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The Neuro-Data Economy: Strategic Frameworks for Consumer Trust and Privacy in the Commercialization of Neural Implants

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ABSTRACT

The emerging neurotechnology industry is rapidly transitioning from primarily therapeutic applications toward broader commercial and consumer-facing markets. This shift creates not only major opportunities for clinical restoration and human–machine integration, but also significant governance, business, and ethical risks. Of particular importance are the commercialization of neural data and the long-term sustainability of implanted devices that create durable user dependence on private firms. This paper examines these challenges through a qualitative multi-method approach combining a case study of the Second Sight Medical Products failure, a comparative analysis of leading neurotechnology firms in 2026, and a review of the evolving regulatory landscape for neural data privacy and neurorights. The analysis identifies a structural mismatch between conventional medical-device business models and the enduring obligations associated with biologically integrated technologies. The Second Sight precedent shows that unsupported implant recipients can face material loss of function when corporate continuity fails. At the same time, the neuro-data economy introduces intensified risks associated with privacy, inferential analytics, and data monetization. In response, this paper proposes a strategic framework for sustainable neurotechnology business models based on hybrid revenue design, structural trust mechanisms, and tiered service architectures. The framework is intended to align profitability with long-term user support, corporate continuity, and robust neural data stewardship. The central argument is that consumer trust in implantable neurotechnology will depend not merely on technical performance, but on governance architectures capable of sustaining responsibility across the full lifecycle of implanted human–technology relationships.

1. Introduction From Restoration to Enhancement

The field of neurotechnology stands at a strategic inflection point. Brain–computer interfaces (BCIs), once largely confined to research settings and high-need therapeutic applications, are increasingly being positioned as scalable infrastructures for both clinical restoration and future enhancement markets. Recent scholarship shows that neurotechnology development is accelerating across clinical, commercial, and governance domains, while translation pressures are pushing the field beyond narrow medical contexts into wider data-driven ecosystems

(Benau, 2025; Cruz et al., 2025; Radu, 2025). In parallel, firms such as Neuralink have publicly articulated long-term ambitions that extend beyond restoration toward human–AI symbiosis and high-volume deployment, thereby signalling a possible transition from specialist medical technology to a broader commercial platform model (Economic Times, 2026; Reuters, 2026).

This transition elevates two interconnected strategic challenges. The first concerns the governance of the emerging neuro-data economy. Neural data is increasingly recognised as a uniquely sensitive class of information because it can reveal cognitive states, affective tendencies, behavioural patterns, and potentially future inferences not contemplated by conventional health-data frameworks (Ienca & Malgieri, 2022; Magee et al., 2024). The second concerns corporate sustainability in contexts where products become biologically integrated into users' bodies and everyday functioning. Implantable neurotechnologies do not create ordinary consumer relationships. Rather, they produce forms of long-term dependency in which software support, maintenance, cybersecurity, and clinical interoperability remain essential long after the initial sale or implantation.

The experience of Second Sight Medical Products provides a highly instructive precedent. Following the withdrawal of sustained support for the Argus retinal prosthesis, implanted users were left with increasingly unsupported systems, thereby exposing the human consequences of weak lifecycle governance in implantable device markets (Bottorff, 2025; Strickland & Harris, 2022). More recent scholarship on BCI commercialization reinforces this concern by showing that scientific or regulatory success alone does not guarantee durable commercial viability; commercialization depends on reimbursement, provider adoption, phased implementation, and long-term support structures (Powell & Zhou, 2026). In this respect, the sustainability problem in neurotechnology is not peripheral to innovation. It is central to whether such markets can achieve legitimacy at all.

This study addresses the strategic and governance challenge facing the neurotechnology sector: how firms can structure business models that ensure long-term functional support, data protection, and ethical stewardship for implanted users while remaining commercially viable and innovative. It does so by analysing the competitive neurotechnology landscape in 2026, examining the governance lessons of the Second Sight case, and evaluating the implications of the neuro-data economy for consumer trust and privacy.

1.1 Research Gap and Theoretical Positioning

A growing body of literature addresses the ethical, legal, and human-rights dimensions of neurotechnology, including mental privacy, neurorights, and the limitations of existing data protection regimes (Eke, 2024; Ienca & Malgieri, 2022; Ligthart, 2025; Magee et al., 2024). A separate literature examines sustainable business models, platform logic, and innovation management in medical and digital industries. However, the intersection of these domains remains underdeveloped. Existing business model research has not adequately theorised the commercial consequences of **biological lock-in**, namely, the condition in which users cannot exit a platform relationship without major clinical, surgical, or embodied cost. Nor has it fully addressed the strategic implications of corporate continuity in sectors where device failure or firm exit may create direct bodily or cognitive harms.

This paper contributes by bringing strategic management, business ethics, stakeholder theory, and platform governance into dialogue with contemporary neurotechnology scholarship. It also situates the discussion within

a broader business-governance literature emerging from BESRA scholarship. Recent work in the International Journal of Advanced Business Studies has argued for neuro-responsible business governance in the Global South and for culturally grounded models of stewardship based on cognitive dignity, relational accountability, and ethical innovation (Musole, 2026a, 2026b). While the present paper addresses a broader transnational commercial landscape, those contributions are relevant because they highlight that neural data governance should not be framed only as a technical compliance problem. It is also a question of institutional responsibility, ethical legitimacy, and normative design.

1.2 Research Methodology

This study adopts a qualitative multi-method research design suited to complex and emergent business phenomena. The research combines three interrelated components. First, it undertakes an in-depth case study analysis of Second Sight Medical Products to examine the relationship between implantable technologies, corporate sustainability, and user dependency. Second, it conducts a comparative analysis of major neurotechnology firms operating in 2026, specifically Neuralink, Synchron, Paradromics, and Blackrock Neurotech, in order to identify contrasting strategic orientations and business logics. Third, it integrates a focused regulatory and literature review of neural data governance, neurorights, and recent post-2024 developments in neurotechnology policy and ethics.

This triangulated approach follows established qualitative research conventions for theory-building in management and organisational analysis. Case study methods are especially appropriate when examining contemporary phenomena embedded in real-world contexts and when the boundaries between the phenomenon and its environment are not sharply defined (Eisenhardt & Graebner, 2007; Yin, 2017). The design also draws on qualitative evaluation principles that support triangulation across documentary, conceptual, and contextual sources in order to strengthen interpretive rigour (Denzin, 1989; Patton, 2014). Accordingly, the goal is not to produce exhaustive sectoral measurement, but to generate analytically robust and practically useful insights concerning sustainable business models in the neuro-data economy.

2. The Competitive Landscape in 2026

The neurotechnology industry in 2026 reflects divergent strategies of value creation, regulation, and commercialization. Some firms remain closely aligned with the traditional medical-device model, emphasising therapeutic restoration, clinical integration, and cautious regulatory progression. Others are increasingly oriented toward scalable data-rich platform models capable of extending beyond therapeutic use.

Company	Flagship technology	Delivery model	Primary strategic orientation	Key governance implication
Neuralink	N1 high-density threads	Invasive robotic implantation	High-bandwidth platform ambition and long-term human–AI integration	Raises strong concerns regarding data governance, scale, and long-term support

Company	Flagship technology	Delivery model	Primary strategic orientation	Key governance implication
Synchron	Stentrode	Endovascular implantation	Minimally invasive therapeutic restoration	Prioritises institutional compatibility and lower procedural barriers
Paradromics	Connexus	High-density invasive interface	High-data-rate clinical performance with platform-enabling potential	Highlights the strategic value of neural data intensity
Blackrock Neurotech	Clinical BCI systems	Conventional clinical implantation pathways	Established therapeutic-medical orientation	More closely resembles regulated MedTech continuity logic

Under the traditional MedTech model, value creation is relatively linear. Firms generate revenue through device implantation, associated procedures, and bounded support arrangements. Stakeholders are typically mediated through hospitals, reimbursement systems, and clinical institutions. This model offers clearer regulatory pathways, but it can struggle with scale, cost, and long-term lifecycle funding.

Platform-oriented strategies operate differently. As the installed user base expands, neural datasets can improve decoding systems, software performance, and service ecosystems in ways analogous to data-network effects in digital markets. Here, value increasingly derives not only from the device itself but from continuous data flows, software updates, algorithmic refinement, and ecosystem integration. This platform logic intensifies governance risk because implanted users face unusually high switching costs. Exit is not simply behavioural or contractual; it may be surgical, medically risky, or impossible in practice.

Recent commercialization analysis confirms that BCI firms cannot rely on technological novelty alone. Powell and Zhou's (2026) comparison of Argus II and Onward Medical shows that successful commercialization depends on phased deployment, physician familiarity, reimbursement strategy, and durable support infrastructure. These insights reinforce the paper's central claim that business model design is not secondary to neurotechnology innovation. It is constitutive of market viability.

3. The Second Sight Precedent and the Problem of Corporate Sustainability

The case of Second Sight Medical Products remains one of the clearest examples of the governance risks created when implanted technologies outlast the business models that support them. The Argus II retinal prosthesis represented a major scientific and clinical achievement, offering a degree of visual restoration to people with profound blindness (da Cruz et al., 2016; Humayun et al., 2016). Yet its longer-term trajectory revealed how vulnerable implanted users can become when firms discontinue support, redirect investment, restructure operations, or leave the market.

The structural issue is not simply that a company failed. It is that implantable neurotechnologies generate durable obligations that exceed the time horizon of ordinary product sales. Recipients of implanted systems often depend on software maintenance, calibration, hardware servicing, specialist clinical knowledge, and interoperability with adjacent infrastructures. When those support systems weaken, the result is not only consumer dissatisfaction but a potentially embodied form of infrastructural breakdown.

Recent work strengthens this interpretation. Vooijs et al.'s (2025) systematic review of neural device explantation identifies post-trial access, autonomy, identity, financial burden, emotional well-being, and neurorights as recurrent issues in the lifecycle of implantable neural devices. These concerns broaden the significance of the Second Sight case. The problem is not limited to device malfunction or company insolvency; it extends to the ethical architecture of long-term dependency itself.

3.1 Structural Limits of Conventional Device Models

Conventional medical-device models often recognise most revenue at or near the point of implantation. For technologies requiring ongoing maintenance over long and uncertain time horizons, such a model is structurally fragile. Venture-backed firms may have strong incentives to prioritise next-generation innovation, investor milestones, or future pipeline development. Those priorities can become misaligned with the continued support needs of legacy implant users.

Regulatory approval does not fully solve this problem. Approval frameworks are largely designed to assess safety and efficacy at market entry rather than to guarantee post-market corporate continuity, financial solvency, or support obligations over decades. Informed consent processes may also understate these risks if they focus primarily on clinical complications while overlooking business continuity, software dependency, and strategic corporate change.

3.2 Strategic Implications for the Neurotechnology Industry

The lesson for neurotechnology firms is that commercialization must be designed around lifecycle responsibility. If implanted users remain structurally dependent on private companies for safety, maintenance, and functionality, then long-term support cannot be treated as a discretionary service or reputational add-on. It must become a central design feature of both governance and business strategy.

4. The Neuro-Data Economy: Privacy, Trust, and Commercialization

As neurotechnology moves beyond narrow therapeutic settings, the economic importance of neural data increases. Neural interfaces may generate information about perception, intention, affect, motor planning, attention, or behavioural patterns. Advances in machine learning expand not only what devices can detect today, but what future models might infer retrospectively from archived data. This future inferential capacity is one reason neural data presents unusually serious governance concerns (Magee et al., 2024; Yang & Jiang, 2025).

4.1 Why Neural Data Is Distinctive

Neural data differs from ordinary consumer data because of its intimacy, interpretive depth, and connection to mental self-determination. It may function simultaneously as health data, behavioural data, biometric data, and a source of predictive inference about cognition and emotion. Once collected and aggregated, such data may produce informational asymmetries that are difficult for users to understand or meaningfully contest. For this

reason, recent scholarship increasingly treats neural data governance as an issue of mental privacy, cognitive liberty, and mental integrity, rather than ordinary data protection alone (Ienca & Malgieri, 2022; Ligthart, 2025; Magee et al., 2024).

4.2 The Emerging Regulatory Landscape

Current regulatory responses remain fragmented. Under the GDPR and related legal frameworks, neural data may often fall within health or special-category personal data, but scholars argue that these categories do not fully address the inferential and future-oriented risks raised by BCI systems (Ienca & Malgieri, 2022; Ligthart, 2025). Post-2024 developments suggest increasing momentum toward more specific neural-data protections. Reporting in 2025 documents that Colorado, California, and Montana enacted laws safeguarding neural data generated beyond conventional medical settings, including requirements for consent, limits on third-party disclosure, and deletion rights (Ruder, 2025). More broadly, governance scholarship has emphasised that neural data protection must be situated within wider debates concerning standards, infrastructure, platform power, and multistakeholder regulation (Radu, 2025).

This evolving landscape has strategic significance. Firms that build business models around expansive secondary use or opaque monetization of neural data may face increasing legal and legitimacy risks. By contrast, privacy-by-design models that minimise data collection, favour local processing where possible, and provide granular user control are likely to be more resilient over time.

4.3 Trust as a Strategic Asset

Within the neuro-data economy, trust is not merely a normative aspiration. It is a market-enabling asset. Users are unlikely to accept permanent or semi-permanent interfaces if they reasonably believe that their most intimate data can be commercially exploited, transferred without meaningful control, or rendered vulnerable by weak cybersecurity or corporate instability. The likely result is not only reputational harm for firms but suppressed market adoption.

5. A Strategic Framework for Sustainable Neurotechnology Business Models

Building on the preceding analysis, this paper proposes a framework for sustainable neurotechnology business models organised around three interrelated pillars: hybrid revenue design, structural trust mechanisms, and tiered service architectures. The purpose is to align commercial sustainability with long-term user support, ethical governance, and consumer trust.

5.1 Pillar One: Hybrid Revenue Models

A viable model for implantable neurotechnology should combine upfront capital recovery with durable service-based revenue. The initial procedural fee may cover manufacturing, surgery, and onboarding, while an ongoing revenue component supports software maintenance, cybersecurity updates, calibration, and long-term technical support. This structure reduces the mismatch between one-time income and continuous obligations.

5.2 Pillar Two: Structural Trust Mechanisms

Trust should not depend solely on promises of goodwill. It should be institutionalised. One mechanism is a legacy support or continuity fund financed through a portion of device-related revenues and held for long-term servicing obligations in the event of insolvency, acquisition, or strategic exit. Another is an industry-backed

support consortium that functions as a provider of last resort for implanted users. Such arrangements distribute risk across the sector and reduce dependence on the solvency of any single firm.

This pillar may also be strengthened by drawing on BESRA scholarship that foregrounds cognitive dignity, relational accountability, and stewardship as normative anchors of responsible business governance (Musole, 2026a, 2026b). While these concepts emerged in a Global South governance context, they offer broader relevance for neurotechnology firms seeking legitimacy in markets where the line between product, service, and person becomes increasingly blurred.

5.3 Pillar Three: Tiered Service Architectures

A tiered service architecture can distinguish between non-negotiable baseline obligations and elective premium offerings.

Tier	Service level	Description	Funding logic
1	Core safety and functionality	Security updates, essential software support, bug fixes, and baseline operational maintenance	Bundled into the initial cost and protected by continuity funding
2	Enhanced support and personalization	Responsive assistance, personalised calibration, and minor service upgrades	Recurring subscription or service contract
3	Premium features and advanced analytics	Experimental features, advanced optional tools, and non-essential enhancements with consent safeguards	Premium subscription supporting R&D and optional service differentiation

This model allows firms to preserve a guaranteed minimum standard of care while still differentiating their commercial offerings. Most importantly, it prevents essential support from becoming contingent on a user's ability or willingness to pay for premium features.

6. Conclusion: Building a Trustworthy Neuro-Data Economy

This analysis yields a clear message for scholars, policymakers, regulators, investors, and neurotechnology firms: the commercialization of implantable neural technologies cannot proceed on business-as-usual assumptions. The Second Sight precedent demonstrates that conventional medical-device logics are inadequate when applied to products that become biologically integrated into users' bodies and daily capacities. In such contexts, long-term support is not ancillary to innovation; it is part of the technology itself.

The emerging neuro-data economy therefore requires governance architectures that place consumer trust, neural data stewardship, and corporate continuity at the centre of business model design. Without credible guarantees regarding lifecycle support, data protection, and institutional accountability, public adoption of implantable neurotechnology will be constrained by justified concerns about abandonment, exploitation, and loss of autonomy. The commercial future of neural implants depends not only on technical performance or

investor confidence, but on whether firms can demonstrate that responsibility will endure for as long as user dependence endures.

The broader implication is that trust in neurotechnology must be built structurally rather than rhetorically. Policymakers should therefore pursue regulatory frameworks that recognise the exceptional sensitivity of neural data and the long temporal horizon of implanted-device obligations. Firms should develop continuity funds, interoperable support standards, and privacy-preserving data practices as core features of competitive strategy. Researchers should continue examining biological lock-in, neural capital, and long-term governance in order to refine theory for embodied platform markets. The central strategic challenge is not simply how to commercialize neural implants, but how to do so in a way that embeds responsibility into the economic foundations of the neuro-data economy. Ultimately, the neuro-data economy will not be defined by the sophistication of its hardware, but by the integrity of its human centred governance; without a foundation of structural trust, the industry risks clinical rejections and social obsolescence.

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