1223	32%	33%
A63F-013/52	Controlling the output signals based on the game progress involving aspects of the displayed game scene	315	1090	25%	29%
A63F-013/211	Input arrangements for video game devices, using inertial sensors	251	537	20%	47%
A63F-013/45	Controlling the progress of the video game	212	1076	17%	20%
A63F-013/428	Processing input control signals of video game devices, by mapping the input signals into game commands, involving motion or position input signals.	190	519	15%	37%

Table 11. A63F-013 trends in Osaka-Kobe-Kyoto Cluster. Personal elaboration from Orbit data

3.3.5 A63F-013 Clusters' Comparison

To provide a comprehensive overview of each cluster, all IPC codes identified in the individual analyses for the Tokyo-Yokohama and Osaka-Kobe-Kyoto clusters, in addition to those identified in the national analysis, were grouped together and compared. The Tokyo-Yokohama cluster shares four of the top five IPC codes with the national top codes, while the Osaka-Kobe-Kyoto cluster shares three. A table containing all eight of these codes was created for the purpose of facilitating a comparative analysis between the two clusters. A preliminary examination of the data reveals that, across all categories, the city of Tokyo consistently exhibits a higher number of patents than Osaka. Notably, the IPC code A63F-013/35, encompassing "interconnection arrangements between game servers and game devices; details of game servers," exhibits a particularly pronounced disparity between Tokyo-Yokohama and Osaka-Kobe-Kyoto, with 783 patents registered in Tokyo-Yokohama versus 89 in Osaka-Kobe-Kyoto, which represents a disparity of 779.78%. Additionally, A63F-013/79, which pertains to "game security or game management aspects involving player-related data, such as identities, accounts, preferences, or play histories," has 728 patents registered in Tokyo-Yokohama compared to 144 in Osaka-Kobe-Kyoto, representing a difference of 406%. The analysis demonstrates that A63F-013/211 ("Input arrangements for video game devices using inertial sensors") is the sole IPC code in which the numbers of registered patents in Tokyo-Yokohama and Osaka-Kobe-Kyoto are nearly analogous, with 259 in Tokyo-Yokohama and 251 in Osaka-Kobe-Kyoto.

IPC Code	Description	Tokyo - Yokohama	Osaka-Kobe-Kyoto Kobe Kyoto	% Difference TY > OKK
A63F-013/55	Controlling game characters or game objects based on the game progress	703	402	74.88%
A63F-013/79	Game security or game management aspects involving player-related data, e.g., identities, accounts, preferences	728	144	405.56%

A63F-013/52	Controlling the output signals based on the game progress involving aspects of the displayed game scene	679	315	115.56%
A63F-013/45	Controlling the progress of the video game	750	212	253.77%
A63F-013/69	Generating or modifying game content before or while executing the game program	623	150	315.33%
A63F-013/35	Interconnection arrangements between game servers and game devices; Details of game servers	783	89	779.78%
A63F-013/211	Input arrangements for video game devices using inertial sensors	259	251	3.19%
A63F-013/428	Processing input control signals of video game devices, involving motion or position input signals	281	190	47.89 %

Table 12. Comparison of A63F-013 trends in Clusters. Personal elaboration from Orbit data

An examination of the distribution of A63F gaming patents registered in the cluster metric reveals significant discrepancies in the concentration of patents between the Tokyo-Yokohama and Osaka-Kobe-Kyoto clusters. This metric, which calculates the proportion of patents within a specific subgroup to the total A63F gaming patents registered in the cluster, indicates a concentration of patenting activities for certain codes in each cluster. This reflects the focal technological areas within each region.

In the Osaka-Kobe-Kyoto cluster, patenting activities are particularly concentrated in the following International Patent Classification (IPC) codes: A63F-013/55 (controlling game characters based on game progress), A63F-013/52 (controlling output signals based on the game scene), A63F-013/211 (input arrangements for video games using inertial sensors), and A63F-013/428 (processing motion or position input signals). In each of these categories, the proportion of patents registered in Osaka-Kobe-Kyoto that fall under the A63F gaming classification exceeds that of Tokyo-Yokohama. Moreover, in each of these domains, the share of patents registered in Osaka-Kobe-Kyoto exceeds the national average:

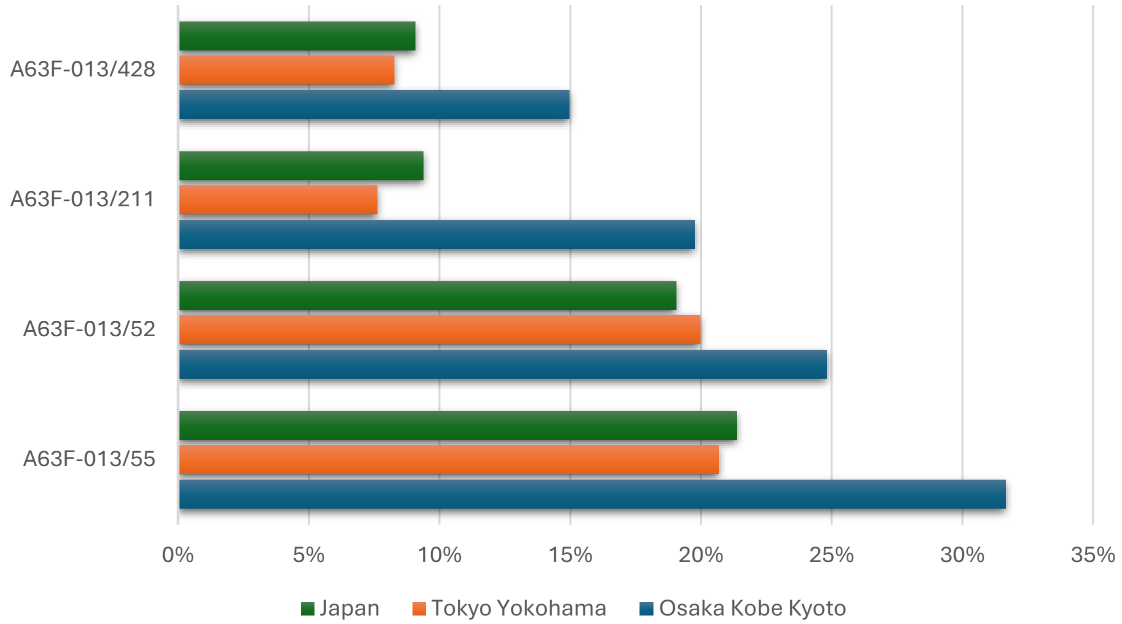

Figure 26. Share of A63F Gaming Patents Registered in the Clusters (a). Personal elaboration from Orbit data

Conversely, the Tokyo-Yokohama cluster demonstrates a more pronounced concentration of patents within the IPC codes A63F-013/79 (relating to the security and management of player-related data), A63F-013/45 (pertaining to the control of game progression), A63F-013/69 (covering the generation or modification of game content), and A63F-013/35 (addressing interconnection arrangements between game servers and devices). Just in a number of IPC codes, the Tokyo-Yokohama cluster accounts for a greater proportion of patents than is reflected at the national level.

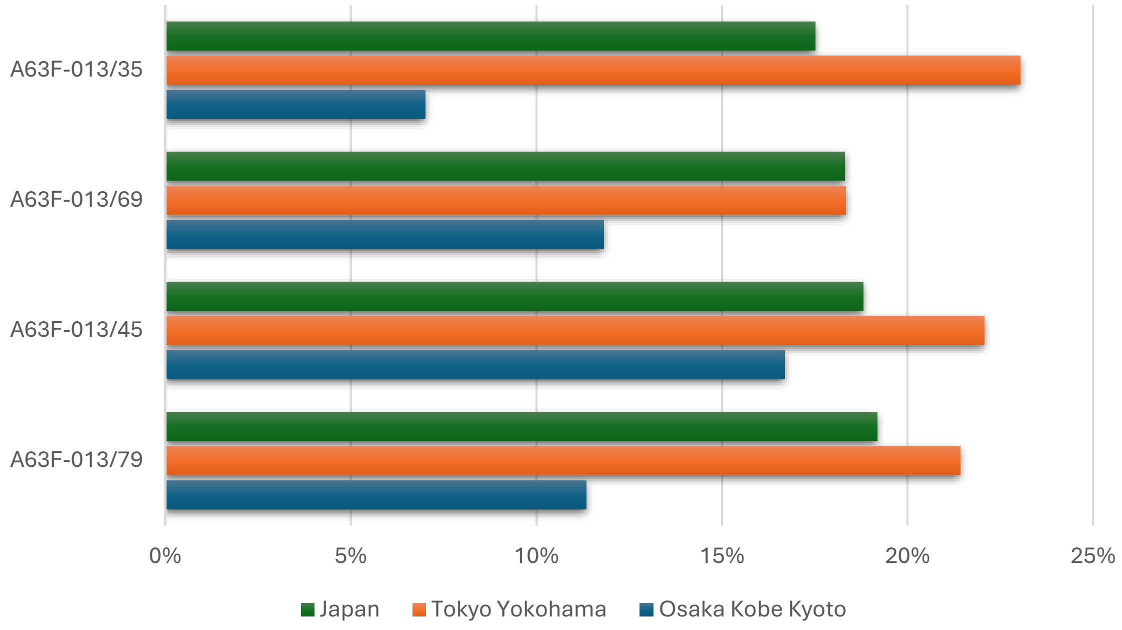

Figure 27. Share of A63F Gaming Patents Registered in the Cluster (b). Personal elaboration from Orbit data

An examination of the Share of Japan A63F-013 Gaming Patents metric for Tokyo and Osaka-Kobe-Kyoto across various IPC codes provides further insights into the national significance of each cluster in relation to specific gaming technologies. The Tokyo-Yokohama cluster consistently demonstrates a high share across the majority of IPC codes, leading in areas such as A63F-013/79 (66%), A63F-013/45 (70%), and A63F-013/35 (78%). These values indicate that the Tokyo-Yokohama region holds a considerable share of Japan's patents in technologies such as game security, game progress control, and server interconnection arrangements. Conversely, the Osaka-Kobe-Kyoto region exhibits a notable share only in A63F-013/211 (47%) and A63F-013/428 (37%), which is nearly equivalent to that of Tokyo in these areas.

3.3.5 Main Companies' Technologies Trends

To gain insight into the technological trajectories embraced by the two clusters, an in-depth examination was conducted on the most frequently cited patents within each cluster, along with the related technologies they represent. Moreover, an analysis of the technology investments of major corporations, as outlined in their respective reports, is essential for identifying the specific technological specialisations present within the clusters.The patent collections of firms like Nintendo, Capcom, and Panasonic indicate that the Osaka-Kobe-Kyoto region emphasizes user interaction via user-friendly and innovative hardware-software combinations instead of concentrating on high-definition technologies.

Nintendo's approach is centred around the creation of unique, integrated hardware and software experiences (Nintendo Co., Ltd. : Investor Relations Information, n.d.). With the Nintendo

Switch, a hybrid console that functions both as a handheld and home console, Nintendo has unified its development focus, enabling consistent title releases and a streamlined R&D process. Its strategy targets a broad audience, aiming to transition from a "one per family" ownership model to a "one per person" model. Nintendo has strategically invested in firms like Bandai Namco, DeNA, and Konami to enhance its gaming ecosystem. The Nintendo Developer Portal acts as a connection for third-party developers, encouraging partnerships to grow the software selection for the Switch, which is advantageous for both Nintendo and its collaborators. Concurrently, the integration of the software development teams, conducted by focusing the R&D on a single platform, has enabled the achievement of a more continuous stream of new titles. Capcom's growth strategy is based on the creation of popular content intellectual properties (IP), supported by the development of games for multiple platforms and the multimedia expansion of content (Integrated Report (Annual Report) |Reports and Materials | CAPCOM, 2023). The strategy of 'single content multiple usage' is employed to produce a range of media, including movies, theatre productions, and other non-game formats, from a single popular proprietary content source, thereby creating multi-level profitability. The company is focusing on motion capture to recreate the natural and bold movements in video games. Panasonic's approach in the gaming industry focuses on enhancing gaming technology through cutting-edge hardware, especially for VR and AR uses (Integrated Report - Library - Investor Relations - Panasonic Holdings, n.d.). While not typically recognized as a game developer, Panasonic has broadened its engagement in gaming by introducing advancements in display technology, VR headsets, and audio systems that enhance the gaming experience on a hardware front.

By analysing the Orbit dataset, the patents within the cluster that have been cited the most are all owned by Nintendo. The patents in question focus on motion data from dual controllers, touch panels for direct path control and general motion control through various technologies. This emphasis on motion data and control technologies demonstrates Nintendo's commitment to immersive interaction. For example, Nintendo has registered patents on ‘Controller with motion sensor and infrared images’ or ‘Control through motion sensors for dynamic gameplay’. Even when analysing only the most cited patents from 2020 onwards, it is evident that Nintendo continues to focus on motion control technologies, in particular the development of sequential action systems based on different inputs and different actors, through “System for sequential actions on a virtual surface via continuous input” or “Character movement on objects in the virtual world based on input”.

In contrast, Tokyo-Yokohama, home to firms such as Sony, Square Enix, and Konami, showcases an emphasis on technologically advanced, high-budget (AAA) games that are intricately connected across various multimedia formats, encompassing AR, VR, and cloud gaming. Sony is concentrating its efforts on the integration of large-scale artificial intelligence (AI) models with the objective of establishing seamless interconnections between real-world and virtual-world data (Sony Group Portal - Corporate Report, 2023). To illustrate, human motion data amassed by high-volume sensors is employed to construct an exact 3D model with computer graphics, which is capable of functioning in virtual space or to create AI characters that are able to interact with real-world actors. Concurrently, Sony's portfolio of patents exemplifies its pioneering role in cloud gaming and immersive technologies designed to revolutionize the traditional gaming environment. Sony's patents for head-mounted display (HMD) systems, which encompass depth perception and eye tracking, illustrate its commitment to superior VR quality. Sony's dedication to cloud gaming is evident through its patents aimed at reducing latency and enhancing streaming quality. Square Enix primarily focuses on creating classical console and PC games, but they have also ventured into the live-service and mobile gaming sectors, which have shown substantial growth (Annual Reports ┃ Investor Relations | SQUARE ENIX HOLDINGS CO., LTD., 2023). Square Enix's multimedia approach expands its IPs into movies, animated series, and products, resulting in a diverse brand experience that attracts international audiences. Square Enix's franchises are often transformed into anime, movies, and merchandise, expanding the fan base and reinforcing the cultural importance of its intellectual properties. The company's efforts in mobile and streaming services help to maintain engagement among fans who may not traditionally play console games. Konami has diversified its business activities, moving beyond traditional gaming into mobile gaming, digital gambling, and fitness technology (Konami Digital Entertainment Co., Ltd. | Konami Digital Entertainment, n.d.). Konami's emphasis on cross-platform content and health-related gaming technology positions it to cater to a broader demographic interested in lifestyle applications of gaming. Konami's collaborations often involve licensing and digital partnerships, enabling it to extend its franchises across different platforms. Its strategy of partnering with mobile platforms supports its goal of broadening the reach and accessibility of its games. Bandai Namco's business model is centred on intellectual property (IP) development and a strategy of engaging with fans (Integrated Report | IR Library | IR Information | Bandai Namco Holdings Inc., n.d.). This involves integrating physical and digital experiences, with the aim of creating immersive gaming experiences across both video games and physical attractions, such as virtual reality (VR) arcades and theme parks. The company places significant value on IP as a means of driving business growth and expansion, with a focus on optimising its value as a core strategic asset. GREE has established a distinctive presence in the mobile and social gaming sectors, with a particular focus on games that emphasise online interactions and social networking (GREE, Inc. - Investor Relations - IR Library - Annual Report, n.d.). GREE engages in collaborative efforts with mobile platforms and game developers with the objective of expanding its portfolio and enhancing player engagement. Partnerships with prominent mobile ecosystems facilitate the integration of GREE's games into the daily lives of users across the globe, underscoring the importance of social connectivity and accessibility.

By analysing the Orbit dataset, the most frequently cited patents from the Tokyo-Yokohama region, with a particular focus on Sony, demonstrate a notable specialisation in advanced user interfaces, augmented (AR) and virtual reality (VR), and cloud gaming and streaming technologies. This concentration of technologies demonstrates the region's dedication to improving the gaming experience using immersive interfaces and high-performance content delivery, particularly in the context of connected and shared gaming. To illustrate, Sony's 'Head mounted display' patent delineates an AR/VR visor equipped with an integrated depth camera for the purpose of tracking real-world objects. The 'Haptic information presentation system and method' patent from the National Institute of Advanced Industrial Science and Technology describes a haptic system designed to generate more realistic haptic sensations. Another patent by Sony, entitled 'Glove interface object with flex sensing and wrist tracking for virtual interaction', describes a glove interface comprising flex sensors that can capture the position of the fingers. This enables the reproduction of a virtual hand in virtual reality (VR) environments. From 2020 onwards, the direction of the cluster in the development of cloud gaming technologies is also elucidated, with a particular emphasis on visual quality in cloud games.

CONCLUSION

This thesis aims to explore and provide a comprehensive analysis of the differences in technological specialisation between the Tokyo-Yokohama and Osaka-Kobe-Kyoto S&T clusters within the video game industry. By examining the patterns of innovation and the nature of technological advancements in each cluster, the study seeks to ascertain whether the companies operating within these regions are primarily engaged in direct competition, focusing on the development of similar technologies, or whether they adopt a more collaborative approach. The latter possibility would entail leveraging the complementary aspects of their respective technological strengths to drive innovation and contribute to the broader growth of the industry.

Initially, the analysis focused on patents filed under class A63F, which covers a variety of gaming-related intellectual property. A detailed examination of the IPC A63F classification reveals that the Tokyo-Yokohama and Osaka-Kobe-Kyoto clusters play a vital role in propelling Japan's gaming sector, accounting for 81% of patents filed in the country within this industry. The Tokyo-Yokohama cluster accounts for 59% of the total, while the Osaka-Kobe-Kyoto cluster accounts for 22%. This distribution proves the importance of both poles in innovation related to gaming. Both clusters have shown peaks in 2011-2012, with Tokyo reaching new highs in 2017 and 2020. Typically, a synchronized pattern is seen, where rises in patents in one group are usually linked to rises in the other, possibly showing a shared reaction to outside forces or similar technological progressions.

It has been noticed a considerably greater amount of patent families in Tokyo-Yokohama than in Osaka-Kobe-Kyoto. On the other hand, the corporate density in that area is much higher, with 42 patents per company, as opposed to Tokyo-Yokohama's 20. This indicates a shift in approach: Tokyo-Yokohama boasts a broad and varied corporate environment, whereas Osaka-Kobe-Kyoto focuses on innovation within a smaller number of highly efficient companies. Tokyo-Yokohama leads in patents registered for G06F (Electrical Data Processing) and G06T (Image Data Processing or Generation), with 24% and 12% of national patents, while Osaka-Kobe-Kyoto contribute 11% and 5%. However, the ratio of patents to the number of companies is still greater in Osaka-Kobe-Kyoto compared to the other cluster (20.57 vs. 8.43 for G06F and 8.8 vs. 4.19 for G06T). This repetition occurs in most of the complementary codes examined.

A subsequent analysis of the sub-codes in class A63F-013 reveals trends in specific technologies. At the national level, the most relevant sub-codes include A63F-013/55 (control of characters according to game progress), A63F-013/79 (security and management of player data), A63F-013/52 (control of output signals according to scene), A63F-013/45 (game progress) and A63F-013/69 (generation or modification of content). Furthermore, the codes are similarly representative of the two clusters too. The data indicates that Tokyo-Yokohama records significantly higher numbers in all sub-codes analysed, reaching up to 780% more than Osaka-Kobe-Kyoto in codes such as A63F-013/35 (interconnections between game servers and devices). However, Osaka-Kobe-Kyoto demonstrates a greater proportion of patents in the single cluster in subcodes A63F-013/55 (controlling game characters based on game progress), A63F-013/52 (controlling output signals based on the game scene), A63F-013/211 (input arrangements for video games using inertial sensors), and A63F-013/428 (processing motion or position input signals) than Tokyo-Yokohama. In contrast, Tokyo-Yokohama is distinguished in subcodes A63F-013/79 (relating to the security and management of player-related data), A63F-013/45 (pertaining to the control of game progression), A63F-013/69 (covering the generation or modification of game content), and A63F-013/35 (addressing interconnection arrangements between game servers and devices), with a focus on security, progress management and connectivity.

This study further examined the leading companies to highlight the significant differences between the two clusters. Nintendo is the leading company in terms of patents in the Osaka-Kobe-Kyoto cluster, with a focus on motion control and immersive interaction technologies. The patents that are mentioned most often feature advancements like motion sensors and touch panels for hands-on control, showing a dedication to advancing interactive and dynamic gaming experiences. Even in recently registered patents, the focus continues to be on creating sequential systems for virtual activities using various intricate inputs. On the other hand, Sony has positioned itself as a leader in advanced technology in the Tokyo-Yokohama area, offering a range of AR/VR interfaces and cloud gaming systems.

Therefore, this study indicates different but complementary cluster strategies. Tokyo-Yokohama is established as a frontrunner in infrastructure and connectivity technologies, whereas Osaka-Kobe-Kyoto stands out for its creative use of interaction tools and immersive experiences. This complementarity helps strengthen Japan's competitiveness in the global gaming industry, while also suggesting opportunities for collaboration between the two clusters to create more integrated and innovative gaming ecosystems. In the upcoming times, the development of cloud and AR/VR technologies in Tokyo-Yokohama, combined with the focus on sensors and dynamic controls in Osaka-Kobe-Kyoto, could create further collaborations and drive the sector towards exploring innovative boundaries in digital entertainment. Companies in Tokyo-Yokohama and Osaka-Kobe-Kyoto should continue to explore partnerships to leverage their complementary strengths. At the same time, as gaming shifts to cloud-based platforms and immersive experiences, companies should prioritize aligning their R&D strategies with global consumer demands. Policies should focus on supporting specific technological advances, while creating platforms for sharing knowledge and promoting collaborative innovation among clusters can facilitate seamless collaboration. Establishing national gaming innovation centers that bring together researchers and developers, paired with specialized university training programs, could guarantee a continuous flow of skilled professionals, enhancing the innovation potential of both areas.

The limitations of this thesis mostly arise from the qualitative nature of the sources available for the analysis of the development of the two clusters and the specific technologies. Although the quantitative analysis of patents can give a detailed overview of trends and technological focuses, it does not provide a deeper understanding of the reasons and mechanisms behind these dynamics. To address this gap, future research could focus on targeted qualitative investigations, for example through interviews with representatives of leading companies in the two clusters, industry experts and local policymakers. Such interviews could yield vital insights into the strategic rationale behind technological choices, the innovation models embraced, and potential synergies between the two clusters. Creating partnerships with universities and research centers in the Tokyo-Yokohama and Osaka-Kobe-Kyoto regions may help in obtaining Japanese primary sources, providing deeper insights into the cultural, economic, and technological factors shaping the growth of each cluster. Additionally, working together with local officials may help in obtaining additional qualitative data such as company reports, strategic documents, and internal analyses, which would expand the study's breadth. In conclusion, utilizing both qualitative and quantitative approaches offers a valuable chance to delve more deeply into the fundamental dynamics of technological advancement in the two clusters.

BIBLIOGRAPHY

Almeida, P. (1996). Knowledge sourcing by foreign multinationals: Patent citation analysis in the U.S. semiconductor industry. *Strategic Management Journal*, *17*(S2), 155–165. https://doi.org/10.1002/smj.4250171113

Altice, N. (2015). *I Am Error*. The MIT Press. https://doi.org/10.7551/mitpress/9484.001.0001

Amano, K., & Rockwell, G. (2021). Representations of Play: Pachinko in Popular Media. In *Media Technologies for Work and Play in East Asia* (pp. 249–264). Bristol University Press. https://doi.org/10.56687/9781529213386-017

Annual Reports | Investor Relations | SQUARE ENIX HOLDINGS CO., LTD. (2023). https://www.hd.square-enix.com/eng/ir/library/ar.html

Aoyama, Y., & Izushi, H. (2003). Hardware gimmick or cultural innovation? Technological, cultural, and social foundations of the Japanese video game industry. *Research Policy*, *32*(3), 423–444. https://doi.org/10.1016/S0048-7333(02)00016-1

Apperley, T. H., & Jayemane, D. (2012). Game Studies' Material Turn. *Westminster Papers in Communication and Culture*, *9*(1), 5. https://doi.org/10.16997/wpcc.145

Asheim, B. T., & Coenen, L. (2005). Knowledge bases and regional innovation systems: Comparing Nordic clusters. *Research Policy*, *34*(8), 1173–1190. https://doi.org/10.1016/j.respol.2005.03.013

Asheim, B. T., & Gertler, M. S. (2006). *The Geography of Innovation: Regional Innovation Systems*. Oxford University Press. https://doi.org/10.1093/oxfordhb/9780199286805.003.0011

Asheim, B. T., & Isaksen, A. (1997). Location, agglomeration and innovation: Towards regional innovation systems in Norway? *European Planning Studies*, *5*(3), 299–330. https://doi.org/10.1080/09654319708720402

Audretsch, B. (1998). Agglomeration and the location of innovative activity. *Oxford Review of Economic Policy*, *14*(2), 18–29. https://doi.org/10.1093/oxrep/14.2.18

Audretsch, D., & Link, A. N. (2018). *Sources of Knowledge and Entrepreneurial Behavior*. University of Toronto Press. https://doi.org/10.3138/9781487512538

Bangash, G., Forestier, P.-A., & Zaman, L. (2024). Cloud Gaming: Revolutionizing the Gaming World for Players and Developers Alike. *Interactions*, *31*(4), 54–57. https://doi.org/10.1145/3665991

Baptista, R., & Swann, P. (1998). Do firms in clusters innovate more? *Research Policy*, *27*(5), 525–540. https://doi.org/10.1016/S0048-7333(98)00065-1

Bathelt, H., Malmberg, A., & Maskell, P. (2004). Clusters and knowledge: local buzz, global pipelines and the process of knowledge creation. *Progress in Human Geography*, *28*(1), 31–56. https://doi.org/10.1191/0309132504ph469oa

Baum, J. A. C., & Haveman, H. A. (1997). Love Thy Neighbor? Differentiation and Agglomeration in the Manhattan Hotel Industry, 1898-1990. *Administrative Science Quarterly*, *42*(2), 304. https://doi.org/10.2307/2393922

Braunerhjelm, P., & Feldman, M. (2008). Cluster Genesis: Technology-Based Industrial Development. *Economic Geography*, *84*(2), 245–246. https://doi.org/10.1111/j.1944-8287.2008.tb00409.x

Breschi, S., & Lissoni, F. (2001). Knowledge Spillovers and Local Innovation Systems: A Critical Survey. *Industrial and Corporate Change*, *10*(4), 975–1005. https://doi.org/10.1093/icc/10.4.975

Breschi, S., & Malerba, F. (2001). The geography of innovation and economic clustering: Some introductory notes. *Industrial and Corporate Change*, *10*(4), 817–833. https://doi.org/10.1093/icc/10.4.817

Breschi, S., & Malerba, F. (2005). Clusters, Networks, and Innovation: Research Results and New Directions. In *Clusters, Networks and Innovation* (pp. 1–26). Oxford University PressOxford. https://doi.org/10.1093/oso/9780199275557.003.0001

Bresnahan, T. (2001). “Old Economy” Inputs for “New Economy” Outcomes: Cluster Formation in the New Silicon Valleys. *Industrial and Corporate Change*, *10*(4), 835–860. https://doi.org/10.1093/icc/10.4.835

Bresnahan, T., Gambardella, A., & Saxenian, A. (2001). “Old Economy” Inputs for “New Economy” Outcomes: Cluster Formation in the New Silicon Valleys. *Industrial and Corporate Change*, *10*, 835–860.

Brown, J. S., & Duguid, P. (1998). Organizing Knowledge. *California Management Review*, *40*(3), 90–111. https://doi.org/10.2307/41165945

Cai, Y. (2022). Neo-Triple Helix Model of Innovation Ecosystems: Integrating Triple, Quadruple and Quintuple Helix Models. *Triple Helix*, *9*(1), 76–106. https://doi.org/10.1163/21971927-bja10029

Cai, Y., & Etzkowitz, H. (2020). Theorizing the Triple Helix model: Past, present, and future. In *Triple Helix* (Vol. 7, Issues 2–3, pp. 189–226). Brill Academic Publishers. https://doi.org/10.1163/21971927-bja10003

Capcom Investor Relations. (2011). *Market data*. https://www.capcom.co.jp/ir/english/2011

Carayannis, E. G., & Campbell, D. F. J. (2009). "Mode 3" and "Quadruple Helix": toward a 21st century fractal innovation ecosystem. *International Journal of Technology Management*, *46*(3/4), 201. https://doi.org/10.1504/IJTM.2009.023374

Carayannis, E. G., & Campbell, D. F. J. (2010). Triple Helix, Quadruple Helix and Quintuple Helix and How Do Knowledge, Innovation and the Environment Relate To Each Other? *International Journal of Social Ecology and Sustainable Development*, *1*(1), 41–69. https://doi.org/10.4018/jsesd.2010010105

Carrascosa, M., & Bellalta, B. (2022). Cloud-gaming: Analysis of Google Stadia traffic. *Computer Communications*, *188*, 99–116. https://doi.org/10.1016/j.comcom.2022.03.006

Castells, M. (1997). *The power of identity: The information age. In Economy, society, and culture* (Vol. 4). Black well Publishers.

Chesbrough, H. (2003). Open Innovation: The New Imperative for Creating and Profiting From Technology. In *Journal of Engineering and Technology Management - J ENG TECHNOL MANAGE* (Vol. 21).

Choo, K. (2013). Playing the Global Game. Japan brand and globalization. In *Asian Popular Culture* (1st ed.). Routledge.

Cieslak, M. (2010). *BBC News - Is the Japanese gaming industry in crisis?* http://news.bbc.co.uk/2/hi/programmes/click_online/9159905.stm

CintTM. (2023). *CintTM survey 2023*. https://www.cint.com/

Cohen, W. M., & Levinthal, D. A. (1990). Absorptive Capacity: A New Perspective on Learning and Innovation. *Administrative Science Quarterly*, *35*(1), 128. https://doi.org/10.2307/2393553

Cohendet, P., Grandadam, D., & Simon, L. (2010). The anatomy of the creative city. *Industry and Innovation*, *17*(1), 91–111. https://doi.org/10.1080/13662710903573869

Consalvo, M. (2006). Console video games and global corporations. *New Media & Society*, *8*(1), 117–137. https://doi.org/10.1177/1461444806059921

Cooke, P. (1996). The new wave of regional innovation networks: Analysis, characteristics and strategy. *Small Business Economics*, *8*(2), 159–171. https://doi.org/10.1007/BF00394424

Cooke, P. (2001). Regional Innovation Systems, Clusters, and the Knowledge Economy. *Industrial and Corporate Change*, *10*(4), 945–974. https://doi.org/10.1093/icc/10.4.945

Cooke, P. (2002). *Knowledge Economies: Clusters, Learning and Cooperative Advantage*. Routledge.

Cooke, P., Gomez Uranga, M., & Etxebarria, G. (1997). Regional innovation systems: Institutional and organisational dimensions. *Research Policy*, *26*(4–5), 475–491. https://doi.org/10.1016/S0048-7333(97)00025-5

Corno, F., Reinmoeller, P., & Nonaka, I. (1999). Knowledge Creation within Industrial Systems. *Journal of Management and Governance*, *3*(4), 379–394. https://doi.org/10.1023/A:1009936712733

Costes, J.-M., & Bonnaire, C. (2022). Spending Money in Free-to-Play Games: Sociodemographic Characteristics, Motives, Impulsivity and Internet Gaming Disorder Specificities. *International Journal of Environmental Research and Public Health*, *19*(23), 15709. https://doi.org/10.3390/ijerph192315709

Crescenzi, R., Iammarino, S., Ioramashvili, C., Rodríguez-Pose, A., & Storper, M. (2023). The Geography of Innovation: Local Hotspots and Global Innovation Networks. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.4424262

Crouch, C., & Farrell, H. (2001). Great Britain: Falling through the Holes in the Network Concept. In *Local Production Systems in Europe: Rise or Demise?* (pp. 154–211). Oxford University PressOxford. https://doi.org/10.1093/oso/9780199242511.003.0006

Davidovici, M. (2014). Paid and Free Digital Business Model Innovations in the Video Game Industry. *Digiworld Economic Journal*, *2*, no. 94, 2nd Q., 83.

Demesetz, H. (1988). The Theory of the Firm Revisited. *The Journal of Law, Economics, and Organization*, *4*(1), 141–161. https://doi.org/10.1093/oxfordjournals.jleo.a036941

Dimita, G. (2023). *Understanding Intellectual Property in Video Games*.

Edquist, C. (2006). *Systems of Innovation: Perspectives and Challenges*. Oxford University Press. https://doi.org/10.1093/oxfordhb/9780199286805.003.0007

Engel, J. S. (2015). Global Clusters of Innovation: Lessons from Silicon Valley. *California Management Review*, *57*(2), 36–65. https://doi.org/10.1525/cmr.2015.57.2.36

Engel, J. S., & del-Palacio, I. (2009). Global networks of clusters of innovation: Accelerating the innovation process. *Business Horizons*, *52*(5), 493–503. https://doi.org/10.1016/j.bushor.2009.06.001

Entertainment Software Association. (2021). *Essential facts about the computer and video game industry*.

Etzkowitz, H. (1993). Technology transfer: the second academic revolution. *Technology Access Report*, *6*, 7–9.

Etzkowitz, H. (2002a). MIT and the Rise of Entrepreneurial Science. In *Research Policy - RES POLICY* (Vol. 33). https://doi.org/10.1016/S0048-7333(03)00121-5

Etzkowitz, H. (2002b). The Triple Helix of University–Industry–Government: Implications for Policy and Evaluation. *Working Paper 2002.11.Sweden: Science Policy Institute*.

Etzkowitz, H. (2003). Innovation in innovation: The Triple Helix of university-industry-government relations. In *Social Science Information* (Vol. 42, Issue 3, pp. 293–337). https://doi.org/10.1177/05390184030423002

Etzkowitz, H., & Leydesdorff, L. (2000). The dynamics of innovation: from National Systems and “Mode 2” to a Triple Helix of university–industry–government relations. *Research Policy*, *29*(2), 109–123. https://doi.org/10.1016/S0048-7333(99)00055-4

Etzkowitz, H., & Zhou, C. (2017). *The Triple Helix: University-industry-government innovation and entrepreneurship.* Routledge.

Fallah, M., & Howe, J. (2004). *Knowledge spillover and innovation in technological clusters*. https://www.researchgate.net/publication/228796741

FIRM PROFILE | UTEC-The University of Tokyo Edge Capital Partners Co., Ltd. (n.d.). Retrieved August 20, 2024, from https://www.ut-ec.co.jp/english/about_utec/firm_profile

Florida, R., & Kenney, M. (1988). Venture capital and high technology entrepreneurship. *Journal of Business Venturing*, *3*(4), 301–319. https://doi.org/10.1016/0883-9026(88)90011-0

Freeman, C. (1987). Technology Policy and Economic Performance: Lesson from Japan. *Pinter Publishers*.

Freeman, J., & Engel, J. S. (2007). Models of Innovation: Startups and Mature Corporations. *California Management Review*, *50*(1), 94–119. https://doi.org/10.2307/41166418

Frost, T. S. (2001). The Geographic Sources of Foreign Subsidiaries' Innovations. *Strategic Management Journal*, *22*(2), 101–123. http://www.jstor.org/stable/3094309

Galvao, A., Mascarenhas, C., Marques, C., Ferreira, J., & Ratten, V. (2019). Triple helix and its evolution: a systematic literature review. In *Journal of Science and Technology Policy Management* (Vol. 10, Issue 3, pp. 812–833). Emerald Group Holdings Ltd. https://doi.org/10.1108/JSTPM-10-2018-0103

Georges, J. (2011). *The History of Nintendo*. Les Éditions Pix'n Love.

Gibson, C., Luckman, S., & Willoughby-Smith, J. (2010). Creativity without Borders? Rethinking remoteness and proximity. *Australian Geographer*, *41*(1), 25–38. https://doi.org/10.1080/00049180903535543

Gilbert, B. A., McDougall, P. P., & Audretsch, D. B. (2008). Clusters, knowledge spillovers and new venture performance: An empirical examination. *Journal of Business Venturing*, *23*(4), 405–422. https://doi.org/10.1016/j.jbusvent.2007.04.003

Gompers, P., & Lerner, J. (2001). The Venture Capital Revolution. *Journal of Economic Perspectives*, *15*(2), 145–168. https://doi.org/10.1257/jep.15.2.145

GP.Bullhound. (2023). *Q2 2023 insights into Digital Media.*

Grabher, G. (1993). The Weakness of Strong Ties; the Lock-In of Regional Development in the Ruhr Area. In *The Embedded Firm: On the Socioeconomics of Industrial Networks* (pp. 255–277). Routledge.

GREE, Inc. - Investor Relations - IR Library - Annual Report. (n.d.). Retrieved November 18, 2024, from https://corp.gree.net/jp/en/ir/library/yuho.html

Hall, P. A., & Soskice, D. (2001). *Varieties of Capitalism: The Institutional Foundations of Comparative Advantage*. Oxford University Press. http://www.amazon.com/Varieties-Capitalism-Institutional-Foundations-Comparative/dp/0199247757

Hasegawa, T., Ito, T., Kawano, R., Kibata, K., & Nonomura, K. (2012). The Japanese gaming cluster. *Harvard Business School, Institute for Strategy and Competitiveness*, *15*.

Hasegawa, K., & Sugawara, T. (2017). Characteristics of university startups in Japan. *2017 IEEE Technology & Engineering Management Conference (TEMSCON)*, 67–72. https://doi.org/10.1109/TEMSCON.2017.7998356

Hedberg, B. (1981). How Organizations Learn and Unlearn. In P. Nystrom & W. Starbuck (Eds.), *Handbook of Organizational Design: Adapting Organisations to Their Environment* (pp. 1–27). Oxford University Press. https://api.semanticscholar.org/CorpusID:166803855

Hellmann, T., & Puri, M. (2002). Venture Capital and the Professionalization of Start-Up Firms: Empirical Evidence. *The Journal of Finance*, *57*(1), 169–197. https://doi.org/10.1111/1540-6261.00419

Hyogo Prefecture | EU-Japan. (n.d.). Retrieved October 24, 2024, from https://www.eu-japan.eu/eubusinessinjapan/hyogo-prefecture

Imai, K., Nonaka, I., & Takeuchi, H. (1985). Managing the New Product Development Process: How Japanese Companies Learn and Unlearn. In *The Uneasy Alliance: Managing the Productivity-Technology Dilemma*. Harvard Business School Press.

Industry Arc. (2024). *Augmented Reality & Virtual Reality For Gaming Market - Forecast(2024 - 2030)*.

Integrated Report | IR library | IR Information | Bandai Namco Holdings Inc. (n.d.). Retrieved November 18, 2024, from https://www.bandainamco.co.jp/en/ir/library/integratedreports.html

Integrated Report - Library - Investor Relations - Panasonic Holdings. (n.d.). Retrieved November 18, 2024, from https://holdings.panasonic/global/corporate/investors/library/annual-report.html

Integrated Report (Annual Report) |Reports and Materials | CAPCOM. (2023). https://www.capcom.co.jp/ir/english/data/annual.html

Izushi, H., & Aoyama, Y. (2006). Industry evolution and cross-sectoral skill transfers: A comparative analysis of the video game industry in Japan, the United States, and the United Kingdom. *Environment and Planning A*, *38*(10), 1843–1861. https://doi.org/10.1068/a37205

Jacobs, J. (1969). *The Economy of Cities*. Random House.

Jaffe, A. B., Trajtenberg, M., & Henderson, R. (1993). Geographic Localization of Knowledge Spillovers as Evidenced by Patent Citations. *The Quarterly Journal of Economics*, *108*(3), 577–598. https://doi.org/10.2307/2118401

Jerald, J. (2015). *The VR Book*. Association for Computing Machinery. https://doi.org/10.1145/2792790

Johns, J. (2006). Video games production networks: value capture, power relations and embeddedness. *Journal of Economic Geography*, *6*(2), 151–180. https://doi.org/10.1093/jeg/lbi001

Kaplan, S. N., & Stromberg, P. (2004). Characteristics, Contracts, and Actions: Evidence from Venture Capitalist Analyses. *The Journal of Finance*, *59*(5), 2177–2210. https://doi.org/10.1111/j.1540-6261.2004.00696.x

Kenney, M. (2000). *Venture Capital in Silicon Valley: Fueling New Firm Formation*.

Kenney, M., & Patton, D. (2009). Entrepreneurial Geographies: Support Networks in Three High-Technology Industries. *Economic Geography*, *81*(2), 201–228. https://doi.org/10.1111/j.1944-8287.2005.tb00265.x

Kent, S. L. (2001). *The ultimate history of video games: from Pong to Pokémon and beyond : the story behind the craze that touched our lives and changed the world.* . Three Rivers Press.

Kerr, A. (2011). *The Culture of Gamework*. Mark Deuze (Ed.), Managing

Media Work. London (etc.): Sage.

Ketchen, D. J., Ireland, R. D., & Snow, C. C. (2007). Strategic entrepreneurship, collaborative innovation, and wealth creation. *Strategic Entrepreneurship Journal*, *1*(3–4), 371–385. https://doi.org/10.1002/sej.20

Kharub, M., & Sharma, R. (2017). Comparative analyses of competitive advantage using Porter diamond model (the case of MSMEs in Himachal Pradesh). *Competitiveness Review: An*

International Business Journal, *27*(2), 132–160. https://doi.org/10.1108/CR-02-2016-0007

Kline, S., Dyer-Witheford, N., & De Peuter, G. (2003). *Digital Play: The Interaction of Technology, Culture, and Marketing.* .

Knight, G., & Cavusgil, S. (1996). The born global rm: A challenge to traditional internationalization theory. *Advances in International Marketing*, *8*, 11–26.

Kobe city | Regional Information - Investing in Japan. (n.d.). Retrieved October 24, 2024, from https://www.jetro.go.jp/en/invest/region/data/kobe-city/

Kohama, H. (2007). *Industrial Development in Postwar Japan*. Routledge. https://doi.org/10.4324/9780203939420

Kohler, C. (2004). *Power-Up: How Japanese Video Games Gave the World an Extra Life*. BradyGAMES.

Konami Digital Entertainment Co., Ltd. | Konami Digital Entertainment. (n.d.). Retrieved November 18, 2024, from https://www.konami.com/games/corporate/en/

Koyama, Y. (2023). *History of the Japanese Video Game Industry* (Vol. 35). Springer Nature Singapore. https://doi.org/10.1007/978-981-99-1342-8

Kuhlmann, S. (2001). Future governance of innovation policy in Europe — three scenarios. *Research Policy*, *30*(6), 953–976. https://doi.org/10.1016/S0048-7333(00)00167-0

Kyoto | Regional Information - Investing in Japan. (n.d.). Retrieved October 24, 2024, from https://www.jetro.go.jp/en/invest/region/data/kyoto/

Kyoto Prefecture | EU-Japan. (n.d.). Retrieved October 24, 2024, from https://www.eu-japan.eu/eubusinessinjapan/kyoto-prefecture

Leydesdorff, L. (2010). The knowledge-based economy and the triple helix model. *Annual Review of Information Science and Technology*, *44*, 365–417. https://doi.org/10.1002/aris.2010.1440440116

Leydesdorff, L. (2012). The Triple Helix, Quadruple Helix, …, and an N-Tuple of Helices: Explanatory Models for Analyzing the Knowledge-Based Economy? *Journal of the Knowledge Economy*, *3*(1), 25–35. https://doi.org/10.1007/s13132-011-0049-4

Leydesdorff, L., & Etzkowitz, H. (1995). The Triple Helix - -University-Industry-Government Relations: A Laboratory for Knowledge Based Economic Development. *Glycoconjugate Journal - GLYCOCONJUGATE J*, *14*, 14–19.

Leydesdorff, L., & Etzkowitz, H. (1998). *The Triple Helix as a Model for Innovation Studies* (Vol. 25, Issue 3).

Leydesdorff, L., & Lawton Smith, H. (2022). Triple, Quadruple, and Higher-Order Helices: Historical Phenomena and (Neo-)Evolutionary Models. *Triple Helix*, *9*(1), 6–31. https://doi.org/10.1163/21971927-bja10022

Leydesdorff, L., & Meyer, M. (2006). Triple Helix indicators of knowledge-based innovation systems. Introduction to the special issue. *Research Policy*, *35*(10), 1441–1449. https://doi.org/10.1016/j.respol.2006.09.016

List, F. (1841). *The National System of Political Economy,*. Longmans, Green and Co.

Loasby, B. J. (1999). *Knowledge, Institutions, and Evolution in Economics*. Routledge.

Lundvall, B.-Å. (1992). *National systems of innovation: Towards a Theory of Innovation and Interactive Learning*. Pinter.

Lundvall, B.-Å., & Maskel, P. (2000). Nation states and economic development:From national systems of production to national systems of knowledge creation and learning. In *The Oxford Handbook of Economic Geography* (pp. 353–372).

Malecki, E. J. (2010). EVERYWHERE? THE GEOGRAPHY OF KNOWLEDGE. *Journal of Regional Science*, *50*(1), 493–513. https://doi.org/10.1111/j.1467-9787.2009.00640.x

Malmberg, A. (1997). Industrial geography: location and learning. *Progress in Human Geography*, *21*(4), 573–582. https://doi.org/10.1191/030913297666600949

Malmberg, A., & Maskell, P. (2002). The elusive concept of localization economies: Towards a knowledge-based theory of spatial clustering. *Environment and Planning A*, *34*(3), 429–449. https://doi.org/10.1068/a3457

Marchand, A., & Hennig-Thurau, T. (2013). Value Creation in the Video Game Industry: Industry Economics, Consumer Benefits, and Research Opportunities. *Journal of Interactive Marketing*, *27*(3), 141–157. https://doi.org/10.1016/j.intmar.2013.05.001

Marshall, A. (1890). *Principles of Economics* (8th ed.). MacMillan .

Martin, R., & Sunley, P. (2003). Deconstructing Clusters: Chaotic Concept or Policy Panacea? *Journal of Economic Geography*, *3*, 5–35.

Masai, Y., Latz, G., & Hijino, S. (2024). Economy of Japan. *Encyclopedia Britannica*.

Maskell, P. (1999). Localised learning and industrial competitiveness. *Cambridge Journal of Economics*, *23*(2), 167–185. https://doi.org/10.1093/cje/23.2.167

Maskell, P. (2001). Towards a Knowledge-based Theory of the Geographical Cluster. *Industrial and Corporate Change*, *10*(4), 921–943. https://doi.org/10.1093/icc/10.4.921

Maskell, P., & Lorenzen, M. (2004). The Cluster as Market Organisation. *Urban Studies*, *41*(5–6), 991–1009. https://doi.org/10.1080/00420980410001675878

Maskell, P., & Törnqvist, G. (1999). *Building a Cross-Border Learning Region. The Emergence of the Northern European Øresund Region*. Copenhagen Business School Press.

McDougall-Covin, P., Oviatt, B., & Shrader, R. (2003). A Comparison of International and Domestic New Ventures. *Journal of International Entrepreneurship*, *1*, 59–82. https://doi.org/10.1023/A:1023246622972

Ministry of Internal Affairs and Communications. (2020). *Population Census*. https://www.stat.go.jp/english/data/kokusei/index.html

Morgan, K. (1997). The Learning Region: Institutions, Innovation and Regional Renewal. *Regional Studies*, *31*(5), 491–503. https://doi.org/10.1080/00343409750132289

Mowery, D. C., & Sampat, B. N. (2006). *Universities in National Innovation Systems*. Oxford University Press. https://doi.org/10.1093/oxfordhb/9780199286805.003.0008

Nelson, R. R. (1993). *National innovation systems: A comparative analysis.* Oxford University Press.

Neven, D., & Dröge, C. (2001). *A Diamond for the Poor ? Assessing Porter ' s Diamond Model for the Analysis of Agro-Food Clusters in the Developing Countries*. https://api.semanticscholar.org/CorpusID:16363982

Nintendo Co., Ltd. : Corporate Information. (n.d.). Retrieved October 26, 2024, from https://www.nintendo.co.jp/corporate/en/index.html

Nintendo Co., Ltd. : Investor Relations Information. (n.d.). Retrieved November 18, 2024, from https://www.nintendo.co.jp/ir/en/index.html

Niosi, J., & Bas, T. G. (2001). The Competencies of Regions - Canada's Clusters in Biotechnology. *Small Business Economics*, *17*(1/2), 31–42. https://doi.org/10.1023/A:1011114220694

Nonaka, I., & Konno, N. (1998). The Concept of "Ba": Building a Foundation for Knowledge Creation. *California Management Review*, *40*(3), 40–54. https://doi.org/10.2307/41165942

Ogawa, T. (2017). *Challenge to financial reconstruction in Osaka University.*

Oguguo, P. C. (2024). *Innovation and Intellectual Property Use in the Global Video Game Industry* (85). https://www.wipo.int/edocs/pubdocs/en/wipo-pub-econstat-wp-85-en-innovation-and-intellectual-property-use-in-the-global-video-game-industry.pdf

Osaka city | Regional Information - Investing in Japan. (n.d.). Retrieved October 24, 2024, from https://www.jetro.go.jp/en/invest/region/data/osaka-city/

Osaka Prefecture | EU-Japan. (n.d.). Retrieved October 24, 2024, from https://www.eu-japan.eu/eubusinessinjapan/osaka-prefecture

Oviatt, B. M., & McDougall, P. P. (2005). Toward a theory of international new ventures. *Journal of International Business Studies*, *36*(1), 29–41. https://doi.org/10.1057/palgrave.jibs.8400128

Pavitt, K. (1987). The objectives of technology policy. *Science and Public Policy*, *14*, 182–188. https://api.semanticscholar.org/CorpusID:155570966

Phillips McDougall, P., Shane, S., & Oviatt, B. M. (1994). Explaining the formation of international new ventures: The limits of theories from international business research. *Journal of Business Venturing*, *9*(6), 469–487. https://EconPapers.repec.org/RePEc:eee:jbvent:v:9:y:1994:i:6:p:469-487

Picard, M. (2013). The foundation of Geemu: A brief history of early Japanese video games. *Game Studies*, *13*.

Pilon, S., & Tremblay, D.-G. (2013). The Geography of Clusters: The Case of the Video Games Clusters in Montreal and in Los Angeles. *Urban Studies Research*, *2013*, 1–9. https://doi.org/10.1155/2013/957630

Porter, M. (1998). Clusters and the New Economics of Competition. *Harvard Business Review*, *76*, 77–90.

Porter, M. E. (1990). *The Competitive Advantage of Nations Harvard Business Review*.

Powell, W. (1989). Neither Market nor Hierarchy : Network Forms of Organization / W.W. Powell. *Research in Organizational Behavior*, *12*.

Powell, W. W., Koput, K. W., & Smith-Doerr, L. (1996). Interorganizational Collaboration and the Locus of Innovation: Networks of Learning in Biotechnology. *Administrative Science Quarterly*, *41*(1), 116. https://doi.org/10.2307/2393988

Ranga, M., & Etzkowitz, H. (2013). Triple Helix Systems: An Analytical Framework for Innovation Policy and Practice in the Knowledge Society. *Industry and Higher Education*, *27*(4), 237–262. https://doi.org/10.5367/ihe.2013.0165

Ranga, M., Mroczkowski, T., & Araiso, T. (2017). University–industry cooperation and the transition to innovation ecosystems in Japan. *Industry and Higher Education*, *31*(6), 373–387. https://doi.org/10.1177/0950422217738588

Roelandt, T., & den Hertog, P. (1999). *Cluster Analysis and Cluster- Based Policy Making in OECD Countries: An Introduction to the Theme*. OECD.

Rosenfeld, S. A. (1997). Bringing business clusters into the mainstream of economic development. *European Planning Studies*, *5*(1), 3–23. https://doi.org/10.1080/09654319708720381

Rosenkopf, L., & Nerkar, A. (2001). Beyond Local Search: Boundary-Spanning, Exploration, and Impact in the Optical Disk Industry. *Strategic Management Journal*, *22*(4), 287–306. http://www.jstor.org/stable/3094369

Rothaermel, F. T., Agung, S. D., & Jiang, L. (2007). University entrepreneurship: a taxonomy of the literature. *Industrial and Corporate Change*, *16*(4), 691–791. https://doi.org/10.1093/icc/dtm023

Rothwell, R. (1991). External networking and innovation in small and medium-sized manufacturing firms in Europe. *Technovation*, *11*(2), 93–112. https://doi.org/10.1016/0166-4972(91)90040-B

Sahlman, W. A. (1990). The structure and governance of venture-capital organizations. *Journal of Financial Economics*, *27*(2), 473–521. https://doi.org/10.1016/0304-405X(90)90065-8

Saxenian, A. (1994). Regional Advantage: Culture and Competition in Silicon Valley and Route 128. . *Harvard University Press*.

Saxenian, A. (2008). The New Argonauts: Regional Advantage in a Global Economy. *Economic Geography*, *84*(1), 105–108. https://doi.org/10.1111/j.1944-8287.2008.tb00393.x

Schmitt, M. (2019). *White, Harrison C. (1981): Where Do Markets Come From ? American Journal of Sociology 87, S. 517 – 547.* (pp. 583–586). https://doi.org/10.1007/978-3-658-21742-6_138

Schumpeter, J. A. (1934). *he theory of economic development: An inquiry into profits, capital, credit, interest, and the business cycle.* Harvard University Press.

Shane, S., & Venkataraman, S. (2000). The Promise of Enterpreneurship as a Field of Research. *The Academy of Management Review*, *25*(1), 217. https://doi.org/10.2307/259271

Sheff, D., & Eddy, A. (1999). *Game Over: Press Start to Continue*. CyberActive Media Group.

Simmie, J., & Sennett, J. (1999). Innovative clusters: Global or local linkages? *National Institute Economic Review*, *170*(1), 87–98. https://doi.org/10.1177/002795019917000112

Smith, A. (1776). *An Inquiry into the Nature and Causes of the Wealth of Nations*.

Sony Group Portal - Corporate Report. (2023). https://www.sony.com/en/SonyInfo/IR/library/corporatereport/

Sorenson, O., & Stuart, T. E. (2001). Syndication Networks and the Spatial Distribution of Venture Capital Investments. *American Journal of Sociology*, *106*(6), 1546–1588. https://doi.org/10.1086/321301

Stam, E. (2015). Entrepreneurial Ecosystems and Regional Policy: A Sympathetic Critique. *European Planning Studies*, *23*(9), 1759–1769. https://doi.org/10.1080/09654313.2015.1061484

Storper, M. (1997). *The Regional World*. Guilford.

Stuart, T. E. (1998). Network Positions and Propensities to Collaborate: An Investigation of Strategic Alliance Formation in a High-Technology Industry. *Administrative Science Quarterly*, *43*(3), 668. https://doi.org/10.2307/2393679

Tallman, S., Jenkins, M., Henry, N., & Pinch, S. (2004). Knowledge, Clusters, and Competitive Advantage. *Academy of Management Review*, *29*(2), 258–271. https://doi.org/10.5465/amr.2004.12736089

Teece, D. J. (2007). Explicating dynamic capabilities: the nature and microfoundations of (sustainable) enterprise performance. *Strategic Management Journal*, *28*(13), 1319–1350. https://doi.org/10.1002/smj.640

Timmons, J. A. (1994). *New venture creation: Entrepreneurship for the 21st century* (4th ed.). Irwin.

Tokyo | Regional Information - Investing in Japan. (n.d.). Retrieved October 24, 2024, from https://www.jetro.go.jp/en/invest/region/data/tokyo/

Tokyo Metropolis | EU-Japan. (n.d.). Retrieved October 24, 2024, from https://www.eu-japan.eu/eubusinessinjapan/tokyo-metropolis

Tracey, P., & Clark, G. L. (2003). Alliances, networks and competitive strategy: Rethinking clusters of innovation. *Growth and Change*, *34*(1), 1–16. https://doi.org/10.1111/1468-2257.00196

Tschang, F. T. (2007). Balancing the Tensions Between Rationalization and Creativity in the Video Games Industry. *Organization Science*, *18*(6), 989–1005. https://doi.org/10.1287/orsc.1070.0299

Vang, J., & Tschang, T. (2008). *Explaining the Spatial Organization of Creative Industries: The Case of the U.S. Videogames Industry*. https://ink.library.smu.edu.sg/lkcsb_research

Video Games - China | Statista Market Forecast. (2024). https://www.statista.com/outlook/dmo/digital-media/video-games/china?currency=eur&locale=en

Video Games - Japan | Statista Market Forecast. (2024). https://www.statista.com/outlook/dmo/digital-media/video-games/japan?currency=eur&locale=en#revenue

Video Games - United States | Statista Market Forecast. (2024). https://www.statista.com/outlook/dmo/digital-media/video-games/united-states?currency=eur&locale=en

Video Games - Worldwide | Statista Market Forecast. (2024). https://www.statista.com/outlook/dmo/digital-media/video-games/worldwide?currency=eur&locale=en

von Hayek, F. A. (1937). Economics and Knowledge. *Economica*, *4*(13), 33. https://doi.org/10.2307/2548786

Waxell, A., & Malmberg, A. (2007). What is global and what is local in knowledge-generating interaction? The case of the biotech cluster in Uppsala, Sweden. *Entrepreneurship and Regional Development*, *19*(2), 137–159. https://doi.org/10.1080/08985620601061184

Wessner, C. W., & Wolff, A. W. (2012). *Rising to the Challenge: U.S. Innovation Policy for the Global Economy*. National Academies Press. https://doi.org/10.17226/13386

Why do Japanese developers keep us waiting? - The Japan Times. (n.d.). Retrieved October 26, 2024, from https://www.japantimes.co.jp/life/2011/10/05/digital/why-do-japanese-developers-keep-us-waiting/

Wilson, P. (2016). The Impact of Culture on Cluster Competitiveness: a Revised Diamond Model. In *Clusters as a Driving Power of the European Economy* (pp. 162–175). Nomos. https://doi.org/10.5771/9783845265889-162

WIPO. (2023a). *Global Innovation Index Osaka-Kobe-Kyoto, Japan*. https://www.wipo.int/export/sites/www/global_innovation_index/en/docs/2023/jp-osaka-kobe-kyoto.pdf

WIPO. (2023b). *Global Innovation Index Tokyo-Yokohama, Japan* . https://www.wipo.int/export/sites/www/global_innovation_index/en/docs/2023/jp-tokyo-yokohama.pdf

WIPO. (2024a). *Global Innovation Index Osaka-Kobe-Kyoto, Japan*. https://www.wipo.int/documents/d/global-innovation-index/docs-en-2024-jp-osaka-kobe-kyoto-7.pdf

WIPO. (2024b). *Global Innovation Index Tokyo–Yokohama, Japan*. https://www.wipo.int/documents/d/global-innovation-index/docs-en-2024-jp-tokyo-yokohama-1.pdf

Yannakakis, G. N., & Togelius, J. (2018). *Artificial Intelligence and Games*. Springer International Publishing. https://doi.org/10.1007/978-3-319-63519-4

Yokohama city | Regional Information - Investing in Japan. (n.d.). Retrieved October 24, 2024, from https://www.jetro.go.jp/en/invest/region/data/yokohama-city.html

Young, A. (1928). Increasing returns and economic progress. *Economic Journal* , *38*, 527–542.

Zackariasson, P., & Wilson, T. (2010). Creativity in the video game industry. *Creativity: Fostering, Measuring and Contexts*, 109–120.

Zahra, S. A., & George, G. (2002). Absorptive Capacity: A Review, Reconceptualization, and Extension. *The Academy of Management Review*, *27*(2), 185. https://doi.org/10.2307/4134351

Zhou, H., & Li, L. (2020). The impact of supply chain practices and quality management on firm performance: Evidence from China's small and medium manufacturing enterprises. *International Journal of Production Economics*, *230*, 107816. https://doi.org/10.1016/j.ijpe.2020.107816

Zonnenshain, A., Fortuna, G., Adres, E., & Kenett, R. S. (2020). Regional development in the era of industry 4.0. *Dynamic Relationships Management Journal*, *9*(2), 19–36. https://doi.org/10.17708/DRMJ.2020.v09n02a02