The Technology Transfer of a Data Framework in the Financial Cooperative Sector

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Abstract. *Financial cooperatives constitute a dynamic ecosystem characterized by high-value, data-intensive innovation that generates substantial revenue. This paper examines the process of transferring a data science framework as a technological asset, using an illustrative case study centered on a member journey optimization project within a financial cooperative. The proposed framework builds on the Technology Package concept, integrating principles from intellectual property law, technology management, and business strategy. It demonstrates how aligning IP strategy with established technology transfer mechanisms can not only unlock new revenue streams but also foster intercooperation within the financial ecosystem.*

1. Introduction

The ongoing digital transformation of the financial sector imposes significant competitive pressure, compelling institutions to innovate as a means of differentiation and survival [ISLAM and WANG 2023]. Within this context, brazilian credit unions must navigate the dual challenge of enhancing their service offerings to meet evolving member expectations while simultaneously competing with the vast resources of traditional banks and the agility of fintechs [LEITE et al. 2022, DE OLIVEIRA et al. 2023]. A primary response has been the development of sophisticated, data-driven solutions, such as frameworks for personalizing the member journey. However, the creation of such a high-value technological asset is merely the initial step in an innovation life cycle that holds the potential to deliver strategic value far beyond its original-use case.

The subsequent challenge lies in the effective management and protection of the intangible assets generated, including proprietary software and artificial intelligence algorithms [BORGES 2024]. The legal protection of these assets through mechanisms such as software registration, patents for computer-implemented inventions, or their maintenance as trade secrets remains a complex and often underutilized strategy in corporate environments [DO AMARAL and LEONARDOS 2022]. This absence of a formal Intellectual Property (IP) strategy frequently results in valuable innovations becoming siloed, representing a failure in knowledge management and significant underutilization of strategic resources [CAMARGO and DE OLIVEIRA 2022]. For the cooperative system, which is built on the principle of intercooperation, this gap constitutes a missed opportunity to strengthen the entire ecosystem.

The bridge between innovation development and its strategic dissemination is Technology Transfer (TT), a formal process that enables the secure and structured flow of knowledge, rights, and technologies between organizations. IP is not an end in itself but rather the foundational framework that underpins TT, formalizing an innovation into a legally defined asset that can be transacted through agreements such as licensing contracts [DE CARVALHO and DE OLIVEIRA 2022]. Registering these agreements with regulatory bodies, such as Brazil's National Institute of Industrial Property (INPI), provides legal certainty for all parties and promotes the efficient transfer and adoption of the technology. [World Intellectual Property Organization 2023].

The processes for legally protecting an algorithm and for licensing a finished product are understood in isolation, but a systematic model for converting the former into the latter is not well-defined. This leads to the question: How can a complex, data-intensive innovation, such as a member journey optimization framework, be systematically structured into a transferable asset that aligns with the strategic and collaborative goals of a financial cooperative ecosystem?

Accordingly, this paper delineates a model for structuring a ”technology package” for a data science framework and analyzes its subsequent transfer. The objective is to demonstrate how the integration of a IP strategy with established TT mechanisms can not only unlock new revenue streams but also serve as a tool to enact the principle of intercooperation.

2. Related Work

The protection of non-physical, technology-based assets such as software and proprietary algorithms presents unique challenges compared to traditional inventions. In Brazil, the primary mechanism for software protection is copyright, secured through the registration of the source code with the INPI, a process that grants the holder exclusive rights of use and commercialization [Instituto Nacional da Propriedade Industrial 2023].

However, when an innovation lies not in the code itself but in a novel, inventive method that produces a technical effect, it may qualify for patent protection as a computer-implemented invention [DO AMARAL and LEONARDOS 2022]. The strategic decision between patenting, which requires public disclosure, and maintaining the innovation as a trade secret, which relies on confidentiality, is of extreme importance. Accurately valuing the intellectual property embedded in artificial intelligence and data-driven models is a prerequisite for capturing their full economic potential, whether through internal use or external commercialization [GHAFELE and GIBERT 2022].

Technology transfer is the formal process through which technology, knowledge, and intellectual property are passed between entities. There are several established models, each with distinct strategic implications. Licensing agreements represent a common vehicle, allowing the IP holder (licensor) to grant usage rights to another party (licensee) in exchange for royalties, thus creating a direct revenue stream without relinquishing ownership [DE CARVALHO and DE OLIVEIRA 2022].

A more integrated approach is the formation of corporate spin-offs, where a new, independent firm is created to commercialize the technology, a model that can foster more agility and attract external investment [CHEN and LIN 2022]. These mechanisms are increasingly viewed through the lens of open innovation, which posits that firms can and should use both internal and external ideas and paths to market to advance their technology [CHESBROUGH and BOGERS 2022]. In this paradigm, a technological asset like a data framework can become the core of a platform ecosystem, creating value not just for the owner but also for complementary partners who build upon it [WEST and BOGERS 2023].

Financial cooperatives operate in a highly competitive environment, facing persistent pressure from both incumbent banks and disruptive fintechs [GRACE and GHERMAN 2023]. Digital transformation is no longer optional but a critical component of their strategy to improve member services and operational efficiency [DE OLIVEIRA et al. 2023]. While cooperatives may lack the R&D budgets of large banks, they possess a unique strategic advantage in their guiding principle of intercooperation.

This principle encourages collaboration among cooperatives, creating a fertile ground for sharing best practices and technologies. However, the principle alone does not guarantee effective technology transfer. Cooperatives can face significant barriers to adopting external innovations, including organizational inertia, a lack of formal internal processes to evaluate and integrate new technologies (low absorptive capacity), and cultural resistance to solutions ”not invented here” [SANTOS and LIMA 2023]. Leveraging intercooperation as a competitive advantage therefore requires not just a willingness to share, but also a structured mechanism to overcome these barriers and facilitate successful technology adoption [DA SILVA and FERREIRA 2024].

While the existing literature provides a solid foundation in these individual areas, a significant gap remains in synthesizing them into a practical, actionable framework. Prior work has not systematically addressed how to structure a complex data science asset as a ”technology package” (unifying the IP, know-how, and support services) and then deploy it through various TT models specifically tailored to the unique, collaborative context of the cooperative financial ecosystem.

3. Methodology

This paper employs a qualitative, conceptual research design to develop and apply a strategic framework for the transfer of technology within the financial cooperative sector. The research is structured in three sequential stages: a comprehensive literature review, the development of a conceptual model, and the application of this model to an illustrative case study.

The first stage involved a targeted literature review to establish the theoretical foundations of the research. The second stage was the development of a conceptual framework. This involved synthesizing the disparate concepts identified in the literature into a cohesive, actionable model. Principles from IP law, technology management, and business strategy were integrated to define the central construct of this paper: the ”technology package”. This construct operationalizes a complex data science innovation by breaking it down into three constituent parts: its legally defensible IP, its operational know-how, and its associated support services. The framework was further elaborated by analyzing how established TT models could be utilized as vehicles for transferring this package.

The final stage consisted of applying the conceptual framework to an illustrative case study. The case selected is the technology transfer of a data framework created to optimize the member journey inside credit unions and cooperatives, a representative example of a high-value, data-intensive innovation, trough the especialized views of consumer experience and data science techniques. By applying the concepts of the ”technology package” and TT models to this specific situation, this stage illustrates how the proposed framework can be used by decision-makers to structure, protect, and ultimately monetize their technological assets.

4. Results and Discussion

This section first defines the components of this framework, referred to as the ”Technology Package.” Following this, the framework is applied to the illustrative case of a member journey optimization model to demonstrate its practical utility. The section concludes with a discussion of the strategic implications, analyzing how different technology transfer models become viable once an innovation is formalized through this structure.

4.1. The Technology Package Framework

The proposed framework addresses the bundling of technological innovation into a transferable asset by structuring it into three distinct yet interdependent layers: the Intellectual Property (IP) Core, the Operational Know-How, and the Support and Evolution Services, addressing challenges such as organizational inertia, lack of process standardization, and limited absorptive capacity that often hinder the effective transfer of data-intensive innovations. This three-layer structure is described below:

1. The Intellectual Property (IP) Core: This layer forms the legal foundation of the asset, establishing unambiguous ownership and providing the legal mechanisms to control, license, and defend the technology. It comprises: Software Copyright, secured through the registration of the source code to protect against unauthorized reproduction [Instituto Nacional da Propriedade Industrial 2023]; Trademark, which protects the brand identity of the solution in the marketplace; and Method Protection, which safeguards the core algorithms and logic either as a trade secret enforced by contractual agreements or, if statutory requirements are met, as a patented computer-implemented invention [DO AMARAL and LEONARDOS 2022];
2. Operational Know-How: This layer contains the complete body of documented knowledge required for a receiving entity to implement, operate, and extract value from the technology. It must include: Technical Documentation, detailing system architecture, data schema, and API specifications; User Manuals and Best Practices, which provide guidance on interpreting model outputs and applying insights to business problems; and Validation and Performance Metrics, which offer benchmarks that substantiate the model's effectiveness;
3. Support and Evolution Services: This external-facing layer ensures the long-term viability and successful integration of the technology. Although it is more focused on the commercial aspect of the product, it still must be accounted for prior to registration, to facilitate future commercialization and the establishment of quality control for the product. It must consist of Training and Implementation Support, providing structured programs for the recipient's technical and business personnel; Maintenance and Technical Support formalized through a service-level agreement (SLA); or a Product Roadmap.

4.2. The member journey optimization framework

The technology package framework application was mapped onto a data intensive framework to optimize the member journey in a credit union. This framework was developed using modern customer experience mapping, statistical inference of members data (these include demographic variables like age, location, profession, membership duration, behavioral variables like frequency and value of transactions, product usage intensity, digital engagement and relational variables like service channel preference, satisfaction indicators, churn probability), consisting in three major components, and using machine learning models to maximize the journey cost efficiency.

The member's journey, illustrated in Figure 2, is mapped using several different techniques and a variety of open-license mapping frameworks. The goal is to identify who the member is upon joining the cooperative, their main characteristics at entry, their potential needs, and how they will interact with the resources made available by the cooperative.

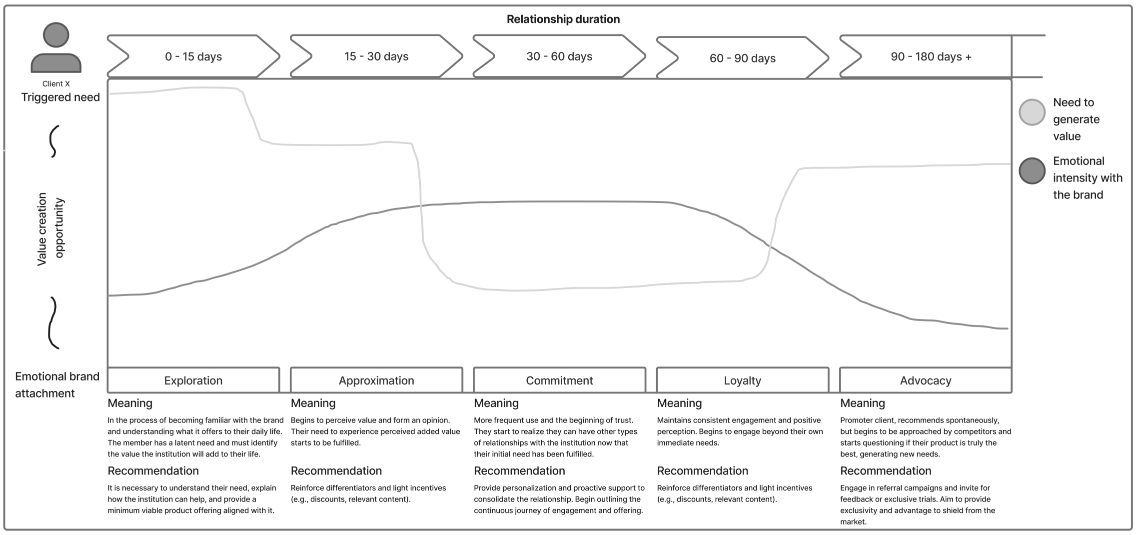

Figure 1. Example persona and customer journey created.

Then, we have the Necessity Sphere, as shown in Figure 3. Here, we move from the member's journey and service interactions to their needs and purchase intent. All offers are made based on the member's needs, considering their life stage and financial situation, and these offers are aligned with their purchasing capacity.

Finally, we have the Recommendation System, illustrated in Figure 4, with its contact intervals and quarantines (periods during which the member should no longer receive product offers). This recommendation system combines various machine learning algorithms trained on multiple consumption and demographic variables of the members.

The framework includes a version of each of its three components tailored to three different market segments: one for individual urban members, one for individual members working in agribusiness, and another for corporate members. In general, this article focuses on the framework as a whole, specifically, on how we can register and transfer this technology framework in its entirety.

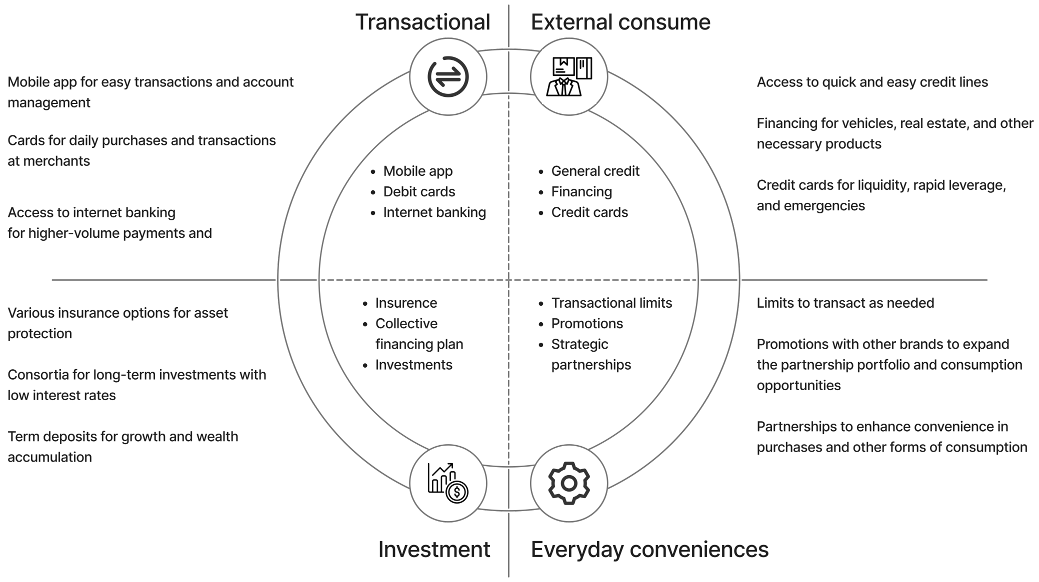

Figure 2. Example a circle of needs and their offers, based on the customer journey created earlier.

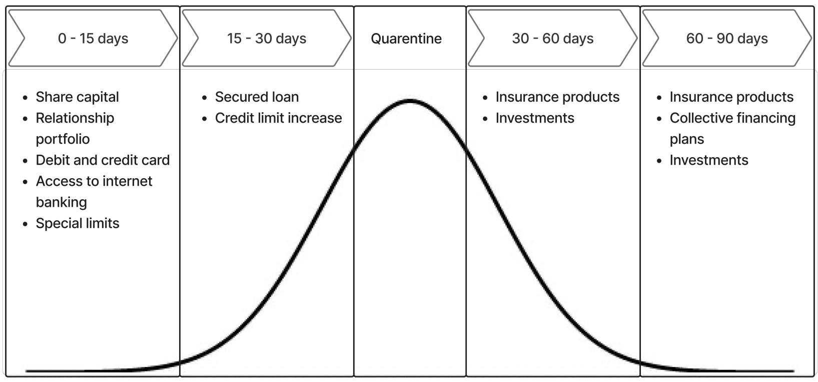

Figure 3. Example of what the machine learning models would offer, based on the categories of relation time with the customer.

4.3. Framework Application

To demonstrate the framework's application, it was mapped onto the case of a "Framework for Optimizing the Member Journey". This is a framework that will permit credit unions and financial institutes alike to create and personalize their own customer journey maps, using artificial intelligence and product recommendation using basic guidelines and guardrails that can be more effective than the usual mechanisms used on the market.

After the development, the framework will be made available as a mapping (canvas design for the journey development) and code product (the models and notebooks used as recommendation for the personalization of the framework). The resulting Technology

Package would be structured as follows, and referenced in Table 1 for a more detailed illustration of how the items of this particular case example would fit within each layer:

1. IP Core: The source code for the clustering and personalization algorithms would be registered to secure copyright. A distinct name, such as "Member-Journey Optimizer," would be registered as a trademark. The specific algorithmic method for segmenting behavioral profiles would be protected as a trade secret, with its confidentiality clauses embedded into all subsequent legal agreements;
2. Operational Know-How: The package would include a data dictionary defining all necessary input variables (e.g., member age, digital maturity, transaction history), technical manuals for API-based integration with existing CRM platforms, and strategic playbooks for marketing teams that link specific customer segments to recommended engagement tactics;
3. Support and Evolution Services: The transfer offer would include a defined block of implementation support hours, an ongoing technical support agreement governed by an SLA, and a commitment to bi-annual model recalibrations to adapt to evolving member behavior patterns.

Table 1. Items expected inside each layer, for the optimization journey product.

Layer	Technical content	Non-tangible asset
IP Core	Notebooks used for coding the machine learning models and a description of all the frameworks used in the code and their licenses.	The developed canvas for the framework, and the developed mapping strategy for canvas creation.
Operational know-how	API documentation for accessing the models in production, best practices for keeping production models updated, manuals for applying the models to production, and manuals on how to apply the canvas and mapping framework.	—
Support & evolution services	—	Service model for using the framework, models and canvas, and roadmap for future evolutions or planned updates.

Each of the three elements was selected based on its relevance to ensuring that the technology transfer process is reproducible and that the technology itself can be effectively utilized and replicated: The IP Core elements were chosen for their legal defensibility and significance in protecting ownership rights; the Operational Know-How elements were identified to ensure full replicability and independent implementation by recipient organizations; and the Support and Evolution Services were defined to guarantee the long-term sustainability and adaptability of the transferred technology.

Such standardization initiatives facilitate the adoption, absorption, and integration of knowledge into existing routines, thereby reducing organizational barriers and generating positive business impacts [GOEL et al. 2023]. In the context of credit unions, this type of structure helps overcome "not invented here" challenges by enabling the transfer of technology that is transparent, well-defined, and reliable.

Although the three proposed elements were selected to standardize the aforementioned requirements and considerations, this does not preclude the inclusion of validation activities involving end users or recipient cooperatives to refine the content of each layer and verify their practical adequacy.

4.4. Strategic monetization after transferring

After structuring the innovation as a formal Technology Package, it will enable its dissemination through several strategic transfer models, each with distinct implications for the cooperative ecosystem. If monetization constitutes an objective, it is possible to employ specific strategies to realize it, drawing upon models that have already been developed in the market.

The Licensing Model is a direct mechanism for enacting intercooperation, and monetization. The originating cooperative can license the Technology Package to other cooperatives for a recurring fee, generating revenue to fund further innovation while providing network partners with advanced capabilities at a cost significantly lower than internal development [DA SILVA and FERREIRA 2024].

The Corporate Spin-Off Model is suited for innovations with market potential that extends beyond the cooperative system. A new, independent firm could be established to commercialize the package, affording it the agility to compete with fintechs and attract external capital [CHEN and LIN 2022]. The originating cooperative, along with a consortium of partners, could retain equity, thereby participating in the venture's upside potential [GRACE and GHERMAN 2023].

Finally, a Service-Based Model leverages the Technology Package as the foundation for a high-value consulting or Software-as-a-Service (SaaS) offering. In this configuration, the originating cooperative would not only provide the technology but also manage its implementation and operation on behalf of other institutions, capturing a greater share of the value chain. Adoption of this structured approach allows cooperatives to systematically convert R&D outputs into legally defensible and commercially viable assets.

5. Final Considerations

This study addressed the strategic challenge of disseminating high-value, data-driven innovations within the financial cooperative sector. We demonstrated that the effective transfer of a technological asset, such as a member journey optimization framework, requires a structured approach that extends beyond the technical artifact itself. By integrating principles from intellectual property law, technology management, and business strategy, we delineated a pathway for converting an internal innovation into a transferable asset.

The primary contribution of this work is the development of the "technology package framework", a conceptual model that provides a systematic methodology for structuring a complex data science asset. This framework synthesizes the legal, operational, and service components of an innovation into a cohesive, well-defined product. By deconstructing the innovation into its IP Core, Operational Know-How, and Support Services, the model bridges the critical gap between technical development and strategic asset management, enabling the innovation to be legally protected, clearly defined, and effectively disseminated.

The practical implications for decision-makers in financial cooperatives are significant. The framework offers a clear roadmap for moving beyond ad-hoc R&D projects toward the creation of legally defensible and commercially viable assets. This provides a mechanism to monetize R&D investments and, more importantly, to enact the principle of intercooperation in a tangible, value-generating manner. By licensing such packages or forming new ventures, the cooperative ecosystem can collectively enhance its competitive capabilities against larger market players.

This study is conceptual in nature, and its primary limitation is the absence of empirical validation. Future research should, therefore, focus on the empirical application of the Technology Package framework. An in-depth case study tracking the transfer of an actual data science asset between cooperatives using this model would provide valuable insights into its practical challenges and financial outcomes. Furthermore, a comparative analysis examining the performance and scalability of the different transfer models, like licensing versus spin-off, would yield data-driven recommendations to guide strategic decision-making for innovation leaders within the cooperative sector.

Additionally, future applications of the framework could include an evaluation component to assess its effectiveness in real-world technology transfer scenarios. Success, on the side of the organization adoption of the technology transferred, could be measured through indicators such as the degree of adoption by recipient cooperatives, the time required for operational integration, and the generation of new collaborative initiatives or revenue streams. Establishing these evaluation criteria would not only validate the framework's practical value but also provide feedback for continuous refinement and scalability within the cooperative ecosystem.

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