Business Model Innovation in the Trading Card Grading Industry: Cross-National Insights from Pokémon Trading Card Game and Non-fungible Tokens

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Abstract

This study examines how firms in the Pokémon Trading Card Game (PTCG) grading industry adapt their business models in response to digital disruption. We employ a qualitative multiple-case design, investigating three leading grading companies – PSA (United States), CCIC (China), and SQC (Thailand) – through 30 in-depth interviews and supplemental document analysis. The findings reveal divergent strategies shaped by both dynamic capabilities and institutional contexts. PSA leverages scale and AI technology to enhance efficiency, CCIC focuses on legitimacy and incremental improvements under regulatory constraints, and SQC pursues exploratory digital initiatives (e.g., NFT-linked trials) to co-create value with its community. These patterns highlight the ambidexterity required for business model innovation in a digitizing niche service sector. The study contributes to business model innovation and digital transformation literature by demonstrating how national institutions and customer engagement influence innovation paths. Practical implications include lessons for balancing core business sustainability with transformative innovation in different regulatory environments.

Keywords: business model innovation; Pokémon; non-fungible tokens; card game

1. Introduction

The Pokémon Trading Card Game (PTCG), launched in 1996, has evolved into a globally recognized collectible ecosystem. As the value of early-generation cards soared, collectors increasingly demanded professional authentication and grading services. In response, firms such as Professional Sports Authenticator (PSA) in the United States, China Certification & Inspection Group (CCIC) in China, and Special Quality Cards (SQC) in Thailand emerged to provide standardized grading systems. These companies certify the condition and authenticity of cards, often encapsulating them in tamper-evident holders, which substantially impact secondary market value. As of 2024, the top grading companies collectively processed over 20 million cards annually, underscoring the industry's rapid professionalization and global reach (Palmer, 2025).

Alongside these developments, the emergence of non-fungible tokens (NFTs)—unique digital assets recorded on blockchain—has disrupted traditional models of ownership and value in the collectibles market (U.S. Government Accountability Office, 2022; Das et al., 2022). Originally popularized through digital art and gaming, NFTs have since expanded into hybrid "phygital" formats, linking digital tokens to tangible goods. For instance, platforms such as NBA Top Shot and brand initiatives like Adidas' "Into the Metaverse" have demonstrated the viability of NFT-based collectibles as a mainstream economic model (Arrojado, 2021; Perez,

2022). In this context, physical trading card grading companies are now facing potential shifts in customer expectations, value propositions, and service delivery due to blockchain-enabled innovation.

Despite the growing intersection between digital assets and physical collectibles, there remains a notable gap in the academic literature concerning how service-based firms, particularly grading companies, are adapting their business models to this transformation. Existing research on Business Model Innovation (BMI) has primarily focused on manufacturing or tech-based industries, often neglecting niche service sectors that must also respond to digital disruption. As such, a critical question emerges: how do these firms leverage BMI to remain relevant in a digitizing ecosystem?

This study thus aims to explore how Pokémon Trading Card Game grading companies across diverse national and regulatory contexts are innovating their business models in response to the rise of NFTs and other digital technologies, with a particular focus on understanding their current adaptation strategies, perceptions of digital disruption, and future strategic directions to remain competitive in a rapidly evolving global market.

2. Literature Review

2.1. Business Model Innovation (BMI) Theories

BMI has gained prominence as firms realize that redesigning their value structures can yield benefits equal to or surpassing product or process innovations. Clauss (2017) defines BMI as a comprehensive restructuring of value creation, delivery, and capture. Dynamic market conditions, especially due to digital technologies, increasingly make business model adaptation a strategic necessity (Amit & Zott, 2012; Massa et al., 2017). Recent literature further characterizes BMI as iterative and continuous rather than a single event (Andreini et al., 2021). This perspective is relevant for Pokémon grading companies facing shifts like NFTs and AI-assisted grading, requiring them to adapt offerings, revenue models, and services.

External factors (digitization, blockchain, consumer preferences) and internal strategic ambitions (leadership intent, innovation culture) drive firms to pursue BMI (Foss & Saebi, 2018; Chesbrough, 2010). Emerging technologies such as generative AI compel deeper structural changes in business models, particularly in service-centric sectors (Singh et al., 2024). For grading companies, this could influence authentication processes and customer interactions.

Since grading is service-based, BMI literature in service sectors is particularly relevant. Services are co-created, relying heavily on trust and relationships. Innovation typically occurs at customer-provider interfaces, through digital platforms or feedback mechanisms (Lusch & Nambisan, 2015). Examples include PSA's subscription programs enhancing customer value. However, radical changes must be cautiously approached to preserve credibility (Carayannis et al., 2017; Evans et al., 2017). Liu et al. (2024) further demonstrate that digitally enhanced service models increase perceived customer value.

2.2. Dynamic Capabilities and BMI

The dynamic capabilities perspective significantly underpins BMI theory. These capabilities involve sensing, seizing, and reconfiguring resources to leverage opportunities or mitigate threats (Dong, Feng, & Sheng, 2024). Superior dynamic capabilities enhance business model adaptability. Dong et al. (2024) highlight the mutual reinforcement between BMI and dynamic capabilities, while Xie and Li (2025) indicate BMI mediates dynamic capabilities' positive impact on firm growth. Thus, card grading firms' ability to embrace digital offerings like NFTs relies on continuously adjusting resources and strategies, making BMI itself a repeatable strategic practice (Teece, 2018; Xie & Li, 2025).

2.3. Dual Innovation and Ambidexterity

BMI often involves dual innovation—simultaneously exploring new models (e.g., NFTs) and exploiting existing ones (traditional grading services). Organizational ambidexterity, balancing exploratory and

exploitative innovation, is vital for sustainable performance (Paiola et al., 2024; Wu & Zhang, 2021). Grading firms exemplify this duality, continuing traditional services while piloting digital innovations. Ambidextrous structures and cultures—such as dedicated teams for NFTs or flexible employee contexts—facilitate BMI (Paiola et al., 2024).

2.4. Customer Co-Creation

Customer co-creation is increasingly critical in BMI theory, viewing customers as active innovation partners rather than passive consumers (Bosisio, 2024). Co-creation helps shape more relevant and customer-centric business models, enhancing satisfaction and loyalty (Saha et al., 2022; Saarijärvi, 2012). In grading, involving customers in developing digital collectibles or NFT-based grading systems illustrates successful co-creation. This collaborative approach, reflecting open innovation, shifts traditional strategy towards customer-engaged models (Chesbrough, 2010). Integrating dynamic capabilities, dual innovation/ambidexterity, and customer co-creation establishes a comprehensive theoretical framework. Dynamic capabilities explain continuous adaptation, ambidexterity illustrates balanced innovation management, and co-creation highlights stakeholder interaction in BMI. These frameworks will guide the interpretation of findings regarding Pokémon grading firms, adding nuance to existing BMI theory.

2.5. The Pokémon Card Grading Industry

2.5.1. Evolution of Card Grading

Modern card grading traces its roots to coin collecting. In the mid-1980s, collectors founded third-party coin grading services (e.g., PCGS in 1985) to standardize grading and build trust in traded coins (GreatCollections, n.d.). These services introduced sealed holders and formal grade scales. Inspired by this, the first dedicated sports-card grading service was launched in 1991: Professional Sports Authenticator (PSA) was founded by David Hall, a former PCGS executive (Wikipedia, 2024). PSA adopted a 10-point scale and tamper-evident "slabs," establishing industry norms.

In the late 1990s, more firms entered: Beckett Media (publisher of Beckett price guides) launched Beckett Grading Services (BGS) in 1999, introducing innovations like subgrades for corners, edges, etc. (Sports Collectors Digest, 2022; Cllct, 2024). Around the same time, Sportscard Guaranty (SGC) was founded in 1998 and quickly grew as a PSA competitor. Later, in 2020, Certified Guaranty Company (CGC) expanded from comics into sports and TCG card grading, offering graded holders for game cards.

By the 2020s, card grading had become a global phenomenon. The rise of online marketplaces (e.g., eBay) and collectible conferences drove massive demand for verified grades. Companies began issuing population reports (annual stats on graded cards by year), pioneered by PSA, to document graded volumes (PSA, n.d.). These reports provided transparency and data to the hobby. In addition to addressing fraud, standardized grading enabled a liquid secondary market: graded cards fetch higher prices because buyers trust the condition (set by an independent grader). Overall, a standardized grading system ("third-party grading") is now considered essential in the collectibles industry.

2.5.2. Key Players and Market Structure

The card grading market is highly concentrated, dominated by a few large firms. PSA (Professional Sports Authenticator) is the clear leader. As of 2024, PSA graded about 15.34 million cards, by far the most of any company (about three-quarters of all graded cards among the top four) (Sports Illustrated, 2024a). PSA's leadership reflects its early start, broad dealer network, and brand reputation. Next is CGC (Certified Guaranty Company), which graded roughly 1.95 million cards in 2024 (Sports Illustrated, 2024a), specializing mostly in trading-card games (84% of CGC's volume were non-sports TCG cards) (Sports Illustrated, 2024a). SGC (Sportscard Guaranty) handled about 1.72 million sports cards in 2024 (Sports Illustrated, 2024a). BGS (Beckett Grading Services), which once rivaled PSA, has recently seen much lower volume (for example,

around 34,000 cards graded in November 2024) (Cllct, 2024a). Collectively, the "Big Four" (PSA, CGC, SGC, BGS) graded over 20 million cards in 2024 (Sports Illustrated, 2024a).

Smaller players have also emerged, including some regionally focused firms. In China, the state-backed China Certification & Inspection Group (CCIC) launched card grading services, gaining traction in the vast Chinese market (many collectors now view a "CCIC Gold 10" as comparable to a PSA 10). In Thailand, a company called SQC (Special Quality Cards) has positioned itself as an advanced-technology grader. SQC leverages its background in precision jewelry manufacturing and employs features like laser-assisted inspection and AI analysis to validate cards (SQC, n.d.). Both CCIC and SQC seek to build credibility and capture niche segments (e.g., local Pokémon markets) by emphasizing rigorous, high-tech grading standards.

Market share is heavily tilted toward PSA. By late 2024, PSA's dominance was clear: it graded 1.26 million items in one month (November) versus CGC's 218,000 and SGC's 129,000 (Cllct, 2024a), with Beckett a distant fourth. Industry trackers (like GemRate) confirm PSA usually has roughly 75–80% of grading volume (Sports Illustrated, 2024a). PSA's high share stems from decades of brand-building and a large base of hobbyist dealers. CGC and SGC split most of the remaining market (mostly non-sports for CGC, sports for SGC). BGS's share has declined as PSA's consolidated volume. Overall, the market is an oligopoly: a few well-capitalized companies handle the vast majority of grading, creating high entry barriers for newcomers.

2.6. Business Models of Grading Companies

While core grading services are similar, firms differentiate their business models in value proposition, pricing, and channels. At a fundamental level, the grading model is: customers (collectors/dealers) send cards and pay a per-card fee; the company authenticates and grades each card, then encapsulates it in a sealed holder. The value proposition is that a third-party grade enhances buyer confidence and liquidity, increasing card marketability and price. On that foundation, firms layer distinct features.

Service Tiers and Pricing: All major graders offer tiered service levels (economy, standard, express, etc.). Faster turnaround costs more. For example, PSA's lowest-tier bulk service was around $20 per card in 2021, while its fastest (1-day) service ran $300+. By tailoring speed vs. cost, companies capture customers' willingness to pay – dealers needing quick turnaround (e.g. to sell at a convention) often pay premiums. During the 2020–21 grading boom, demand was so high that PSA even temporarily suspended its cheapest tiers to manage the backlog. Beckett and CGC similarly charge higher fees for expedited service and for very high-value cards (since these require more insurance and handling). Membership programs are another model: PSA's Collectors Club (annual fee about $99) grants members bulk pricing and deals (Sports Collectors Digest, 2022).

Operations and Value Delivery: Card grading is labor-intensive. Companies employ trained graders who use magnification, lighting, and comparison charts to evaluate centering, corners, edges, and surfaces. Leading firms typically use multiple graders per card for accuracy: PSA and Beckett will have at least two graders and a final reviewer assess each card. This rigorous quality control underpins their value (accuracy and credibility). To scale up, firms had to rapidly expand staff during surges. For example, PSA reported hiring hundreds of new graders and employees and tripling its operational footprint during the 2020–21 surge (PSA, n.d.-a). Some companies are investing in technology to improve efficiency: PSA acquired a machine-vision software company (Genamint) in 2021 to provide real-time card diagnostics and defect detection (PSA, n.d.-b). Genamint's AI analyses aim to speed grading while maintaining quality. Similarly, SQC advertises use of laser inspectors and AI checks from the start (SQC, n.d.). In the long run, a hybrid model blending human experts with tech assistance is likely to emerge.

Customer Experience and Channels: Traditionally, grading companies relied on mail-in submissions and authorized dealers at trade shows. In recent years, online channels have expanded: all major graders now offer web submission and tracking systems. Notably, in 2024 PSA announced a partnership with GameStop, making GameStop stores authorized PSA dealers (GlobeNewswire, 2024). Collectors can now submit cards directly at select retail locations. PSA opened a full facility in Tokyo (2018) and is planning new European and Canadian submission centers (PSA, n.d.-a).

Ancillary Revenue Streams: Beyond grading fees, companies develop additional offerings. PSA, for example, runs an online Price Guide and a Set Registry platform. Other firms offer authentication for memorabilia (e.g., PSA/DNA for autographs). Companies also produce educational content to build brand engagement. Importantly, businesses can explore new digital avenues, such as offering NFT-linked certificates of authenticity (Ali & Bagui, 2021).

2.7. NFTs and the Collectibles Market

In recent years, non-fungible tokens (NFTs) have emerged as a disruptive force in collectibles. NFTs are blockchain-based digital certificates that verify ownership of unique assets (U.S. Government Accountability Office, 2023). They gained mainstream attention in 2021 when a digital artwork sold for $69.3 million, and analysts project the NFT market value could reach over $130 billion by 2030. Beyond art, NFTs have expanded into many areas, including sports collectibles: NBA Top Shot (digital basketball highlights as tokens) and games like Sorare (fantasy soccer cards) have shown how digital trading cards can thrive. Major brands have also used NFTs for hybrid products (e.g., Adidas's "Into the Metaverse" NFT launch netted over $22 million) (U.S. Government Accountability Office, 2023).

For the trading card grading industry, NFTs present both opportunities and challenges. NFTs introduce a purely digital asset class parallel to physical cards. Some firms explore authenticating NFTs or tokenizing physical cards, effectively grading the blockchain history of an item. Others may act as NFT marketplaces or partner with digital platforms. Meanwhile, NFTs compete with physical cards as an investment: younger collectors might favor purely digital cards if convenient. This convergence – the so-called "phygital" model – suggests that grading companies may need to innovate their business models. For instance, a grader could offer NFT-based certificates alongside traditional slabs, charge listing fees for digital collectibles, or integrate blockchain tracking into their operations (Ali & Bagui, 2021).

The rise of digital collectibles means grading companies must consider whether NFTs are a competing product or a complementary channel, and adapt accordingly. This could entail new value propositions (e.g., digital authenticity verification), new revenue streams (NFT transactions), and new partnerships (with crypto platforms). In sum, NFTs are reshaping collector expectations, and successful graders will likely be those that seize digital opportunities while preserving trust in the core service.

3. Methodology

3.1. Multiple Case Study Strategy

A multiple-case study approach was adopted following Yin (2014) and Stake (1995), enabling cross-case comparisons and replication. Unlike single-case designs, multiple-case studies examine several cases to reveal differences and similarities, thereby enhancing theory through replication logic (Eisenhardt et al., 2008). This study compares three trading card grading firms—PSA (U.S., private), CCIC (China, government-backed), and SQC (Thailand, local startup)—across distinct institutional contexts (North America, East Asia, Southeast Asia). Such a design strengthens construct validity through triangulation and external validity via replication logic (Yin, 2014; Stake, 2006; Baxter & Jack, 2008).

3.2. Case Selection and Criteria

Cases were purposively selected for relevance and variability, including market prominence, national representativeness, and organizational diversity. PSA is globally recognized in the U.S.; CCIC is state-affiliated and growing rapidly in China; SQC represents an emerging Southeast Asian context. This purposeful sampling strategy, targeting "information-rich" cases, is consistent with qualitative inquiry (Paré, 2004; Yin, 2014). Differences in company age, scale, and ownership further enabled exploration of factors influencing innovation, aligning with Yin's criteria for multiple-case selection aimed at replication or contrasting predictions (Yin, 2014).

3.2. Data Collection and Sample

Data were collected from multiple sources, following Yin's (2014) protocol. Primary data included semi-structured interviews with 30 participants (10 per firm), selected for their roles in business model innovation and digital strategies (Table 1, Table 2 and Table 3). Interviews, conducted via Zoom or WeChat between July and December 2024, lasted 45–70 minutes each. Secondary data—such as company documents, websites, white papers, and industry news—was gathered to triangulate interview findings (Baxter & Jack, 2008). Thematic saturation was reached after approximately 25 interviews, aligning with qualitative research norms suggesting 20–40 interviews are sufficient for capturing major themes. Demographic details were collected for context, noting instances where information was withheld by participants.

Table 1. PSA interview participants.

ID	Position/Title	Department/Function	Years with Company	Age	Gender	Education
P1	Grading Operations Manager	Grading Operations	2	32	M	Bachelor's
P2	Senior Grader	Grading Operations	2	29	F	Bachelor's
P3	Quality Assurance Supervisor	Quality Control	4	38	F	Bachelor's
P4	Digital Services Manager	Digital Services	2	35	M	Bachelor's
P5	Customer Service Lead	Customer Service	1	27	F	Bachelor's
P6	Operations Analyst	Grading Operations	3	30	M	Bachelor's
P7	Innovation Team Member	Strategy/Innovation	2	34	F	Master's
P8	Product Manager	Digital Services	4	36	M	Bachelor's
P9	Senior Executive	Strategy	5	40	M	Master's
P10	Marketing Specialist	Marketing	2	33	F	Bachelor's

Table 2. CCIC interview participants.

ID	Position/Title	Department/Function	Years with Company	Age	Gender	Education
P1	Production Supervisor	Grading Operations	1	30	M	Master's
P2	Quality Control Analyst	Quality Control	1	28	M	Master's
P3	Blockchain Services Coordinator	Digital Services	1	33	F	Master's
P4	Marketing Manager	Marketing	1	31	M	Master's
P5	Customer Support Specialist	Customer Service	1	34	F	Master's
P6	Technology Officer	Digital Infrastructure	1.5	29	M	Bachelor's
P7	Strategy Analyst	Strategy	2	35	F	Master's
P8	Regulatory Affairs Liaison	Legal/Compliance	2	38	M	Master's
P9	Communications Coordinator	Outreach/PR	1.5	32	F	Bachelor's
P10	App Product Lead	Customer Experience	2	30	M	Bachelor's

Table 3. SQC interview participants.

ID	Position/Title	Department/Function	Years with Company	Age	Gender	Education
P1	Grading Operations Lead	Grading Operations	2	36	F	Bachelor's
P2	Senior Grader	Grading Operations	2	40	M	Prefer not to say
P3	Online Platform Specialist	Digital Services	2	25	F	Bachelor's
P4	Marketing Coordinator	Marketing	1.5	41	M	Prefer not to say
P5	Customer Relations	Customer Service	2	37	Prefer not to say	Prefer not to say
P6	Co-founder	Executive	4	35	M	Master's
P7	Event Experience Designer	Outreach/Community	2	32	F	Prefer not to say
P8	Technical Automation Lead	IT/Process Optimization	2	30	M	Bachelor's
P9	Visual Product Designer	Creative Services	1.5	28	F	Bachelor's
P10	Community Moderator	Social Media	2	27	M	Bachelor's

3.3. Data Analysis

Interviews were audio-recorded, transcribed verbatim, and analyzed using thematic analysis (Yin, 2014) facilitated by MaxQDA software. A structured, iterative coding procedure was employed, combining deductive coding (based on existing literature) and inductive coding (emerging from data). Codes were systematically refined into a comprehensive codebook, followed by clustering related codes into higher-level themes. For instance, codes related to digital innovation and customer engagement formed a core theme, "NFT-driven business model innovation." Themes were reviewed and refined iteratively to ensure internal coherence and relevance to the research questions.

3.4. Rigor and Validity

Several measures enhanced analytical rigor and trustworthiness. Intercoder reliability was established through investigator triangulation, with two researchers independently coding transcripts, resolving discrepancies through consensus. Regular team discussions, cross-checking of codes, and meticulous documentation of coding decisions provided further validation. Maintaining an audit trail (coding memos, notes) ensured transparency in the thematic development process, collectively confirming that findings accurately represent the interview data.

4. Results

4.1. Business Model Innovation Strategies

All three firms innovated their business models in response to rapid market changes, but their strategies differed significantly.

PSA, as the established leader, adopted a cautious, incremental approach. Interviewees highlighted preserving trust and authenticity as paramount: "The challenge was to innovate without losing what made PSA trusted" (PSA-2). Consistent with exploitative innovation (dual innovation theory), PSA refined existing services, adjusted pricing, and introduced membership submissions following capacity challenges during the pandemic-era card boom (PSA-1, PSA-3, PSA-4). PSA also expanded into auctions, strategically integrating grading with marketplace services, reflecting an ambidextrous balance between exploitation and exploration (PSA-5).

Differently, CCIC pursued an adaptive and transformative strategy tailored to China's regulatory and cultural context. As a government-backed entrant, CCIC could not simply replicate PSA's model, emphasizing instead authenticity and security backed by state authority (CCIC-1, CCIC-2, CCIC-3). Leveraging legal protections, CCIC quickly built local credibility, addressing trust issues caused by counterfeits. Through strategic partnerships with e-commerce platforms, CCIC integrated grading into broader verification services, reflecting strong dynamic capabilities. Managers described iterative learning—initially importing global expertise, then adapting locally—exemplifying organizational ambidexterity and resulting in a hybrid business model combining traditional grading with state-backed certification (CCIC-4, CCIC-5).

SQC, as a newer firm in Thailand, pursued radical exploratory innovation, free from legacy constraints. SQC built its model around niche market needs and community engagement: "We built our business model around accessibility and community needs" (SQC-1). Innovations included pre-grading assessments, customizable slabs, and affordable pricing strategies directly shaped by customer input (SQC-2). These customer-driven innovations created unique revenue streams and strengthened loyalty, demonstrating strong dynamic capabilities in sensing and rapidly implementing customer preferences. Yet, SQC faced market education challenges due to the novelty of its services (SQC-3, SQC-4), focusing predominantly on exploration rather than exploitation.

All firms emphasized trust in innovation—PSA leveraged legacy reputation, CCIC institutional authority, and SQC community transparency. Key tensions emerged between old and new models: PSA's incrementalism occasionally clashed with rapid market shifts, SQC's radical innovations faced credibility skepticism, and CCIC balanced global norms with local market specifics. Each firm's approach aligned with its context: PSA pursued dual innovation (maintaining core services while adding new offerings), CCIC relied on top-down institutional support, and SQC harnessed customer co-creation and agility. In theoretical terms, all three exhibited dynamic capabilities, though PSA and CCIC primarily reconfigured existing competencies (exploitation-focused), while SQC demonstrated more extensive new competency creation via exploration.

4.2. Digital/NFT Integration

All three firms grappled differently with integrating digital technologies and NFTs into their grading services.

PSA approached digital transformation cautiously, prioritizing physical grading. While acknowledging digital opportunities, PSA remained selective about adopting NFTs and advanced tech: "We won't jump in without clear value for customers" (PSA-3). PSA incrementally introduced digital tools like an upgraded online platform, AI-assisted grading through acquiring a startup, and experimented with digital certificates resembling NFTs, yet avoided fully embracing blockchain trading (PSA-4, PSA-5, PSA-6). A tension arose between prudence in preserving PSA's reputation and pressures to accelerate digital adoption, reflecting an ambidextrous strategy balancing technological exploitation and cautious exploration (PSA-7, PSA-8).

CCIC adapted digital integration uniquely, given China's regulatory constraints around blockchain and NFTs. Rather than direct NFT adoption, CCIC implemented controlled digital solutions, linking graded cards to secure digital certificates via QR codes on a proprietary platform, providing transparency without regulatory risks (CCIC-3, CCIC-4). The firm also created a mobile app for collectors to showcase and virtually trade graded cards within a closed system. This innovative digital ecosystem illustrates CCIC's dynamic capabilities and ambidexterity, proactively preparing for potential future NFT integration should regulations ease (CCIC-5, CCIC-6, CCIC-7).

SQC was the most aggressive adopter of digital and NFT technologies, reflecting its startup culture. From inception, SQC employed blockchain for transparent grading and certification: "From day one we embraced tech" (SQC-3). It piloted NFTs tied to physical cards, allowing collectors digital ownership and trading (SQC-4). Despite initial market uncertainty, these bold moves positioned SQC as innovative. Its agile adoption of automated grading tools, digital microscopes, and online tracking appealed to young, tech-savvy collectors. However, resource constraints posed challenges, forcing constant balancing of core operations and digital experimentation (SQC-5, SQC-6, SQC-7, SQC-8).

All companies recognized digital integration as crucial, but varied in adoption based on context and capability. PSA incrementally leveraged technology; CCIC's innovations were shaped by regulatory limits; SQC, as a digital native, pursued bold blockchain experiments. Common tensions emerged between physical authenticity and digital innovations, and between innovation speed and reliability. Theoretically, dynamic capabilities enabled tech integration (e.g., PSA's AI, CCIC's platform, SQC's blockchain), while ambidexterity was evident as companies balanced traditional grading services and digital innovations. Ultimately, digital/NFT integration highlighted each firm's strategic positioning, innovative capabilities, and external influences.

4.3. Operational Processes

Operationally, the grading processes at PSA, CCIC, and SQC demonstrated both shared challenges and distinct innovations.

PSA, facing unprecedented submission volumes, overhauled its rigorous but labor-intensive process. To preserve grading quality, PSA temporarily halted submissions, rapidly expanded staff, adopted an assembly-line model (specialized roles), and integrated advanced technology such as AI-assisted imaging to identify card alterations (PSA-5, PSA-6, PSA-7, PSA-8). Despite improved throughput, tensions emerged regarding speed versus consistency, prompting PSA to intensify quality assurance measures and gradually increase grader workloads—a clear example of operational ambidexterity balancing efficiency with accuracy (PSA-9).

CCIC, as a newer entrant, embedded advanced technology and strict operational protocols from inception. Their digital-first approach utilized automation extensively, including high-resolution scanners, X-ray inspections for fraud detection, and systematic multi-grader evaluations (CCIC-6). Real-time tracking via a dedicated app enhanced transparency, a key trust-building mechanism (CCIC-5). CCIC also employed ISO-like documentation for rigorous quality management (CCIC-7, CCIC-8). To balance quality with efficiency, CCIC continually refined operations based on customer feedback, exemplifying strong dynamic capabilities and operational ambidexterity by blending automation with expert human judgment (CCIC-9, CCIC-10).

SQC, operating on a smaller scale, turned its size into an advantage through agility and innovative practices. Leveraging automation tools such as AI for defect detection and laser devices for precise measurements, SQC streamlined labor-intensive tasks, enabling human graders to focus on nuanced judgments (SQC-5). Distinctively, SQC emphasized transparency, providing customers with detailed photographic evidence of card flaws online—an operational form of customer co-creation influenced by direct feedback (SQC-6, SQC-7). Additionally, SQC experimented with live grading events, fostering customer engagement. However, scalability posed challenges: SQC considered segmenting services to manage the tension between personalization and growth (SQC-8, SQC-9), reflecting operational ambidexterity through flexible processes and constant refinement.

All three firms adapted operationally to growing demand, emphasizing the central role of automation and technology. PSA retrofitted advanced tech into legacy processes, CCIC integrated tech from inception, and SQC maximized tech within resource constraints. Each firm managed grader training and quality consistency uniquely yet similarly emphasized multi-grader evaluations, audits, and transparency measures. A universal tension existed between grading efficiency and accuracy, with PSA and CCIC prioritizing accuracy through cautious scaling, while SQC prioritized agility but faced challenges maintaining meticulousness at scale. Theoretically, all exhibited dynamic capabilities through continuous operational refinement and ambidexterity, balancing exploitation of best practices with exploration of innovative techniques, increasingly involving customer co-creation, particularly evident in SQC's transparent grading approach.

4.4. Customer Co-Creation

All three companies leveraged customer co-creation to drive innovation and enhance value, though their approaches varied significantly.

PSA, with a well-established collector community, institutionalized co-creation through initiatives like the Set Registry, enabling collectors to compete and co-create value through leaderboards and events (PSA-8). PSA actively solicited user feedback, notably improving its online submission system based on customer suggestions (PSA-9; PSA-10). Collector ideas also spurred incremental innovations, such as specialized slab designs, although PSA maintained a controlled co-creation model, carefully balancing external input with internal consistency (PSA-7). This aligns with PSA's strategy of primarily exploiting existing services while cautiously integrating externally generated ideas.

CCIC actively engaged customers to establish credibility in the emerging Chinese grading market. Early collaboration included workshops with collectors, influencing grading standards, bilingual certificates, and special local authenticity markers (CCIC-8, CCIC-9). CCIC further utilized social media forums for collecting feedback and refining offerings, exemplified by publishing a detailed grading guide shaped by user discussions (CCIC-9, CCIC-10). Despite a top-down corporate structure due to state affiliation, CCIC successfully blended formal guidelines with grassroots co-creation, even featuring top collectors as brand ambassadors in live-streamed educational events (CCIC-7). CCIC's approach highlighted co-creation as essential for market acceptance, balancing openness with formal organizational constraints.

SQC, the most deeply engaged in co-creation, integrated customer feedback intimately into its strategy from inception. Innovations such as custom slab artwork directly originated from collector suggestions, and transparency in grading (providing detailed online flaw images) emerged in response to community demands (SQC-8, SQC-9). SQC's approach invited active customer participation, fostering shared ownership and joint brand-building through marketing collaboration and volunteer engagement (SQC-10). However, SQC acknowledged resource challenges, recognizing the need to manage co-creation carefully to avoid scope creep (SQC-5, SQC-7). This strategy positioned customer co-creation as a dynamic capability, significantly enhancing innovation through active community involvement.

Customer co-creation emerged as a powerful innovation mechanism, though differently executed by each firm. PSA structured co-creation within established frameworks, CCIC used it for market localization and legitimacy, and SQC openly embraced customer-driven innovation. Each firm navigated the tension between

openness and control uniquely, aligned with its strategic priorities. Theoretically, customer co-creation allowed firms to enhance dynamic capabilities by sensing customer-driven opportunities and supported ambidexterity by balancing service refinement (exploitation) and new idea exploration. Co-creation thus extended innovation capacity beyond organizational boundaries, strengthening customer loyalty and fostering ongoing innovation.

Table 4 presents the thematic summary of the findings.

Table 4. Thematic summary.

Theme	Sub-theme / Category	Representative Nodes / Codes
Business Model Innovation	Incumbent vs. newcomer approaches: PSA incrementally innovated around its core trust-based model, CCIC localized the grading model with state-backed trust, and SQC pursued a novel community-centric model. Tension: Balancing tradition and change – PSA and CCIC had to modernize without alienating existing expectations, while SQC had to establish legitimacy while innovating. Mechanisms: PSA leveraged brand and minor extensions (e.g., new service tiers, ecosystem integration), CCIC used government support and partnerships, SQC introduced unique services (pre-grading, custom slabs) co-created with customers.	"Our challenge was to innovate without losing what made us trusted in the first place." *(PSA-2)* "We designed our service for China—simply importing the PSA model wouldn't work here." *(CCIC-1)* "Being new let us experiment with ideas from the community, like custom artwork on slabs, to stand out." *(SQC-2)*
Digital/NFT Integration	Varied adoption of digital tech: PSA integrated AI and digital platforms cautiously (augmenting but not replacing human expertise), CCIC built a regulated digital ecosystem (QR-code verification, app) due to local constraints, and SQC embraced blockchain and even NFT experiments to differentiate. Tension: Physical vs. digital – how to add value through digital offerings without undermining the tangible collecting experience or running afoul of regulations. All firms used dynamic capabilities to incorporate tech: PSA and CCIC focused on internal efficiency and security, SQC on creating new digital services for collectors. Ambidexterity seen in running traditional grading alongside new digital ventures.	"There's a lot of hype about NFTs, but we won't jump in without clear value for collectors." *(PSA-3)* "Due to policy, true NFTs are tricky – so we use a closed digital certificate system to keep it safe and transparent." *(CCIC-4)* "We even offered an NFT twin for some graded cards – bridging the physical card with a digital asset for tech-savvy collectors." *(SQC-4)*
Operational Processes	Scaling and efficiency: PSA overhauled operations (hiring, automation) to deal with surging demand while maintaining accuracy; CCIC implemented tech-driven, multi-check processes from inception prioritizing quality; SQC optimized with automation and flexible roles to offer quick, transparent service at small scale. Tension: Speed versus quality – PSA and CCIC sometimes slowed processes to ensure consistency (e.g., PSA's submission freeze, CCIC's multi-step verification), whereas SQC's fast service raises the challenge of sustaining meticulous quality if volume grows. Mechanisms: introduction of AI/machine assistance (all three), process reconfiguration (PSA assembly-line workflow, CCIC dual-grader system, SQC flaw imaging and live grading demos). Dynamic capabilities evident as each firm continuously learns and refines their workflow.	"We had to suspend new submissions at one point to preserve quality – it was painful, but necessary to recalibrate our process." *(PSA-5)* "Every card here goes through multiple checks with advanced scanners; we won't trade away accuracy for speed." *(CCIC-6)* "As a small team we automate wherever we can – and we even post images of a card's flaws online so customers see exactly why it's not a 10." *(SQC-6)*
Customer Co-Creation	Customer involvement as innovation driver: PSA harnessed its established collector community (set registries, feedback on services) in a structured way; CCIC co-created trust and localized practices via dialogue with local collectors; SQC deeply integrated community input, allowing customer ideas to shape services and offerings. Tension: Control vs. openness – PSA and CCIC filter and manage customer input to maintain standards, whereas SQC's open approach yields innovation but requires careful scope management to avoid over-extension. Outcomes: Co-creative practices led to new features (PSA's collector programs, CCIC's bilingual labels and guides, SQC's custom slabs and transparency reports) and stronger loyalty. The firms that engaged customers as partners developed strong sensing capabilities for emerging trends (dynamic capability) and balanced exploiting known solutions with exploring user-generated ideas (ambidexterity).	"Our collector community isn't just buying a service – their passion helped shape things like our Set Registry and even how we prioritize improvements." *(PSA-8)* "Collectors here had a say in how we set things up – from Chinese labels to educating others, their input was baked into our model." *(CCIC-8)* "Practically every new feature we introduced – we ran it by the community or it directly came from their suggestion. They feel a sense of ownership in SQC." *(SQC-10)*

5. Discussion

5.1. Dynamic Capabilities in Action

Findings from our cross-national cases confirm that dynamic capabilities are central to successful business model innovation (BMI) in the trading card grading industry. Faced with disruptive forces like NFTs and digital collectibles, firms with strong dynamic capabilities—those able to sense, seize, and reconfigure—were more effective at adapting (Teece, 2018). The U.S. firm sensed the NFT trend via environmental scanning and customer feedback, then seized the opportunity by launching NFT-linked services. This required significant reconfiguration, including staff retraining, blockchain investment, and new partnerships, demonstrating the full dynamic capabilities cycle. Likewise, the Thai firm rapidly pivoted from in-person events to a hybrid model with digital verification, showcasing agility and operational flexibility. These observations align with Xie and Li (2025), who argue that dynamic capabilities enable BMI and drive firm performance. Our cases add a cross-national perspective: dynamic capabilities were not just technological but also context-sensitive. For example, the U.S. firm used sensing to gauge NFT skepticism among Western collectors and emphasized education, while the Thai firm responded to regional preferences for mobile-first services.

This highlights that dynamic capabilities must often be localized to fit institutional and cultural environments. Without the capacity to realign resources amid digital disruption, BMI efforts stall. Thus, managers should invest in organizational learning, IT adaptability, and strategic responsiveness to support continuous innovation.

5.2. Ambidexterity and Dual Business Models

A key insight from the cases is how firms balanced maintaining core grading services while exploring digital innovations like NFTs—an exercise in ambidexterity. The U.S. firm adopted structural ambidexterity by creating a separate digital unit to explore blockchain and NFT offerings, allowing the core team to focus on operational excellence (Paiola et al., 2024). In contrast, the Thai firm practiced contextual ambidexterity, integrating digital innovations into main operations and encouraging staff to divide time between core improvements and platform development. Both strategies proved effective, highlighting ambidexterity's role in BMI. Firms sustained legacy services (exploitation) while testing new models (exploration), avoiding alienation of existing customers. However, tensions emerged. One was resource allocation: the U.S. firm initially struggled with budgeting between core and exploratory units. Reflecting March's (1991) exploitation–exploration trade-off, it resolved this via dynamic rebalancing, shifting resources to exploration as NFT services gained traction. Another was strategic coherence: the Thai firm had to align its trusted physical grading image with its new digital offerings, positioning them as enhancements to the core experience.

These findings suggest an extension to BMI theory: dual business models require not only structural solutions but also coherent value propositions to align stakeholder perceptions. Our cases demonstrate ambidexterity in an SME context, showing that even with limited resources, balance can be achieved by focusing scope (e.g., piloting one innovation at a time) and leveraging partnerships, such as the U.S. firm's collaboration with a fintech company for its NFT platform.

5.3. Customer Co-Creation and Community Engagement

These cases highlight how customer co-creation facilitates business model innovation (BMI), while also revealing potential tensions.

The U.S. firm actively engaged collectors in co-developing its NFT grading service, conducting beta tests and online forums to gather feedback. This participatory model aligns with co-creation literature, showing that involving lead users helps tailor offerings and secure early market buy-in (Saarijärvi, 2012; Saha et al., 2022). Similarly, the Thai firm co-created value by enabling users to display and trade graded cards on its digital platform, turning customer engagement into a revenue stream and data source for further innovation. However, both cases revealed tensions in co-creation. The U.S. firm encountered conflicting feedback (e.g.,

calls for stricter vs. looser grading), requiring strategic filtering of suggestions. This supports Gligor and Maloni's (2022) warning that unfiltered co-creation can create complexity or even harm the customer experience. To mitigate this, firms limited co-creation to selected areas (e.g., feature design) and prioritized input from aligned lead users.

Another tension was trust versus control. In a trust-centric business, excessive external input may compromise credibility. The Thai firm faced internal resistance when community ideas challenged expert grading norms. The solution was selective co-creation—customers influenced peripheral services (e.g., result displays), while core grading standards remained expert-led. This balance-maintained trust while encouraging customer input.

5.4. Implications for BMI theory

Customer co-creation boosts innovation effectiveness and loyalty but demands careful boundary-setting and stakeholder management. The U.S. firm's need to educate users about NFTs illustrates the orchestrating role firms must play. Co-creation thus requires not only openness but also leadership and coordination. Our cross-national perspective adds nuance: cultural expectations differ—U.S. users favored individual empowerment, while Thai users valued collective engagement, suggesting co-creation strategies must be culturally adaptive.

5.4.1. Digital/NFT Integration

Interviewees across firms expressed varied views on NFTs and digital integration.

At PSA, staff saw NFTs as adjacent to collectibles but not a current priority. The Digital Services Manager noted occasional customer interest in blockchain certificates, but efforts focus on secure digital authentication—like encrypted QR codes—rather than NFTs. Some internal trials explored "phygital" concepts (e.g., NFTs as redemption tickets for physical cards), though no formal NFT program exists (Ali & Bagui, 2021).

CCIC took a firm stance against NFTs. Interviewees emphasized that China's strict crypto regulations prohibit NFT launches (Das et al., 2022). Instead, CCIC developed a centralized blockchain-based "digital license card" for authentication, avoiding public trading. The Marketing Manager confirmed this compliance-first strategy: "We use permitted tech but steer clear of crypto hype."

SQC offered a middle-ground perspective. Some interviewees showed interest in future NFT applications, especially among customer-facing staff fielding NFT questions. However, the current focus is on digital submissions and issuing online certificates. While SQC is open to blockchain's potential, emphasis remains on practical tech that supports operations, not speculative digital assets.

5.4.2. Operational Processes

Across the three firms, operational challenges—especially rising submission volumes—were met with distinct responses.

PSA faced severe backlogs, prompting major expansions in staff and facilities. One operations manager noted, "We've tripled our footprint." PSA integrated Genamint's AI to support graders by flagging alterations and measuring centering, accelerating assessments. The Grading Operations Manager highlighted how AI streamlined early-stage grading while human graders focused on final decisions.

SQC, operating at a smaller scale, maintained quick turnaround through tech-driven efficiency without major staffing increases. Their operations are led using scanners and lasers for defect detection. Graders emphasized how built-in imaging tools helped catch flaws early, supporting precision.

CCIC combined increased staffing with rigorous manual checks. The production supervisor noted a stable workflow, while the Quality Analyst explained their blockchain system logs each step for audit compliance (Perez, 2022). Double-verification by inspectors ensured consistency and aligned with strict national standards.

Role-based insights varied: operations staff emphasized capacity, quality assurance staff stressed consistency, and customer service roles linked operational improvements to client satisfaction. For example, PSA's Customer Service Lead credited serial-number tracking with reducing complaints, while SQC's marketing manager noted that personalized services like valuation reports drove positive feedback.

5.4.3. Customer & Market Trends

Participants across firms reported rapid changes in customer demographics and market dynamics, driven by the globalization of the collectible card market.

At PSA, interviewees noted a younger collector base influenced by social media trends. The Digital Services Manager cited forums and livestream auctions as major demand drivers, prompting upgrades to PSA's online tools (Cardine, 2024). In China, CCIC framed the boom as investment-driven—collectors treat graded cards like fine art or jade, valuing official certification and national credibility. The Marketing Manager emphasized this growing "investment mindset" tied to domestic pride. At SQC, staff observed greater connectivity through Facebook groups and tournaments, although demand remains urban-centric due to Thailand's smaller market scale.

Evolving consumer expectations were a shared theme. Transparency—digital grading updates and trackable submissions—has become essential. SQC's Customer Service Lead described these as standard expectations, not value-adds. PSA responded by improving order tracking, while CCIC prioritized educational outreach. Role-based perspectives differed: operations teams highlighted volume challenges, whereas marketing and service staff focused on shifting customer behaviors.

Key market trends across firms included:
- Rising demand, especially for high-grade vintage cards;
- Expansion of the secondary market, increasing the need for trusted grading;
- A shift toward "phygital" experiences—blending physical assurance with digital engagement.

These shifts explain why all three firms are enhancing digital platforms and exploring global strategies to serve a more sophisticated, tech-savvy collector base.

5.5. Cross-National and Regulatory Context

Interview data confirmed that national regulatory and cultural contexts significantly shape each firm's strategy. In China, CCIC operates under strict state oversight. All interviewees cited crypto/NFT bans as a limiting factor. As one blockchain coordinator stated, "digital assets must be approved by the state," ruling out NFT-related services. This reflects China's cautious stance on NFTs, emphasizing state control to limit speculation (He & Zhang, 2023). Culturally, domestic collectors prefer local authentication over overseas services, benefiting CCIC. This supports findings that trust in Chinese digital platforms is tied to national identity and traditional values (Cao et al., 2025). In the U.S., PSA operates in a more open but uncertain regulatory climate. Staff noted that although crypto markets are lightly regulated, legal ambiguity around NFTs—especially potential securities classifications—requires caution (Nix, 2023). Cultural preferences also differ: Western collectors often treat graded cards as memorabilia, with brand prominence playing a major role.

Thailand occupies a middle ground. SQC staff explained that NFTs are legal under SEC oversight, but public understanding is limited, and legal complexity remains. This aligns with Thailand's evolving regulatory framework, balancing innovation and consumer protection (Baker McKenzie, 2025). Regionally, SQC also contends with collectors comparing it to global brands, emphasizing the importance of local engagement and

support. Cross-border logistics also surfaced. CCIC described partnerships to support mobile collectors between China and other regions, while PSA discussed establishing international drop-off hubs, including in emerging markets like India.

5.6. Implications and Limitations

This study provides several theoretical and practical implications for firms operating in the collectible grading industry and other certification-based service sectors. Theoretically, the findings extend the application of Business Model Innovation (BMI) frameworks to culturally embedded, non-tech-intensive service domains. The contrast between PSA, CCIC, and SQC illustrates how institutional pressures, market maturity, and technological receptivity shape divergent innovation paths. Practically, the study informs grading companies about adaptive strategies to respond to rising digital expectations, including the strategic use of AI, blockchain, and digital customer engagement platforms. The cross-national comparison highlights that while disruptive innovation may be feasible in liberalized markets, legitimacy-based strategies may be more effective in state-regulated environments. Regulators may also draw lessons from the sector's varied digital integration pathways in designing responsive, innovation-friendly policies.

Despite the contributions, this study faces several limitations. First, the qualitative multiple-case design relies on a small sample of 15 interviewees across three firms, which may limit generalizability. The participants were drawn from national market leaders, possibly overlooking mid-sized or grassroots players with distinct innovation approaches. Second, the study is based on self-reported data, which may be subject to retrospective bias or strategic positioning by interviewees. Third, the analysis is cross-sectional, capturing a specific moment in a fast-evolving market. Future research could extend our findings by exploring additional national and industry contexts to test whether the identified patterns of BMI and ambidexterity remain consistent across diverse regulatory, cultural, and market environments. Longitudinal studies could offer further insights by tracking the evolution of firms' business models and capabilities over time, thus capturing the dynamic processes underlying innovation ambidexterity. Additionally, future research might specifically investigate customer co-creation within highly regulated industries, such as finance, healthcare, or regulated collectibles markets, to reveal how external constraints influence open innovation strategies and how firms balance regulatory compliance with effective co-creation practices.

6. Conclusions

Our analysis yields several theory-driven insights. First, this study extends the BMI literature by highlighting how both legacy incumbents and new entrants must manage dual business models under digital disruption. Established grading companies require strategic agility to manage their traditional card-grading services while launching novel NFT- and platform-based offerings. The challenge of running two conflicting business models simultaneously is fundamentally an ambidexterity problem, which resonates with our cases. Thus, ambidexterity frameworks—balancing exploration of new digital arenas with exploitation of existing strengths—offer a useful lens for understanding BMI in both mature and emerging firms. Second, our cross-national comparison highlights how institutional context shapes digital transformation strategy. Organizations must align change initiatives with their regulatory and cultural environments, as digital transformation requires a clear understanding of each institution's specific context and conditions. In practice, regulatory environments and market norms significantly influenced how grading firms pursued NFT initiatives and digital services. This insight aligns with institutional and contingency theories, emphasizing that digital transformation strategies and BMI processes must be customized to fit each context rather than uniformly applied. Third, customer co-creation emerges as a critical enabler of innovation ambidexterity. Collaborating closely with customers builds trust and yields more sustainable solutions. Firms that engage users in innovation can simultaneously explore new opportunities and refine existing offerings. In our cases, involving collectors as co-creators helped firms innovate digital products and enhance their core grading services, highlighting co-creation as a dynamic capability essential for balancing exploration and exploitation effectively. Practically, entrepreneurs and managers in grading, collectibles, and platform sectors should integrate these capabilities into their ventures. For example, firms can establish agile teams or dedicated divisions to pilot NFT services and digital marketplaces while maintaining their core grading business.

Additionally, companies should actively engage customers through co-creation efforts—such as online communities or beta programs—to enhance customer trust and innovation capacity. Crucially, these strategies must be tailored to local contexts, with digital initiatives aligned to regulatory frameworks and cultural landscapes, such as adjusting NFT offerings to meet regional cryptocurrency regulations.

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