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## **A comparative study of how open platform policies influence consumer value perception: Italy vs Japan**

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## **Abstract**

Over the past decade, smart home technologies have evolved into interconnected platform ecosystems in which value emerges from the coordinated interaction of devices, services, and users. In this setting, platform openness has emerged as a key design and governance principle shaping interoperability, innovation, and user experience. However, existing research has primarily examined platform openness from a firm-level and ecosystem governance perspective, while its implications for consumer perceived value remain underexplored, particularly in cross-national contexts.

This study investigates how platform openness influences consumer perceived value in smart home ecosystems. Rather than conceptualizing openness as a single attribute, the study adopts a multidimensional perspective, capturing how openness affects consumers' interactions with data, interfaces, complementary services, and market offerings. Consumer perceived value is conceptualized as a trade-off between perceived benefits, such as convenience, compatibility, and personalization, and perceived sacrifices, including complexity, uncertainty, and concerns related to control and security.

The study adopts a cross-national comparative approach focusing on Italy and Japan, two technologically advanced markets characterized by distinct cultural orientations and institutional contexts. The empirical analysis is based on product-level data collected from Amazon Italy and Amazon Japan and employs regression models to examine how different dimensions of platform openness are associated with consumer ratings across countries. By integrating platform ecosystem theory with consumer value perspectives, this research shifts attention from firm-level outcomes to consumer-level value creation and highlights the culturally contingent nature of openness in digital ecosystems.

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# CHAPTER 1 – Introduction

## 1.1 Research background

The rise of the digital economy has transformed digital platforms into one of the dominant organizational forms for coordinating innovation and economic activity (Cusumano & Gawer, 2003; McIntyre & Srinivasan, 2016). Digital platforms enable diverse actors to interact through shared technological infrastructures that support large-scale value co-creation (Tiwana et al., 2010; Hein et al., 2020). Unlike traditional linear business models, platforms rely on modular architectures, network effects, and boundary resources to orchestrate distributed innovation and market coordination (Eisenmann, Parker & Van Alstyne, 2006, 2009). As connectivity, data availability and intelligent automation continue to expand, platforms have evolved from simple matchmaking mechanisms into complex socio-technical ecosystems in which value increasingly emerges from coordinated interactions among multiple participants (Gawer, 2014). In this context, a major direction in recent platform research and practice concerns how platforms design and govern their boundaries, in particular, how “open” they are to external participation and integration (West, 2007; Gawer, 2014).

Within this context, platform openness has become a central theoretical construct in platform research. Platform openness refers to the degree to which a platform grants external actors access to its technological interfaces, development resources and market participation (West, 2007; Gawer, 2014). Prior studies conceptualize openness as a strategic and governance-related design choice that shapes the balance between distributed innovation and platform control (Gawer, 2014; Tiwana, 2014). By lowering entry barriers and enabling third-party participation, openness can stimulate innovation, expand the variety of complementary offerings and strengthen indirect network effects (Boudreau, 2010; Parker, Van Alstyne & Jiang, 2017). At the same time, openness is not a single “switch”: platforms can selectively open some layers (for example, interfaces or development toolkits) while constraining others (like certification or data policies), making openness a multidimensional governance mechanism (West, 2007; Tiwana, 2014). Smart home platforms provide a concrete illustration of how these mechanisms operate at the product level. Major smart home ecosystems such as Amazon Alexa, Google Home, and Apple HomeKit expand by enabling device manufacturers to integrate products through standardized interfaces and compatibility programs, thereby increasing the pool of complementary devices and reinforcing ecosystem value through interoperability and

integration breadth (Gawer, 2014). For instance, Amazon's ecosystem provides technical resources for smart home integration and compatibility pathways via its developer services and programs, supporting product integration through standardized interfaces and certification-oriented governance (Amazon Developer Documentation). Similarly, Google's smart home ecosystem supports integration approaches such as cloud-to-cloud connectivity, which aims to facilitate interoperability across heterogeneous devices through shared technical specifications and developer-facing tooling (Google Home / Smart Home developer documentation). These examples show openness in practice as a product-relevant architecture and governance design that shapes how many devices can connect, how integration occurs, and how ecosystem variety and coordination scale.

While openness is often discussed as an ecosystem-level driver of innovation and complement variety, it is also expected to matter for consumer perceived value because consumers increasingly adopt and evaluate "systems" rather than isolated devices (Tiwana et al., 2010; Hein et al., 2020). In smart home settings, product usefulness depends strongly on compatibility, automation possibilities, and smooth coordination across devices and services (Tiwana et al., 2010; Hein et al., 2020). From a consumer perspective, platform openness may simultaneously generate benefits, such as interoperability, flexibility, and personalization, and sacrifices, including complexity, uncertainty, and concerns related to control and security (West, 2007; Boudreau, 2010; Tiwana, 2014). In line with Zeithaml's (1988) conceptualization of perceived value and the Value-Based Adoption Model, consumer value emerges from a trade-off between perceived benefits and perceived sacrifices (Kim et al., 2018). However, openness can also introduce limitations: highly open ecosystems may increase configuration effort, expand the space of potential failures, and create governance concerns like inconsistent quality across complements, fragmented user experience, or perceived exposure of data and permissions (Boudreau, 2010; Tiwana, 2014). Therefore, openness is theoretically ambivalent: it can increase value by enabling integration and variety, but it can also reduce value if it increases uncertainty or complexity at the system level.

Despite its central role in platform theory, the consumer-level implications of platform openness remain insufficiently developed in the existing literature. Prior research has predominantly examined platform openness from a supply-side perspective, focusing on innovation incentives, ecosystem governance, boundary control, and firm-level strategic outcomes (Gawer, 2014; Boudreau, 2010; Parker, Van Alstyne & Jiang, 2017). In parallel,

studies on technology adoption and user experience have largely concentrated on individual technologies or products, emphasizing constructs such as perceived usefulness, ease of use, trust, and privacy concerns (Davis, 1989; Venkatesh et al., 2012). As digital platforms increasingly operate as ecosystem orchestrators that coordinate interactions among multiple complementary offerings, consumers are no longer evaluating isolated products but integrated systems composed of interconnected devices and services (Tiwana et al., 2010; Hein et al., 2020). This shift reveals a critical gap: although platform openness is widely recognized as a driver of ecosystem expansion, how platform openness translates into consumer perceived value at the ecosystem level remains theoretically underexplored and empirically insufficient. Building on this gap, the first research question is:

**RQ1: What is the relationship between platform openness and consumer perceived value in platform-based ecosystems?**

A second gap concerns the assumption that consumer responses to openness are homogeneous across contexts. The effects of platform openness on consumer perceptions are unlikely to be uniform across national contexts. Prior comparative research suggests that European consumers, including those in Italy, tend to exhibit heightened sensitivity to privacy, system control and installation complexity (Balta-Ozkan et al., 2013), reinforced by regulatory regimes such as the GDPR and the Digital Markets Act. By contrast, research in Japan indicates a markedly different orientation. Government initiatives such as the Ministry of Internal Affairs and Communications' White Paper on Society 5.0 describe a national vision in which technological integration, automation and data sharing support social well-being and efficiency. Japanese consumers often display higher trust in digital infrastructures and interpret automation positively, viewing technology as an extension of reliability and social care. These structural and cultural differences imply that openness may hold different meanings and value implications across countries. Yet, systematic cross-national analyses of how consumers perceive platform openness in smart homes remain scarce. This gap motivates the second research question:

**RQ2: How do the effects of platform openness on consumer perceived value differ between national contexts, specifically between Italy and Japan?**

This study aims to advance platform research by linking platform openness, conceptualized as a multidimensional governance construct, to consumer perceived value at the ecosystem level, and by explicitly examining the role of cultural differences in shaping consumer responses to

openness. Specifically, this study examines how platform openness shapes consumer perceived value in smart home ecosystems and how these effects differ across national contexts, with a focus on Italy and Japan. To address these objectives, the study adopts a cross-national comparative research design and uses smart home platforms as an empirical setting in which platform openness can be observed at the product level. The empirical analysis draws on product-level data collected from Amazon Italy and Amazon Japan and operationalizes platform openness through multiple dimensions (including access to data, interfaces, development resources, and entry conditions), which are then linked to consumer evaluations using regression-based models. By combining an ecosystem governance perspective with a consumer-value outcome and a comparative design, the study provides a structured empirical approach to assessing openness not only as an ecosystem expansion mechanism but also as a potential driver (or limiter) of perceived value in platform-based environments (West, 2007; Gawer, 2014).

## **1.2 Overview of the study**

The research subject of this study is the relationship between platform openness and consumer perceived value in platform-based ecosystems, with a specific focus on smart home platforms. Smart home ecosystems are chosen as the empirical setting because they represent a mature and rapidly expanding segment of the digital platform economy in which platform governance characteristics are directly reflected at the product level. Smart home products derive much of their functionality and value from their integration with digital platforms, such as voice assistants and home automation ecosystems, rather than from isolated device features. As a result, platform-related characteristics such as interoperability, compatibility, access to data, and integration conditions are explicitly communicated to consumers and observable through product descriptions and technical specifications. This makes the smart home industry particularly suitable for studying platform openness in practice. Moreover, smart home platforms involve multiple actors, including platform owners, device manufacturers, developers, and end users, and therefore exemplify the ecosystem logic emphasized in platform theory. Using smart homes as the research subject allows platform openness to be examined empirically while remaining theoretically grounded in broader platform research.

The empirical analysis is based on product-level data collected from Amazon Italy and Amazon Japan, two national marketplaces that provide highly standardized and comparable product information. The final dataset consists of 502 smart home products, covering a wide range of device categories and platform ecosystems. For each product, data were manually collected on platform compatibility, supported standards and integration features, price, product characteristics, and consumer evaluations in the form of product ratings. Platform openness is operationalized as a multidimensional construct encompassing user data openness, interface openness, developer tools openness, and market entry openness, and these dimensions are mapped to products based on declared platform compatibility. Using multivariate regression models, the analysis indicates that platform openness is not uniformly associated with consumer perceived value across dimensions or national contexts. In the pooled sample, several openness dimensions show limited or non-significant relationships with consumer ratings, suggesting that openness cannot be treated as a single, homogeneous construct. When national context is taken into account, clearer cross-country differences emerge. Some openness dimensions are evaluated more positively in one country than in the other, while others show little variation across contexts. Overall, the findings suggest that the relationship between platform openness and consumer perceived value depends both on the specific openness dimension considered and on the national context in which consumers evaluate platform-based ecosystems.

The novelty of this study lies in its integration of platform governance theory with consumer perceived value in a cross-national empirical setting. While prior research has extensively examined platform openness from the perspective of firms, innovation incentives, and ecosystem governance, consumer-level implications have remained comparatively underexplored. This study addresses this gap by conceptualizing platform openness as a multidimensional construct and empirically linking its dimensions to consumer evaluations at the ecosystem level rather than at the level of isolated products. Furthermore, by adopting a comparative design between Italy and Japan, the study moves beyond assumptions of homogeneous consumer responses and explicitly examines how national context moderates the effects of platform openness. This contributes to the growing literature on digital ecosystems by demonstrating that openness-related value creation is context-dependent and shaped by institutional and cultural environments. From a practical perspective, the findings offer insights for platform owners and complementors by highlighting that increasing openness does not automatically enhance consumer perceived value and that different openness strategies may be more or less effective depending on the market context. Overall, the study advances

understanding of how platform design choices translate into consumer value and provides a structured empirical framework for future research on platform openness and user outcomes.

### **1.3 Structure of the thesis**

This thesis is structured as follows. Chapter 1 introduces the research background and motivation of the study. It outlines the rise of digital platforms and the increasing relevance of platform openness as a governance mechanism, highlights the theoretical and empirical gaps regarding consumer perceived value, and formulates the two research questions that guide the analysis. The chapter also presents an overview of the study, describes the empirical setting, and explains the overall structure of the thesis.

Chapter 2 develops the theoretical foundation of the thesis. It reviews the literature on platform ecosystems, platform architecture, and platform governance, with particular emphasis on the concept of platform openness and its multidimensional nature. The chapter then introduces Hofstede's cultural dimensions theory and applies it to a comparative discussion of Japan and Italy. Building on these theoretical perspectives, the chapter concludes with the development of testable hypotheses linking platform openness to consumer perceived value in different national contexts.

Chapter 3 describes the research design and methodology. It explains the selection of smart home platforms as the empirical setting, the rationale for choosing Italy and Japan, and the data collection process based on Amazon marketplaces. The chapter also details the construction of dependent, independent, moderating, and control variables and presents the empirical models and estimation strategy used in the analysis.

Chapter 4 reports the empirical results. It presents the main regression findings, discusses hypothesis testing outcomes, and reports robustness checks to assess the stability of the results. Chapter 5 interprets the findings, discusses theoretical and practical contributions, and outlines limitations and directions for future research. Finally, Chapter 6 concludes the thesis by summarizing the main results and contributions.

## **CHAPTER 2 - Literature review and hypotheses development**

### **2.1 Platform ecosystems**

#### **2.1.1 Concept of platform ecosystem**

Digital platforms function as multi-sided ecosystems in which multiple categories of actors, platform sponsors, platform providers, complementors, and end users, interact through shared technological and governance structures (Gawer & Cusumano, 2014; Tiwana et al., 2010). Before examining more advanced characteristics of these ecosystems, it is useful to clarify what distinguishes platforms from traditional forms of organization and why they have become a dominant structure for value creation in the digital economy. As described by Eisenmann, Parker, and Van Alstyne (2006, 2009), a digital platform is an online infrastructure that enables interactions and exchanges of information, goods, or services among multiple user groups, typically producers, consumers, and other stakeholders. What fundamentally distinguishes platforms from traditional linear business models is that value creation does not rely on the internal production of goods or services, but on the orchestration of interactions among independent actors whose participation is interdependent (Rochet & Tirole, 2003; Parker, Van Alstyne & Jiang, 2017). From this perspective, platform value does not originate solely from the technological core but emerges from the continuous participation of external contributors, who supply complementary products and services that extend the platform's overall functionality. Hein et al. (2020) emphasize that platforms derive value from the size, diversity, and engagement of their participant communities rather than from proprietary technologies alone. Without sustained participation by complementors and users, even technologically advanced platforms struggle to generate meaningful economic or experiential value.

At the core of platform ecosystems lie specific operation mechanisms that distinguish them from other organizational forms. One central mechanism is modularity. Modularity refers to the decomposition of complex systems into loosely coupled components connected through standardized interfaces, allowing complementors to innovate independently without altering the platform core (Baldwin & Clark, 2000; Tiwana et al., 2010). Through modular architectures, platforms lower entry barriers for external innovators, expand the range of complementary offerings, and accelerate ecosystem growth. At the ecosystem level, modularity supports

generativity, defined as the capacity of a platform to enable unprompted, heterogeneous, and combinatorial innovation by distributed actors (Yoo et al., 2010; Tiwana, 2014). This generativity has been widely recognized as a key driver of platform competitiveness and long-term sustainability (Cennamo & Santaló, 2019). However, increased modularity and ecosystem expansion do not automatically translate into value realization. Tiwana (2014) argues that excessive fragmentation and weak coordination can undermine system usability and coherence. From a consumer perspective, modularity may shift part of the coordination and integration burden from the platform to the user, requiring individuals to evaluate compatibility, configure interactions among components, and manage system complexity. In addition to modularity, platform ecosystems are shaped by network effects, whereby the value of the platform increases as more participants join the system (Rochet & Tirole, 2003). Indirect network effects are particularly salient: an increase in complementors enhances value for users, which in turn attracts additional complementors. While these dynamics help explain rapid scaling and market dominance, prior studies emphasize that ecosystem size alone does not guarantee positive user experiences. As platforms expand, increasing diversity among complements may intensify coordination challenges, making the quality of interaction among components more important than sheer quantity (Gawer, 2014).

Building on these foundational characteristics, prior research has proposed several classifications of digital platforms based on their primary function and ecosystem structure. A widely used distinction differentiates transaction platforms from innovation platforms (Gawer & Cusumano, 2014). Transaction platforms primarily facilitate exchanges between distinct user groups by reducing search and transaction costs, whereas innovation platforms provide technological foundations upon which complementors develop new products and services. These distinctions are consistent with earlier work on multi-sided platforms and network effects (Eisenmann, Parker, & Van Alstyne, 2006; 2009). Other classifications emphasize governance intensity and degrees of openness and control (Eisenmann et al., 2009; Parker, Van Alstyne & Jiang, 2017). Some platforms adopt relatively open strategies that encourage broad third-party participation, while others maintain tightly controlled ecosystems to ensure quality, security, or consistency. These classifications highlight that platforms are heterogeneous organizational forms and that their outcomes depend critically on design and governance choices rather than on technological infrastructure alone (Eisenmann, Parker & Van Alstyne, 2009; Tiwana, 2014; Gawer, 2014). Understanding these differences is essential for analyzing how platforms evolve and how their structural characteristics shape ecosystem behavior.

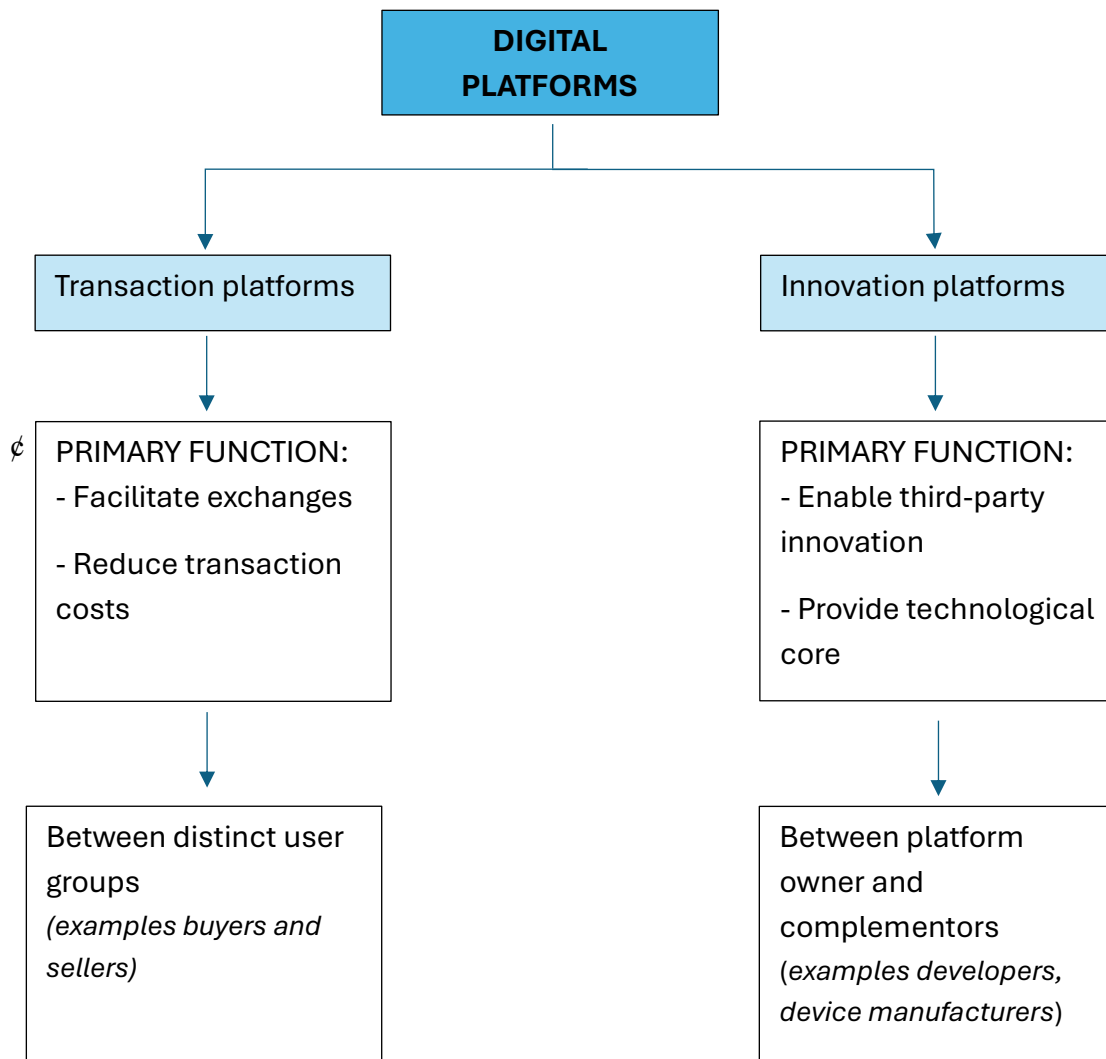


Figure 1 - Classification of digital platforms: transaction platforms vs innovation platforms.

Central to the analysis of platform ecosystems is the concept of platform architecture. Platform architecture refers to the structural arrangement of core components, peripheral complements, and interfaces that together enable interaction, innovation, and coordination within the ecosystem (Baldwin & Woodard, 2009). Platforms are commonly conceptualized as systems composed of a stable core surrounded by a modular periphery that enables distributed and parallel innovation (Henderson & Clark, 1990; Baldwin & Woodard, 2009).

Boundary resources, such as application programming interfaces (APIs), software development kits (SDKs), and technical documentation, play a critical role in linking the core and the periphery by defining how external actors can access platform functionalities without

compromising system integrity (Ghazawneh & Henfridsson, 2013; Tiwana, 2014). Through architectural design, platforms determine not only the scope of innovation but also the degree of interoperability, integration effort, and coordination required across components. As a result, platform architecture shapes both ecosystem growth dynamics and the quality of system-level outcomes experienced by users.

Beyond their architectural characteristics, digital platforms are also distinguished by governance mechanisms that regulate participation, innovation, and access to core resources. Platform governance refers to the rules, standards, certification processes, and control mechanisms through which platform sponsors coordinate ecosystem interactions (Boudreau & Hagiu, 2009; Tiwana, 2014). Governance is implemented through instruments such as technical standards, review procedures, access policies, and certification programs. Recent research highlights the importance of boundary resources as key governance tools that balance openness and control within platform ecosystems (Ghazawneh & Henfridsson, 2013; Tiwana, 2014). By carefully calibrating access to interfaces and development resources, platforms shape innovation incentives, complement diversity, and ecosystem stability. Governance choices therefore influence not only firm-level outcomes but also the overall structure, coherence, and long-term evolution of platform ecosystems (West, 2007; Boudreau, 2010).

Despite extensive research on these systems, several shortcomings remain. First, much of the existing literature focuses on firm-level outcomes such as innovation performance, market dominance, and ecosystem growth, while paying comparatively limited attention to user- or consumer-level consequences (Gawer, 2014; Parker, Van Alstyne & Jiang, 2017). Second, ecosystem expansion and modular variety are often treated as inherently beneficial, without sufficiently accounting for coordination costs, system complexity, and experiential challenges that may arise as ecosystems scale (Tiwana, 2014; Tang & Inoue, 2021). Finally, platform ecosystem research frequently adopts a context-neutral perspective, implicitly assuming that architectural and governance mechanisms generate similar effects across markets. This leaves open important questions regarding how platform design choices are interpreted and experienced by users in different institutional environments. These gaps point to the need for research that links platform ecosystem characteristics, particularly platform openness, to consumer perceived value.

## 2.1.2 Platform openness

Following the discussion of platforms as digital ecosystems, it is crucial to examine one of the key factors shaping their evolution and performance: platform openness. While the concept of openness is frequently invoked in discussions of digital platforms, its meaning and implications are not always immediately clear, particularly with respect to how platforms coordinate innovation, participation, and control. Platform openness has therefore emerged as a central analytical construct for understanding how digital ecosystems develop and how value creation is organized across heterogeneous actors. Platform openness generally refers to the degree to which a platform grants external actors access to its technological resources, interfaces, data, and markets (West, 2007; Gawer, 2014). Rather than indicating a binary condition, openness represents a strategic and governance-related design choice that determines how authority and decision rights are distributed between platform owners and ecosystem participants (Gawer, 2014; Parker, Van Alstyne & Jiang, 2017). As emphasized by Gawer (2014), openness is a fundamental architectural and governance principle that shapes how ecosystems expand, innovate, and allocate control. Importantly, openness does not simply imply transparency or unrestricted access. Instead, it reflects deliberate choices about which components of the platform are exposed, under what conditions, and to whom. Platforms may open certain layers, such as interfaces or development tools, while retaining tight control over others, such as data governance, certification, or pricing rules (Tiwana, 2014; West, 2007). As a result, openness should be understood as a multidimensional and configurable property of platform ecosystems rather than a single, uniform attribute.

Across platform ecosystems, openness functions as a structural mechanism that defines the boundary conditions for participation (Gawer, 2014; West, 2007). It determines who can access platform resources, how interfaces are disclosed, how development rights are allocated, and how value creation opportunities are distributed between platform sponsors and complementors. Eisenmann, Parker, and Van Alstyne (2006, 2009) highlight that openness shapes participation on both sides of the platform, influencing the extent to which complementors can innovate and users can adopt interoperable solutions. At a more granular level, existing research suggests that platform openness should not be treated as a single, uniform condition, but rather as a multidimensional construct encompassing distinct mechanisms through which access and participation are enabled (Gawer, 2014; Parker, Van

Alstyne & Jiang, 2017). Building on this perspective, platform openness can be differentiated along four complementary dimensions.

First, **user data openness** concerns the extent to which user- and device-related data can be accessed, shared, and reused within the ecosystem. Based on research on platform governance and data governance in digital ecosystems, this study defines user data openness as a controlled form of data accessibility that determines who can access which user-related data, under what conditions, and for which purposes (Gawer, 2014; Tiwana, 2014; Janssen, Charalabidis, Y., & Zuiderwijk, A. 2012). In digital platform environments, user data constitute a critical resource that enables personalization, automation, learning effects, and continuous service improvement. Rather than being limited to raw information, user data encompass a broad set of behavioral, contextual, and operational signals that emerge from ongoing interactions between users, devices, and the platform infrastructure. This definition is consistent with research on data governance and open data infrastructures, which emphasizes that data openness does not imply unconditional access, but rather structured sharing mechanisms based on explicit rules designed to balance innovation, usability, and privacy concerns (Janssen, Charalabidis, Y., & Zuiderwijk, A. 2012). Within platform ecosystems, these governance arrangements influence how data-related responsibilities and rights are allocated, ultimately affecting both innovation processes and users' perceptions of reliability and control.

Second, **interface openness** captures the availability and variety of functional and interaction interfaces through which actors interact with the platform. Interface openness operates at the interaction layer of the platform, shaping how actions, commands, and information flows are executed across devices and services. In platform architecture and governance research, interfaces represent critical boundary points that mediate coordination between heterogeneous actors and components (Gawer, 2014; Baldwin & Woodard, 2009). An open interface architecture allows multiple devices, applications, and services to invoke platform functions in standardized and transparent ways, thereby enabling interoperability, automation, and flexible system configuration. Prior research shows that architectural openness at the interface level directly affects whether and how complementors and users can interact with a platform without excessive technical or procedural constraints, thereby influencing ecosystem growth and usability (Anvaari & Jansen, 2010; Boudreau, 2010). From a governance perspective, exposing such interfaces in a standardized and well-documented manner reduces interaction costs and mitigates ecosystem fragmentation, whereas excessive restriction may limit usability and

constrain system-level value realization (Boudreau, 2010; Tiwana, 2014). Existing studies further emphasize that open and interoperable interfaces allow innovation and configuration to become more modular, as different actors can independently develop and combine compatible components without requiring direct coordination with the platform owner (West, 2007). At the same time, greater interface openness may increase interaction complexity, requiring users to navigate multiple control options or overlapping functionalities, thereby increasing cognitive load (Tiwana, 2014).

Third, **developer tools openness** reflects the degree to which platforms provide technical resources that support third-party innovation, such as allowing developers, manufacturers and service providers, to access its technological resources. In platform governance research, these resources are commonly described as boundary resources, a concept introduced by Ghazawneh and Henfridsson (2013) to capture the interfaces through which complementors interact with a platform's core architecture. In practice, these resources typically include standardized development interfaces and support mechanisms such as application programming interfaces (APIs), software development kits (SDKs), data access rules, and developer guidelines that regulate external access to platform functionalities while maintaining governance oversight. These boundary resources define how complementors can interact with the platform's core without compromising system integrity. A substantial body of research on digital ecosystems shows that open development environments reduce innovation costs, stimulate third-party creativity and accelerate the emergence of compatible products and services. In his analysis of open platform strategies, Boudreau (2010) demonstrates that granting controlled access to development resources encourages experimentation and increases innovation variety. Similarly, Parker, Van Alstyne and Jiang (2017) highlight that lowering development barriers facilitates complementor entry and expands ecosystem functionality. At the same time, prior research also emphasizes that greater development openness raises coordination requirements and governance challenges, as increasing numbers of heterogeneous complements must be aligned with platform standards and quality expectations (Tiwana, 2014). From a consumer perspective, developer tools openness indirectly shapes perceived value by influencing the diversity, performance, and compatibility of complementary offerings available within the ecosystem. When development resources are accessible and well-documented, external actors are more likely to introduce innovative and specialized functionalities, which may enhance perceived usefulness, system richness, and long-term platform attractiveness (Boudreau, 2010; Cennamo & Santalo, 2019). However, development openness may also expose consumers to

potential downsides, such as inconsistent integration quality, software instability, or security vulnerabilities, particularly when governance mechanisms are weak or unevenly enforced (Tiwana, 2014).

Fourth, **market entry openness** concerns the rules and procedural conditions governing entry into the ecosystem. In platform markets, reducing entry barriers is a strategic mechanism to stimulate innovation, broaden product variety, increase competition and accelerate the overall expansion of the ecosystem. Platform theory emphasizes that when complementors can enter more easily, they enrich the platform's value proposition by introducing diverse functionalities, price levels and design alternatives, thereby enhancing consumer choice and ecosystem attractiveness (Eisenmann, Parker & Van Alstyne, 2009; Parker, Van Alstyne & Jiang, 2017). Prior research shows that market entry dynamics play a crucial role in shaping platform growth. By reducing entry barriers, platforms encourage organic participation and lower innovation costs for complementors, activating positive feedback loops in which increased product availability attracts more users, which in turn further stimulates complementor entry. This mechanism reinforces indirect network effects and supports long-term ecosystem development (Rochet & Tirole, 2003; Eisenmann, Parker & Van Alstyne, 2009). Broader research on multi-sided platforms further highlights that different forms of openness related to access for new participants strongly influence platform competitiveness and market potential. When platforms facilitate entry for external firms, the resulting increase in product and service variety tends to strengthen indirect network effects and enhance the perceived attractiveness of the ecosystem. Conversely, when entry is highly restricted, innovation may slow, complementary offerings become more limited, and ecosystem growth is constrained (Eisenmann, Parker & Van Alstyne, 2009; Parker, Van Alstyne & Jiang, 2017).

A substantial body of research highlights the advantages of platform openness for ecosystem development and innovation. By lowering entry barriers and enabling third-party participation, openness stimulates innovation variety and accelerates the introduction of complementary products and services (Boudreau, 2010). Open platforms allow specialized complementors to contribute niche functionalities, thereby expanding the functional scope and adaptability of the ecosystem. From an architectural perspective, openness supports modularity and interoperability, enabling components to evolve independently while remaining compatible with the platform core (Baldwin & Clark, 2000; West, 2007). This modular innovation structure enhances generativity, defined as the capacity of a platform to enable unprompted and

combinatorial innovation by distributed actors (Yoo et al., 2010; Tiwana, 2014). As the number and diversity of complements increase, platforms benefit from indirect network effects, whereby greater complement availability enhances user value, which in turn attracts additional complementors (Rochet & Tirole, 2003). Openness can also enhance ecosystem resilience and adaptability. Platforms that expose interfaces and development resources are better positioned to respond to technological change, as innovation efforts are distributed across multiple actors rather than centralized within the platform owner (Gawer, 2014). Over time, this distributed innovation capacity can strengthen platform competitiveness and long-term sustainability. For these reasons, openness is often associated with faster ecosystem growth, increased product diversity, and enhanced system-level value creation.

Despite these advantages, platform openness also introduces significant challenges. Allowing broad participation increases coordination complexity and may undermine system coherence if standards and governance mechanisms are weak (Tiwana, 2014). Excessive openness can lead to fragmentation, inconsistent quality across complements, and difficulties in ensuring reliable user experiences (Boudreau, 2010). From a governance perspective, openness may intensify competition among complementors, potentially reducing incentives for investment and innovation if returns become uncertain (West, 2007). Platforms must also manage risks related to security, data misuse, and intellectual property leakage when access to core resources is expanded. As a result, openness involves trade-offs between innovation, control, and quality assurance. Empirical research suggests that effective platform strategies typically lie between full openness and full closure. West (2007) argues that hybrid strategies, in which core components remain stable while interfaces and participation mechanisms are selectively opened, allow platforms to balance ecosystem growth with coordination and control. These trade-offs highlight that openness is not inherently beneficial, but must be carefully designed and governed to support sustainable value creation.

While much of the literature focuses on firm- and ecosystem-level outcomes, platform openness also has important implications for consumers. In platform-based systems, consumers increasingly evaluate integrated ecosystems rather than isolated products. Openness can enhance consumer value by enabling interoperability, flexibility, and personalization, allowing users to combine devices and services from different providers (Tiwana et al., 2010; Hein et al., 2020). At the same time, openness may impose cognitive and coordination costs on users. Highly open ecosystems can increase configuration effort, decision complexity, and uncertainty

regarding compatibility and quality (Boudreau, 2010; Tiwana, 2014). From a value-based perspective, openness therefore influences consumer perceived value through a trade-off between perceived benefits and perceived sacrifices (Zeithaml, 1988, Kim et al., 2018). Whether openness enhances or diminishes perceived value depends on how effectively platforms coordinate ecosystem components and reduce user-facing complexity.

Despite growing interest in platform openness, existing research exhibits several limitations. First, much of the literature conceptualizes openness at the platform or ecosystem level without systematically examining how different openness dimensions translate into consumer outcomes. Second, empirical studies often treat openness as a unidimensional construct, overlooking the distinct mechanisms through which data access, interfaces, development tools, and entry conditions shape value creation (Gawer, 2014; Parker, Van Alstyne & Jiang, 2017). Moreover, consumer-level implications of platform openness remain underexplored, particularly in comparative and cross-national contexts. Most studies implicitly assume homogeneous consumer responses, neglecting the possibility that openness-related benefits and costs may be perceived differently across institutional and cultural environments. This study addresses these gaps by conceptualizing platform openness as a multidimensional construct and empirically linking its dimensions to consumer perceived value in smart home ecosystems. By adopting a cross-national comparative design between Italy and Japan, the study further examines whether the effects of platform openness vary across national contexts, thereby contributing to a more nuanced understanding of openness as a context-dependent governance mechanism.

## 2.2 Hofstede's cultural dimensions theory

### 2.2.1 Introduction to Hofstede's cultural dimensions theory

Cross-national differences have long been recognized as a key factor shaping how individuals interpret, evaluate, and respond to technological and organizational systems. In this context, the concept of *national character* is used to describe the relatively stable set of shared cultural values, social norms, and cognitive orientations that characterize individuals within a given national society. National character does not refer to individual personality traits, but rather to collective patterns of thinking and behavior that emerge through shared historical experiences, social institutions, education systems, and cultural norms (Hofstede, 2001; House et al., 2004). These shared orientations influence how individuals perceive authority, uncertainty, cooperation, and long-term outcomes, thereby shaping attitudes toward technology, organizations, and governance structures (Hofstede, 2001; Straub, Loch & Hill, 2001). The foundations of the national character concept can be traced back to early cultural and sociological research on value systems. Kluckhohn and Strodtbeck (1961) were among the first scholars to conceptualize culture as a system of shared value orientations that guide perception, evaluation, and behavior at the societal level. Their framework emphasized that societies differ systematically in how they resolve fundamental problems related to human nature, social relations, time orientation, and activity patterns. Building on this perspective, Hofstede (2001) later formalized and operationalized the concept of national culture, defining it as the “collective programming of the mind” that distinguishes the members of one nation from another. Through large-scale cross-national empirical research, Hofstede developed a systematic framework that allows national character to be compared across countries along a set of stable cultural dimensions. This work marked a major methodological advancement by translating abstract cultural values into measurable constructs that could be empirically analyzed and compared across national contexts.

Hofstede's cultural dimensions framework originated from an extensive empirical study conducted at IBM between the late 1960s and early 1970s, involving employees from more than 70 countries. By analyzing differences in attitudes and work-related values across national subsidiaries, Hofstede identified recurring patterns that could not be explained by organizational factors alone. Instead, these patterns reflected deeper, nationally shared value structures. Over time, Hofstede's original four-dimensional model was refined and expanded

through subsequent empirical research, eventually resulting in a six-dimensional framework (Hofstede, 2001; Hofstede & Minkov, 2010). This framework has since become one of the most widely used and influential approaches for analyzing cross-national differences in attitudes, decision-making, and behavior in fields such as international business, organizational studies, marketing, and information systems.

National character has been extensively applied in international business and information systems research to explain variation in how individuals evaluate and adopt technologies. Prior studies show that cultural orientations influence trust in technological systems, sensitivity to risk and uncertainty, expectations toward standardization and control, and perceptions of value (Straub, Loch & Hill, 2001). As digital and platform-based systems increasingly operate across national borders, the relevance of cultural frameworks capable of capturing systematic cross-country differences has become even more pronounced. To systematically capture national character differences, this study adopts Hofstede's cultural dimensions framework as its primary analytical lens. Hofstede's model conceptualizes national culture along six dimensions: Power Distance (PDI), Individualism versus Collectivism (IDV), Masculinity versus Femininity (MAS), Uncertainty Avoidance (UAI), Long-Term Orientation (LTO), and Indulgence versus Restraint (IVR). Each dimension reflects a distinct societal tendency that influences how individuals reason, behave, and evaluate technological systems:

Power Distance Index (PDI) describes the extent to which inequality and hierarchical decision-making are accepted in a society (Hofstede, 2001; Hofstede & Minkov, 2010). This dimension captures how power is distributed and legitimized within social and organizational structures, reflecting whether authority relationships are perceived as natural and desirable or as something that should be questioned and minimized (House et al., 2004; Dorfman et al., 2012). When PDI is high, people tend to accept hierarchical structures as normal, expect centralized authority, and are comfortable with authority control. Decision-making processes in high-PDI societies are typically concentrated at the top of organizations, and individuals are less likely to challenge superiors or established rules. Authority is often associated with responsibility and expertise, and unequal power relations are viewed as functional rather than problematic. By contrast, when PDI is low, people tend to want to have more equal social relations, to engage in more decentralized decision-making, and to prefer participative forms of governance (Kirkman, Lowe & Gibson, 2006). In such contexts, authority is more frequently questioned, and legitimacy is derived from consultation, transparency, and shared responsibility. These

differences influence how individuals relate to institutions, organizational governance, and technological systems that embed hierarchical or centralized control structures (Kirkman, Lowe & Gibson, 2006).

Masculinity versus Femininity (MAS) reflects the extent to which societies emphasize achievement, performance, and competition versus cooperation, care, and quality of life (Hofstede et al., 2010). This dimension captures dominant value orientations regarding success, social roles, and the evaluation of outcomes. In high-masculinity societies, success is often defined in terms of measurable performance, achievement, and material rewards. Competition is valued, and individuals are encouraged to strive for excellence and efficiency (Srite & Karahanna, 2006; House et al., 2004). Performance indicators, rankings, and technological superiority tend to be positively evaluated, and systems that enhance productivity and control are often perceived favorably. In lower-masculinity societies, by contrast, greater emphasis is placed on balance, well-being, and interpersonal relationships (Beugelsdijk et al., 2015). Cooperation, inclusiveness, and quality of life are prioritized over aggressive competition. In such contexts, usability, harmony, and social impact may be valued more strongly than sheer performance or efficiency. These differences influence how individuals assess organizational practices, technological systems, and innovation outcomes.

Uncertainty Avoidance (UAI) reflects the degree to which society members are conditioned to prefer predictable over unpredictable situations, to minimize risk, and to feel emotionally secure in structured rather than unstructured environments (Hofstede, 2001). This dimension captures societal tolerance for ambiguity, uncertainty, and change. Cultures with high Uncertainty Avoidance tend to exhibit stronger sensitivity to ambiguity, security risks, and system complexity (Doney, Cannon & Mullen, 1998; Venkatesh et al., 2012). In such contexts, rules, standards, and formal procedures play an important role in reducing uncertainty and providing psychological comfort. Individuals may exhibit lower tolerance for experimentation and greater concern for reliability, safety, and consistency (Doney, Cannon & Mullen, 1998). By contrast, cultures with low UAI are generally more comfortable with ambiguity, flexible rules, and evolving situations (House et al., 2004). Risk-taking and experimentation are more socially accepted, and individuals may be more willing to engage with novel or less structured systems. These differences shape how people respond to innovation, governance arrangements, and technological complexity.

Long-Term Orientation (LTO) represents the degree to which a society values long-term planning, adaptation, perseverance, and future-oriented behavior (Hofstede & Bond, 1988; Hofstede et al., 2010; Beugelsdijk et al., 2015). This dimension reflects how societies balance respect for tradition with openness to change and future investment. Cultures with high LTO emphasize learning, persistence, and strategic investments that ensure long-term stability and adaptability (Beugelsdijk et al., 2015). Decisions are evaluated based on their future consequences, and gradual improvement over time is valued. Individuals in such contexts may accept short-term sacrifices in exchange for long-term benefits. In contrast, low-LTO cultures tend to focus more strongly on immediate outcomes, tradition, and short-term performance. Stability is often associated with preserving established practices rather than adapting to future challenges. These orientations influence how individuals evaluate innovation, change, and long-term system evolution.

Indulgence versus Restraint (IVR) reflects the extent to which societies allow relatively free gratification of basic human desires related to enjoyment, pleasure, and freedom of choice (Hofstede et al., 2010). This dimension captures societal norms regarding self-control, regulation, and the expression of individual desires. In indulgent societies, individuals tend to place greater value on enjoyment, variety, and personal freedom. Leisure, self-expression, and exploration are socially accepted, and individuals may be more open to experimentation and choice diversity (Guo et al. 2018). Systems that enable customization and exploration may therefore be positively perceived. In restrained societies, gratification is more strongly regulated by social norms and expectations. Self-control, discipline, and adherence to rules are emphasized, and individuals may be more cautious toward excessive choice or novelty. These orientations shape how people evaluate flexibility, freedom, and system complexity.

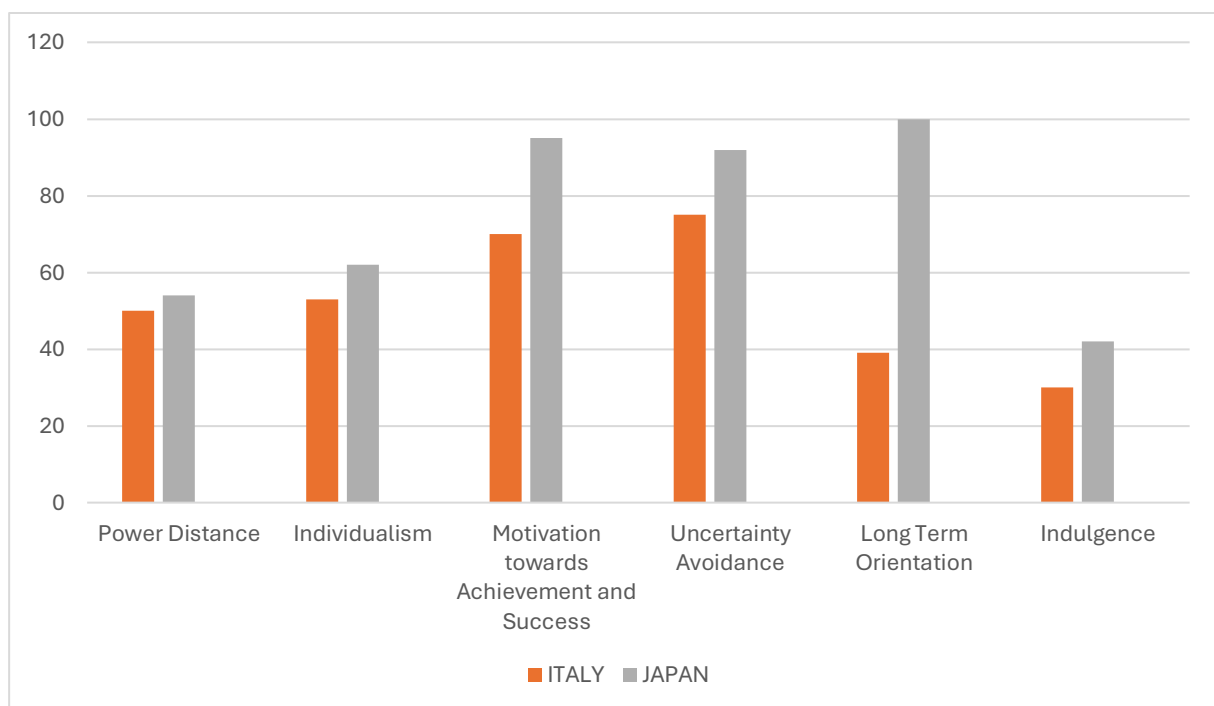
Despite its widespread use, Hofstede's cultural dimensions theory has been subject to several criticisms. One frequently cited limitation concerns its reliance on national-level averages, which may obscure within-country variation and individual differences (McSweeney, 2002). Culture is dynamic and context-dependent, and national scores may not fully capture evolving social values or subcultural diversity. Additionally, Hofstede's original data were collected several decades ago, raising questions about temporal validity in rapidly changing technological environments. Another critique concerns the potential risk of cultural determinism, whereby national culture is treated as a fixed explanatory factor rather than as one influence among many shaping individual behavior. Scholars have also noted that some

dimensions may overlap conceptually or interact in complex ways that are difficult to disentangle empirically (Beugelsdijk et al., 2015). Nevertheless, Hofstede's framework remains highly relevant for comparative research. Its strength lies in providing a systematic, transparent, and widely validated structure for analyzing cross-national differences at a macro level. Subsequent updates and extensions, including the addition of new dimensions and refinements by Hofstede and Minkov (2010), have strengthened its empirical robustness. As a result, Hofstede's model continues to be extensively applied in international business, information systems, and technology adoption research, particularly when the objective is to compare national contexts rather than individual behavior. In this study, the framework provides a theoretically grounded basis for analyzing how national culture shapes evaluations of complex socio-technical systems.

### **2.2.2 Personality comparison between Japan and Italy**

Understanding how consumers evaluate platform openness across countries requires a cultural framework capable of explaining systematic differences in attitudes toward innovation, risk, competition, and long-term system stability. Cross-national research in information systems and consumer behavior consistently shows that cultural orientations shape how individuals interpret technological complexity, governance arrangements, and value creation mechanisms (Hofstede, 2001; Straub, Loch & Hill, 2001; Srite & Karahanna, 2006). Building on Hofstede's cultural dimensions model, this section compares the cultural profiles of Japan and Italy in order to identify which dimensions are most relevant for interpreting cross-national differences in consumer perceptions of platform-based ecosystems. While both countries are technologically advanced and characterized by mature consumer markets, prior studies highlight that they exhibit distinct cultural orientations that influence how individuals evaluate performance, control, uncertainty, and future outcomes in digital systems (Beugelsdijk et al., 2015; Venkatesh et al., 2012). Hofstede's framework identifies six core cultural dimensions: Power Distance (PDI), Individualism (IDV), Masculinity (MAS), Uncertainty Avoidance (UAI), Long-Term Orientation (LTO), and Indulgence versus Restraint (IVR) (Hofstede, 2001; Hofstede & Minkov, 2010). Empirical comparative research suggests that cultural dimensions exert meaningful explanatory power primarily when national scores differ substantially, as small differences tend to have limited behavioral

implications (Beugelsdijk, Maseland & Van Hoorn, 2015). Following prior comparative studies, differences greater than ten points are typically considered analytically relevant. When comparing Japan and Italy, four dimensions exceed this threshold: Masculinity, Uncertainty Avoidance, Long-Term Orientation, and Indulgence versus Restraint. By contrast, Power Distance and Individualism display relatively similar scores across the two countries and therefore offer limited leverage for explaining variation in consumer responses. Accordingly, this section focuses on the four dimensions that exhibit the strongest divergence between Japan and Italy. Each dimension is examined in terms of how it shapes consumer attitudes toward performance, risk, flexibility, and future orientation, factors that are directly relevant to the evaluation of platform openness in smart home ecosystems. Rather than reiterating theoretical definitions, the analysis emphasizes comparative interpretation, highlighting how the same platform characteristics may generate different perceived benefits and sacrifices across national contexts. This comparative approach provides the foundation for linking platform openness to culturally contingent patterns of consumer perceived value.



*Figure 2 - Comparison of Hofstede's cultural dimensions between Italy and Japan.*

Masculinity (MAS) represents one of the most pronounced cultural differences between Japan and Italy. Japan scores significantly higher on masculinity than Italy, indicating a stronger cultural emphasis on achievement, competition, performance, and technological excellence. In high-masculinity contexts, success is often associated with efficiency, functional superiority, and visible performance outcomes. As a result, Japanese consumers may evaluate platform openness more positively when it enhances system capabilities, automation potential, and technological sophistication. In the context of smart home platforms, openness that enables advanced integrations, performance optimization, and expanded functionality may therefore align well with Japanese consumers' performance-oriented expectations. Platform openness that facilitates interoperability across devices and enables complex automation routines may be interpreted as a source of competitive and functional advantage. Italian consumers, by contrast, operate in a comparatively lower-masculinity context, where quality of life, balance, and usability tend to receive greater emphasis (Hofstede, 2001; Beugelsdijk et al., 2015). While performance remains important, excessive focus on technical complexity may not necessarily translate into higher perceived value. This divergence suggests that openness-related features that prioritize system power and extensibility may be more strongly valued in Japan, whereas in Italy the same features may be evaluated through a more cautious lens, particularly if they compromise simplicity or ease of use. Masculinity thus shapes how consumers trade off technological performance against experiential considerations when evaluating open platform ecosystems.

Uncertainty Avoidance (UAI) constitutes another major point of divergence between Japan and Italy, with both countries exhibiting relatively high scores but Japan scoring notably higher. High-UAI cultures are characterized by strong sensitivity to ambiguity, risk, and unpredictability, and they tend to favor structured environments governed by clear rules, standards, and safeguards (Doney, Cannon & Mullen, 1998; Venkatesh et al., 2012). In such contexts, consumers place high value on system reliability, security, and predictability. For Japanese consumers, high uncertainty avoidance implies that platform openness may generate ambivalent evaluations. While openness can enable flexibility and innovation, it may also introduce perceived risks related to data sharing, interoperability failures, and coordination complexity. Existing research shows that in high-UAI contexts, technologies are valued positively only when strong governance, reliability assurances, and clear standards are in place (Straub et al., 2001; Srite & Karahanna, 2006). Italian consumers, although also sensitive to uncertainty, tend to exhibit slightly greater tolerance for experimentation and

system variability (Beugelsdijk et al., 2015). This difference suggests that Japanese consumers may respond more negatively to openness configurations that appear loosely governed or poorly standardized, whereas Italian consumers may be somewhat more willing to accept experimentation and variation. In smart home ecosystems, where privacy, security, and operational stability are salient concerns, uncertainty avoidance plays a critical role in shaping how consumers perceive the trade-offs between openness and control.

Long-Term Orientation (LTO) represents a further dimension along which Japan and Italy differ substantially. Japan exhibits a very high long-term orientation, reflecting a strong emphasis on perseverance, future planning, and sustained investment in long-term outcomes. Italian culture, by contrast, is characterized by a more moderate orientation, balancing respect for tradition with shorter-term considerations (Beugelsdijk et al., 2015). This difference has important implications for how consumers evaluate platform openness. In high-LTO contexts such as Japan, consumers may place greater value on openness when it supports future-proof investments, ecosystem longevity, and compatibility with evolving technologies. Prior studies show that long-term oriented consumers are more willing to tolerate short-term learning costs or complexity if they perceive technologies as supporting sustained improvement and long-term benefits (Venkatesh et al., 2012; Beugelsdijk et al., 2015). Italian consumers, operating in a lower-LTO context, may place relatively greater emphasis on immediate usability and short-term benefits. Openness that promises future flexibility may be valued less if it introduces present-day complexity or uncertainty. Consequently, the same openness features may be interpreted as strategic investment in Japan but as unnecessary complication in Italy, highlighting the context-dependent nature of openness-related value creation.

Indulgence versus Restraint (IVR) further differentiates Japan and Italy in terms of attitudes toward enjoyment, choice, and self-expression. Italy scores higher on indulgence, indicating a cultural orientation that values variety, enjoyment, and freedom of choice. Japan, by contrast, is more restrained, emphasizing self-control, moderation, and adherence to social norms. These orientations influence how consumers perceive the experiential aspects of platform openness. In more indulgent contexts such as Italy, openness that expands choice, customization, and exploration may be positively associated with consumer perceived value (Guo et al., 2018). Consumers may appreciate the ability to experiment with different devices, services, and configurations, viewing openness as a source of enjoyment and personalization. In more restrained contexts such as Japan, however, excessive choice and customization may

be perceived as burdensome rather than liberating. The existing literature suggests that restrained cultures tend to prefer curated, well-integrated systems that limit unnecessary complexity (Minkov, 2011; Beugelsdijk et al., 2015). As a result, openness emphasizing breadth and variety may be evaluated less positively unless accompanied by strong guidance and simplification mechanisms. IVR thus shapes whether openness is experienced as empowering or overwhelming.

While Power Distance (PDI) and Individualism (IDV) are central components of Hofstede's framework, they exhibit relatively limited score differences between Japan and Italy. Both countries display moderate levels of power distance and a mix of individualistic and collectivist tendencies, reducing the explanatory power of these dimensions for the present comparative analysis. As a result, PDI and IDV are not emphasized as primary drivers of cross-national variation in consumer responses to platform openness. Although these dimensions may still shape general attitudes toward authority and autonomy, their limited divergence suggests that they are unlikely to account for systematic differences in perceived value between the two countries. Focusing on dimensions with stronger empirical divergence allows the analysis to remain parsimonious and theoretically grounded.

Taken together, the comparison between Japan and Italy highlights that cultural differences shape how consumers interpret the benefits and sacrifices associated with platform openness. Masculinity influences the relative importance of performance versus usability, uncertainty avoidance shapes sensitivity to risk and governance, long-term orientation affects evaluations of future-proof investments, and indulgence versus restraint conditions responses to choice and flexibility (Hofstede, 2001; Srite & Karahanna, 2006; Beugelsdijk et al., 2015). These dimensions provide a coherent cultural framework for understanding why identical platform openness configurations may generate different consumer evaluations across national contexts. By linking cultural orientations to openness-related mechanisms such as interoperability, complexity, control, and variety, this section establishes the theoretical foundation for the hypotheses developed in the next chapter. Rather than treating platform openness as a universally valued attribute, the analysis underscores its context-dependent nature and motivates a comparative empirical examination of consumer perceived value in smart home ecosystems.

## 2.3 Hypothesis development

Building on the preceding theoretical discussion, this section develops hypotheses on the relationship between platform openness and consumer perceived value in Italy and Japan. Platform openness is treated as a multidimensional construct composed of four distinct dimensions, user data openness, interface openness, developer tools openness, and market entry openness, each reflecting a different mechanism through which platforms enable access, interaction, and participation. Because these mechanisms involve different benefit–sacrifice trade-offs for consumers, their effects on perceived value are expected to vary across openness dimensions (Zeithaml, 1988). Moreover, cross-national differences in cultural orientations provide theoretical grounds to expect systematic variation in how these openness dimensions are evaluated in Italy and Japan.

### 2.3.1 User data openness (Userdataopen)

User data openness refers to the degree to which a platform allows access to, reuse, and interaction with different categories of user-related data generated within the ecosystem. From a consumer perspective, user data openness is primarily experienced through the extent to which the ecosystem can “learn” from users and adapt to their routines, preferences, and context. Prior research on smart home technologies and data-driven services shows that consumers associate cross-device data integration with higher perceived usefulness, improved automation quality, and stronger perceptions of system intelligence, particularly when platforms are able to learn and adapt over time (Balta-Ozkan et al., 2013; Wilson, Hargreaves & Hauxwell-Baldwin, 2015; Shin, 2019). In line with value-based frameworks such as Zeithaml’s (1988) conceptualization of perceived value and the Value-Based Adoption Model, consumer perceived value emerges from a trade-off between perceived benefits and perceived sacrifices. On the benefit side, user data openness can enable more adaptive and convenient experiences, because data portability or data reuse across services can support personalization, continuity of use, and automation that better fits household routines. Consumers may perceive such outcomes as higher usefulness, reduced effort, and improved system responsiveness. On the sacrifice side, user data openness can generate privacy concerns, surveillance perceptions, unclear responsibility for data handling, and reduced

control over what information is collected and how it is used. Even when the platform provides advanced functionality, consumers may discount benefits if they perceive risks as high or governance as opaque.

This benefit–sacrifice trade-off is expected to differ systematically between Japan and Italy because consumers in the two countries differ in cultural orientations that shape their sensitivity to risk and their temporal orientation toward long-term system learning. Japan scores substantially higher than Italy on Uncertainty Avoidance (UAI) and Long-Term Orientation (LTO), indicating a stronger preference for predictable, well-governed environments and a greater emphasis on long-term outcomes (Hofstede Insights, 2023; Hofstede, 2001). Uncertainty Avoidance reflects how strongly consumers prefer predictable, reliable, and low-risk technological environments, and high-UAI contexts are typically more sensitive to ambiguity and perceived exposure (Venkatesh et al., 2012; Doney, Cannon & Mullen, 1998). Applied to user data openness, this implies that Japanese consumers may place greater weight on the “risk” side of data sharing, particularly concerns about control, misuse, or unclear accountability, unless the platform provides transparent and credible safeguards. In contrast, Italian consumers, while not indifferent to privacy and risk, may show relatively lower sensitivity to ambiguity and may be more willing to accept some uncertainty if the system’s convenience benefits are salient. At the same time, Long-Term Orientation shapes how consumers evaluate the future implications of data practices. LTO captures attitudes toward long-term system evolution, learning, and future-proof investments (Beugelsdijk et al., 2015). In higher-LTO contexts such as Japan, consumers may evaluate data-driven learning more positively because they value gradual improvement and future benefits from adaptive systems. This can increase the perceived upside of user data openness, as consumers may interpret data reuse across services as enabling long-term personalization quality, system refinement, and continuous improvement. In Italy’s more moderate LTO context, immediate usability and short-term outcomes may weigh more heavily, which can reduce the marginal value of long-term learning benefits if they are not immediately visible. Japan and Italy therefore differ in the cultural drivers that shape how consumers weigh convenience versus control and present versus future benefits when evaluating data-intensive smart home ecosystems. These differences suggest that identical levels of user data openness may lead to systematically different consumer value assessments across the two countries. Based on this reasoning, this study proposes the following hypothesis.

*H1. User data openness has a stronger positive effect on consumer perceived value for Japanese consumers than for Italian consumers.*

### **2.3.2 Interface openness (Interfaceopen)**

Interface openness refers to the degree to which a platform exposes and makes accessible the functional interfaces through which users, devices, and services interact with the platform's core functionalities. From the consumer perspective, interface openness is experienced as the availability of interaction pathways that allow devices to communicate, routines to be built, and automations to be triggered in a way that feels coherent at the household level. Prior research on smart home adoption and interoperability highlights that consumers derive value not merely from the presence of multiple devices, but from the extent to which these devices can be seamlessly coordinated through stable and intelligible interaction interfaces (Shin, 2019; Wilson, Hargreaves & Hauxwell-Baldwin, 2015). In smart home systems, perceived value depends strongly on whether consumers can actually realize interoperability in practice: whether a device can be controlled reliably, whether it can coordinate with other devices, and whether routines can be configured without friction. In value-based terms, consumers evaluate interface openness through a trade-off between perceived benefits and perceived sacrifices (Zeithaml, 1988). More open and accessible interaction interfaces can increase perceived benefits by enabling broader compatibility, smoother automation, and flexible configuration options that fit different lifestyles. However, interface openness can also increase perceived sacrifices when a highly open interaction layer produces multiple overlapping control options, inconsistent interaction patterns across brands, or an increased configuration burden. Consumers may face cognitive load when deciding among alternative routines, triggers, and integration pathways, especially if the ecosystem lacks intuitive guidance. The same openness feature can therefore be experienced either as "freedom" (more possibilities) or as "work" (more coordination and effort).

The consumer-level interpretation of this trade-off is expected to differ between Japan and Italy because consumers in the two countries differ in cultural orientations that shape preferences for structure and tolerance for interaction complexity. In particular, Japan scores higher than Italy on Uncertainty Avoidance, suggesting a stronger preference for predictability, standardization, and reliability (Hofstede Insights, 2023; Hofstede, 2001). UAI

reflects how strongly consumers prefer predictable, reliable, and low-risk environments (Venkatesh et al., 2012). When applied to interface openness, this implies that Japanese consumers may reward openness when it delivers stable interoperability and consistent automation (benefit side), but may penalize openness when it creates ambiguous configurations, inconsistent device behaviors, or perceived unreliability (sacrifice side). Because high-UAI consumers are more sensitive to uncertainty and operational failure, everyday breakdowns (such as routines not triggering, devices failing to coordinate) are likely to carry a larger perceived cost. At the same time, Japan and Italy differ on Indulgence versus Restraint (IVR), which shapes whether consumers experience variety and choice as enjoyable or as burdensome (Hofstede Insights, 2023; Hofstede et al., 2010). IVR shapes preferences for variety, enjoyment, freedom of choice, and exploratory consumption (Guo et al., 2018). Italy's more indulgent orientation indicates that consumers may place greater value on customization, experimentation, and the ability to explore alternative configurations, which can amplify the perceived benefits of interface openness. Japan's more restrained orientation suggests that extensive choice can be evaluated more cautiously: consumers may prefer curated, well-integrated interaction patterns and may experience high levels of interaction heterogeneity, rather than standardization, as increasing effort rather than enjoyment. This matters because interface openness often expands the number of interaction possibilities (interfaces, triggers, scenes, routines), which can either empower or overwhelm. Therefore, Japanese and Italian consumers may interpret interface openness differently. In high uncertainty avoidance contexts such as Japan, consumers place greater emphasis on reliability, predictability, and system coordination. When platform interfaces are open and sufficiently standardized, complementors can more effectively utilize platform services and develop products that integrate smoothly within the ecosystem. This can enhance interoperability, reduce uncertainty in device interaction, and improve the overall coherence of the smart home system. As a result, interface openness may generate greater perceived value for Japanese consumers by supporting reliable automation and stable system integration. Overall, interface openness is expected to be positively associated with consumer perceived value because it supports system-level interoperability and automation. However, due to cultural differences in uncertainty avoidance and preferences for system reliability, this effect is expected to be stronger in the Japanese context. Based on this reasoning, this study proposes the following hypothesis:

*H2. The positive effect of interface openness on consumer perceived value is stronger for Japanese consumers than for Italian consumers.*

### **2.3.3 Developer tools openness (Developertoolsopen)**

Developer tools openness reflects the degree to which platforms provide technical resources that support third-party innovation, such as APIs, SDKs, documentation, testing environments, and developer portals. Although this dimension primarily targets complementors, its consumer-level relevance lies in the outcomes that consumers experience downstream: the breadth of available functions, the pace of feature improvement, and the variety of compatible products and services that can be integrated into the ecosystem (Boudreau, 2010; Tiwana, 2014; Hein et al., 2020). From a consumer perspective, developer tools openness can create perceived benefits by expanding ecosystem functionality and enabling more specialized complements. Consumers may perceive higher usefulness and system richness because the ecosystem can better fit diverse household needs and offer functionalities that would not exist in a tightly closed environment. In line with value-based perspectives, however, these benefits must be weighed against perceived sacrifices (Zeithaml, 1988). When developer-driven variety increases, consumers may also encounter uneven complement quality, unstable integrations, inconsistent user experiences, or security concerns. Consumers do not only value “more options”; they also value coherence and reliability. If openness at the developer layer leads to fragmentation or uncertain compatibility, consumers may experience greater effort in selecting, configuring, and maintaining the system, costs that are highly salient in everyday smart home use.

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Cross-national differences between Japan and Italy provide theoretical grounds to expect different consumer reactions to this benefit–sacrifice trade-off. Japan scores substantially higher than Italy on Masculinity (MAS) and also higher on Uncertainty Avoidance (UAI) (Hofstede Insights, 2023). Masculinity determines how much consumers appreciate achievement, performance, competition, and technological efficiency (Srite & Karahanna, 2006; Hofstede et al., 2010). In a high-MAS context such as Japan, consumers are more likely to value advanced functionality, performance improvements, and technology-driven superiority. This suggests that the benefit side of developer tools openness, faster innovation, better features, a richer ecosystem may be particularly valued by Japanese consumers, who

may interpret developer-driven innovation as a competitive and functional advantage. Italian consumers, operating in a lower-MAS context, may place comparatively greater emphasis on usability and balance rather than on incremental performance gains, which can reduce the marginal benefit of “more advanced features” produced by extensive third-party innovation. At the same time, Japan’s higher UAI implies stronger sensitivity to risk, reliability concerns, and the uncertainty associated with heterogeneous complements (Venkatesh et al., 2012; Hofstede, 2001). This introduces an important tension: Japanese consumers may value innovation outcomes, but they may also penalize ecosystems where developer openness produces inconsistent quality, unclear accountability, or unpredictable integration. In consumer terms, Japanese perceived value should increase particularly when the ecosystem combines developer tools openness with credible governance signals (such as stable standards, compatibility assurances, predictable performance). Italy’s moderately high but less extreme UAI suggests that Italian consumers may be somewhat more tolerant of experimentation and variation, but they may still discount developer-driven variety if it translates into “work” (setup burden, maintenance effort) rather than “value” (useful features). Overall, Japan and Italy differ in the cultural configuration that shapes how consumers interpret developer tools openness: Japan’s stronger performance orientation amplifies the perceived benefits of innovation, while its stronger uncertainty sensitivity increases the perceived costs of fragmentation and instability. Because developer tools openness simultaneously expands innovation potential and coordination complexity, its association with consumer perceived value is expected to vary systematically across national contexts. Although developer tools openness involves a trade-off between innovation benefits and coordination risks, the cultural gap between Japan and Italy suggests that performance-oriented considerations may dominate. In particular, the difference in Masculinity (25) between the two countries is larger than the difference in Uncertainty Avoidance (17), indicating a stronger relative emphasis on performance and technological advancement in the Japanese context. Based on this reasoning, this study proposes the following hypothesis:

*H3. Developer tools openness has a stronger positive effect on consumer perceived value for Japanese consumers than for Italian consumers.*

### 2.3.4 Market entry openness (Marketentryopen)

Market entry openness concerns the rules and procedural conditions governing entry into the ecosystem and thus captures whether platforms impose strong certification requirements, approval processes, or contractual constraints on product and service integration. Previous studies emphasize that entry conditions play a central role in shaping ecosystem structure, competitive dynamics, and the diversity of complementary offerings available to users (Eisenmann, Parker & Van Alstyne, 2009; Parker, Van Alstyne & Jiang, 2017). From a consumer perspective, the most visible consequence of market entry openness is how the ecosystem “feels” in terms of variety, price dispersion, and the availability of alternatives. When market entry is open, consumers can access a wider set of compatible devices and services across brands and price levels. This can increase perceived benefits through greater freedom of choice and potentially better fit with household preferences. Open entry can also intensify competitive pressure, which consumers may interpret as faster product iteration, improved features, and better value-for-money. At the same time, market entry openness can generate perceived sacrifices. A larger, more heterogeneous market can produce quality dispersion, uncertainty about reliability, and a higher cognitive burden when evaluating which complements are safe choices. In smart home ecosystems, where consumers depend on interoperability and stable functioning, uncertainty about compatibility, security, and long-term support can reduce satisfaction. Consumers may worry that low-quality complements will degrade the experience of the whole ecosystem or that future updates will break compatibility. As a result, the consumer-level impact of market entry openness reflects a trade-off between choice/competition benefits and uncertainty/complexity costs (Zeithaml, 1988).

Japan and Italy differ in cultural orientations that shape whether consumers perceive expanding market variety as empowering or as risky and burdensome. Japan scores substantially higher than Italy on Masculinity (MAS), indicating a stronger emphasis on competition, achievement, and performance outcomes (Hofstede Insights, 2023; Hofstede et al., 2010). MAS determines how much consumers appreciate competition, performance, and technological efficiency (Srite & Karahanna, 2006). In a higher-MAS context, intensified competition among complementors may be interpreted more positively, because consumers may expect competition to drive performance improvements, product optimization, and superior technological outcomes. This indicates that Japanese consumers may place greater

value on the competitive benefits of open entry, especially when entry expands access to cutting-edge devices and high-performing complements. However, Japan and Italy also differ on Indulgence versus Restraint (IVR), which shapes preferences for variety, choice, and exploratory consumption (Guo et al., 2018). Italy's more indulgent orientation suggests that consumers may place greater value on variety and the ability to explore different options and configurations. Japanese consumers, in a more restrained context, may be less likely to view extensive choice as intrinsically enjoyable; they may prefer guidance, curated selections, and clarity. This creates a nuanced prediction: Japanese consumers may value the performance and competition benefits of open entry, but they may also be wary of excessive variety if it increases decision effort or uncertainty. Italian consumers may enjoy variety and personalization benefits, but they may also experience diminishing returns if openness produces confusion or compatibility concerns. Because market entry openness simultaneously increases variety and intensifies selection effort, the Japan–Italy comparison is best interpreted through how consumers weight competition/performance benefits versus choice/complexity costs. Japan's higher MAS implies stronger appreciation for competition-driven improvement (benefit side), while differences in IVR suggest different emotional responses to variety and exploration (Guo et al., 2018; Srite & Karahanna, 2006). Overall, market entry openness is expected to be positively associated with consumer perceived value because it expands options and can enhance value-for-money, but the strength of this effect should differ across countries due to culturally shaped responses to competition and to variety (Hofstede Insights, 2023; Zeithaml, 1988). Based on this reasoning, this study proposes the following hypothesis:

*H4.* Market entry openness has a stronger positive effect on consumer perceived value for Japanese consumers than for Italian consumers.

## **CHAPTER 3 - Research design and methodology**

### **3.1 Overview of research methods**

This chapter describes the research design and methods used to empirically test the theoretical framework developed in the previous chapters. It presents the comparative cross-national approach, explains the data collection process from Amazon Italy and Amazon Japan, and illustrates how product-level variables are operationalized. The chapter also introduces the empirical strategy and regression specifications used to examine how platform openness relates to consumer evaluations across the two national contexts.

The study adopts a comparative research strategy and uses the smart home industry as an empirical setting in which platform openness can be observed and measured in practice. Smart home devices are employed as a concrete application domain to capture platform dynamics at the product level, while the theoretical scope of the thesis remains anchored in platform theory. In this sense, the smart home context functions as an empirical lens rather than as the object of theoretical inquiry, allowing platform openness to be examined through observable product-level characteristics.

From a methodological perspective, the analysis relies on a cross-national comparison between Italy and Japan. These countries represent technologically advanced markets with widespread diffusion of digital platforms and smart devices, while also differing in cultural and institutional contexts. This combination makes them suitable for examining whether and how platform openness varies across national settings. The comparison is implemented using product-level data collected from Amazon's national marketplaces, which provide structured and comparable information on device compatibility, technical standards, and integration characteristics.

The chapter is organized as follows. Section 3.1 introduces smart homes as the research subject, outlining their defining characteristics, platform-based operating mechanisms, and relevance for studying platform openness. The second section explains the rationale for selecting Italy and Japan as the countries of comparison. The third section describes the data collection and cleaning process. Section 3.4 introduces the variables used in the empirical analysis, including dependent, independent, moderating, and control variables. Finally, Section 3.5 presents the analytical model and estimation strategy.

### 3.1.1 Research subject

Smart homes are generally defined as residential environments in which devices, appliances, and services are interconnected through digital technologies, enabling monitoring, automation, and remote control (Balta-Ozkan et al., 2013). At a more advanced level, smart homes rely on digital platforms that coordinate interactions among heterogeneous devices, users, and third-party service providers. These smart home platforms, such as Amazon Alexa, Google Home, and Apple HomeKit, serve as centralized infrastructures that enable interoperability, data exchange, and service integration across connected products (Gawer, 2014). Smart home platforms therefore act as technological and organizational hubs that govern access to resources, define technical standards, and shape the conditions under which complementors can participate in the ecosystem. Importantly, these platforms make governance choices explicitly visible through documented interfaces, supported protocols, certification requirements, and compatibility declarations. As a result, smart home ecosystems allow platform characteristics, such as openness or restriction, to be observed empirically at the product level rather than inferred indirectly (Baldwin & Woodard, 2009; Gawer, 2014).

From an operational perspective, smart home platforms coordinate interactions between users, devices, and complementary services through a combination of application programming interfaces (APIs), software development kits (SDKs), data-sharing rules, and automation mechanisms. Product functionality and user experience are therefore shaped not only by the intrinsic features of individual devices, but also by the governance structures imposed by the platforms to which they are connected (Tiwana, 2014). These structures influence how devices communicate, which data can be accessed, and how services can be combined within the ecosystem. Crucially, these governance mechanisms translate into observable and measurable product-level outcomes, such as the range of supported functions, degree of automation, and breadth of compatibility with other devices and services. This makes smart home products particularly suitable for empirical analysis of platform openness, as abstract governance principles can be traced through concrete market artifacts, including product descriptions and technical specifications (Boudreau, 2010; Jacobides, Cennamo & Gawer, 2018).

The development of smart home platforms has closely followed broader trends in digital platform evolution. Early systems were characterized by closed architectures and proprietary standards, limiting third-party participation and interoperability. Over time, increasing

competition and the need to attract complementors have pushed many platform owners toward more open architectures, exposing selected data resources, interfaces, and development tools while maintaining control over critical governance dimensions (West, 2007; Gawer, 2014). This evolution highlights that platform openness is not a binary condition but a multidimensional and continuous construct that varies across different governance dimensions. In the smart home context, openness manifests through differentiated access to user data, availability of interaction interfaces, support for third-party development, and conditions for market entry. Capturing these dimensions empirically allows for a fine-grained analysis of how different forms of openness shape ecosystem participation and value creation, rather than treating openness as a single aggregate attribute (West, 2007).

For these reasons, smart home products provide a particularly appropriate empirical setting for observing platform openness in practice. Their functionality depends on connectivity to one or more digital platforms, and their market value is closely linked to interoperability, standardization, and access to platform ecosystems (Gawer, 2014). As a result, smart home devices reflect platform governance strategies in a tangible and observable way, allowing platform openness to be examined empirically without constraining the theoretical scope of the study to a single industry. Using smart homes as the research subject therefore enables the analysis to remain grounded in platform theory while relying on concrete, product-level evidence.

### **3.2 Selection of countries for comparative cultural study**

The empirical core of this study is based on a comparative cross-national research design focusing on Italy and Japan. Comparative approaches are particularly suitable for examining how technological and organizational phenomena are shaped by broader socio-cultural and institutional environments, especially when the objective is to assess how the same theoretical constructs operate across different national contexts rather than to describe a single market (Boudreau, 2010; Jacobides, Cennamo & Gawer, 2018).

Italy and Japan are selected because they share several important structural characteristics that make them highly comparable empirical contexts. Both countries are advanced economies with widespread diffusion of digital platforms and mature consumer electronics markets. In both

national contexts, global platform ecosystems such as Amazon Alexa, Google Home, and Apple HomeKit play a central role in structuring market interactions between platform owners, device manufacturers, and complementors (Gawer, 2014). These shared characteristics reduce the likelihood that observed differences in product performance or consumer evaluation are driven by disparities in technological maturity or basic market infrastructure. A further methodological advantage of this comparison lies in the use of Amazon's national marketplaces as data sources. Amazon operates localized platforms that follow highly standardized product-page structures across countries, including comparable sections for technical specifications, platform compatibility, supported protocols, certification requirements, and integration features. This structural consistency allows product-level data collected from Amazon Italy and Amazon Japan to be coded using a unified framework, ensuring a high degree of comparability between the two datasets and supporting the validity of cross-national analysis.

At the same time, Italy and Japan differ along cultural and institutional dimensions that are theoretically relevant for the study of platform openness and consumer perceived value. Prior research shows that national context shapes attitudes toward technological risk, coordination, and governance, which in turn influence how openness-related features are interpreted and evaluated by consumers. These differences motivate the use of a comparative cross-national design rather than a single-country analysis.

From an ecosystem perspective, national context can shape how openness-related design and governance choices, such as compatibility decisions, supported standards, and integration possibilities, translate into consumer perceptions and market outcomes (West, 2007; Gawer, 2014). By combining strong structural similarities with meaningful cultural and institutional differences, the Italy–Japan comparison provides a theoretically grounded and empirically robust setting for examining whether and how the relationship between platform openness and consumer perceived value varies across national contexts. This comparative logic directly motivates the data collection and variable construction strategy described in the following section.

Beyond cultural differences, the selection of Italy and Japan is further motivated by structural differences in market organization, ecosystem composition, and approaches to technological standardization, which are directly relevant for the study of platform openness (Gawer, 2014; Jacobides, Cennamo & Gawer, 2018). From an ecosystem perspective, the Japanese smart home market is characterized by a strong presence of domestic manufacturers and locally

embedded platform ecosystems, such as Panasonic, Sharp, and LINE Clova, which coexist with global platforms like Amazon Alexa and Google Home. These domestic ecosystems are often embedded in tightly coordinated industrial networks and emphasize system reliability, long-term compatibility, and controlled integration. As a result, participation in the Japanese market is frequently mediated by formal standards, certification schemes, and approval processes, reflecting a governance logic that prioritizes stability and trust (West, 2007; Boudreau, 2010).

In contrast, the Italian smart home market is more strongly shaped by international platform ecosystems and a heterogeneous mix of global manufacturers. Market participation relies primarily on widely adopted global standards, with fewer dominant domestic platforms and less reliance on nationally specific certification regimes. This structure is associated with more modular ecosystem configurations, in which openness-related features such as multi-platform compatibility and ease of integration may play a more salient role in shaping consumer perceptions (Gawer, 2014).

Differences in approaches to standardization further reinforce the relevance of the comparison. Japan exhibits a stronger orientation toward formal coordination mechanisms and certification-based governance, while European markets, including Italy, rely more heavily on market-based coordination and voluntary standards (Hofstede, 2001; Steenkamp, 2019; West, 2007). These institutional differences suggest that the same openness-related governance mechanisms may generate heterogeneous value perceptions across national contexts. Taken together, variations in ecosystem structure, platform governance, and standardization practices strengthen the analytical leverage of the Italy–Japan comparison and provide a robust foundation for examining context-dependent effects of platform openness (Jacobides, Cennamo & Gawer, 2018; Tang & Inoue, 2023).

### **3.3 Data collection**

The empirical analysis conducted in this study is based on product-level data collected from Amazon's national marketplaces. The data collection strategy is designed to support a cross-national comparison between Italy and Japan by ensuring that data from both countries are gathered following the same principles, coding logic, and variable definitions. This parallel structure is essential to ensure that observed differences in platform openness reflect genuine

differences in ecosystem configurations rather than inconsistencies in data collection procedures.

Following the data collection and screening procedures described below, the final dataset consists of 502 products, of which 279 are collected from Amazon Italy and 223 from Amazon Japan. Each observation corresponds to a distinct product listing and represents the unit of analysis used in the empirical models. Smart home products are selected as the empirical focus of the data collection process because they represent a market segment where platform-related characteristics are especially visible and explicitly communicated. The functionality of smart home devices depends on their capacity to connect to digital platforms, to communicate through specific protocols, and to integrate with complementary products and services (Gawer, 2014). As a result, product pages typically report information that is directly relevant to platform ecosystem participation, such as declared compatibility with voice assistants and smart home ecosystems such as Amazon Alexa, Google Home, Apple HomeKit, Tuya, supported connectivity standards (Wi-Fi, Zigbee, Bluetooth, Matter), and sometimes references to automation or integration features. This makes smart home products a suitable empirical setting in which platform openness can be observed through publicly available and relatively standardized information.

To build the datasets, the study adopts a structured workflow that is applied first to Amazon Italy and then replicated on Amazon Japan. In both cases, product identification begins with keyword searches on the marketplace, followed by systematic screening of results and manual extraction of product information into an Excel template. The use of manual coding is intentional: many openness-relevant details (especially compatibility claims and technical standards) are communicated in semi-structured formats such as titles, bullet points, technical descriptions, and product images, requiring careful interpretation and consistent decision rules.

Data collection for the Italian market was conducted on Amazon.it using keyword searches that reflect how consumers and sellers refer to smart-home products in Italian. The primary search terms were “*domotica intelligente*” and “*smart home*”, which capture a broad range of connected devices across multiple product categories. Search results were inspected across multiple pages to reduce the influence of algorithmic ranking mechanisms and sponsored placements. Each product encountered in the search results was reviewed individually to verify relevance to the smart-home ecosystem. Inclusion was based on the presence of explicit indicators that the product is a connected or platform linked device. In practice, the most

common inclusion signals were clear statements or labels indicating compatibility with major platforms (for example “Works with Alexa”, “Compatible with Google Home”, “Apple HomeKit”), compatibility with broader smart-home ecosystems (such as Tuya), or explicit references to IoT connectivity that implies platform integration (for instance app control combined with smart home ecosystem support).

The Japanese dataset was constructed following the same procedure and using the Italian dataset as the direct methodological template, ensuring cross-national comparability. Data collection was conducted on Amazon.co.jp using Japanese keyword searches intended to mirror the Italian strategy and approximate how Japanese consumers search for smart-home products. The primary search terms include “スマートホーム” (smart home), “スマート家電” (smart appliances), and “ホームオートメーション” (home automation). As in the Italian case, search results were scanned across multiple pages, products were screened for clear relevance to the smart-home ecosystem, and only items with sufficient technical and compatibility information were included. Particular attention was paid to the consistent interpretation of platform compatibility claims across languages. To maintain cross-national consistency, the Japanese dataset employs the same Excel template, coding logic, and variable structure as the Italian dataset. This ensures that the two datasets are structurally equivalent and suitable for comparative analysis, minimizing measurement distortion across national contexts. Product identification was carried out by performing keyword-based searches directly on Amazon’s national marketplaces. For each search query, data collection started from the first page of results suggested by the platform and continued sequentially across subsequent result pages. All smart home products available at the time of data collection were considered, and the screening process proceeded until no additional eligible products were identified. This data collection strategy reflects the actual visibility structure encountered by consumers when searching for smart home products on Amazon. However, product positioning and selection are influenced by Amazon’s ranking algorithms, which may account for factors such as sales performance, number of reviews, recency, sponsored placements, and the prominence of Amazon-owned products. Consequently, the sample may over-represent products with higher marketplace visibility. This limitation is acknowledged as an inherent characteristic of marketplace-based data and is taken into account when interpreting the empirical results.

In addition to product selection, a data-cleaning phase was conducted to improve data reliability, internal consistency, and cross-national comparability of the dataset. The objective

of this phase was to remove observations that could introduce noise, ambiguity, or measurement error into the empirical analysis. First, products with incomplete, unclear, or contradictory information regarding platform compatibility, technical specifications, or manufacturer identity were excluded. This step was necessary because platform openness is operationalized based on explicitly declared compatibility, and ambiguous cases could not be coded consistently across countries. Second, duplicate listings referring to the same product were identified and removed to avoid double counting. Third, products that appeared in search results but did not clearly qualify as smart-home or platform-connected devices were excluded, even if they were loosely marketed as “smart” products. Price information was checked for consistency, and temporary discounts or promotional prices were not recorded, as the analysis focuses on listed product prices at the time of observation. In addition, the distributions of key numerical variables were inspected to identify extreme values. While no observations were removed solely on this basis, potential outliers were flagged and subsequently addressed through robustness checks in the empirical analysis, as discussed in Chapter 4. Some smart home products appear in both national marketplaces, typically global devices offered by the same manufacturer in Italy and Japan. These listings were treated as separate observations, as they correspond to distinct product pages, pricing conditions, language environments, and consumer review populations. The empirical analysis does not rely on a matched-product design, but rather focuses on comparing consumer evaluations within each national marketplace. This approach is consistent with the objective of examining ecosystem-level patterns rather than tracking identical products across countries.

The core structure of the dataset is built around a detailed compatibility and technology matrix. Compatibility with platforms and ecosystems such as Amazon Alexa, Google Home, Apple HomeKit, Xiaomi Mijia, Huawei Hilink, Samsung SmartThings, Philips Hue, Tuya, IFTTT, IoLife and Honeywell was coded using binary indicators: a value of 1 was assigned when compatibility was explicitly stated on the product page (in text or clearly displayed labels), while 0 was assigned when such compatibility was not declared. This binary approach was adopted because it creates a transparent and replicable coding scheme and avoids subjective interpretation about “implicit” compatibility. At this stage, the objective of data collection is descriptive and archival. The purpose is to systematically store openness-relevant product attributes in a consistent format so that they can later be transformed into analytical variables using clearly defined operationalization rules.

Overall, the data collection strategy combines systematic keyword-based identification, careful manual screening, and standardized extraction into a unified dataset structure. This approach provides a transparent and replicable empirical foundation for the comparative analysis. The next section builds on this dataset by explaining how the collected raw attributes are transformed into analytical variables and how the dimensions of platform openness are operationalized consistently across both countries. Table 1 reports descriptive statistics for the pooled sample, summarizing key product-level variables used in the empirical analysis, including ratings, price, review volume, and platform openness dimensions. This overview provides a preliminary picture of the sample composition and the general distribution of variables across the dataset.

	A	B	C	D	E	F	G	H	I	J	K	L
1	Productname	Price	Point	Reviewnum	Saledate	Userdataopen	Interfaceopen	Developertoolsopen	Marketopen	JAN/ITA	domipro	platconnect
2	【New】Echo Sho	147,308	4,2	632	16	5,000	4,000	9,000	0,000	0	0	1
3	Echo Studio (エコー)	192,179	4,2	4467	72	5,000	4,000	9,000	0,000	0	0	1
4	SwitchBot 温湿度	17,821	4,1	62270	45	3,833	3,167	6,833	0,167	0	0	6
5	SwitchBot カーテ	57,506	4,2	1655	27	4,000	3,200	7,200	0,200	0	0	5
6	Nature Remo mini	29,051	4,1	13174	59	4,500	4,500	8,500	0,000	0	1	2
7	【Amazon.co.jp限	17,308	4,3	1596	26	4,333	4,000	8,000	0,000	0	0	3
8	SwitchBot LED電球	24,231	4,1	6225	46	3,833	3,167	6,833	0,167	0	0	6
9	リンクジャパン	31,923	4	1411	65	3,667	3,667	8,333	0,000	0	1	3
10	SwitchBot 学習リ	44,744	3,2	744	18	2,000	2,000	8,000	0,000	0	0	1
11	Philips Hue スマ	69,077	4,2	1152	29	3,667	3,667	8,333	0,000	0	0	3
12	【Amazon Alexa認	38,135	3,7	80	45	4,500	4,500	8,500	0,000	0	0	2
13	【Works with Ale	17,308	3,8	3343	82	3,667	3,667	8,333	0,000	0	0	3
14	TP-Link WiFiスマ	15,897	4,2	10256	26	4,500	4,500	8,500	0,000	0	0	2
15	SwitchBot スマ	121,667	4,2	7798	23	4,000	3,200	7,200	0,200	0	0	5
16	TP-Link Tapo スマ	7,692	4,0	3827	14	4,500	4,500	8,500	0,000	0	0	2
17	【Works with Ale	12,692	4,2	22093	45	3,833	3,167	6,833	0,167	0	0	6
18	TP-Link Tapo スマ	17,077	4,4	285	16	4,500	4,500	8,500	0,000	0	0	2
19	Nature Remo Lapi	51,154	4,2	3444	17	4,500	4,500	8,500	0,000	0	1	2
20	スイッチボット	76,795	4	5308	23	4,000	3,200	7,200	0,200	0	0	5
21	Nature Remo 3ネ	63,974	4,2	3444	64	4,500	4,500	8,500	0,000	0	1	2
22	スマートプラグ	24,353	3,9	382	15	4,500	4,500	8,500	0,000	0	0	2
23	SwitchBot 防水温	12,692	4,2	22093	31	4,000	3,200	7,200	0,200	0	0	5
24	SwitchBot スマ	166,538	4,1	3656	22	3,833	3,167	6,833	0,167	0	0	6
25	【Amazon.co.jp限	15,897	3,4	683	14	3,667	3,667	8,333	0,000	0	0	3
26	キャンディハウ	41,538	4,1	2480	31	3,667	3,667	8,333	0,000	0	0	3
27	SwitchBot スマ	25,513	3,5	1534	44	3,833	3,167	6,833	0,167	0	0	6
28	【+style】スイッ	12,692	3,6	332	33	4,500	4,500	8,500	0,000	0	1	2
29	【New】Echo Spo	73,59	4,2	3997	16	5,000	4,000	9,000	0,000	0	0	1
30	Echo Dot (エコー	47,949	4,2	8947	33	5,000	4,000	9,000	0,000	0	0	1

Figure 3- Excerpt of the smart home product dataset from Amazon Italy and Amazon Japan.

<b>Variable</b>	<b>Min</b>	<b>Max</b>	<b>Mean</b>
USERDATA OPENNESS	2.00	5.00	4.16
INTERFACE OPENNESS	0.00	5.00	3.83
DEVELOPERTOOLS OPENNESS	0.00	9.00	7.89
MARKETENTRY OPENNESS	0.00	1.00	0.11
PRICE	5.81	952.56	77.80
NUMBER OF REVIEWS	5	147,244	3,645.49
SALE DATE	4	115	43.20

*Table 1 – Descriptive statistics*

### **3.4 Variable construction**

This section explains how the raw data collected from Amazon Italy and Amazon Japan are transformed into analytical variables. The purpose of this section is to describe how platform openness is operationalized in a systematic and transparent way, clarifying how observable platform and product characteristics are converted into measurable variables for cross-national comparison. Platform openness is operationalized at the platform level and then assigned to products based on declared compatibility. Smart-home platforms differ substantially in how they regulate participation by third-party manufacturers and developers, particularly with respect to entry requirements, certification procedures, and developer access conditions. These differences reflect distinct platform governance strategies and have direct implications for the degree of openness experienced by products embedded in each ecosystem (Eisenmann, Parker & Van Alstyne, 2009; Boudreau, 2010). On this basis, the following sections introduce the dependent, independent, moderating, and control variables used in the empirical analysis.

### 3.4.1 Dependent variable

From a consumer perspective, the openness of a digital platform ultimately manifests in users' perceived value. Perceived value has been classically defined as a consumer's overall assessment of a product or system based on a trade-off between perceived benefits and perceived sacrifices (Zeithaml, 1988). Rather than representing a purely objective or technical evaluation, perceived value reflects a subjective judgment shaped by consumers' experiences, expectations, and interpretations of system performance. As such, perceived value incorporates functional, emotional, and cognitive dimensions and is influenced by how individuals interact with a technology over time (Zeithaml, 1988; Park et al., 2018). This perspective highlights that consumers do not evaluate technologies solely on the basis of isolated attributes, but through an integrated assessment of what they gain and what they give up when adopting and using a system.

Prior research has extensively employed perceived value as a key explanatory construct in studies of technology adoption and continued use. Within value-based adoption frameworks, perceived value emerges when perceived benefits, such as convenience, efficiency, enjoyment, and control, outweigh perceived sacrifices, including monetary cost, time investment, effort, uncertainty, and perceived risk (Park et al., 2018 ; Zeithaml, 1988). Importantly, perceived value is dynamic rather than static: it can evolve as users accumulate experience, encounter system limitations, or reassess their expectations. This conceptualization has been widely applied in digital and service contexts, where technologies are embedded in ongoing usage situations rather than discrete purchase decisions. As a result, perceived value has become a central lens for understanding not only initial adoption, but also user satisfaction, continued use, and long-term engagement with digital systems.

In platform-based digital ecosystems, the relevance of perceived value extends beyond individual products to encompass the performance of the integrated "whole system". Users experience value not simply through isolated device functionalities, but through how well devices, applications, and services work together within a shared ecosystem. In this context, platform characteristics such as interoperability, compatibility, and coordination across components play a critical role in shaping perceived value. Prior research suggests that, particularly in smart home environments, perceived value is closely linked to users' ability to configure devices across providers, integrate functionalities seamlessly, and retain autonomy

over system composition. Platforms that enable users to mix and match products or services, transfer data or preferences across devices, and avoid lock-in are often perceived as offering greater flexibility and control, thereby enhancing perceived value.

Existing comparative research indicates that perceived value and acceptance of platform-based technologies, including smart home systems, can vary across national contexts due to differences in institutional trust, cultural expectations, and the perceived role of market actors and public institutions in shaping digital services (Balta-Ozkan et al., 2013). These differences suggest that the benefit–sacrifice trade-off underlying perceived value may be interpreted differently across countries, reinforcing the importance of examining perceived value in platform ecosystems from a cross-national perspective.

Consistent with this conceptualization, the present study operationalizes consumer perceived value using product ratings displayed on Amazon. In online marketplaces, consumers rely heavily on rating information when forming quality expectations, particularly in contexts where direct inspection of products is not possible (Zhu & Zhang, 2010). On e-commerce platforms, aggregated consumer evaluations in the form of ratings play a central role in shaping perceived product value and influencing purchase behavior (Sridhar & Srinivasan, 2012). Prior empirical research demonstrates that product ratings are informative indicators of consumer perception and post-purchase evaluation. Unlike review volume, which primarily reflects product popularity or diffusion, ratings capture consumers' qualitative assessment of overall satisfaction and experienced performance (Westbrook & Oliver, 1991). Large-scale studies based on Amazon data further confirm that rating-based measures effectively capture consumer sentiment and perceived value, even when compared with more complex sentiment-analysis techniques applied to textual reviews.

This study therefore uses product rating as the dependent variable. For each product, the rating corresponds to the average score displayed on the Amazon product page at the time of data collection and reflects consumers' cumulative evaluation from product release to observation. This standardized and directly observable indicator allows for consistent comparison across products and national markets while avoiding language-specific biases inherent in textual data. This dependent variable is referred to as '*yRating<sub>i</sub>*'.

### 3.4.2 Independent variables

Consistent with the multidimensional perspective adopted in the theoretical chapters, platform openness is not treated as a single composite construct but is decomposed into four distinct dimensions: user data openness, interface openness, developer tools openness, and market entry openness. Each dimension reflects a different aspect of how platform governance structures enable or constrain participation, interaction, development, and value creation within digital platform ecosystems (West, 2007; Gawer, 2014; Parker, Van Alstyne & Jiang, 2017). Following prior empirical research on platform ecosystems, openness is first measured at the platform level and then mapped onto products based on declared platform compatibility (Landsman & Stremersch, 2011; Cennamo & Santaló, 2019). This approach reflects the assumption that products do not possess intrinsic openness characteristics; rather, their exposure to openness depends on the platform ecosystems in which they are embedded. Platform openness is therefore captured as a graded property reflecting the breadth of resources, interfaces, and participation opportunities offered by each platform, rather than through simple open/closed classifications.

The construction of the independent variables begins with the identification of platform compatibility. For each product and each platform, such as Amazon Alexa, Google Home, Apple HomeKit, Huawei Hilink, Xiaomi Mijia, SmartThings, IFTTT, and Tuya, a value of 1 is assigned when compatibility is explicitly stated on the product page, while a value of 0 is assigned otherwise. This compatibility matrix captures the degree of product-level multi-homing, a central concept in platform ecosystem research (Landsman & Stremersch, 2011; Jacobides, Cennamo & Gawer, 2018). Platform openness is then operationalized through platform-specific openness scores for each dimension. Rather than relying on binary classifications, openness is treated as a graded property reflecting the breadth of resources, interfaces, and participation opportunities offered by each platform. Following established approaches in the platform governance literature, each openness dimension is constructed by counting the number of openness-related components supported by the platform within that dimension (Boudreau, 2010; West, 2007; Tang & Inoue, 2023).

Once platform-level openness scores are established, they are mapped onto products through declared compatibility. When a product supports multiple platforms, the openness scores of the supported platforms are aggregated by computing their arithmetic mean for each openness

dimension. This aggregation reflects the assumption that multi-homing products are exposed to the combined governance environments of multiple platforms, while avoiding disproportionate weighting of any single ecosystem (Jacobides, Cennamo & Gawer, 2018). On this basis, four independent variables are constructed and used in the empirical analysis. Each variable is introduced and defined in detail in the following subsections.

	Amazon Alexa	Google Home	Apple Homekit	Huawei Hilink	Xiaomi Mijia	Sharp Cocoro	IFTTT	Clova	SmartThings
Userdata open	5	4	2	3	4	1	5	3	4
Interface open	4	5	2	3	3	2	2	3	3
Developer toolsopen	9	8	8	7	6	1	4	5	7
Marketentryopen	0	0	0	0	0	0	1	0	0
	Panasonic Eolia	Philips Hue	loLife	Honeywell	Tuya				
Userdata open	2	4	1	3	4				
Interface open	2	3	1	3	3				
Developer toolsopen	3	5	1	4	6				
Marketentryopen	0	1	0	0	1				

*Table 2 - Platform-level openness scores assigned to each smart home platform for the four openness dimensions*

This study systematically reviewed the official developer documentation of each focal platform, including developer portals, integration guidelines, API and SDK materials, certification

requirements, and related participation rules. Based on these materials, the study developed a researcher-constructed coding scheme designed to summarize the openness characteristics of each platform in a comparable and transparent manner. The resulting platform-level scores were then mapped onto products based on their declared compatibility with the respective platforms. This procedure allows the operationalization of platform openness to be grounded in official platform governance materials rather than inferred solely from product-level descriptions.

The first independent variable is **user data openness**, which reflects the breadth of user- and device-related data that platforms make accessible within their ecosystems. At the product level, user data openness is computed as the arithmetic mean of the user data openness scores of the platforms with which the product is compatible. Higher values indicate exposure to ecosystems that provide broader access to data resources. Drawing on the empirical operationalization adopted in this study, user data openness is reflected in the availability of multiple categories of user-related data within smart-home platforms. These include:

- **User behavior data**, referring to information about how users interact with the platform and connected devices, such as usage patterns, routines, and frequency of specific actions.  
*Examples:* the time periods when users most frequently use smart lighting;
- **Device status data**, capturing the operational state of connected devices.  
*Examples:* the temperature settings, on/off status, or system performance indicators;
- **Usage frequency data**, indicating how often users engage with specific functions or services.  
*Examples* how frequently a user plays music through a smart speaker or activates a particular automation routine.
- **Event data**, recording specific user actions or system events.  
*Example:* unlocking a smart lock or activating a predefined “home” or “away” mode.
- **Trigger data**, used to initiate automated actions when certain conditions are met.  
*Examples:* lights turning on automatically when motion is detected;
- **Setting data**, reflecting user-defined preferences, schedules, and customization choices within the platform.  
*Examples:* scheduling settings for smart appliances;

- **Voice data**, derived from voice commands issued through digital assistants.  
*Example:* voice commands given to a smart speaker to control devices or request information;
- **Environmental data**, including information about the user's environment.  
*Example:* indoor temperature, humidity levels, or lighting conditions within the home environment.

The openness of these data categories determines the extent to which third-party developers, device manufacturers, and service providers can design interoperable services, advanced automation, and personalized user experiences. Prior research on open data and data sharing shows that increased data accessibility enables innovation by allowing actors to recombine datasets, extract insights, and develop value-added services (Lindman, Kinnari & Rossi, 2014).

The second independent variable is interface openness, which captures the variety of functional interfaces through which users and developers can interact with devices and services. Platform-level interface openness reflects the number of distinct interaction interfaces supported by each platform. Product-level interface openness is obtained by averaging the interface openness scores of the supported platforms.

In the context of digital ecosystems, interface openness can be operationalized through the availability and accessibility of different types of functional interfaces. In smart-home platforms, these typically include:

- **Control interface:** an interface through which users can directly control the status and operation of devices.  
*Example:* users turn smart bulbs on or off using a smartphone app or voice assistant (“Turn on the living room light.”).
- **Status inquiry interface:** an interface that allows users to check the current status or information of devices.  
*Example:* when a user asks “What is the current room temperature?”, the system returns the current value.
- **Skill (function) interface:** an interface that enables devices to perform specific skills or tasks, often requiring integration with other services.

*Example:* users request a smart speaker to “Play my morning playlist” or “Set an alarm for 7 AM.”

- **Scene interface:** an interface that allows users to combine multiple device states and quickly switch to a predefined scene.

*Example:* “Movie Night” dims lights, closes curtains, and turns the TV on to a specific channel.

- **Trigger interface:** an interface that automatically executes specific operations when predefined conditions are met.

*Example:* the system turns off lights and appliances when the user leaves the house.

These interfaces define how users and devices interact with the platform on a daily basis and determine the degree of flexibility, automation, and ease of use experienced within the ecosystem. From a governance perspective, exposing such interfaces in a standardized and well-documented manner lowers interaction costs and reduces fragmentation, while excessive restriction can limit system usability and constrain ecosystem expansion (Boudreau, 2010).

The third independent variable is developer tools openness, which reflects the extent to which platforms support third-party development through technical resources such as APIs, SDKs, documentation, testing tools, and developer portals. This dimension is measured by counting the number of development-related resources provided by each platform. At the product level, developer tools openness is calculated as the average developer tools openness score of the platforms supported by the product. Higher values indicate integration with ecosystems that are more supportive of external innovation and complementor participation.

The fourth independent variable is market entry openness, which captures the degree to which platforms impose formal restrictions on product entry into the ecosystem. Unlike the other dimensions, market entry openness reflects governance conditions rather than technical features. Following prior research on platform governance (Eisenmann, Parker & Van Alstyne, 2009; Boudreau & Hagi, 2009), market entry openness is coded at the platform level based on whether mandatory certification or approval processes are required for product integration. Product-level market entry openness is then computed as the average market entry openness score of the platforms with which the product is compatible. The resulting platform-level openness scores are summarized in the platform dimension matrix reported in Table 2, where each value represents the count of openness-related components supported by the platform within that dimension, rather than a simple open/closed indicator.

### 3.4.3 Moderator variable

To examine whether the relationship between platform openness and perceived product value differs across national contexts, this study introduces a country-level moderating variable. Consistent with the comparative research design adopted in this thesis, national context is modeled as a moderator rather than as a simple control variable, allowing the analysis to capture systematic differences between the Italian and Japanese smart-home markets.

The moderating variable is derived directly from the national Amazon marketplace from which each product observation is collected. Specifically, a dummy variable is constructed to represent the country in which the product is sold: products listed on Amazon Japan are coded as 1, while products listed on Amazon Italy are coded as 0. This coding scheme enables a clear and interpretable comparison between the two national contexts. The country dummy captures institutional, cultural, and market-level differences that may influence how platform openness is interpreted and valued by consumers. Prior research suggests that consumers' responses to platform governance mechanisms, interoperability, and ecosystem openness may vary across countries due to differences in technological maturity, trust in digital platforms, and user expectations (Hofstede, 2001; Steenkamp, 2019).

By interacting the country dummy with the platform openness dimensions, the empirical models assess whether the effects of user data openness, interface openness, developer tools openness, and market entry openness on product ratings differ between Japan and Italy. This moderating specification allows the analysis to go beyond average effects and to explicitly test cross-national heterogeneity in the relationship between platform openness and consumer perceived value. This variable is referred to as "*xJANITA*".

### 3.4.4 Control variables

To control for alternative factors that may influence consumer evaluation independently of platform openness, the empirical models include a set of product-level control variables derived from Amazon product pages.

### *Product protocol structure*

To control for technological differences in how smart home products connect and communicate within platform ecosystems, the empirical models include a control variable capturing the product protocol structure. Smart home devices rely on specific communication protocols, such as Bluetooth, Wi-Fi, Thread, Zigbee, Z-Wave, and Matter, to interact with platforms and other connected devices. These protocols determine key technical characteristics of the ecosystem, including interoperability, communication range, system stability, and integration effort, which may influence consumer evaluations independently of platform openness. The product protocol structure variable captures the set of communication protocols explicitly supported by each product, as declared on the Amazon product page. By controlling for protocol structure, the analysis accounts for baseline technological differences that may affect consumer perceived value through ease of integration, compatibility, and system stability. This variable is referred to as “*xProtocol*”.

### *Brand origin (domestic vs. foreign)*

To capture potential country-of-origin effects, brands are classified as domestic or foreign relative to the national market in which the product is sold. For the Italian dataset, brands headquartered in Italy are coded as domestic, so equal to 1, and all others as foreign, equal to 0; the same logic is applied to Japan. Country-of-origin effects are particularly relevant in technology markets, where consumer trust, perceived quality, and brand familiarity may differ systematically between domestic and foreign producers. Including this variable allows the model to control for differences in consumer evaluation that are attributable to brand origin rather than to platform openness or ecosystem characteristics. This variable is referred to as “*xOrigin*”.

### *Product price*

Product price is included as a control variable to account for differences in market positioning and perceived quality. The price recorded corresponds to the listed price on Amazon at the time of data collection, excluding temporary discounts or promotional offers. Consistent with standard practice in empirical e-commerce research, the natural logarithm of price is used in the regression models to reduce skewness and reflect diminishing marginal effects of price on consumer evaluation (Duan et al., 2008; Zhu & Zhang, 2010). Controlling for price helps

distinguish the effects of platform openness from valuation effects related to premium or budget positioning. This variable is referred to as “*xPrice*”.

#### *Number of reviews*

The number of reviews is included as a control variable to capture product visibility, diffusion, and market exposure. A substantial body of literature demonstrates that review volume is closely associated with product popularity and sales intensity on online platforms (Duan et al., 2008). While product rating is used as the dependent variable in the main models, controlling for review volume helps avoid conflating perceived quality with simple popularity effects. As review counts are highly skewed, the natural logarithm of the number of reviews is used in the analysis. This variable is referred to as “*xReview*”.

#### *Product release date*

Product age is controlled for using the time elapsed between the product’s release (or first availability on Amazon) and the data-collection date. Products that have been on the market longer typically accumulate more consumer feedback and may exhibit more stable ratings, while newer products may show greater variability in evaluation. Following prior studies, the logarithmic transformation of product age is used in the empirical analysis to capture non-linear lifecycle effects on consumer evaluation (Duan et al., 2008). This variable is referred to as *ReleaseDate*. This variable is referred to as “*xRelease*”.

#### *Platform connectivity*

To control for differences in ecosystem exposure across products, the models include a measure of platform connectivity, capturing the number of smart-home platforms with which a product is compatible. This variable reflects the degree of multi-homing at the product level and is constructed by counting the number of platforms explicitly declared as compatible on the Amazon product page. Prior research on platform ecosystems shows that multi-homing can influence product performance and user perception independently of platform governance characteristics, as products connected to multiple ecosystems may benefit from greater interoperability, flexibility, and visibility (Landsman & Stremersch, 2011; Cennamo & Santaló, 2019). At the same time, platform connectivity does not capture openness per se, but rather the breadth of ecosystem participation experienced by a product. Including this variable as a control

helps isolate the effects of platform openness from those driven by simple exposure to multiple platforms. This variable is referred to as “*xPlatconnect*”.

### 3.5 Empirical specifications and model structure

Building on the definition of dependent and independent variables, the empirical analysis adopts a structured modeling strategy to examine how platform openness is associated with product-level outcomes and how this relationship differs between the Italian and Japanese markets. The unit of analysis remains the individual smart-home product, and all model specifications are estimated using product-level observations derived from Amazon marketplaces. The analytical strategy follows a progressive logic. Rather than relying on a single regression specification, the analysis is implemented through a sequence of models that gradually introduce additional elements in order to isolate different dimensions of the empirical relationship under investigation. This approach is consistent with prior empirical studies on smart-home platforms and platform complementarity, which emphasize the importance of distinguishing baseline effects from context-dependent mechanisms.

#### *Baseline model*

The first specification, referred to as the *baseline model*, is designed to examine the direct association between platform openness and perceived product value at the product level. This model includes the main effects of the four platform openness dimensions, user data openness, interface openness, developer tools openness, and market entry openness, together with a comprehensive set of product-level control variables and a country dummy variable. The purpose of the baseline model is to establish a reference point for the empirical analysis by capturing the average relationship between platform openness and consumer evaluation, while controlling for systematic cross-national differences between Italy and Japan, without explicitly modeling heterogeneous effects across countries. By focusing exclusively on main effects, this specification allows the contribution of each openness dimension to be assessed independently, while holding constant other observable product characteristics.

Formally, the baseline model can be expressed as:

$$yRating_i = \beta_1 xUserdataopen_i + \beta_2 xInterfaceopen_i + \beta_3 xDevelopertoolsopen_i + \beta_4 xMarketentryopen_i + \beta_5 xJANITA_i + \beta_6 xProtocol_i + \beta_7 xOrigin_i + \beta_8 xPrice_i + \beta_9 xReview_i + \beta_{10} xRelease_i + \beta_{11} xPlatconnect_i + \varepsilon_i + C.$$

The product rating of product  $i$ ,  $yRating_i$ , is expressed as a linear function of platform openness dimensions and control variables. Specifically, it is regressed on user data openness,  $xUserdataopen_i$ , interface openness,  $xInterfaceopen_i$ , developer tools openness,  $xDevelopertoolsopen_i$ , and market entry openness,  $xMarketentryopen_i$ . In addition, the model includes a set of product-level control variables capturing protocol structure,  $xProtocol_i$ , brand origin,  $xOrigin_i$ , product price,  $xPrice_i$ , number of reviews,  $xReview_i$ , and product release timing,  $xRelease_i$  and platform connectivity,  $xPlatconnect_i$ . The specification also includes a country dummy variable ( $xJANITA_i$ ), coded as 1 for Japan and 0 for Italy, to control for average differences in consumer evaluation across the two national markets and an error term  $\varepsilon_i$  and a constant term  $C$ .

In this specification, each coefficient associated with the openness dimensions captures the marginal association between a specific aspect of platform openness and perceived product value, conditional on the other openness dimensions, national context, and the included control variables. This structure allows the analysis to disentangle the effects of different governance dimensions, rather than treating platform openness as a single aggregated construct. Importantly, while the baseline model controls for cross-national differences through the inclusion of the country dummy, it does not incorporate interaction terms. As such, it provides pooled estimates across the Italian and Japanese markets and serves as a benchmark against which subsequent specifications introducing cross-national heterogeneity can be compared.

#### *Cross-national comparison and interaction terms*

To explicitly account for cross-national differences between Italy and Japan, the empirical analysis extends the baseline specification by introducing a country dummy variable and interaction terms. This second specification, referred to as the interaction model, is designed to examine whether the relationship between platform openness and perceived product value varies across national contexts. The country dummy variable, labeled  $xJANITA$ , is coded as 1 for products sold in the Japanese market and 0 for products sold in the Italian market. While

the country dummy captures average differences in product evaluation between Italy and Japan, the central objective of this study is not merely to compare mean rating levels across countries. Rather, the analysis seeks to examine whether the relationship between platform openness and perceived product value differs across national contexts. To address this question, the model incorporates interaction terms between the country dummy and each of the four platform openness dimensions. To mitigate potential multicollinearity issues arising from the inclusion of multiple interaction terms in a single specification, the moderating effects are examined using a stepwise modeling strategy. Specifically, each interaction between a platform openness dimension and the country dummy is estimated in a separate regression model. As a result, in addition to the baseline model, four interaction models are estimated, yielding a total of five models analyzed in this study.

The interaction model is specified as follows:

$$y_{\text{Rating}_i} = \beta_1 x_{\text{Userdataopen}_i} + \beta_2 x_{\text{Interfaceopen}_i} + \beta_3 x_{\text{Developertoolsopen}_i} + \beta_4 x_{\text{Marketentryopen}_i} + \beta_5 (x_{\text{Userdataopen}_i} \times x_{\text{JANITA}_i}) + \beta_6 (x_{\text{Interfaceopen}_i} \times x_{\text{JANITA}_i}) + \beta_7 (x_{\text{Developertoolsopen}_i} \times x_{\text{JANITA}_i}) + \beta_8 (x_{\text{Marketentryopen}_i} \times x_{\text{JANITA}_i}) + \beta_9 x_{\text{JANITA}_i} + \beta_{10} x_{\text{Protocol}_i} + \beta_{11} x_{\text{Origin}_i} + \beta_{12} x_{\text{Price}_i} + \beta_{13} x_{\text{Review}_i} + \beta_{14} x_{\text{Release}_i} + \beta_{15} x_{\text{Platconnect}_i} + \varepsilon_i + C.$$

The interaction model expresses the rating of product  $i$  as a function of the four platform openness dimensions, the country dummy, and the interactions between each openness dimension and the country dummy, while retaining the same set of product-level control variables included in the baseline model. In this framework, the coefficients associated with the openness dimensions represent the estimated effects for the reference category (Italy), while the interaction coefficients capture how these effects differ in the Japanese market. A statistically significant interaction term therefore indicates that the effect of a specific openness dimension on perceived product value is not uniform across countries, but instead depends on the national context in which the product is embedded.

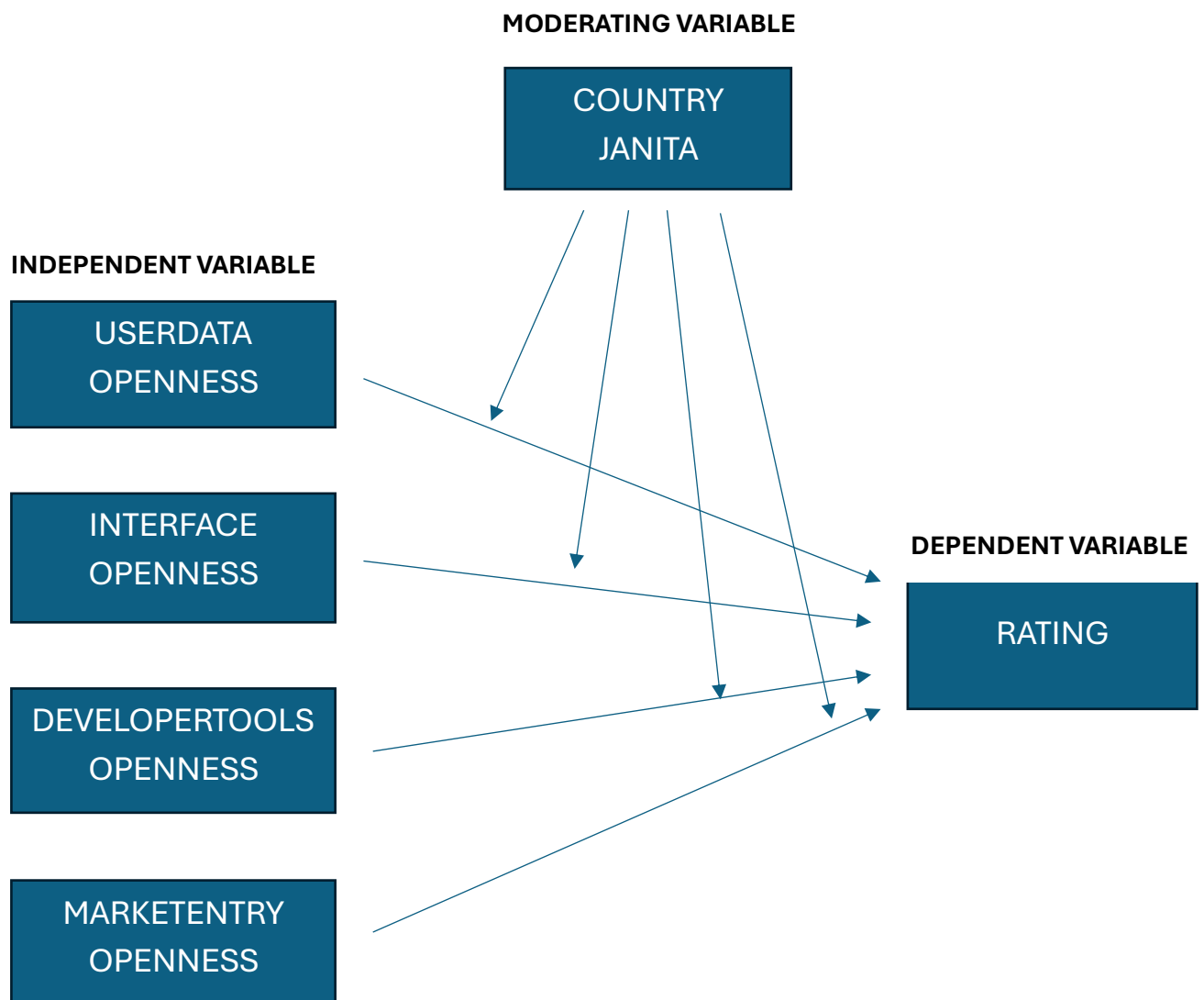
By explicitly modeling these interaction effects, the analysis avoids assuming that platform openness operates in the same way across markets. Instead, it allows the empirical relevance of each openness dimension to be assessed in a comparative perspective, consistent with the hypotheses developed in Chapter 2 and with prior research emphasizing the context-dependent nature of platform governance (Eisenmann, Parker & Van Alstyne, 2009; Boudreau, 2010).

From an estimation and diagnostic perspective, the empirical analysis is conducted using multivariate regression techniques in order to estimate the association between platform openness and consumer perceived value at the product level. All models are estimated using ordinary least squares (OLS), which is appropriate given the continuous nature of the dependent variable (product rating) and the cross-sectional structure of the dataset. The unit of analysis is the individual smart-home product, and all specifications are estimated using pooled observations from Amazon Italy and Amazon Japan, following the same variable definitions and coding rules described in the previous section. The analytical strategy is designed to balance interpretability and robustness. Rather than relying on a single specification, a sequence of regression models is estimated, starting from a baseline model and then introducing interaction terms between the country dummy and each platform openness dimension. This stepwise approach allows the analysis to isolate average effects from context-dependent mechanisms, while ensuring that changes in coefficient estimates can be directly attributed to the introduction of interaction terms rather than to differences in model structure.

Prior to model estimation, correlation matrices are examined to provide a preliminary overview of the relationships among the key variables, including product rating, platform openness dimensions, the country dummy, and control variables. This descriptive analysis helps identify potential patterns and assess whether simple bivariate associations are consistent with the multivariate regression results, without serving as a substitute for the main econometric analysis.

To assess potential multicollinearity among explanatory variables, variance inflation factor (VIF) values are computed for all models. A conservative threshold of 7 is adopted. Across all specifications, the maximum VIF value remains below this threshold, indicating that multicollinearity does not pose a concern in the estimated models. Higher VIF values associated with interaction terms remain within acceptable limits and reflect the expected correlation between main effects and their interactions rather than problematic redundancy. Given the cross-sectional nature of the data and the presence of multiple explanatory variables, all models are estimated with a constant term and include a common set of product-level control variables. This ensures consistency across specifications and reduces the risk of omitted variable bias. The same estimation strategy is applied uniformly across the baseline and interaction models to guarantee comparability of results.

Overall, this empirical approach provides a solid methodological foundation for testing the hypotheses developed in Chapter 2. By combining OLS estimation with systematic diagnostic checks and a transparent modeling strategy, the analysis ensures that the observed relationships between platform openness, national context, and perceived product value reflect systematic patterns in the data rather than artifacts of model specification.



*Figure 4: Conceptual framework illustrating the relationship between platform openness dimensions, country as a moderating variable, and consumer ratings.*

## **CHAPTER 4: Results**

### **4.1 Analysis results**

This section presents the results of the empirical analysis examining the relationship between platform openness and consumer perceived value in the smart-home market, using product-level data from Amazon Italy and Amazon Japan. Product rating is used as the dependent variable in all models, while platform openness is operationalized through four dimensions: user data openness, interface openness, developer tools openness, and market entry openness. Overall, the results show that the relationship between platform openness and consumer perceived value is not uniform across dimensions and national contexts. In the baseline model, platform openness dimensions do not exhibit robust direct associations with product ratings at conventional significance levels. However, there are significant cross-national differences in average ratings between Italy and Japan, motivating the interaction models (Models 2–5) that test whether the associations between openness and product ratings differ by country. Five regression models are estimated. Model 1 serves as a baseline specification including only main effects and control variables, while Models 2–5 introduce interaction terms between platform openness dimensions and the country dummy (JANITA) to capture cross-national differences. The results are presented sequentially to facilitate comparison across model specifications.

### 4.1.1 Model 1: Basic model

Model 1 represents the baseline specification of the empirical analysis. It examines the association between platform openness and product rating while controlling for average cross-national differences through the inclusion of the country dummy (JANITA), but without interaction terms.

Variable	Estimate	Standard error	p-value
(Intercept)	3.770***	0.175	0.000
x_Userdataopen	-0.040	0.040	0.321
x_Interfaceopen	0.059	0.045	0.190
x_Developertoolsopen	-0.027	0.024	0.262
x_Marketentryopen	0.141	0.109	0.194
x_JANITA	0.328***	0.035	0.000
x_Protocol	-0.064	0.130	0.621
x_ReviewNum	0.070***	0.008	0.000
x_Price	0.033*	0.017	0.050
x_Release	-0.101**	0.031	0.001
X_Origin	-0.006	0.050	0.900
x_Platconnect	0.009	0.012	0.478
Adjusted R <sup>2</sup>	0.311		

Notes: \*\*\*  $p < 0.001$ , \*\*  $p < 0.01$ , \*  $p < 0.05$ . The dependent variable ( $y$ ) is *product rating*.

Table 3: Baseline regression results (Model 1).

Table 3 reports the estimated coefficients for Model 1. The adjusted R<sup>2</sup> of 0.311 indicates that the model explains a substantial share of the variation in product ratings. In this baseline specification, none of the platform openness dimensions shows a statistically significant association with product ratings at conventional levels. In contrast, the country dummy JANITA is positive and highly significant ( $\beta = 0.328$ ,  $p < 0.001$ ), indicating that products sold on the Japanese Amazon marketplace receive significantly higher average ratings than those sold in Italy, holding all other factors constant. This finding points to systematic cross-national

differences in consumer evaluation behavior or market conditions and motivates the introduction of interaction terms in subsequent models. Variance Inflation Factor (VIF) values for all variables are well below commonly accepted thresholds ( $VIF < 5$ ). The mean VIF is 1.97, indicating that multicollinearity is not a concern in the baseline specification, and the estimated coefficients can be interpreted as stable and reliable.

#### 4.1.2 Model 2: Userdataopenness interaction

Model 2 introduces an interaction term between user data openness and the country dummy (JANITA) in order to examine whether the association between user data openness and product ratings differs between the Italian and Japanese markets. Compared to the baseline model, this specification allows the effect of user data openness to vary across national contexts, while keeping all other openness dimensions and control variables constant.

Variable	Estimate	Standard error	p-value
(Intercept)	3.735***	0.178	0.000
x_Userdataopen	-0.068	0.048	0.154
x_Interfaceopen	0.059	0.045	0.189
x_Developertoolsopen	-0.018	0.026	0.483
x_Marketentryopen	0.154	0.109	0.159
x_JANITA	0.323***	0.035	0.000
x_Userdataopen_JANITA	0.061	0.056	0.278
x_Protocol	-0.059	0.130	0.650
x_ReviewNum	0.070***	0.008	0.000
x_Price	0.035*	0.017	0.038
x_Release	-0.097**	0.031	0.002
x_Origin	-0.005	0.050	0.915
x_Platconnect	0.012	0.012	0.354
Adjusted R <sup>2</sup>	0.311		

Notes: \*\*\*  $p < 0.001$ , \*\*  $p < 0.01$ , \*  $p < 0.05$ . The dependent variable ( $y$ ) is *product rating*.

*Table 4: Regression results including user data openness and country effects (Model 2).*

Table 4 reports the estimated coefficients for Model 2. The interaction term between user data openness and JANITA is positive ( $\beta = 0.061$ ) but not statistically significant ( $p = 0.278$ ). This indicates that the relationship between user data openness and product ratings does not differ significantly between Italy and Japan. In other words, there is no evidence of a moderating effect of national context on the relationship between user data openness and consumer perceived value. The adjusted  $R^2$  of 0.311 indicates that the model explains approximately 31.1% of the variance in product ratings. This represents only a very modest improvement compared to the baseline model, suggesting that the inclusion of the user data openness interaction does not substantially increase the overall explanatory power of the specification. Regarding multicollinearity, variance inflation factor (VIF) values remain within acceptable limits. The highest VIF is observed for the interaction term  $x\_Userdataopen\_JANITA$  (VIF = 3.72), which is below commonly accepted thresholds. The mean VIF of 2.10 further indicates that multicollinearity is not a concern in this model and that coefficient estimates can be considered stable. These findings suggest that access to user and device data, as a dimension of platform openness, is perceived relatively uniformly by consumers across the two markets and does not generate country-specific valuation effects. The results show that the interaction between user data openness and the country dummy is not statistically significant. Therefore, H1 is not supported.

### **4.1.3 Model 3: Interface openness interaction**

Model 3 introduces an interaction term between interface openness and the country dummy (JANITA) to examine whether the relationship between interface openness and product ratings differs between Italy and Japan. All other openness dimensions and control variables are retained to ensure comparability with the baseline model.

Variable	Estimate	Standard error	p-value
(Intercept)	3.712***	0.177	0.000
x_Userdataopen	-0.027	0.040	0.509
x_Interfaceopen	-0.009	0.056	0.876
x_Developertoolsopen	-0.011	0.026	0.675
x_Marketentryopen	0.149	0.109	0.171
x_JANITA	0.321***	0.035	0.000
x_Interfaceopen_JANITA	0.111*	0.055	0.044
x_Protocol	-0.035	0.130	0.787
x_ReviewNum	0.069***	0.008	0.000
x_Price	0.032	0.017	0.054
x_Release	-0.094**	0.031	0.003
x_Origin	-0.006	0.049	0.907
x_Platconnect	0.014	0.012	0.271
Adjusted R <sup>2</sup>	0.316		

Notes: \*\*\*  $p < 0.001$ , \*\*  $p < 0.01$ , \*  $p < 0.05$ . The dependent variable ( $y$ ) is *product rating*.

*Table 5: Regression results including interface openness and country effects (Model 3).*

Table 5 reports the estimated coefficients for Model 3. In this specification, the main effect of interface openness is not statistically significant ( $\beta = -0.009$ ,  $p = 0.876$ ), indicating that, in the Italian market (baseline category), interface openness does not exhibit a statistically significant association with consumer ratings. At the same time, the interaction term between interface openness and JANITA is positive and statistically significant ( $\beta = 0.111$ ,  $p < 0.05$ ). This indicates that the relationship between interface openness and product ratings is stronger in the Japanese market compared to the Italian market. The explanatory power of the model improves slightly compared to the baseline and previous interaction model, with an adjusted R<sup>2</sup> of 0.316. With respect to multicollinearity, VIF values remain within acceptable ranges. The mean VIF of 2.18 indicates that multicollinearity is not problematic and does not undermine the reliability of the estimated coefficients. The interaction between interface

openness and the country dummy is statistically significant and positive. Therefore, H2 is supported.

#### 4.1.4 Model 4: Developertoolsopen Interaction

Model 4 introduces an interaction term between developer tools openness and the country dummy (JANITA) to examine whether the relationship between the availability of developer-oriented resources and product ratings differs between the Italian and Japanese markets. As in the previous specifications, all other openness dimensions and control variables are retained to ensure comparability across models.

Variable	Estimate	Standard error	p-value
(Intercept)	3.773***	0.174	0.000
x_Userdataopen	-0.025	0.040	0.529
x_Interfaceopen	0.053	0.045	0.238
x_Developertoolsopen	-0.046	0.026	0.082
x_Marketentryopen	0.148	0.109	0.173
x_JANITA	0.325***	0.035	0.000
x_Developertoolsopen_JANITA	0.070	0.037	0.061
x_Protocol	-0.070	0.129	0.588
x_ReviewNum	0.069***	0.008	0.000
x_Price	0.031	0.017	0.070
x_Release	-0.100**	0.031	0.001
x_Origin	-0.004	0.049	0.934
x_Platconnect	0.013	0.012	0.300
Adjusted R <sup>2</sup>	0.315		

Notes: \*\*\*  $p < 0.001$ , \*\*  $p < 0.01$ , \*  $p < 0.05$ . The dependent variable ( $y$ ) is *product rating*.

*Table 6 Regression results including developer tools openness and country (Model 4).*

Table 6 reports the estimated coefficients for Model 4. The interaction term between developer tools openness and JANITA is positive and marginally significant ( $\beta = 0.070$ ,  $p = 0.061$ ). This result indicates that the association between developer tools openness and consumer perceived value differs across national contexts. Specifically, the relationship between developer tools openness and product ratings tends to be stronger in the Japanese market compared to the Italian market. The main effect of developer tools openness is not statistically significant in the pooled sample. This suggests that developer-oriented platform resources do not exert a uniform correlation on consumer evaluations across markets, but their impact depends on national context. The adjusted  $R^2$  of 0.315 is comparable to the baseline and previous interaction models, indicating stable explanatory power. Variance inflation factors remain within acceptable thresholds, and the mean VIF (1.98) indicates that multicollinearity is not severe and does not compromise the reliability of coefficient estimates. The interaction between developer tools openness and the country dummy is marginally significant. Therefore, H3 receives partial support.

#### **4.1.5 Model 5: Marketentry openness interaction**

Model 5 introduces an interaction between market entry openness and the country dummy variable (JANITA) to examine whether the association between market entry openness and product ratings differs between Italy and Japan. All other openness dimensions and control variables are retained to ensure comparability with the previous model specifications.

Variable	Estimate	Standard error	p-value
(Intercept)	3.945***	0.192	0.000
x_Userdataopen	-0.042	0.040	0.287
x_Interfaceopen	0.065	0.045	0.149
x_Developertoolsopen	-0.016	0.025	0.523
x_Marketentryopen	0.358*	0.147	0.016
x_JANITA	0.328***	0.035	0.000
x_Marketentryopen_JANITA	-0.318*	0.147	0.031
x_Protocol	-0.244	0.154	0.113
x_ReviewNum	0.070***	0.008	0.000
x_Price	0.029	0.017	0.090
x_Release	-0.103***	0.031	0.001
x_Origin	0.000	0.049	0.996
x_Platconnect	0.014	0.012	0.260
Adjusted R <sup>2</sup>	0.316		

Notes: \*\*\*  $p < 0.001$ , \*\*  $p < 0.01$ , \*  $p < 0.05$ . The dependent variable ( $y$ ) is *product rating*.

*Table 7: Regression results including market entry openness and country (Model 5).*

Table 7 reports the estimated coefficients for Model 5. The interaction term between market entry openness and JANITA is negative and statistically significant ( $\beta = -0.318$ ,  $p = 0.031$ ). This result indicates that the relationship between market entry openness and consumer perceived value differs across national contexts. Specifically, market entry openness is more positively associated with product ratings in the Italian market, while the effect becomes substantially weaker in the Japanese market. The main effect of market entry openness is statistically significant in the pooled sample ( $\beta = 0.358$ ,  $p = 0.016$ ), indicating that entry conditions are positively associated with product ratings across countries. The adjusted R<sup>2</sup> remains stable at 0.316, suggesting that the inclusion of the interaction term improves interpretive insight without affecting overall model fit. Variance inflation factors remain within acceptable limits. While the VIF value for market entry openness (5.68) is higher than those of

other variables, it remains within commonly accepted thresholds for multicollinearity. The mean VIF of 2.27 further indicates that multicollinearity does not pose a serious concern in this specification and that coefficient estimates can be interpreted with confidence. The interaction between market entry openness and the country dummy is statistically significant and negative. Therefore, H4 is not supported.

## **4.2 Robustness checks**

### **4.2.1 Winsorization robustness test**

To assess the robustness of the empirical results and to verify whether the estimated relationships are influenced by extreme observations or sample-specific effects, robustness checks were conducted. The purpose of these analyses is to ensure that the main findings are not driven by a limited number of atypical observations, but instead reflect systematic patterns in the data. This is particularly important in empirical studies based on online marketplace data, where variables such as consumer ratings or platform-related indicators may exhibit skewed distributions or isolated extreme values. Accordingly, this study implements two complementary robustness strategies. First, an extreme data test based on winsorization is applied to the dependent variable and to the platform openness dimensions, and all regression models are re-estimated using the modified variables. Second, separate regressions are estimated for the Japanese and Italian subsamples in order to assess whether the main results are driven by one specific national context.

To evaluate whether the estimated relationships are sensitive to extreme observations, a robustness test based on winsorization was conducted. Winsorization mitigates the influence of outliers by constraining extreme values within empirically determined bounds, while preserving the full sample size. In this study, winsorization was applied to the dependent variable (product rating) and to the four platform openness dimensions: user data openness, interface openness, developer tools openness, and market entry openness. Cutoff values were determined directly from the empirical distributions of the variables. The proportion of modified observations is very limited across all variables, indicating that extreme values are relatively rare in the dataset. The resulting winsorization intervals therefore emerge directly from the data rather than being imposed *ex ante*:

- For the dependent variable *Rating*, 9 observations, corresponding to 1.79% of the sample, were modified, with values constrained within the range [3.0000, 4.7000]. This implies that all ratings below 3.0000 were set equal to 3.0000, and all ratings above 4.7000 were set equal to 4.7000.
- For *Userdataopen*, 3 observations (0.60%) were winsorized within the range [2.0000, 5.0000], while *Interfaceopen* was affected in 6 cases (1.20%), with values capped within [2.0000, 4.5000].
- In the case of *Developertoolsopen*, 4 observations (0.80%) were modified, resulting in a final range of [5.0000, 9.0000].
- Finally, *Marketentryopen* exhibited almost no extreme values, with only a single observation (0.20%) being winsorized within the range [0.0000, 1.0000].

After winsorization, all regression models presented in Section 4.1 were re-estimated. The estimated coefficients, their statistical significance, and overall model fit remain largely unchanged. In particular, the direction, magnitude, and significance of the key interaction terms are highly stable across original and winsorized specifications, while adjusted  $R^2$  values exhibit only negligible changes. These results indicate that the main findings are not driven by extreme observations and are robust to alternative treatments of outliers.

#### *Comparison of distribution for winsorized variables*

To further assess the impact of winsorization on the data, this table compares the distributional properties of the original variables with those obtained after winsorization. Specifically, it reports the mean and standard deviation of each variable before and after the procedure, together with the percentage change in these moments. This comparison helps assess whether winsorization materially alters the central tendency or dispersion of the variables, or mainly affects a limited number of extreme observations.

Variable	Original Mean	Original standard deviation	Winsorized mean	Winsorized standard deviation	Mean Change (%)	Standard deviation Change (%)
Product ratings	4.118	0.385	4.120	0.373	0.040	-3.090
Userdata open	4.159	0.578	4.167	0.533	0.190	-7.870
Interface open	3.827	0.588	3.831	0.542	0.100	-7.900
Developertool sopen	7.986	0.915	8.010	0.769	0.290	-15.940
Marketentry open	0.115	0.249	0.110	0.205	-4.190	-17.650

*Table 8: Descriptive statistics before and after winsorization*

For the dependent variable, product rating, the winsorized mean remains virtually unchanged compared to the original mean (4.120 versus 4.118), with a negligible increase of 0.04%, while the standard deviation decreases by approximately 3%. This indicates that winsorization attenuates the influence of a small number of extreme ratings without altering the overall distribution of consumer evaluations. For the platform openness dimensions, changes in means are generally limited, while reductions in standard deviation indicate lower dispersion after winsorization. User data openness exhibits a reduction in dispersion of approximately 8%, reflecting the presence of a small number of extreme values in the original distribution that slightly inflated variability. Interface openness shows only modest changes in mean and dispersion, suggesting that its distribution was already relatively well behaved. Developer tools openness presents a somewhat larger reduction in dispersion after winsorization, indicating that the procedure mainly attenuates the influence of a limited number of extreme observations. Market entry openness displays only minor changes, consistent with its more discrete structure. Overall, the comparison of distributions indicates that winsorization does not materially distort the central tendencies of the key variables, while it effectively reduces excessive dispersion caused by isolated extreme values. These results confirm that the

winsorized variables provide a reliable basis for reassessing the regression models and support the robustness of the empirical findings with respect to outliers.

### *Comparison of interaction coefficients*

After re-estimating the models using winsorized variables, the stability of the key interaction effects was further assessed by directly comparing the interaction coefficients obtained from the original and winsorized specifications. This comparison focuses on the interaction terms between each platform openness dimension and the country dummy (JANITA), as these coefficients capture the core cross-national differences examined in the study.

<b>Interaction term</b>	<b>Original coefficient</b>	<b>Original significance</b>	<b>Winsorized coefficient</b>	<b>Winsorized significance</b>	<b>Coefficient change</b>	<b>Robustness evaluation</b>
<b>Userdata</b> <b>Open</b> × <b>JANITA</b>	0.061		0.059		-0.002	✓ Stable
<b>Interface</b> <b>open</b> × <b>JANITA</b>	0.111	*	0.107	*	-0.004	✓ Stable
<b>Developertools</b> <b>open</b> × <b>JANITA</b>	0.070		0.078	*	0.008	✗ Change
<b>Marketentry</b> <b>open</b> × <b>JANITA</b>	-0.318	*	-0.306	*	0.012	✓ Stable

Notes: \*\*\*  $p < 0.001$ , \*\*  $p < 0.01$ , \*  $p < 0.05$ .

*Table 9: Comparison of interaction coefficients: original vs. winsorized models.*

The comparison shows a high degree of consistency between the original and winsorized estimates. For the interaction between user data openness and JANITA, the coefficient remains positive after winsorization, changing only marginally from 0.061 to 0.059. The negligible coefficient change ( $-0.002$ ) and the unchanged lack of statistical significance indicate that this

interaction effect is not sensitive to extreme values in the data. A similar pattern is observed for the interaction involving interface openness. The coefficient decreases slightly from 0.111 to 0.107 after winsorization, while maintaining the same level of statistical significance. This suggests that the moderating association of national context on interface openness is robust and not driven by outliers. The interaction between developer tools openness and JANITA shows a modest increase in magnitude (from 0.070 to 0.078) and becomes statistically significant after winsorization, suggesting that the relationship may be sensitive to extreme observations but remains directionally consistent. Finally, the interaction between market entry openness and JANITA also remains stable, with the coefficient changing only slightly from  $-0.318$  to  $-0.306$  after winsorization. These results indicate that the direction and magnitude of the interaction coefficients are largely unaffected by winsorization, confirming that the observed cross-national differences in the effects of platform openness are not driven by extreme observations but reflect systematic patterns in the data.

#### *Comparison of model fit*

A further robustness check examines whether winsorization affects the overall goodness of fit of the estimated models. To this end, the adjusted  $R^2$  values from the original regressions are compared with those obtained after winsorization for each of the five model specifications.

<b>Model</b>	<b>Original Adjusted R<sup>2</sup></b>	<b>Winsorized Adjusted R<sup>2</sup></b>	<b>Change (%)</b>
<b>Model 1: Basic model</b>	0.311	0.313	0.160
<b>Model 2: Userdataopen interaction</b>	0.311	0.313	0.150
<b>Model 3: Interfaceopen interaction</b>	0.316	0.317	0.130
<b>Model 4: Developertoolsopen interaction</b>	0.315	0.317	0.240
<b>Model 5: Marketentryopen interaction</b>	0.316	0.318	0.130

*Table 10: Comparison of model fit (Adjusted R<sup>2</sup>) before and after winsorization*

Across all five specifications, the adjusted R<sup>2</sup> values remain remarkably stable after winsorization. In the baseline model, the adjusted R<sup>2</sup> increases only marginally, from 0.311 to 0.313, corresponding to a change of approximately 0.16%. Similarly small changes are observed in the interaction models, with increases ranging between approximately 0.13% and 0.24%. These differences are quantitatively negligible and indicate that the overall ability of the models to explain variation in product ratings is not meaningfully affected by winsorization.

The slight increases in adjusted R<sup>2</sup> are consistent with the attenuation of the influence of extreme observations and do not imply any substantive change in model fit. The stability of adjusted R<sup>2</sup> values across all specifications provides further evidence that the empirical results are robust and not driven by a small number of influential observations.

### 4.2.2 Sample split by country: Japan and Italy

As a second robustness check, the empirical analysis estimates the regression models separately for the Japanese and Italian subsamples. This subsample comparison allows a more direct assessment of whether the relationships between platform openness dimensions and product ratings are driven by a specific national context, rather than by pooled estimation assumptions. Separate regressions are estimated for the Japanese and Italian subsamples using the same model structure and control variables as in the main analysis. The resulting coefficients for each openness dimension are then compared across countries, together with the corresponding measures of model fit.

Openness dimension	Japan coefficient	Italy coefficient	Coefficient difference	Interpretation
Userdataopen	-0.016	0.010	0.026	Not significant in both countries
Interfaceopen	0.027	0.057	0.030	Not significant in both countries
Developertoolsopen	-0.055	0.016	0.070	Not significant in both countries
Marketentryopen	0.212	0.087	-0.125	Not significant in both countries
Model fit				
Adjusted R <sup>2</sup>	0.244	0.152	+0.092	The model explains more variance in Japan

Notes: \*\*\*  $p < 0.001$ , \*\*  $p < 0.01$ , \*  $p < 0.05$ .

*Table 11: Comparison of openness coefficients: separate regressions for Japan and Italy.*

Table 11 reports the coefficients obtained from the separate regressions for Japan and Italy, along with the coefficient differences (Italy – Japan). To formally assess whether the observed

coefficient differences between the Japanese and Italian subsamples are statistically significant, the interaction terms in the pooled regression models provide the appropriate statistical test. The interaction coefficients directly estimate the difference between the country-specific effects and therefore represent the statistical significance test of the coefficient differences reported in the subsample comparison. Therefore, the statistical significance of the country differences discussed in this subsection corresponds to the interaction results reported in the main regression models.

The results show that the coefficients differ in direction and magnitude across the two countries, although none of the openness coefficients is statistically significant within the country-specific estimations. User data openness exhibits very small coefficients in both cases (Japan:  $\beta = -0.016$ ; Italy:  $\beta = 0.010$ ), which is consistent with the absence of significant cross-national heterogeneity found in the pooled interaction model. Interface openness shows positive coefficients in both countries (Japan:  $\beta = 0.027$ ; Italy:  $\beta = 0.057$ ). However, these country-specific estimates are not statistically significant, and the formal test of cross-country differences is provided by the pooled interaction specification, which indicates a significantly stronger effect in Japan. Developer tools openness exhibits a small negative coefficient in the Japanese estimation ( $\beta = -0.055$ ) and a slightly positive coefficient in the Italian estimation ( $\beta = 0.016$ ). Although these estimates are not statistically significant, the directional difference suggests some cross-national variation and is broadly consistent with the evidence of a weak or only partially robust country-specific effect found in the pooled models. Market entry openness shows positive coefficients in both countries, with a numerically larger coefficient in Japan ( $\beta = 0.212$ ) than in Italy ( $\beta = 0.087$ ). However, these estimates are not statistically significant in the country-specific analysis, and the pooled interaction model indicates that the effect is significantly more positive in Italy than in Japan.

It is important to note that estimating separate country models substantially reduces the number of observations available for each estimation. This reduction in available data leads to larger standard errors and consequently lowers the statistical power of the tests. As a result, variables that may exhibit meaningful relationships in the full dataset may fail to reach conventional levels of statistical significance in the country-specific analysis. This attenuation of statistical power is a well-known statistical phenomenon and does not imply that the null hypothesis necessarily holds. Despite the limited statistical significance of individual coefficients, the comparison of model fit provides an additional insight. The adjusted  $R^2$  is

substantially higher in the Japanese estimation (0.244) than in the Italian estimation (0.152), indicating that the model explains a larger share of the variation in product ratings in Japan. One possible interpretation is that platform openness plays a more central role in shaping consumer evaluations in the Japanese market. In contrast, product ratings in the Italian market may be influenced more strongly by other factors not captured by the openness variables included in the model. Overall, the country-specific analysis provides an additional robustness perspective and supports the interpretation that the relationship between platform openness and consumer perceived value varies across national contexts. In particular, the difference in explanatory power across the two markets further supports the inclusion of the country moderator (JANITA) in the pooled regression models.

## CHAPTER 5 - Discussion

### 5.1 Interpretation of results

The purpose of the empirical study was to examine how different dimensions of platform openness relate to consumer perceived value and whether the strength of these relationships varies across national contexts, specifically between Italy and Japan. To empirically examine these relationships, the study adopts smart home platforms as a concrete application domain in which platform openness and system-level consumer evaluations can be observed. Using product ratings from Amazon Italy and Amazon Japan as a proxy for perceived value, the analysis shows that platform openness should not be treated as a single, uniform construct and that cultural context plays a meaningful moderating role (Gawer, 2014; Tiwana, 2014; De Reuver et al., 2018). While the baseline model reveals limited direct effects of openness on product ratings, the interaction models uncover systematic cross-national differences, indicating that consumers in Italy and Japan evaluate openness-related features in distinct ways.

The first hypothesis examined whether the relationship between user data openness and consumer perceived value differs between Italy and Japan. Specifically, H1 predicted a stronger positive association for Japanese consumers, reflecting their higher long-term orientation and greater preference for system learning and automation benefits. The empirical results do not provide support for this hypothesis. In Model 2, the interaction term between user data openness and the country dummy (Userdataopen  $\times$  JANITA) is positive and statistically insignificant. This indicates that user data openness does not exhibit a differential association with product ratings between the two national contexts. The inclusion of the interaction term also leads to only a negligible change in model fit, suggesting that allowing the effect of user data openness to vary by country does not improve the explanatory power of the model. Based on these results, H1 is not supported.

This finding suggests that, at the product level, consumers in Italy and Japan have similar perceptions of user data openness. One possible explanation is that user data openness is largely mediated by platform-level governance mechanisms and regulatory frameworks, which may standardize consumer perceptions across markets (Tiwana, 2014; Gawer, 2014). In addition, the execution of these practices related to user data is often not directly observable at the point of purchase on online marketplaces such as Amazon, limiting their salience in consumer rating behavior (Dellarocas, 2003). As a result, although user data

openness is theoretically central to platform intelligence and long-term system optimization, it may not translate into observable differences in consumer perceived value across national contexts in this setting (Tiwana, 2014; Janssen et al., 2012).

The second hypothesis examined whether interface openness is positively associated with consumer perceived value and whether this relationship differs between Italy and Japan. H2 predicted that interface openness would have a positive correlation on perceived value in both countries, with a stronger effect expected for Japanese consumers than for Italian consumers. The empirical results support this hypothesis. In Model 3, the main effect of interface openness is not statistically significant, indicating that, in the Italian market (the baseline category), interface openness does not exhibit a statistically significant association with consumer ratings. At the same time, the interaction term between interface openness and the country dummy (Interfaceopen  $\times$  JANITA) is positive and statistically significant. This indicates that the correlation of interface openness on product ratings is stronger in the Japanese market compared to the Italian market. The inclusion of the interaction term also leads to an improvement in model fit, indicating that capturing country-specific variation in the effect of interface openness enhances the explanatory power of the model. On the basis of these findings, H2 is supported. This result suggests that consumers in Japan may derive greater perceived value from open and flexible interaction interfaces than consumers in Italy. One possible explanation is that interface openness directly affects daily user interaction and system usability, making it highly salient at the product level (Davis, 1989; Venkatesh et al., 2012). In the Japanese market, broader interface openness may be interpreted more positively when it enhances system integration, automation potential, and platform functionality. As a result, differences in how consumers value flexibility, coordination, and system performance are more likely to translate into observable rating behavior for interface openness than for less visible openness dimensions (Ghazawneh & Henfridsson, 2013).

The third hypothesis focused on developer tools openness and its relationship with consumer perceived value. H3 predicted that higher levels of openness in developer tools would be more positively associated with perceived value for Japanese consumers than for Italian consumers, reflecting the expectation that performance-oriented benefits of third-party innovation would outweigh uncertainty-related costs in the Japanese context. The results provide partial support for this hypothesis. In Model 4, the interaction term between developer tools openness and the country dummy (Developertoolsopen  $\times$  JANITA) is positive

and marginally significant. This indicates that, although developer tools openness does not exhibit a significant direct effect in the pooled sample, its association with product ratings tends to be stronger in the Japanese market compared to the Italian market. Based on these results, H3 receives partial support. Although end users may not directly observe developer tools or boundary resources, prior research suggests that openness toward third-party development can enhance innovation, compatibility, and ecosystem diversity, which may translate into improved system-level performance and consumer value (Boudreau, 2010; Parker, Van Alstyne & Jiang, 2017; Ghazawneh & Henfridsson, 2013). Even if end users may not directly observe developer tools or boundary resources, their effects are reflected in the availability, performance, and diversity of compatible products and services. However, the present findings suggest that in the Japanese context these potential innovation benefits may be valued more positively, particularly when openness supports ecosystem variety, functionality, and technological performance. At the same time, because the interaction term is only marginally significant in the main specification, this result should be interpreted with caution. Overall, developer tools openness appears to have a more favorable, though not fully robust, association with consumer perceived value in Japan than in Italy, underscoring the importance of cultural context in moderating the consumer-level impact of platform openness.

The fourth hypothesis examined whether market entry openness is positively associated with consumer perceived value and whether this effect is stronger in Japan than in Italy. H4 predicted that lower entry barriers and greater complementor participation would enhance perceived value by increasing product variety and competition, and this effect would be more pronounced in Japan. The empirical results do not support this hypothesis. In Model 5, the interaction term between market entry openness and the country dummy ( $\text{Marketentryopen} \times \text{JANITA}$ ) is negative and statistically significant. This indicates that market entry openness is more positively related to product ratings in Italy than in Japan. The model fit also improves with the inclusion of the interaction term, confirming the relevance of national context for this relationship. Based on these results, H4 is not supported.

Open market entry increases complementor participation and intensifies competition, which prior research associates with higher innovation rates and improved ecosystem performance (Rochet & Tirole, 2003; Jacobides et al., 2018). In the present study, these ecosystem-level outcomes appear to be more positively reflected in consumer evaluations in Italy than in Japan. One possible explanation is that Italian consumers may value the broader variety and increased competition associated with open market entry more strongly, whereas in the Japanese market

these benefits may be partially offset by concerns related to system coherence, quality dispersion, or uncertainty. The results indicate that platform openness influences consumer perceived value in a selective and context-dependent manner, and that national context plays a key role in determining which openness dimensions are significant for consumers (Hofstede, 2001; Straub et al., 2001).

## 5.2 Theoretical Contributions

This study contributes to the literature on digital platforms by advancing a consumer-centered perspective on platform openness in smart home ecosystems. Moving beyond firm-level and governance-oriented analyses, the research demonstrates that platform openness is a multidimensional construct whose effects on consumer perceived value are neither uniform nor culturally neutral. This perspective builds on earlier work showing that openness is not a uniform platform characteristic, but instead emerges from different combinations of governance, access, and interaction mechanisms across platforms (Benlian, Hilkert, & Hess, 2015). In line with recent platform research that conceptualizes digital platforms as socio-technical systems integrating architecture, governance, and user interaction (de Reuver, Sørensen, & Basole, 2018), the study highlights that openness generates value primarily when it is directly experienced by users or translated into observable system-level outcomes. These findings refine existing platform theories and provide new insights into how openness operates as a value creation mechanism at the consumer level within digitally mediated ecosystems. Rather than generating value by itself, openness appears to matter insofar as it shapes the organization and coordination of ecosystem participants, a view consistent with prior ecosystem research (Kapoor & Agarwal, 2017).

The analysis advances platform ecosystem theory by extending existing conceptualizations of openness beyond innovation incentives and ecosystem growth to its ability to enhance platform value at the consumer level. Earlier platform research has primarily examined openness as a strategic and architectural choice shaping complementor participation, innovation variety, and competitive dynamics (Gawer, 2014; Boudreau, 2010; Parker, Van Alstyne & Jiang, 2017). While these studies emphasize how openness affects ecosystem performance from the supply side, they offer limited understanding of how openness in an ecosystem translates into value as perceived by end users embedded within the ecosystem. By empirically demonstrating that

different dimensions of openness have heterogeneous effects on consumer perceived value, this study reinforces the view of platforms as layered socio-technical systems in which governance and architecture interact with user experience. The findings suggest that openness does not automatically enhance consumer value through ecosystem expansion alone. This insight is consistent with prior research on platform and ecosystem governance, which emphasizes that openness requires active coordination and governance to translate into value, rather than functioning as an automatic value-generating mechanism (Wareham, Fox, & Giner, 2014). Instead, value emerges when openness contributes to coherent system integration, usability, and observable performance improvements at the ecosystem level, particularly through dimensions that directly shape user interaction. This challenges implicit assumptions in platform theory that greater openness uniformly increases ecosystem value through indirect network effects. Moreover, the study highlights the importance of distinguishing between openness mechanisms that operate directly at the interaction layer (such as interface openness), which can have stronger and more visible effects on consumer perceived value, and those that operate indirectly through complementor innovation and market structure (such as developer tools openness and market entry openness), whose effects may translate into perceived value in a more context-dependent manner. This distinction advances platform ecosystem theory by clarifying how architectural and governance decisions cascade from the platform core to the user experience. In doing so, the study aligns with recent calls to integrate architectural modularity, governance, and user-facing outcomes into a unified analytical framework (Tiwana, 2014; Hein et al., 2020). Overall, the findings contribute to a more nuanced understanding of platform ecosystems as systems whose success depends not only on participation and scale, but also on how openness is translated into recognizable value for end users.

This research makes a direct contribution to the emerging literature on platform openness and consumer outcomes by explicitly linking openness dimensions to perceived value. Existing studies on openness have largely focused on developer incentives, innovation performance, or platform governance, while consumer research has tended to examine isolated technologies using constructs such as perceived usefulness, ease of use, or trust (Davis, 1989; Venkatesh et al., 2012). As a result, the consumer-level implications of platform openness at the ecosystem level have remained underexplored. By adopting a value-based perspective grounded in perceived value theory (Zeithaml, 1988) and the Value-Based Adoption Model (Kim et al., 2018), this study conceptualizes consumer evaluation of platforms as a balance between benefits and sacrifices arising from openness. This view is also consistent with

multidimensional conceptualizations of consumer perceived value, which emphasize functional, emotional, and experiential components rather than purely utilitarian benefits (Sweeney & Soutar, 2001). This demonstrates that openness enhances perceived value when it improves usability, automation, compatibility, or functional richness, but may fail to generate value when benefits are obscured by complexity, uncertainty, or lack of visibility at the point of purchase. The findings also indicate that openness dimensions whose effects are indirect and less visible to consumers, such as developer tools openness, may translate into perceived value in a weaker and more context-dependent way, even when they enhance innovation at the ecosystem level.

Importantly, the study shows that consumers do not evaluate openness as an abstract governance principle, but through its tangible consequences for system interaction and product performance. This insight advances consumer-oriented platform research by highlighting that openness operates as an indirect value mechanism whose effects depend on salience, transparency, and system-level integration. By empirically separating multiple openness dimensions, the study provides a more detailed analysis of how platforms create or fail to generate value for users. This contributes to a clearer conceptual bridge between platform governance research and consumer behavior theory.

In addition, the analysis advances cross-cultural consumer behavior research by demonstrating that consumer responses to platform openness are culturally contingent and dimension-specific. Prior research on information systems demonstrates that national culture systematically shapes how users evaluate and respond to technological characteristics, even when systems are functionally equivalent across countries (Straub, Loch, & Hill, 2001). However, existing cross-national studies have largely focused on general attitudes such as trust, risk perception, and regulatory sensitivity (Hofstede, 2001; Balta-Ozkan et al., 2013), offering limited insight into how platform-level design choices translate into consumer value perceptions within ecosystem contexts. By comparing Italy and Japan, the study shows that cultural orientations influence not whether openness matters, but how and when it matters. Openness dimensions that are directly experienced by users or that shape visible ecosystem outcomes exhibit stronger cross-national variation, whereas less observable openness mechanisms tend to generate more homogeneous or weaker evaluations. This finding refines cultural theories of technology adoption by highlighting that cultural effects are mediated by the visibility and experiential relevance of platform features. The results indicate that national culture moderates consumer value

perception primarily through differences in tolerance for complexity, attitudes toward automation, and expectations regarding system performance. This contributes to cross-cultural research by moving beyond generalized adoption models toward a more contextualized understanding of consumer evaluation in complex digital ecosystems. Rather than treating culture as a uniform background variable, the study demonstrates how cultural traits selectively amplify or attenuate the value effects of specific platform design choices. This research advances cross-cultural consumer behavior theory by integrating cultural dimensions with platform ecosystem characteristics, showing that consumer value creation in digital environments emerges from the interaction between technological openness and culturally embedded evaluation frameworks.

### **5.3 Practical contributions**

This study offers several practical implications for platform owners, complementors, and ecosystem participants operating in smart home markets and other platform-based industries. By demonstrating that openness dimensions affect consumer perceived value in distinct and context-dependent ways, the findings highlight the importance of treating openness as a configurable design choice rather than a uniform strategic principle. The results suggest that platform firms should carefully calibrate openness across data, interfaces, development tools, and market access, taking into account not only technical efficiency but also consumer perceptions shaped by cultural and institutional environments.

For platform owners and ecosystem orchestrators, the findings provide clear guidance on how openness should be strategically governed and designed. First, the results show that not all openness dimensions contribute equally to consumer perceived value. Interface openness and market entry openness exhibit relatively stronger and more visible associations with consumer evaluations, although the strength of these effects differs across countries: interface openness is more positively associated with product ratings in the Japanese market, while market entry openness shows a stronger positive association in the Italian market.

This suggests that platform companies should prioritize openness dimensions that directly shape user interaction and observable system performance when aiming to improve consumer satisfaction. Second, the positive effects of interface openness indicate that investments in

intuitive, standardized, and flexible interaction mechanisms, such as voice interfaces, automation routines, and scene-based controls, can enhance perceived value by improving usability and reducing interaction friction. However, the empirical results indicate that this positive association is stronger in Japan than in Italy. Platform companies should therefore focus on reducing interaction friction, simplifying configuration processes, and providing clear interface standards that allow consumers to experience openness without excessive cognitive effort. Third, the results underline the importance of governance quality in open ecosystems. Developer tools openness and market entry openness may generate consumer value when accompanied by effective coordination mechanisms and when aligned with local consumer expectations, such as certification programs, quality controls, and compatibility standards. Platform firms should avoid equating openness with unrestricted access. Instead, they should adopt selective openness strategies that allow innovation while preserving system stability and trust. In practice, this means maintaining transparent approval processes, enforcing minimum performance requirements, and actively curating the ecosystem to prevent fragmentation. Moreover, the cross-national differences observed in the study suggest that global platform companies should avoid uniform openness strategies across markets. While higher openness may be rewarded in some contexts more than in others, the results show that different openness dimensions are valued differently across markets. In the present study, interface openness appears to be more positively valued in Japan, whereas market entry openness shows a relatively stronger positive association with consumer ratings in Italy. Adaptive openness design thus becomes a key managerial capability for platform firms operating internationally.

The findings also have important implications for complementors, including device manufacturers, software developers, and service providers participating in platform ecosystems. First, the findings provide tentative evidence that developer tools openness may benefit complementors indirectly when high-quality integrations with open platforms improve functionality, compatibility, and system coherence. Even if consumers are not aware of underlying APIs or SDKs, the resulting improvements in functionality, compatibility, and system coherence are reflected in higher product evaluations. In addition, the cross-national differences identified in the study imply that complementors should be well advised to employ light localization strategies that adapt interaction design and product positioning across markets without altering core functionality. For example, in markets such as Japan, complementors may emphasize automation reliability, performance optimization, and seamless integration with

existing routines. In markets such as Italy, the same products may benefit from clearer setup guidance, simplified default configurations, and explicit communication of privacy and control features. Importantly, these adaptations do not require changes to the underlying technology. Rather, they involve adjustments in user interface design, documentation, onboarding processes, and marketing communication. By aligning these elements with culturally shaped consumer expectations, complementors can increase perceived value without incurring significant development costs. The findings also suggest that complementors should actively monitor platform governance changes. As platform owners adjust openness levels, certification rules, or interface standards, complementors that adapt quickly are more likely to benefit from enhanced visibility and consumer trust. Participation in open ecosystems therefore requires not only technical integration capabilities but also strategic awareness of platform governance dynamics.

Although this study focuses on smart home platforms, the practical implications extend to a wide range of platform-based ecosystems. Many digital platforms share similar structural features, including modular architectures, multi-sided participation, and openness-based governance mechanisms. As a result, the insights regarding openness, consumer perceived value, and cultural moderation are applicable beyond the smart home context. For example, in digital health platforms, interface openness, such as interoperability between devices, apps, and data dashboards, may directly influence user trust and perceived reliability, while excessive data openness without transparent governance could raise privacy concerns. Similarly, in mobility platforms such as ride-sharing or electric vehicle ecosystems, openness in market entry and developer tools may enhance service variety and innovation, but only when coordinated through clear standards and quality controls. In software and cloud service platforms, the findings suggest that exposing flexible interfaces and encouraging third-party innovation can enhance user value, provided that complexity is managed and system coherence is maintained. Across these contexts, the key lesson is that openness affects consumer value primarily through observable interaction quality and system-level outcomes, rather than through more abstract conceptions of technology access. Thus, platform managers in different industries can apply the study's insights by identifying which openness dimensions are most visible, and which aspects of openness strategies are better aligned with user expectations and usage contexts.

While this study compares Italy and Japan, the findings are not limited to these two countries. Rather, they highlight broader mechanisms through which cultural orientations and institutional

contexts jointly shape consumer evaluations of platform openness. Countries sharing similar cultural profiles, such as high uncertainty avoidance, strong long-term orientation, or performance-oriented values, may display comparable responses to specific openness dimensions. For instance, markets such as South Korea or Germany may resemble Japan in valuing reliability, automation, and system integration, whereas Southern European countries may exhibit patterns closer to Italy, with greater emphasis on transparency, simplicity, and perceived control. In addition to cultural factors, national legal and regulatory frameworks may further influence how platform openness is interpreted by consumers. Differences in data protection regimes, privacy regulations, and platform governance requirements can shape expectations regarding data use, transparency, and accountability. Prior cross-cultural research shows that privacy attitudes and risk perceptions vary systematically across countries, reflecting the combined influence of cultural norms and institutional arrangements. These considerations suggest that cultural distance and regulatory context, rather than geographic location alone, are critical for understanding how platform openness translates into consumer perceived value. Platform firms and complementors operating internationally can therefore anticipate consumer responses in new markets by considering both cultural profiles and institutional environments when designing openness-related governance and interface strategies.

## **5.4 Limitations and future research directions**

This study provides new insights into how different dimensions of platform openness influence consumer perceived value in smart home ecosystems across national contexts. However, as with any empirical research, the findings are subject to several limitations related to data sources, sample scope, and methodological choices, which open avenues for future research.

The first limitation is related to the secondary data used, which is based on product ratings from Amazon Italy and Amazon Japan as a proxy for consumer perceived value. While online ratings provide a large-scale and behaviorally grounded measure of consumer evaluations, they capture only an aggregated outcome of user experiences and do not allow direct observation of the underlying cognitive processes driving value perception. Ratings may reflect multiple factors beyond platform openness, such as brand reputation, price promotions, delivery experience, or reviewer heterogeneity, which cannot be fully disentangled when relying exclusively on marketplace data. Future research could address this limitation by integrating platform-based

data with primary data collection methods, such as consumer surveys, experiments, or interviews. Survey-based studies could directly measure perceived benefits and sacrifices associated with specific platform openness dimensions, including privacy concerns, perceived control, usability, and trust. Experimental designs could further isolate causal mechanisms by manipulating openness-related features, such as the degree of interface flexibility and data-sharing transparency. Combining behavioral data with perceptual measures would allow future studies to validate and refine the mechanisms identified in this research and to better distinguish between observable product-level outcomes and subjective value judgments.

A second limitation relates to the cross-national scope of the study, which focuses exclusively on Italy and Japan. While these two countries provide a theoretically meaningful contrast due to their distinct cultural orientations and institutional contexts, the findings cannot be assumed to generalize uniformly across all national contexts. Consumer responses to platform openness may vary in countries with different cultural profiles, levels of technological maturity, or regulatory environments. Future research could extend the analysis to a broader set of countries to examine whether the observed patterns persist or vary across other cultural and institutional settings. Including countries with intermediate or divergent profiles, as well as emerging digital markets, would allow researchers to test whether cultural distance, rather than specific national identities, drives differences in openness evaluation. Moreover, future studies could explicitly model the interaction between cultural dimensions and regulatory regimes, such as data protection laws or platform governance policies, to better understand how formal institutions and informal norms jointly shape consumer value perceptions. Expanding the geographic scope would strengthen the external validity of the findings and contribute to a more differentiated cross-national theory of platform openness.

In addition to cultural and institutional factors, future research could further investigate whether consumer responses to platform openness are also shaped by differences in technological literacy and educational background across countries. Prior research in information systems suggests that users' digital skills and technical competence influence how they evaluate and adopt complex technologies, particularly when systems require configuration, learning, and active interaction (Venkatesh et al., 2012; Straub et al., 2001). In contexts such as Japan, where technological competence and technical education are often considered relatively widespread, consumers may be better equipped to understand, configure, and exploit advanced functionalities, automation features, and ecosystem integrations. This capability-based

perspective aligns with research showing that higher levels of user expertise increase perceived usefulness and reduce perceived complexity and uncertainty in technology use (Burton-Jones & Hubona, 2006; Sun & Zhang, 2006). Future studies could therefore incorporate individual-level indicators such as educational attainment, STEM background, or digital skills to disentangle cultural effects from capability-based explanations. Integrating such measures would allow researchers to examine whether cross-national differences in the valuation of platform openness reflect not only cultural orientations, but also differences in users' ability to effectively leverage open and technologically sophisticated ecosystems.

Another limitation concerns the methodological design and model specification adopted in this study. The analysis relies on cross-sectional data and linear regression models, which estimate the static associations between platform openness dimensions and consumer perceived value. As a result, the study cannot assess dynamic effects, such as how consumer responses to openness evolve over time as platforms mature, governance rules change, or users gain experience with smart home ecosystems. Future research could adopt longitudinal designs to examine how the value of openness changes across different stages of platform development. Panel data or time-series analyses would enable researchers to explore whether openness has stronger effects during the early phases of ecosystem development or whether governance tightening alters consumer perceptions over time. In addition, future studies could refine the operationalization of platform openness by incorporating alternative or more granular indicators, such as quality-adjusted measures of interface complexity, transparency of data governance, or heterogeneity among complementors. Advanced modeling approaches, including nonlinear specifications or multilevel models, could also capture heterogeneity across products, platforms, and user groups. Addressing these methodological limitations would enhance the precision and explanatory power of future research on platform openness and consumer value.

## CHAPTER 6 - Conclusion

This thesis investigated the relationship between platform openness and consumer perceived value in smart home ecosystems, with particular attention to how this relationship varies across national contexts. As outlined in the introductory chapters, existing research on digital platforms has predominantly examined openness from a firm level or ecosystem governance perspective, focusing on innovation incentives, complementor participation, and market expansion. By contrast, this study approached platform openness from the consumer's point of view, asking how different openness dimensions are reflected in end users' evaluations of products sold through different platform ecosystems. To address this question, the thesis compared consumer responses in Italy and Japan, two countries characterized by distinct cultural orientations and institutional environments.

As described in the methodological framework, the empirical analysis is based on product data collected from Amazon Italy and Amazon Japan, comprising approximately 502 smart home products sold across multiple platform ecosystems. Consumer ratings were used as a measurable indicator of perceived value, capturing aggregated evaluations of product performance and user experience. Platform openness was conceptualized as a multidimensional construct and operationalized through four distinct dimensions: userdata openness, interface openness, developertools openness, and marketentry openness. The empirical strategy involved estimating a series of linear regression models, beginning with a baseline specification and then adding interaction terms between openness dimensions and a country dummy variable. As shown by the robustness analyses, additional tests based on winsorization and separate country regressions were conducted to ensure that the findings were not driven by extreme observations or country particularities.

The results of the empirical analysis demonstrate that platform openness does not have a homogeneous or immediate effect on consumer perceived value. As this study has shown, user data openness does not display significant or differentiated associations with product ratings across Italy and Japan. This suggests that data-related openness mechanisms, which are theoretically at the core of the conceptualization of platform intelligence and long-term optimization, are weakly visible to consumers and therefore play a limited role in shaping product-level evaluations. In contrast, openness dimensions that directly affect user interaction and observable system outcomes are more strongly associated with perceived value. Interface

openness exhibits significant cross-national variation, with evidence indicating a stronger positive association with perceived value in Japan than in Italy. Developer tools openness shows a limited and context-dependent relationship with perceived value, with only weak evidence of cross-national differences. Market entry openness also displays cross-national differences, with a stronger positive association with perceived value in Italy than in Japan.

These findings indicate that platform openness generates consumer value primarily when it is translated into tangible and observable improvements in system performance, integration, and daily use. As demonstrated by this analysis, openness that remains abstract, vague, or distant from the user experience does not automatically enhance perceived value. Moreover, the results also reveal that national context moderates how and when specific openness dimensions become salient, rather than whether openness matters at all. Cultural orientations and institutional environments shape consumer sensitivity to complexity, automation, and performance outcomes, thereby influencing how openness is evaluated.

This thesis makes several contributions to the literature. From a theoretical perspective, it advances platform ecosystem research by explicitly linking platform openness to consumer perceived value and by demonstrating that openness functions as a selective and indirect value-creation mechanism rather than a universally beneficial governance principle. By empirically disentangling multiple openness dimensions, the study provides a more nuanced understanding of how architectural and governance choices cascade from the platform core to impact end user results. From a cross-cultural perspective, the findings extend consumer research by showing that cultural context conditions the value effects of platform openness in dimension-specific ways. For practice, as discussed in the implications chapter, the results suggest that platform owners and complementors should adopt adaptive openness strategies, prioritizing dimensions that enhance interaction quality and system coherence while ensuring that openness configurations are congruent with culturally induced expectations of consumers.

Although these contributions are made, the research is not without limitations. It is based on secondary data collected from online marketplaces, focuses on two national contexts, and adopts a cross-sectional research design. As noted in the limitations chapter, future research could extend this work by integrating primary data sources, expanding the geographic scope, and adopting longitudinal approaches to capture how consumer responses to platform openness evolve over time. Overall, this thesis provides a comprehensive and consumer-oriented

understanding of how platform openness translates into perceived value and how these effects vary across national contexts.

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