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Understanding innovation adoption differences between the USA and Brazil: a comparative study of automotive oems

Entendendo as diferenças na adoção de inovação entre Estados Unidos da América e Brasil: um estudo comparativo entre fabricantes originais de equipamentos automotivos

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HIGHLIGHTS

- This study explains why the same automotive product innovation follows different organizational adoption paths in developed and emerging markets, showing how cost, supplier ecosystems, and market structure jointly shape OEM decision-making in the United States and Brazil.
- Using semi-active damping systems as a revealing case, the research applies a qualitative comparative approach based on interviews with OEM and supplier executives, systematically analyzed through NVivo to assess the relative salience of innovation adoption factors.
- Findings reveal a stable cross-country core in which cost is central, but strong divergences emerge: supplier ecosystem density and market pressure dominate adoption decisions in the United States, while trialability and price sensitivity prevail in Brazil.
- The study advances theory by proposing three interacting mechanisms—supplier ecosystem density, market structure and segmentation, and organizational absorptive capacity—and translates them into a practical, multi-gate framework to guide managers planning multinational innovation launches.

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KEYORDS

Innovation Adoption

Automotive Industry

Oems

Supplier Ecosystem

Absorptive Capacity

ABSTRACT

Objective: To explain why the same product innovation can follow different organizational adoption paths across automotive markets in developed and emerging economies, examining how contextual factors shape OEM adoption decisions.

Design/Methodology/Approach: This study employs a qualitative comparative design, using semi-active damping systems as a revealing case. Empirical evidence is drawn from semi-structured interviews with OEM and supplier executives in the United States of America and Brazil, analyzed through systematic qualitative coding in NVivo guided by a consolidated conceptual model of adoption factors.

Originality/Relevance: The study offers a comparative perspective on innovation adoption across distinct institutional contexts, treating end-user perspectives as contextual influences rather than the unit of analysis, thereby extending adoption research in the automotive sector.

Main Results/Findings: The findings reveal a shared cross-country core in which cost remains pivotal, while the salience of other determinants differs substantially. In Brazil, a price-sensitive segment mix and headquarters-centered "black-box" sourcing diminish the influence of supplier-related factors. In the United States of America, a denser local supplier ecosystem and stronger competitive pressure heighten the importance of supplier availability and market pressure, accelerating feasibility assessment and integration planning.

Theoretical/Methodological Contributions/Implications: The study synthesizes the results into three interacting mechanisms—supplier ecosystem density, market structure and segments, and organizational absorptive capacity—formulated as testable propositions that advance theoretical explanations of cross-country innovation adoption.

Social/Managerial Contributions: The proposed framework provides actionable guidance for managers planning cross-country innovation launches, supporting strategic alignment between adoption decisions and market-specific conditions in developed and emerging automotive markets.

PALAVRAS-CHAVE

Adoção de Inovação

Indústria Automotiva

Oems

Ecossistema de Fornecedores

Capacidade Absortiva

RESUMO

Objetivo: Investigar por que uma mesma inovação de produto pode seguir trajetórias distintas de adoção organizacional em mercados automotivos de economias desenvolvidas e emergentes, analisando como fatores contextuais influenciam as decisões de adoção por fabricantes de equipamentos originais (OEMs).

Design/Metodologia/Abordagem: O estudo adota uma abordagem qualitativa comparativa, utilizando os sistemas de amortecimento semiativo como caso revelador. A evidência empírica foi obtida por meio de entrevistas semiestruturadas com executivos de OEMs e fornecedores nos Estados Unidos da América e no Brasil, analisadas por codificação qualitativa sistemática no software NVivo, com base em um modelo conceitual consolidado de fatores de adoção.

Originalidade/Relevância: A pesquisa contribui ao explorar comparativamente a adoção de uma mesma inovação em contextos institucionais distintos, incorporando a perspectiva do usuário final como influência contextual e ampliando a compreensão sobre diferenças entre economias desenvolvidas e emergentes no setor automotivo.

Principais Resultados/Achados: Os resultados revelam um núcleo comum entre os países, no qual o custo permanece como fator central de decisão, mas com diferenças significativas na relevância de outros fatores. No Brasil, a predominância de segmentos sensíveis a preço e o modelo de suprimento "caixa-preta" centrado na matriz reduzem o peso das considerações relacionadas aos fornecedores. Nos Estados Unidos da América, um ecossistema local de fornecedores mais denso e maior pressão competitiva aumentam a importância do fornecedor e da pressão de mercado, acelerando a avaliação de viabilidade e o planejamento de integração.

Contribuições Teóricas/Metodológicas/Implicações: O estudo propõe três mecanismos interativos com proposições testáveis, avançando teoricamente ao integrar fatores organizacionais, de mercado e de fornecimento em um modelo explicativo da adoção de inovação em diferentes contextos econômicos.

Contribuições Sociais/Gerenciais: Os achados resultam em um framework acionável para gestores envolvidos em lançamentos multinacionais, oferecendo subsídios para o alinhamento de estratégias de adoção de inovação às características específicas de cada mercado.

1. Introduction

The automotive industry has undergone successive waves of transformation, from Ford and Sloan's assembly-line paradigm to Toyota's lean production and China's rise to global production leadership (OICA, 2017), and it now faces new discontinuities driven by autonomous driving, fuel cells, and vehicle connectivity. In this context, organizational innovation adoption begins with framing the problems to be solved (Utterback, 1994; Roberts, 2007; Drejer, 2002), followed by selecting alternatives and implementing them under resource constraints (Tornatzky & Fleischer, 1990). Because time and capital are limited, adoption decisions should be disciplined and aligned with organizational, technological, and environmental conditions (Nahm et al., 2003; Kitchell, 1995; Chong & Zhou, 2014; Wang et al., 2010; Tornatzky & Fleischer, 1990; Damanpour & Schneider, 2006).

Although adoption determinants have been extensively studied in domains such as education, sustainability, e-commerce, information systems, artificial intelligence, and mobile applications (Hameed et al., 2012; Islam et al., 2020; Al-Hattami et al., 2022; Nystrom et al., 2002; Westphal et al., 1997), the literature offers comparatively limited coverage of product innovation adoption in the automotive sector (Williams et al., 2009), with most work emphasizing alternative propulsion in developed countries (Yeh, 2007; Zhang et al., 2011; Ozaki & Sevastyanova, 2011). Motivated by this gap, we investigate which factors shape managerial decisions to adopt product innovations in OEMs operating in a developed market (USA) and a developing market (Brazil). We propose a conceptual model of adoption factors tailored to the automotive context and test it through semi-structured interviews with 20 executives in Brazil and the USA, analyzed in NVIVO11. The results indicate that OEMs assign different weights to adoption factors depending on national market characteristics, underscoring the managerial value of accounting for local conditions to reduce adoption errors that can erode profitability.

2. Theoretical Framework

2.1 Innovation adoption by organizations

Innovation is essential for business survival, as it prevents obsolescence and being overtaken by competitors who introduce radical innovations. This process involves creating and implementing new ideas based on market demand (Tidd et al., 2008). At some point, the adopter decides to use the innovation as the best available option. At some point during this process, the adopter (an individual, group, or organization) decides to use the innovation as the best available option (Rogers, 2003).

The adoption of innovation in organizations involves the implementation of a new business model, equipment, system, policy, program, product, process, or service, either developed internally or obtained from an external organization (Daft, 1978). This process is much more complex than individual adoption and requires several factors, including an organization's willingness to innovate (Rogers, 2003; Damanpour & Schneider, 2006). This willingness is influenced by both internal factors, such as the individual characteristics of leaders, and external factors, such as competitive pressures and cultural aspects (Büschgens et al., 2013).

Understanding the complex mechanisms and variables involved in the process of organizational innovation adoption is fundamental for those who formulate corporate strategies and researchers alike. Tornatzky and Fleischer (1990) established three basic contexts that influence the process of decision-making and implementation of technological innovations: organizational, technological, and environmental.

2.2 National Innovation Systems (NIS)

National Innovation Systems theory frames innovation as a system-level outcome of interactions among firms, universities, governments, standards bodies, and intermediaries, where the quality of linkages, not only the volume of inputs, drives learning, diffusion, and appropriation (Lundvall, 2007; Nelson, 1993). Cross-country differences thus reflect the architecture and connectivity of three mutually reinforcing pillars: knowledge infrastructures that support search, testing, and validation; supplier ecosystem density that determines access to specialized problem-solving and tacit/codified know-how; and complementary assets (manufacturing scale-up, regulatory and quality capabilities, distribution, finance, and IP) that enable commercialization and value capture.

Advanced economies tend to exhibit thick, interoperable infrastructures, including stable public funding, metrology and standards capacity, mature IP regimes, and bridging institutions that connect research to production, reducing uncertainty and coordination costs and accelerating cumulative innovation (Fagerberg & Srholec, 2008; Lundvall, 2007). Many emerging economies, by contrast, face uneven scientific capability and weaker university–industry linkages across regions and sectors, making diffusion more dependent on "islands of excellence" and foreign partnerships and limiting the efficiency with which knowledge is converted into capabilities (Anouze et al., 2024; Fagerberg & Srholec, 2008; Nelson, 1993). Supplier density follows a similar pattern: thick bases in developed systems provide specialized inputs, field support, and standards participation, enabling rapid iteration, while thin ecosystems raise search and coordination frictions, slow scaling, and often lock local firms into subordinate roles within global value chains (Gereffi et al., 2005). Profiting from innovation further depends on access to complementary assets (Teece, 1986). Developed systems typically offer deeper markets for scale-up and enforceable contracting, whereas emerging systems often exhibit scarcity or concentration of complements, though contractual access via specialized service platforms can partially substitute and reshape make–buy and licensing choices (Moreira et al., 2023). These structural differences are amplified by global innovation network position, where cross-border collaboration centrality is associated with value-chain upgrading (Xu et al., 2024), and by multinational R&D location dynamics that respond to improvements in local infrastructures and complements even under political uncertainty (Sinani et al., 2025).

2.3 Absorptive Capacity (ACAP) in OEM-Supplier adoption

Absorptive capacity (an organization's ability to recognize the value of external knowledge, assimilate it, and apply it commercially) explains why some OEMs convert supplier-originated innovations into integrable, scalable solutions while others stall (Cohen & Levinthal, 1990; González, 2024; Zahra & George, 2002). In OEM settings, heavier reliance on upstream suppliers expands exposure to technical variety but increases interpretation and coordination burdens. ACAP resolves this tension by converting access into use. Potential ACAP (acquisition and assimilation) screens and structures incoming information, whereas realized ACAP (transformation and exploitation) embeds it in design rules, manufacturing instructions, and verification protocols (Zahra & George, 2002). Evidence from automotive supply networks indicates that stronger ACAP is associated with superior project and innovation outcomes, underscoring internal learning routines as necessary complements to external sourcing (González, 2024).

Trialability and perceived complexity operate largely through ACAP. Trialability reduces uncertainty via prototypes, simulations, and staged pilots; higher-ACAP firms design more diagnostic experiments and interpret ambiguous results with greater fidelity, accelerating convergence toward integrable architectures (Cohen & Levinthal, 1990; Moore & Benbasat, 1991). Complexity is not only technical but also cognitive and organizational; ACAP mitigates it by enabling problem decomposition, codifying supplier tacit knowledge, and coordinating cross-functional integration (Newey, 2024). At the network level, ACAP mediates the returns to supplier/customer collaboration, implying that collaboration without internal learning capacity yields limited gains, whereas collaboration coupled with ACAP supports systematic innovation upgrading (Sang et al., 2024).

2.4 Institutional path dependence

Institutional path dependence explains why adoption decisions rarely begin from a blank slate. Historical policy choices and organizational commitments generate self-reinforcing feedback that narrows the set of technologies and business models firms perceive as viable (North, 1990). Increasing returns and quasi-irreversible investments can create lock-in, such that switching costs and network externalities outweigh technical superiority, as illustrated by the QWERTY case (David, 1985). Institutions “carry history” by stabilizing expectations, routines, and information channels, which biases choices toward extensions of the dominant trajectory rather than discontinuities (David, 1994).

Three co-evolving layers shape contemporary adoption calculus. First, industrial policy legacies configure complementarities by privileging solutions aligned with existing infrastructures and penalizing alternatives lacking compatible assets (David, 1994; North, 1990). Research on sustainability transitions shows that new options diffuse faster where prior policies built complementary infrastructures and expectations, while incumbent regimes persist when earlier choices entrenched skills, evaluation standards, and supporting assets (Eitan & Hekkert, 2023; Geels, 2025). Second, legacy product portfolios embed architectures, certification routines, and service networks that raise cannibalization and coordination costs. Firms evaluate novelty through portfolio fit and asset redeployability, which can extend payback horizons for architectural shifts even when technical advantages are evident (David, 1994; Geels, 2025). Third, market segmentation locks in performance heuristics, interface standards, and legitimacy criteria. Because segments and firm routines co-evolve, the balance between standardization and adaptation reflects a historically constituted search for relational fit, stabilizing particular adoption paths and making course corrections costly (Poulis, 2024).

Overall, institutional feedback defines permissible complementarities, legacy portfolios raise the cost of deviation, and segmentation anchors evaluation benchmarks. Adoption outcomes thus reflect whether these layers enable exploration of new complementarities or reproduce the constraints that sustained the incumbent trajectory.

2.5 Conceptual model

Several theoretical models have been developed in an attempt to address the process of organizational innovation adoption, relating organizational level and the individual adopter within an organization (Frambach & Schillewaert, 2002), associating the complexity and size of the organizational structure with innovation (Damanpour, 1996), analyzing the relation between the characteristics of the innovation, its adoption, and implementation (Tornatzky & Klein, 1982), studying the relation between organizational change, organizational structure, and innovation (Damanpour & Gopalakrishnan, 1998), and evaluating the organizational, technological, and environmental contexts as influencers of the process of adoption and implementation of technological innovations (Tornatzky & Fleischer, 1990).

Frambach and Schillewaert (2002) developed a multilevel model for organizational innovation adoption that includes individual determinants and emphasizes perceived innovation characteristics as key factors. These characteristics (relative advantage, compatibility, complexity, trialability, and observability) were adopted from Rogers' seminal model (2003) and were influenced by external factors such as suppliers and network effects. The authors also introduced the variable of "uncertainty" and divided it into technical, financial, and social categories. Finally, the authors noted that an adopter's traits may include organization size, structure, and innovative posture.

Most research studies on innovation adoption and diffusion analyze the domains of electronic commerce, information systems, IT, Internet, wireless communication, and websites (Williams et al., 2009). To the best of our knowledge, the proposal of a conceptual theoretical model for innovation adoption in the automotive industry is innovative for both academia and the market.

This study analyzed the factors affecting the adoption of semi-active damping systems by vehicle manufacturers in Brazil and the USA. Tables I and II show the conceptual theoretical model's influence factors and dimensions related to external environmental factors and perceived innovation characteristics, supported by the relevant literature. Table III highlights the conceptual model's dimensions related to Innovation Management, addressing a gap in existing literature.

Table 1. Influence factors and dimensions for adoption of semi-active systems by OEMs (influences of the environment external to the Manufacturer)

Dimension/Factors	Description	Reference
1. Influences of the Environment External to the Manufacturer		
1.1. Network externalities	Degree to which manufacturers are influenced to adopt semi-active systems by other competitors that have already adopted the innovation	Frambach and Schillewaert (2002); Cao et al. (2014); Hameed et al. (2012); Ukobitz and Faullant (2021); Jacob and Teutenberg (2022)
1.2. Market pressure	Degree to which innovation adoption is necessary to maintain the manufacturer’s competitive position against competitors	Tornatzky and Fleischer (1990); Frambach and Schillewaert (2002); Lin (2014); Chong and Zhou (2014); Wang and Cheung (2014)
1.3. Market demand	Tendency for end consumers and users of vehicles to adopt the innovation	Rogers (2003); Venkatesh et al. (2012); Wu et al. (2003); Ozaki and Sevastyanova (2011); Yeh (2007)
1.4. Supplier	Influence of the number of suppliers on the manufacturer’s market and whether supply takes place globally or locally	Ozorhon et al. (2014); Bunduchi et al. (2011); Chong and Zhou (2014)
1.5. Legislation	Influence of normative pressure (legislation) on innovation adoption	Cao et al. (2014); Zailani et al. (2015); Wu et al. (2003)
1.6. Technology trends	Influence of technology trends on innovation adoption (for example, the introduction of autonomous vehicles bringing about the adoption of semi-active damping systems).	Ozaki and Sevastyanova (2011); Zhang et al. (2011); Yeh (2007)

Source: authors.

Table 2. Influence factors and dimensions for adoption of semi-active systems by OEMs (perceived innovation characteristics)

Dimension/Factors	Description	Reference
2. Perceived Innovation Characteristics		
2.1. Relative advantage	Degree of perceived technical, financial, and operating advantages of the system compared to traditional damping systems	Rogers (2003); Frambach and Schillewaert (2002); Damanpour and Schneider (2006); Tornatzky and Klein (1982)
2.2. Complexity	Degree of cognitive difficulty (understanding how the system operates) and its use by members of the manufacturer	Chaterjee et al. (2020); Rogers (2003); Frambach and Schillewaert (2002); Tornatzky and Klein (1982); Damanpour and Schneider (2006);
2.3. Trialability	Degree to which the system was tested at a limited scale by the manufacturer, or the ability of the supplier to demonstrate the system’s functionality. Proof of concept exercises done	Rogers (2003); Frambach and Schillewaert (2002); Chong and Zhou (2014)
2.4. Uncertainty	Degree of technical, financial, and social uncertainty from the implementation of the innovation at the manufacturer	Rogers (2003); Frambach and Schillewaert (2002); Wang and Cheung (2014); Kitchell (1995)
2.5. Cost	Influence of cost with the adoption of the innovation by the manufacturer (whether the adoption is competitive to render it viable)	Damanpour and Schneider (2006); Bunduchi et al. (2011); Lin (2014)
2.6. Quality	Influence of the product quality as perceived by the manufacturer and by the end customer when adopting the innovation	Damanpour and Schneider (2006); Premkumar and Roberts (1999); Nahm et al. (2003); Chao et al. (2007)

Source: authors.

Table 3. Influence factors and dimensions for adoption of semi-active systems by OEMs (Innovation Management)

Dimension/Factors	Description	Reference
3. Innovation Management		
3.1. Supplier participation	Degree to which the supplier participates in the development of the innovation	Tornatzky and Fleischer (1990); Chong and Zhou (2014); Martin et al. (2016)
3.2. Access level	Level of access the manufacturer has to information from the supplier about the prospective technology	Tornatzky and Fleischer (1990); Chong and Zhou (2014); Nahm et al. (2003)

3.3. Innovativeness	Propensity of the adopter to gamble on radical innovations (market launch strategy – in niche or mass segments)	Trivedi and Srivastava (2022); Rogers (2003); Damanpour and Schneider (2009); Nagy et al. (2016); Blichfeldt and Faullant (2021)
3.4. Development at HQ	Influence of the development strategy (centered around HQ or pursued totally or partially at the subsidiary) on innovation adoption	Baglieri et al. (2014); Baglieri et al. (2010); Costa et al. (2015); Birkinshaw and Hood (1998)

Source: authors.

3. Methodology

3.1 Design research

The main objective of this research was to identify the differences, if any, between the relative importance of the factors influencing product innovation adoption by organizations in the automotive sectors in the USA and Brazil. Moreover, it sought to discuss the reasons for such differences, if any were to be found.

A qualitative approach was chosen because this model suits the analysis of a complex topic that has seen little research (Yin, 2010; Creswell, 2007), namely the patterns of product innovation adoption in organizations in the automotive industry. After analyzing the various research methods, basic research was chosen as in Patton (2002).

This study analyzed research data to gain diverse perspectives on the phenomenon of interest (Creswell, 2007). The authors evaluated innovation adoption factors in Brazil and the USA by surveying vehicle manufacturers and suspension and damping system suppliers in both countries. Executives from the engineering, R&D, marketing, and sales departments at plants in both countries were interviewed using semi-structured interviews (Brannen, 1992). The script was pre-tested with four senior professors experienced in innovation management, and their feedback was incorporated into the original script (see Appendix A).

3.2 Data collection and analysis

Brazilian data were collected in Sep/Oct-2017 through interviews with representatives of six OEMs, four damper/suspension suppliers, and one automotive trade association. U.S. data were gathered via interviews with four professionals in Apr/May-2018. All interviews were recorded and transcribed, and interviewee profiles are reported in Appendix B.

A second research stage (Jun/Jul-2018) used semi-structured interviews with executives in both countries to identify the most and least influential factors in semi-active damper adoption. A summary of findings was returned to respondents for feedback. Data was coded into categories and analyzed in NVivo 11 Pro using qualitative content analysis, preserving confidentiality. Each NVivo node mapped to a conceptual-model adoption factor (Section 2.2), enabling cross-country comparison. Following Miles et al. (2014), the first stage emphasized assessing the relative salience of factors and dimensions, supported by systematic linkage between coded nodes and interview evidence.

Figure 1. Example of imported interview text from NVivo coding software


ANÁLISE DO FATOR CUSTO COMPETITIVO

<Internas\\OEM_D_USA_RN_20180504> - § 2 referências codificadas [1,67% Cobertura]

Referência 1 - 0,85% Cobertura
Very, very expensive and the after launch advantage is function. That is a cost equation.

Referência 2 - 0,82% Cobertura
Again, it tricks down to what is the cost, what is the benefit and what is the need.

<Internas\\TIER _A2_FS_20180413> - § 1 referência codificada [0,47% Cobertura]

Referência 1 - 0,47% Cobertura
So financially, this system is becoming cheaper, so it is becoming more attractive.

<Internas\\TIER_A1__AC_20180406> - § 3 referências codificadas [2,31% Cobertura]

Referência 1 - 0,41% Cobertura
Ainda é um mercado de nicho, eu concordo, mas a tendência é que quanto mais volume tiver, mais barato vai ficando.

Referência 2 - 1,40% Cobertura
...e levam em consideração inclusive o risco, o custo versus o valor percebido. Ultimamente a gente também, como experiência, às vezes acontece a conversa começar com a introdução de um semiativo em alguma plataforma e isso acaba virando: A gente desistiu, a gente não tem "Budget", isso não vai para a frente, vamos só com o passivo mesmo, então vamos "matar" essa conversa do sistema semiativo

Referência 3 - 0,51% Cobertura
quanto mais volume, mais expert você fica, mais você consegue reduzir custo pelo efeito de demanda e eles conseguem ficar mais eficientes.

<Internas\\TIER_C_FR_20180406> - § 1 referência codificada [1,68% Cobertura]

Referência 1 - 1,68% Cobertura
FR: Financeiro... (inaudível). Hoje é muito importante que se tenha um custo extremamente competitivo para você conseguir alguma coisa. Os fornecedores já estão fornecendo com um custo otimizado, o pessoal já trabalha há um bom tempo com as montadoras.

Source: NVIVO.

After the individual code analysis was completed with respondents' citations, a comparison between all collected data for each specific factor was made to determine the comparison between factors' importance for each market. An example of this analysis for the "perceived innovation characteristics" dimension adoption factors is shown in Appendix C.

In the second stage, the three most and least important factors in both markets were identified, compared, and are shown in Appendix C.

3.3 The innovation: Semi-active damping systems

Dampers reduce the effects of road irregularities by controlling suspension motion, shaping ride comfort, handling, and safety. In passive systems, damping forces are defined by internal valves calibrated to balance comfort and stability; once calibrated, the damper is sealed and cannot be adjusted in operation (Dixon, 2007). Adaptive and semi-active systems emerged in the mid-1980s with embedded electronics, enabling electronic adjustment of damping curves based on real-time sensor inputs on road conditions, cornering, and braking. A control unit actuates electromagnetic valves, periodically varying damping forces to improve control relative to passive designs. These systems diffused first in luxury vehicles and later expanded to broader segments alongside rising electronic content in automobiles.

As an information-rich, mid-complexity innovation, semi-active dampers provide a revealing case for cross-country adoption. They are established in developed markets, appearing in luxury and increasingly mid-class models, while in Brazil they remain concentrated in imported luxury vehicles. Adoption feasibility and timing depend on supplier ecosystem density, segment mix, and cost structure. Focusing on the OEM adoption decision, the case illustrates how National Innovation Systems condition access to standards, testing, and appropriability, and how OEM absorptive capacity translates supplier know-how into design rules, strengthens the evidentiary value of trials, reduces perceived complexity, and converts supplier reliance into capability building.

4. Results and Discussion

4.1 Results of the research in the Brazilian automotive market

Interview data were analyzed to assess the relative importance of factors shaping Brazilian OEMs' adoption of semi-active damping systems. Within the "external environment influences" dimension, respondents emphasized network externalities, market pressure, market demand, suppliers (local and global), and legislation. Notably, "technology trends" was not perceived as influential, diverging from adoption research that typically treats technological trends as an environmental driver (e.g., Rogers, 2003; Tornatzky & Fleischer, 1990; Damanpour & Schneider, 2006; Venkatesh et al., 2012; Zailani et al., 2015).

Under "innovation characteristics perceived by the manufacturer," relative advantage (technical, financial, and organizational) was consistently treated as relevant, consistent with prior work (Rogers, 2003; Tornatzky & Klein, 1982; Premkumar & Roberts, 1999; Damanpour & Schneider, 2006). However, respondents stressed that system cost materially offsets perceived benefits in Brazil, limiting adoption feasibility. Perceived complexity was contingent on the development model. Where systems are delivered as a supplier-managed "black box," complexity is largely neutralized from the OEM's decision calculus; where OEMs engage in co-development and interface design, complexity becomes salient, consistent with evidence that perceived ease of use can shape adoption intentions in other technology settings (Chatterjee et al., 2020). Trialability was unanimously considered decisive: prototypes and staged validation reduce uncertainty, while key risks were framed as both market risk (insufficient demand) and technical risk (quality failures from inadequate adaptation to Brazilian road conditions).

Within "innovation management," supplier involvement was described as variable. Most OEMs prefer end-to-end, black-box provision, while a minority collaborate with suppliers earlier in vehicle design, echoing mixed findings in prior adoption studies on the role of supplier participation (e.g., Martin et al., 2016; Chong & Zhou, 2014). "Access level" was also conditional. Headquarters-centered strategies reduce the need for deep technical transparency in the subsidiary, although some access remains necessary for local adaptation; a subset of OEMs actively seeks deeper knowledge to support learning and future capability. Innovativeness, proxied through launch strategy preferences, revealed conservative and cost-reduction biases. Respondents commonly recommended launching the system as an optional feature on high-priced models, suggesting limited willingness to diffuse more radical features into mass-market segments, consistent with literature linking executive orientation to innovation adoption posture (Roberts et al., 2021; Wu et al., 2003; Lin, 2014; Ozorhon et al., 2014; Trivedi & Srivastava, 2022). Finally, interview evidence indicates that adoption authority varies. In many cases, headquarters makes development and adoption decisions, leaving local adoption dependent on market conditions; in others, subsidiaries drive adoption, aligning with "reverse innovation" dynamics (Govindarajan & Trimble, 2012).

When respondents ranked factors by salience, the most important were relative advantage, trialability, and cost, consistent with prior synthesis studies (e.g., Jeyaraj et al., 2006; Hameed et al., 2012; Premkumar & Roberts, 1999; Bunduchi et al., 2011). Conversely, market pressure was rated low, largely due to weak demand. Similarly, factors commonly expected to be influential (supplier and complexity) were not strongly salient in Brazil, a pattern plausibly linked to low market pull and the prevalence of black-box sourcing that shifts technical burden upstream and dampens local capability accumulation.

4.2 Results of the research in the USA automotive market

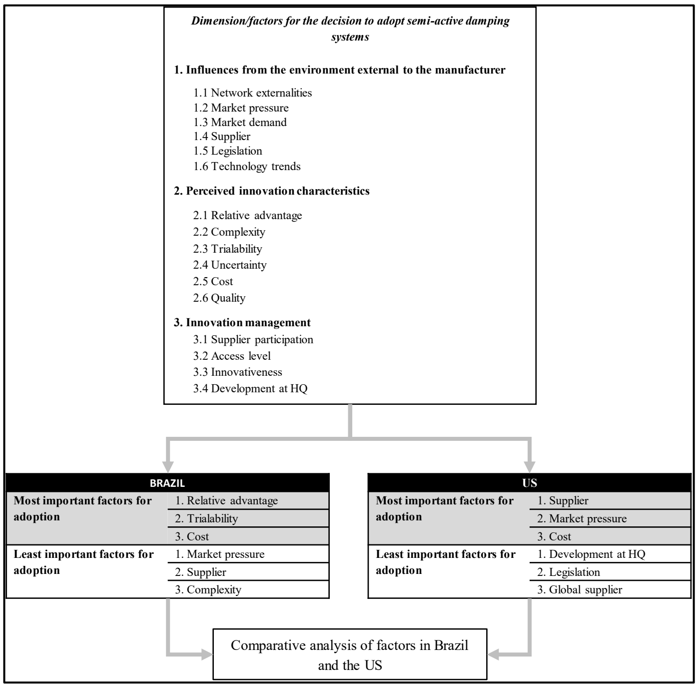
The U.S. phase examined one OEM and two suspension-system suppliers. Interviews with engineering and sales managers used the same protocol as the Brazilian stage to assess the perceived importance of factors shaping adoption of semi-active damping systems. The analysis identified the three most important factors as supplier, market pressure, and cost, and the three least important as development at HQ, legislation, and global supplier.

Supplier salience reflected a comparatively dense ecosystem. Interviewees reported at least five domestic suppliers offering semi-active systems, and proximity to OEM facilities was viewed as enabling richer communication, faster iteration, and better tailoring to customer needs. Respondents also emphasized that because suppliers deliver differentiated technical solutions and OEMs seek product differentiation, monopoly or oligopoly conditions would be undesirable, aligning with prior observations on the role of inter-firm networks in automotive innovation (Dodourova & Bevis, 2014; Mondragon et al., 2009).

Market pressure was likewise central. Semi-active systems appear in U.S. models beyond the premium segment, and comfort is perceived as a valued customer benefit. At the same time, interviewees stressed competitive necessity to deliver innovations at acceptable cost, particularly as new entrants intensify rivalry and stimulate incumbents' investment in advanced technologies. Cost remained a primary determinant, consistent with broader adoption research (Hameed et al., 2012; Jeyaraj et al., 2006; Tornatzky & Klein, 1982), but respondents framed the decision as a cost-benefit trade-off.

By contrast, development at HQ and global supplier were rated as minor influences. Respondents argued that, as a mature technology, semi-active systems do not require HQ-centric development and can be adapted by local teams to segment- and region-specific conditions. Legislation was also considered of low relevance because there is no U.S. requirement mandating semi-active dampers. Other factors (relative advantage, trialability, and complexity) were not ranked as extreme (most/least) influences. Relative advantage was interpreted primarily through competitive differentiation, particularly in high-margin segments where consumers accept incremental costs (Dodourova & Bevis, 2014; Beiker et al., 2016). Trialability was typically addressed via testing during concept proof and business-plan stages, after which adoption proceeds. Complexity was linked to technical expectations: higher OEM technical capability increases demands for supplier transparency and detailed understanding of system performance and integration requirements (Mondragon et al., 2009). Finally, results were compared with the Brazilian findings to derive cross-country contrasts in factor salience (Figure 2).

Figure 2. Comparative analysis of the importance of factors that influence the adoption of semi-active damping systems (Brazil and the USA)



Source: authors

A comparative analysis of Brazilian and USA respondents indicates that adoption of semi-active damping systems is shaped by a stable core of classic determinants, yet the relative salience of key factors differs systematically across markets (summary in Appendix D). "Relative advantage" is generally relevant, consistent with adoption theory (Jeyaraj et al., 2006; Hameed et al., 2012; Wang et al., 2010), but it is not an extreme (most/least) driver in the USA sample. This pattern reflects a trade-off: technical gains in comfort, stability, and safety are weighed against higher development and manufacturing costs. In Brazil, limited willingness to pay makes the financial component of relative advantage unfavorable, whereas in the USA luxury segment the technical premium is more readily monetized.

Supplier-related factors show the sharpest cross-country divergence. "Supplier" was among the least important factors in Brazil but among the most important in the USA, consistent with evidence that supplier networks matter for innovation in automotive settings (Dodourova & Bevis, 2014; Mondragon et al., 2009; Hameed et al., 2012). Interviewees emphasized that proximity and variety of suppliers facilitate communication, faster adjustment, and selection among differentiated technical solutions. The USA ecosystem reportedly includes at least five suppliers, enabling OEM choice; Brazil had fewer suppliers at the time of the study. "Global supplier," by contrast, was not decisive in either market and was among the least important in the USA results, suggesting that local engineering presence and interface work matter more than global contracting arrangements for this specific, integration-intensive component.

"Trialability" was particularly salient in Brazil, where systems are often sourced as black boxes with localized customization, making proof-of-concept testing and validation central to risk reduction. This aligns with prior findings that trialability supports adoption under uncertainty (Jeyaraj et al., 2006; Hameed et al., 2012; Carlo et al., 2012; Glöbisch et al., 2017; Seitz et al., 2015). In the United States of America, trialability was not ranked as an extreme factor, likely because the technology is mature and standard validation routines are institutionalized during concept and business-plan phases.

"Market pressure" was rated low in Brazil but high in the United States of America. The USA respondents linked adoption to competitive dynamics and consumer demand for advanced features, particularly in profitable premium/performance niches. In Brazil, the dominance of cost-sensitive B and SUV segments implies weak demand for semi-active damping and limited competitive pressure to adopt (Carlo et al., 2012; Glöbisch et al., 2017). Cost was highly salient in both markets, consistent with the broader adoption literature (Hameed et al., 2012; Jeyaraj et al., 2006; Premkumar & Roberts, 1999; Tornatzky & Klein, 1982). Respondents noted that diffusion beyond premium segments requires cost-down trajectories, especially where conventional dampers meet baseline expectations.

Finally, "development at HQ" and "legislation" were minor drivers, especially in the USA sample, diverging from work that emphasizes headquarters-centered development in global automotive innovation (Baglieri et al., 2014; Costa et al., 2015; Da Matta et al., 2015; Lema et al., 2015). Respondents framed semi-active damping as a mature technology that can be adapted locally, reducing the centrality of HQ development. Legislation was not perceived as a strong trigger in either market, consistent with studies finding limited regulatory compulsion for such components relative to mandated safety technologies (Ozaki & Sevastyanova, 2011; Palmer et al., 2018; Seitz et al., 2015). Complexity was low-salience in Brazil due to black-box sourcing, while in the United States of America it was moderated by OEM technical expectations and demands for supplier transparency, including software compatibility and calibration

4.3 Theoretical contributions

Studies on the adoption of product innovation by organizations in the automotive industry are not frequent in the literature, and when they are conducted, they usually focus on the adoption of alternative propulsion systems (Yeh, 2007; Zhang et al., 2011; Sperry, 2004; Ozaki & Sevastyanova, 2011). The main contribution of this study to the literature is that manufacturers give different levels of importance to influence factors when deciding whether to adopt a product innovation, mainly due to automotive market dynamics.

This study fills a gap in the literature by providing a conceptual model of the factors influencing product innovation adoption by organizations in the automotive market.

The empirical findings partially contradict the literature on innovation adoption factors in certain contexts. For instance, the factor "market pressure" was found to be of limited importance in the Brazilian automotive market, while in the U.S. market it is considered crucial.

This study shows that the factors affecting organizational innovation adoption differ between countries, and the location of innovation development can impact the significance of trialability. Reverse innovation requires supplier collaboration, increasing the need for experimentation, as suggested by Mondragon, et al. (2009) and Lema, et al. (2015).

4.4 Managerial implications

This study demonstrates that the success of innovation adoption depends on the ability to comprehend the unique characteristics of different countries.

The practical implications of this study provide insight into the relative significance of the factors that influence the adoption of product innovations by automotive market organizations in developing countries compared to developed countries. Given that much of the literature on innovation adoption by organizations focuses on developed countries, it is crucial for managers working in developing countries to consider local conditions for innovation adoption in developing countries. Failure to do so could result in misguided managerial decisions that may be avoided by analyzing studies conducted in developed countries as a point of reference for the current study.

It is important to mention that the data collected in this study will be valuable to the market. Therefore, understanding the factors that influence innovation adoption in different countries is a valuable tool for making strategic decisions regarding new product development and market launches. This, in turn, contributes to a company's profitability and growth.

To inform managerial decisions regarding innovation adoption, the authors propose a five-gate decision tool aligned with the adoption factors of the conceptual model.

Gate 1 - Business case

- Does the total cost of ownership (TCO) of the semi-active damping system justify its adoption and implementation in the target country?
- Is the expected price point (and associated demand sensitivity) compatible with adoption and implementation in the target country?

Gate 2 - Ecosystem readiness

- What is the number and identity of qualified suppliers of semi-active damping systems in the target country?
- Do these suppliers maintain local engineering and testing facilities (and field support) sufficient to develop and adapt systems to regional operating conditions?
- Can these suppliers commit to the OEM's development schedule and milestones (e.g., prototype, validation, and PPAP) and provide effective support throughout the program?

Gate 3 - Technical feasibility

- Are validation activities for semi-active damping systems conducted during the concept design and business planning phases at the headquarters?
- Are the systems supplied as black-box modules for regional deployment, with customization or parametrization for local operating conditions?
- Are the systems co-developed by the supplier and OEM from project inception, and if so, can the supplier's engineers provide the complete technical data and documentation required for OEM development and integration?

Gate 4 - Organizational readiness

- What is the supplier's absorptive capacity, including skills, prior related knowledge, data access/quality, simulation toolchains, and test infrastructure, to co-design semi-active damping systems with the OEM? If the system is delivered as a black-box module, which ACAP elements remain accessible to the OEM (e.g., interface specifications, calibration data, and diagnostic/telemetry protocols)?
- Under black-box delivery, how are decision rights allocated between headquarters and the subsidiary across architecture definition, interface standards, trial design and acceptance, engineering change approval, and PPAP signoff?

Gate 5 - Regulatory context

- Which national safety classifications and standards apply to semi-active damping systems in the target country, and do any of them mandate their installation in vehicles?
- If applicable, what compliance requirements and resource commitments must the supplier allocate to meet these standards within the regulatory timelines?

In developing-country contexts such as Brazil, Gate 1 should assess the total cost of ownership within a cost-driven market to determine whether launching the innovation in new models is economically justified. In the United States, Gate 1 should evaluate the TCO to test the feasibility of migrating semi-active damping systems from their typical luxury-segment applications to lower-cost segments. Gates G2-G4 should explicitly consider supplier absorptive capacity: in Brazil, the ability to adapt black-box systems to local operating conditions; in the USA, the capability to co-develop these systems with the OEM from the outset. Gate 5 analyzes the regulatory context in both countries to identify any mandates or compliance requirements that would condition the introduction of semi-active damping systems in new models.

5. Conclusion

Our cross-country evidence points to three interacting mechanisms that explain why the same mid-complex, information-rich subsystem travels different adoption paths in the United States and Brazil. First, supplier ecosystem density (NIS) shapes the salience of "supplier" as an adoption driver. In the USA, a thicker tier-1/2 base with local engineering support increases the evidentiary value of trials, reduces integration frictions, and elevates “supplier” to a top factor; in Brazil, thinner local availability and HQ-centered “black-box” sourcing mute that influence. Second, the market structure and segments (institutional legacies) sort out the demand pressure. A larger luxury share in the USA sustains “market pressure” for handling features at acceptable price points, whereas an SUV-heavy, cost-sensitive mix in Brazil depresses willingness-to-pay and shifts emphasis to cost containment. Third, organizational absorptive capacity (ACAP) reweights “trialability,” “complexity,” and “access level”. Teams with local decision rights and prior related knowledge learn more from prototypes, convert suppliers’ tacit know-how into explicit design rules, and reduce perceived complexity. In contrast, HQ-centric arrangements with limited access prioritize cost and underinvest in internal capability building. Together, these mechanisms account for the observed pattern: supplier and market pressure rank higher in the USA; cost dominates in Brazil; trialability matters where local teams co-design while keeping the unit of analysis on OEM adoption rather than end-user demand.

The following table summarizes the three testable propositions grounded in our comparative analysis. Each maps a distinct mechanism (supplier ecosystem density, market structure and segment mix, and organizational absorptive capacity) to predict decision weights and time-to-integration outcomes.

Table 4. Mechanism-based propositions for cross-country adoption of semi-active damping systems

Proposition	Description
Proposition 1 (supplier ecosystem density)	Holding product cost and segment constant, OEMs embedded in regions with higher local tier-1/2 density and on-site engineering support will assign greater decision weight to “supplier” and will adopt semi-active systems at higher rates and shorter time-to-integration than OEMs in thinner ecosystems.
Proposition 2 (market structure and segments)	Net of cost, the share of premium/performance segments in a country will positively predict the decision weight of “market pressure” and the probability of first launch as an option on high-priced trims, whereas a higher share of SUV cost-sensitive segments will depress both.
Proposition 3 (Organizational ACAP).	For a given supplier offer, subsidiaries with higher realized ACAP (transformation/exploitation routines, prior related knowledge, and cross-functional integration) will report higher decision weight for “trialability,” lower perceived “complexity,” and higher required “access level,” and will progress from prototype to PPAP faster than HQ-centric, low-ACAP settings.

Source: authors.

The evidence supports an explanatory account centered on three interacting mechanisms. Supplier ecosystem density helps clarify why “supplier” carries more weight in the USA than in Brazil. The market structure and segment mix align with the observed divergence in “market pressure,” with premium and performance segments sustaining optional launches at higher price points, while a SUV-heavy, cost-sensitive mix shifts emphasis toward cost control. Organizational absorptive capacity reweights “trialability,” “complexity,” and “access level,” with locally empowered teams converting prototypes into stable design rules faster than headquarters-centric models.

This study is constrained by its 2017-2018 window, focus on a single subsystem, an asymmetric USA sample relative to Brazil, and possible context effects; generalizability beyond the focal period and technology remains uncertain. Replications in adjacent subsystems (e.g., ADAS, brake-by-wire, power electronics) and matched comparisons of HQ-centric versus locally empowered development can probe generalizability and isolate governance-ACAP interactions using observable outcomes such as decision weights, option take rates, integration cycle times, and PPAP milestones.

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Project administration				
Resources				
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APPENDIX A. Interview Protocol

Questions for Identification (respondent)

- Date and local of the interview
- Company's name and department
- Name, function and academic background
- How long have you been working in the company and in your current function?
- Do you have professional experience in shock absorbers?

Specific questions

1. Does your company sell vehicles equipped with semi-active damping systems? Why?
2. Do your competitors sell vehicles equipped with semi-active damping systems?
3. What are the factors (market, technical and financial) that would influence the adoption of semi active damping systems by your company?
4. Are there just semi-active damping systems suppliers in the USA market? Should just one supplier exist, how this would affect your company decision to adopt this innovation?
5. How competitors use of semi-active damping systems would influence your company's decision to commercialize vehicles with this kind of shock absorbers?
6. How would the possibility of the semi-active damping systems supplier to participate in the suspension design of a vehicle to be produced by your company affect company's decision to adopt this innovation?
7. How would access to your supplier's information regarding semi-active damping systems influence your company's decision to buy such systems? Would it be necessary for the buyer to have detailed technical knowledge about the system, or would it be sufficient to buy the system in a 'black box' procurement procedure?
8. How would the innovation perceived risk level influence your company's decision to launch vehicles in the market with semi-active damping systems? How does your company make this risk level evaluation?
9. What are the main advantages regarding the use of semi-active damping systems compared to conventional shock absorbers? How would these advantages influence your company to produce vehicles using this kind of shock absorber?
10. Just in case your company decides to adopt semi-active damping systems in their vehicles, what would be the market launch strategy?

APPENDIX B. Profile of interviewees

Role, education and worktime	Organization	Country	Interview date
Project leader, MSc and BSc in mechanical engineering, 5 years	OEM "A" – 20.000 employees, with one engineering Center (1000 people) and three plants	Brazil	2017/09/14
Executive manager, mechanical engineer, 21 years	OEM "B" – 4000 employees, one Engineering Center and one plant	Brazil	2017/09/29
Engineering manager, mechanical engineer, 26 years	OEM "C" – 8.000 employees, one Engineering Center and four plants	Brazil	2017/10/03
Engineering supervisor, mechanical engineer, 23 years	OEM "D" – 8000 employees, two engineering centers, and two plants	Brazil	2017/10/09
Senior product engineer, mechanical engineer, 10 years	OEM "E" – 2500 employees, one engineering center (300 people) and one plant	Brasil	2017/10/10
Product analyst, MSc and BSc mechanical engineering, 31 years	OEM "F" – 13.000 employees, one engineering center (700 people) and four plants	Brazil	2017/09/29
Technology leader, MSc and Materials Engineer, 21 years	TIER "A" - Suspension systems manufacturer, one engineering center and 5000 workers	Brazil	2017/09/20
Project leader, MSc and BSc mechanical engineering, 15 years	TIER "A" – Suspension systems manufacturer, one engineering center and 5000 workers	Brazil	2017/09/20
Engineering coordinator, MSc and BSc mechanical engineer, 17 years	TIER "A" – Suspension systems manufacturer, one engineering center and 5000 workers	Brazil	2017/09/20
Senior Engineering analyst, mechanical engineer, 14 years	TIER "A" – Suspension systems manufacturer, one engineering center and 5000 workers	Brazil	2017/09/20
Engineering manager, electrical engineer and MSc engineering, 15 years	TIER "B" – Suspension systems manufacturer, one engineering center and 1400 workers LATAM	Brazil	2017/09/28
Product engineering coordinator, mechanical engineer, 4 years	TIER "C" – Suspension systems manufacturer, one engineering center (7 people) and 440 workers	Brazil	2017/10/06
Sales manager, electrical engineer with MBA in Finance, 6 years	TIER "C" – Suspension systems manufacturer, one engineering center (7 people) and 440 workers	Brazil	2017/09/21
R&D Director, electrical engineer, 2 years	TIER "D" - Automotive Companies Association	Brazil	2017/10/09
CEO, Business administration and accounting, 2 years	TIER "E" – Autoparts manufacturer, one engineering center (9 people) and one plant	Brazil	2017/09/28
Supervisor, Tech Expert, mechanical engineer, 29 years	OEM "D" – one engineering center (400 people) and seven plants (100.000 workers)	USA	2018/05/04
Sales, Engineering and Program Manager, mechanical engineer, 5 years	TIER "A" - Suspension systems manufacturer, one application center (12 people) and one plant	USA	2018/04/13
Account Manager, mechanical engineer, 17 years	TIER "A" - Suspension systems manufacturer, one application center (12 people) and one plant	USA	2018/04/06
Director of Sales and Application Engineering, 4 years	TIER "C" – Suspension systems manufacturer, one engineering center (150 people) and 2 plants	USA	2018/04/06

APPENDIX C. Example of innovation adoption factors analysis– Perceived Innovation Characteristics (Brazil)

DIMENSION	***Perceived Innovation Characteristics***					
FACTOR	*Perceived advantage*	*Complexity*	*Trialability*	*Uncertainty*	*Cost*	*Quality*
OEM A	(+) *technical (+) *financial	(-) * Black Box Supply	(+) *vitual tests	(-) *technical risk	(+) *semi-active x passive	
OEM B	Inconclusive answer: advantage lies on customer's perception	(-) * Black Box Supply	(+) *virtual and physical tests	Inconclusive answer: * Risk evaluation in made in Business Plan	(+) *intelligent system x current	
OEM C	(+) *technical (truck) (+) *financial	(-) * Black Box Supply	(+) * tests in Business Plan	Inconclusive answer: : technical risk is due to supplier	(+) *semi-active damping systens x current system + maintenance costs	(+) *reliability
OEM D	(+) *technical	(+/-) * depends on OEM development strategy	(+)	(+) *market risk	(+) *semi-active damping systens x current system + maintenance costs	
OEM E	(+) *technical (+) *financial		(+) * concept proof tests	Inconclusive anser – risk evalution made in Business Plan	(+) *semi-active damping system x current system	(+) * noise
OEM F	(+) *technical (+)*financial		(+) * concept proof tests	Inconclusive anser – risk evalution made in Business Plan	(+) * semi-active damping system x current system	
TIER A	(+) *technical (+)*financial		(+) * concept proof tests	(-) *market risk (+) *technical risk	(+) * semi-active damping system x current system	
TIER B	(+) *technical		(+) * concept proof tests (Brazil)	Inconclusive anser – risk evalution made in Business Plan	(+) * semi-active damping system x current system	
TIER C	(+) *technical (+) *financial		Inconclusive answer- trialability in HQ or doesn't know	(+) *market risk (+) *technical risk	(+) * semi-active damping system x current system	
TIER D	(+) *technical (+)*financial		(+) * tests made in Business Plan	(+) *market risk		
TIER E	(+) *technical (+) *financial		(+) * testes na prova de conceito (no Brasil)	(+) *technical risk (recall)		

APPENDIX D. Synthesis analysis of most and least influence semi-active damping adoption factors in OEM (Brazil and USA)

Influence factor	Importance of the factor	Comments
Relative advantage (degree of perceived technical, financial, and operational advantages of the semi-active damping system)	Brazil: One of the three most important; USA: Neither among the most nor among the least important;	Technical advantage: Semi-active damping improves ride comfort while enhancing vehicle stability and safety. Financial advantage: The system carries a price premium that is typically unattractive to Brazilian consumers but is acceptable to U.S. buyers.
Supplier (influence of the number of semi-active damping system suppliers in the OEM market)	Brazil: One of the three least important; USA: One of the three most important;	In the US, supplier proximity and variety enable better communication and strongly influencing adoption. In Brazil, supplier number would not significantly influence adoption, as the technology could be imported as a black box and adapted locally.
Global supplier (influence of the supplier being local or global on innovation adoption)	Brazil: Neither among the most nor among the least important; USA: One of the three least important;	Although OEMs operate with global sourcing strategies, local supplier presence in the USA supports communication and adaptation of complex technologies, resulting in low influence on adoption.
Trialability (degree to which the semi-active damping system was tested)	Brazil: One of the three most important; USA: Neither among the most nor among the least important;	Trial activities occur during proof-of-concept and business plan phases. In Brazil, systems would be supplied as black boxes with local adaptation.
Market pressure (degree to which adoption is necessary to maintain competitive position)	Brazil: One of the three least important; USA: One of the three most important;	In the United States, increased competition and demanding consumers drive OEM adoption to protect market share. In Brazil, low demand for luxury vehicles results in negligible competitive pressure.
Cost (influence of cost competitiveness on OEM adoption)	Brazil: One of the three most important; USA: One of the three most important;	In Brazil, the small luxury segment and high costs discourage adoption. In the US, despite higher development costs, profitability in the luxury segment offsets these expenses.
Development at headquarters (influence of centralized versus subsidiary-based development)	Brazil: Neither among the most nor among the least important; USA: One of the three least important;	Semi-active damping systems are mature technology. Development is usually centralized, though reverse innovation may occur. In Brazil, adoption decisions are typically made at headquarters with subsequent local adaptation.
Complexity (degree of difficulty in understanding technical details by OEM engineers)	Brazil: One of the three least important; USA: Neither among the most nor among the least important;	In Brazil, black-box supply minimizes the influence of complexity. In the United States, higher OEM technical capability increases the need to understand software and system integration details.