Solutions Analysis

This analysis formally proposes the integrated solution for the Arborwood Cost Calculator project (the “Gateway" initiative), connecting organizational needs to technical architecture and addressing critical risks, legal requirements, and ethical imperatives.

Proposed Solutions and Architecture

The solution to Arborwood’s problem requires recognition that the challenge is both one of technical execution and governance risk. The first component is the inclusion of a mandatory, non-technical checkpoint requiring formal legal and compliance approval after requirements are defined but before development begins. The inclusion of this gateway in the project serves to mitigate the risk of regulatory violations by mandating a thorough legal review of the project deliverables and formally approving them. The second component is the API integration that replaces manual data entry with a direct, automated, and secure API call to the core student administration system, which serves as the definitive source of truth.

Model and Architecture

The proposed architectural model employs a microservice architecture centered around an API gateway pattern. This approach adheres to the principle of Separation of Concerns, isolating the user-facing front-end component from the sensitive, transaction-critical data sources held within the administrative system. Specifically, the front-end will be a new component residing within the Adobe Experience Manager (AEM) content management system, handling the user interface and calculation display logic. A custom-built API will act as the data conduit, retrieving current information from the administrative system. This architecture ensures the Single Source of Truth (SSOT) principle is maintained and enables enforcement of the Principle of Least Privilege (PLP), guaranteeing the calculator always pulls the most current, official cost data directly from the organizational source of truth while constraining access to only required data. Because the data in the source system is updated no more often than on a quarterly basis, the fetch will not be in real-time, but rather only when source system data changes or when required on an ad hoc basis by business stakeholders.

Technology Recommendation and Principles

The recommendation is to develop the API layer using the University’s existing Node.js framework and hosting it within Arborwood’s existing Google Cloud Platform (GCP) cloud environment, leveraging Cloud Functions for the underlying event-driven code to ensure high availability and isolation.

* Data integrity is strictly enforced by the SSOT principle, which eliminates the potential for manual data entry errors.
* Security is maintained through adherence to the PLP as enforced by Arborwood’s existing policies, ensuring the API only has read-only access to the minimum necessary financial data fields in the administrative system.
* Resilience is achieved by utilizing the microservice pattern, which allows the calculator to function independently and maintain availability even if other internal systems are disrupted.

Needs, Industry Alignment, and Stakeholder Concerns

The integrated solution directly addresses an organizational problem and key stakeholder concerns while ensuring Arborwood maintains alignment with industry best practices.

Addressing Organizational Needs and Stakeholder Concerns

The University’s marketing team is continually searching for methods by which conversions can be increased on its commercial, publicly-facing websites. The proposed calculator solution resolves the friction point in the enrollment funnel by addressing the lack of cost transparency. By furnishing the solution with data from the enterprise source of truth, prospects are able to access the accurate, personalized estimate they desire, removing a major barrier to conversion. At a time when the online learning sector in higher education is becoming increasingly saturated, Arborwood’s marketing team has identified cost transparency as a major differentiator that has the potential to contribute nearly $10 million in revenue in the first year of the calculator’s implementation.

For Arborwood’s legal leadership, the most pressing concern is the high risk of statutory violation and the potential for litigation stemming from imprecise cost estimates. The combination of highly complex and granular calculations for hundreds of degree programs, coupled with the need to ensure the availability of accurate data, underscores the need for a comprehensive legal review of the project’s requirements and deliverables as part of a larger, formal approval process. Neither business stakeholders nor IT have the expertise to evaluate the compliance implications or litigation risk of the solution, and initiating development of the solution without legal approval poses the threat of abandonment of the final deliverable due to unconstrained risk. By incorporating a mandated compliance gateway in the project charter, formal, documented legal oversight occurs before significant capital is committed to development.

Information Technology’s concerns, which include technical debt, manual data entry risk, and system fragility, are mitigated by the API integration, which replaces risky manual processes with a maintainable, secure, and resilient data service, ultimately reducing future maintenance overhead. And in an organization where skepticism is an ongoing concern, the legal review and approval gateway affords IT with the confidence to move forward with development, secure in the knowledge that a fully compliant and defined solution will be built and delivered.

Connection to Global IT Trends

The entire solution aligns Arborwood with the global IT trend related to data integration via real-time data ecosystems. While this project’s data needs are not truly real-time, the implementation of a dedicated API layer is a necessary step towards building a modern, integrated enterprise architecture. In fact, the data retrieved from the student administration system can be leveraged for several purposes other than the cost calculator, which, over time, will form the foundation of a larger-scale integration effort that has the potential to result in substantial cost savings while bringing the websites into alignment with larger IT trends. This strategic move away from outdated, manual processes towards secure, instantaneous data calls is mandatory for competing in the higher education industry, where prospective students expect the same accurate data seen in the financial services or e-commerce sectors. Arborwood is well-served by recognizing that American consumers have come to place a great deal of value in information that is easy to consume, relevant to their needs, and personalized to their requirements. Lastly, the adoption of a cloud-native approach to data integration is fully aligned with the University’s larger cloud migration strategy and automation initiatives, which have been ongoing for several years.

Risk Analysis and Minimization

The project, while essential, carries specific implementation risks that must be systematically managed through proactive mitigation strategies.

One risk relates to the availability of subject matter experts (SMEs). The project is dependent on the time and availability of SMEs from the student administration system development team for defining and validating the precise API endpoints. If these resources are denied, data integrity will be compromised. The strategy to minimize this involves executive sponsorship and allocation, securing formal executive approval for dedicated SME bandwidth, with this risk being monitored weekly in the Project Steering Committee.

A second major risk is data integrity failure, where the API is incorrectly coded, leading to inaccurate data, which could result in regulatory violations. This is minimized through the compliance gateway approval, which mandates final legal and IT validation of all calculation use cases and data mappings *before* development. Furthermore, automated unit and integration testing of the API will be implemented to ensure 100% data fidelity against source systems.

Finally, there is the risk of legacy system dependency, where the API's success relies on the stability and availability of the legacy administrative system. This must be addressed by formalizing contractual service level agreements with the administrative system’s operations team to guarantee minimum API uptime. Although data fetch will not happen in real time, marketing will have the ability and authority to initiate it at any time of their choosing, and thus the SLA must ensure data availability as if the call were made in real time.

This systemic approach ensures that the project’s high-level risk of regulatory non-compliance is broken down into manageable technical and governance risks, each addressed by a specific, proactive mitigation strategy.

Risk Matrix

| Risk ID | Risk Description | Probability (P) | Impact (I) | Score  (P x I) | Mitigation Strategy |
| --- | --- | --- | --- | --- | --- |
| R-01 | SME Resource Constraints. Subject Matter Expert Availability.  Resources from the administration system team may be unavailable to dedicate time to support and validate API endpoints. | High | High | High | Secure executive sponsorship allocating dedicated and protected resources. |
| R-02 | Legacy System Dependency.  The new API is dependent on the availability and integrity of a system outside of the influence of the business stakeholders. | Low | High | Medium | Establish contractual service level agreements mandating system uptime and change management controls. |
| R-03 | Data Integrity Failure.  The new API contains faulty logic or data mapping errors, leading to inaccurate calculations. | Medium | High | High | Enforce the legal and compliance review and approval gate to validate calculations and data accuracy. Automate all unit and integration testing with robust development of detailed use case-driven test cases. |

Implementation Barriers and Mitigation Strategies

During the review and analysis of this project retrospectively, it was striking to notice the cultural barriers that exist between marketing and IT. Marketing is, by its nature, prone to rapid directional changes that can impair the ability of IT to deliver solutions. IT has been tasked with innovating more automated and intuitive solutions at the enterprise level, but rarely has the bandwidth to do so owing to the constant “swirl” of shifting priorities on the part of its business partners. This project mandates that resources be wholly dedicated to this project without competing priorities in a bid to enable uninterrupted development of the solution. However, in the larger context of the organization, this may not be realistic. Business and IT leadership buy-in on this point is critical and may require an executive project champion to ensure that all parties to the project remain focused on it to the exclusion of other initiatives. A project manager tasked with carrying this project to completion will require substantial executive support to ensure that resource allocation constraints are honored.

In addition, the student administration system is a monolithic PeopleSoft implementation with an arcane table structure. IT has had access to the underlying databases for some time, but has not had access to SME resources who can assist in data mapping activities, and has engaged in inefficient guesswork in a bid to understand the data and its architecture. While this project calls on the source system’s development team to support the API development effort, the degree of SME availability is difficult to estimate. The project is not viewed as a strategic, enterprise-level initiative, and securing cross-organization buy-in is challenging. A project manager running this effort will also need executive support to secure the needed resources from an organization that is part of neither IT nor marketing.

The ability to ferret out potential risks and barriers to implementation requires substantial knowledge of organizational culture and priorities. In any organization, the quality of interpersonal relationships, competing priorities, and resource constraints has an enormous impact on effective collaboration and transparency. As I’ve related elsewhere, it is incumbent on a project manager to build and retain trust in order to, in turn, gain insight into how to elicit an accurate picture of the overarching landscape. The quality of the relationships established with stakeholders, interested parties and executive leadership is crucial to ensuring honest, forthright communication. Cultivation of strong cross-functional relationships is essential for the candid disclosure of technical vulnerabilities, compliance risks, and cultural obstacles.

Leveraging Borrowed Credibility

The most foundational element of my development as a business analyst and project manager was established on day one. I was afforded the opportunity to work with a number of very experienced mentors who were able to lend their credibility to my efforts. Lacking existing relationships required that I “borrow” credibility so that I could go on to earn it on my own over time. The challenge in the beginning is not lack of skill or ability, but a lack of history. Stakeholders may be hesitant to share critical information with someone they do not have a professional relationship with. Ultimately, the human landscape of any organization is the network of influence and resistance that determines a project’s success. By leveraging the credibility of experienced resources, someone new to performing the functions of managing or participating in a project accelerates their own development in the role.

Legal, Ethical, and Policy Analysis

Legal Issues and Resolution

The primary legal issue is the mandated compliance with the Higher Education Act (HEA), 20 U.S.C. § 1094, which requires accurate financial disclosures, along with the mitigation of litigation risk. Although Arborwood hosts the HEA-mandated Net Price Calculator on its site, the mandated calculator fails to provide the granularity and use-case specificity that prospective students seek. Failure to maintain data accuracy and to perform highly accurate, highly granular calculations exposes the institution to regulatory scrutiny and the potential for litigation, resulting in significant financial penalties. Thus, the mitigation strategy is the legal and compliance gateway, which operationalizes legal compliance by requiring the legal team to certify the calculation methodology and required disclaimers *before* the code is written, effectively embedding legal approval into the project lifecycle.

Ethical Issues and Resolution

The project is rooted in an ethical imperative of equity and transparency. Academic research clearly indicates that the current lack of precise financial information disproportionately hinders the enrollment of minority and low-income students. The solution, driven by the need for maximum transparency and personalization, addresses this ethical issue directly. The calculator acts as a tool for social equity, empowering at-risk populations with the precise information needed to make informed educational decisions. This alignment is central to Arborwood’s mission to foster economic mobility through programs that offer career advancement and employment stability.

Policy Issues and Potential Conflict

The most significant policy challenge is the potential conflict between the existing manual data maintenance policy and the new automated data flow via the API. The manual policy creates regulatory risk, and the automated solution renders the policy obsolete. To mitigate this, the project must result in the creation of a new Data Governance Policy that formally designates the administrative system as the SSOT for tuition and other cost data and establishes clear ownership and validation processes for the new API endpoints. This proactive measure prevents a policy vacuum that could otherwise allow data errors that have the potential to undermine the project's compliance goals.