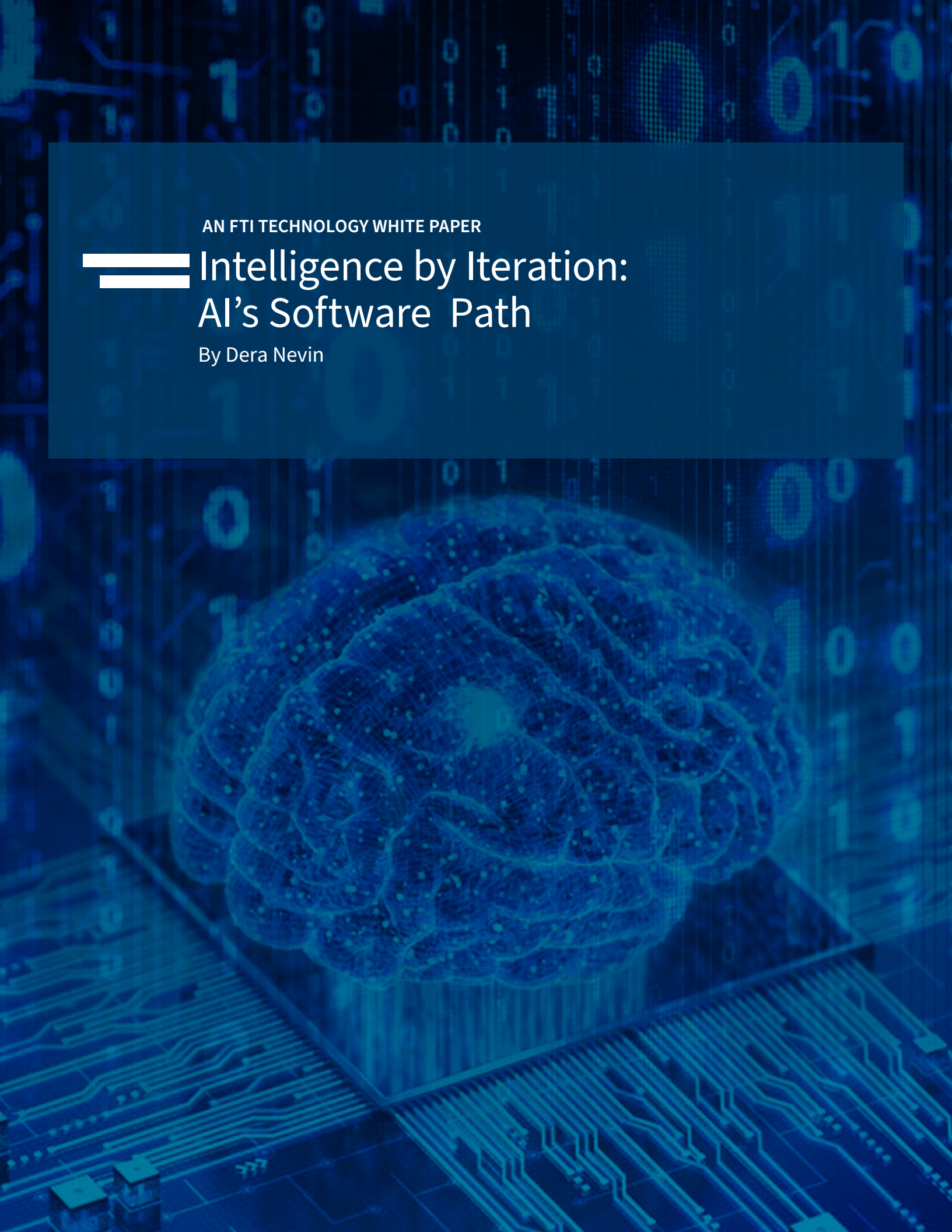
AN FTI TECHNOLOGY WHITE PAPER

Intelligence by Iteration: AI's Software Path

By Dera Nevin

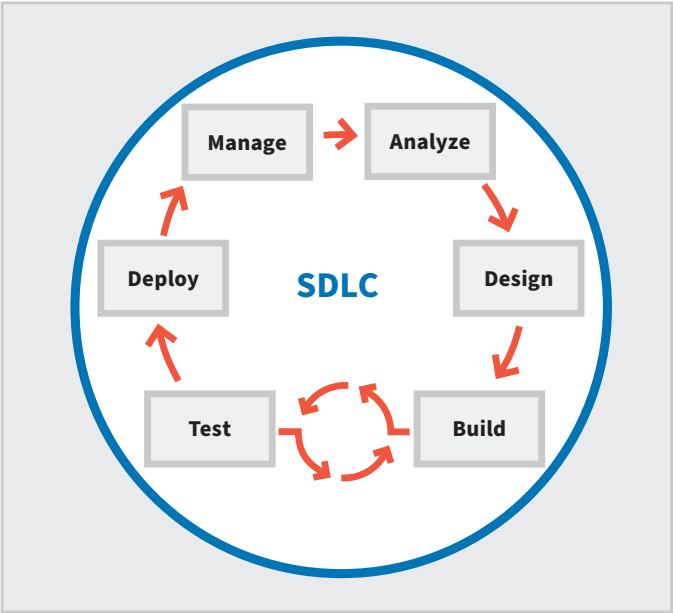


Since early 2018, firms have spent billions of dollars for first mover advantage on the promise of artificial intelligence technology, particularly generative AI. For many though, the results have fallen flat, largely due to gaps in following standard software development lifecycle (SDLC) processes or appropriately adapting SDLC to the specific needs of AI model testing, documentation and monitoring. These early and ongoing failures are costly, potentially risky and can cause loss of trust among customers and partners.

So, how can organizations learn from what's gone wrong within their own organization or others and strengthen their posture for future AI success?

Implementing AI governance is a critical place to start, and that also means recognizing that the best practices and steps that have long been relied upon in enterprise software development — namely SDLC — can provide a useful framework for AI software development. Importantly, this means that sales, marketing and other departments that may be charging forward with AI adoption or implementation must work with technical and governance experts from the start to ensure AI models and tools are properly trained, tested, deployed and monitored.

As a level-setting review, the SDLC, in either a waterfall or dispersed across various agile approaches, generally consists of six specific activities that underpin successful development cycles:



1. **Analyze:** What is the business problem being solved and why?
2. **Design:** What are the process and technological activities that can be created to solve parts or all of the business problem? In the case of an AI system, attention must also be paid to the data and model selected (or developed).
3. **Build:** Take the designed processes and well-planned approach to solve the business problem and build a solution in process flows and using tools to expedite certain process functions.
4. **Test:** Test the results, ensuring that what was expected from the process and technology, under many different conditions, is in fact what resulted and was wanted.
5. **Deploy:** Supported by a change management strategy, incrementally roll-out the processes and technology with oversight and controls to ensure that nothing unexpected occurs. Have a rollback process in place if unwanted results that may endanger customers, employees or the business emerge.
6. **Manage:** Ensure that the processes and technology continue to operate as expected. In AI, this likely includes ensuring no data or model drift (the results are uniform if the inputs are the same), no bias (the results are independent of human traits, geography and other factors that could result in inaccurate predisposition, prejudice or other slanting), consistency and accuracy. Outputs must also be explainable.

In conventional enterprise systems, results are mathematical, finite, traceable, and auditable. Even in decision trees, the process of understanding how the tool got to its answer is repeatable, knowable and understandable.

In contrast, AI outputs (particularly those arising from deep learning algorithms) are often variable, even when based on statistical predictions. Key to addressing this variability in development is understanding:

1. An AI model or system will always be reliant on vast amounts of data to be trained and tested. Thus, data quality is paramount and attention needs to be paid to ensuring the correct selection and treatment of data are aligned with the business purpose and development of the AI model.
2. The AI governance policies, guidelines, standards, controls and procedures that are in place.
3. AI development requires the existence of a robust, managed and governed SDLC, to effectively analyze, design, build, test, deploy and manage AI models and AI systems.

These three considerations should be fully understood through subcomponent ideas, concepts and actions that should be addressed before undertaking the AI journey, discussed further below. There are several areas that must be integrated within the data governance framework. They include the following.

Identifying data sources and conducting a full provenance and lineage analysis

For AI development and modeling, identifying data sources and conducting a full provenance and lineage analysis will be helpful for ensuring model reliability and ethical development. This process involves documenting the origin, transformations and usage of training (and testing) data, from raw collection to final model input. By tracing the data's journey, developers can identify potential biases, ensure data quality and establish transparency in model creation. It will also ensure that data subject to regulatory compliance requirements (such as personal data) or contractual requirements (such as confidential data) is not incorporated into the model in unauthorized ways. This rigorous analysis promotes responsible AI practices and facilitates reproducibility, fostering trust in the model's outputs.

Additionally, data governance also involves critical components that ensure data integrity, compliance and ethical AI practices. These include:

- Importance of secure and compliant data access protocols.
- Identifying internal and external data sources relevant to AI models.
- Tracing the provenance and lineage of data to confirm no legal, regulatory, contractual, copyright or other IP impairments that would be engaged by its use.
- Ensuring data quality, accuracy and consistency across sources.
- Implementing data governance frameworks to manage data usage.
- Leveraging metadata where appropriate for better data discovery and management.
- Addressing contractual and regulatory requirements.

Law and policy considerations

Data governance also involves the development of compliance frameworks, policies and mechanisms to ensure the legal, ethical, transparent and secure management of data used in AI models and systems, such as:

- **Data privacy:** Ensuring compliance with data protection laws to safeguard personal information and user privacy, including the cross-border transfer of personal data and the honoring of data subject requests.
- **Regulatory compliance:** Ensuring AI data practices align with existing and emerging regulations and adapting to future legislative developments.
- **Intellectual property rights:** Ensuring data practices align with existing IP rights.
- **Contractual rights:** Ensuring data practices align with existing contractual rights and obligations.
- **Bias and fairness:** Addressing and mitigating biases in AI data to promote fairness and prevent discriminatory outputs and outcomes. Biased outcomes can also result from computational bias arising from improperly stewarded data.
- **Transparency:** Transparency in data collection, management and usage.
- **Accountability**: Establishing clear accountability mechanisms for data misuse and output results.
- **Ethical guidelines:** Crafting ethical guidelines that govern the use and sharing of data to and within AI systems, prioritizing human rights and societal well-being.

Data stewardship

An important aspect of a data governance program is the implementation of data stewardship, defined as the responsible management and oversight of data assets. This involves assigning specific roles and responsibilities for data quality, security and usage, ensuring that data is consistently accurate, reliable and compliant with applicable regulations. Effective data stewardship cultivates a culture of data accountability, which is crucial for maximizing the value of data while minimizing associated risks. Data stewardship contributes to implementing and maintaining data governance programs in the following ways:

- **Ensures data integrity and business relevance:** Data stewardship maintains high-quality, accurate data that is aligned with business objectives, ensuring AI systems are fed reliable and relevant data for decision making.
- **Supports data governance and accountability:** By defining roles and responsibilities, data stewardship integrates seamlessly with governance frameworks, helping businesses ensure that AI initiatives adhere to internal policies and external regulations.
- **Strengthens security and data protection:** Stewardship helps businesses mitigate data security risks, protecting sensitive information and maintaining customer trust in AI-driven processes.
- **Prepares businesses for AI scalability:** Stewardship ensures that as AI projects expand, data management practices are scalable, enabling businesses to grow their AI capabilities efficiently and sustainably.

Model management

Emphasizing the "build-test-build-test" iterative process of the SDLC is critical to ensuring that an AI model works effectively and can adapt to evolving data and business needs. Moreover, some emerging regulations and standards require it. Here's how iterative testing fits into the SDLC for AI development:

- **Rapid prototyping and initial model building:** Understand the available existing models that may address the defined problem, focusing on whether quick iterations through defined processes such as additional training, feature engineering or fine turning are required and appropriate, and consider how to test and document model refinement feasibility and ensure the approach aligns with business goals.
- **Frequent testing during model development:** Throughout the model development process, constantly test the model using subsets of data to evaluate performance, accuracy and any biases. Consistently review the training and test data against outputs. This iterative approach helps identify early issues, such as overfitting and underfitting, hallucinations or unexpected or unreproducible outputs and allows for rapid adjustments in algorithm selection, feature engineering or fine-tuning.
- **Feedback loop and error analysis:** After each test, analyze the model's performance, including false positives, false negatives and areas where the model underperforms. Feed this analysis back into the model-building phase, making targeted improvements with each iteration.
- **Validation and cross-validation:** Integrate cross-validation techniques during each iteration to ensure that the model performs well not only on the training data but also on new, unseen data.
- **Automated testing pipelines:** Set up automated testing pipelines to quickly evaluate changes in model architecture, algorithms or data preprocessing.
- **Monitoring and retraining in production:** Even after deployment, maintain the build-test process by continuously monitoring the model's real-world performance and retraining it as necessary as new data becomes available.

Enterprise AI governance

Models for responsible or ethical AI governance are currently varied. However, representation from certain stakeholder constituencies and populations may contribute to a more comprehensive and effective AI governance program:

Enterprise governance

AI governance starts with defining the corporate strategy for AI by documenting:

- Target operating models for the governance program to set out clear roles and responsibilities for AI risk.
- Compliance assessments to establish program maturity and remediation priorities.
- Accountability processes to record and demonstrate compliance.
- Policies and procedures to formulate policy standards and operational procedures.

Product governance

AI governance also requires policy standards to be applied at the product level and may also require the implementation of product-level operating models, assessments, accountability processes and policies and procedures. Organizations can ensure their AI products match their enterprise strategy by using:

- AI literacy programs for product teams, so that they understand the principles of responsible AI and how those are implemented in practice within their work.
- Risk and controls frameworks to define AI risk and treatment based on widely recognized standards such as ISO and NIST.
- Impact assessments to identify and address risk prior to product development or deployment.
- Conformity assessments, to ensure that AI when deployed meets defined and regulated standards.
- Quality management procedures within the SDLC to address risk by design.
- Third-party due diligence assessments and post-launch model and market monitoring.

Operational governance

The organization's AI strategy must ultimately be operationalized throughout the business through the development of:

- Performance monitoring protocols to ensure AI models and AI systems continue to perform adequately for their intended purposes.
- Transparency and human oversight initiatives to ensure individuals are aware and can make informed choices when they interact with AI models or systems or when AI-powered decisions are made.
- Incident management plans to identify, escalate and respond to serious incidents, malfunctions and national risks impacting AI models and systems and their operation.



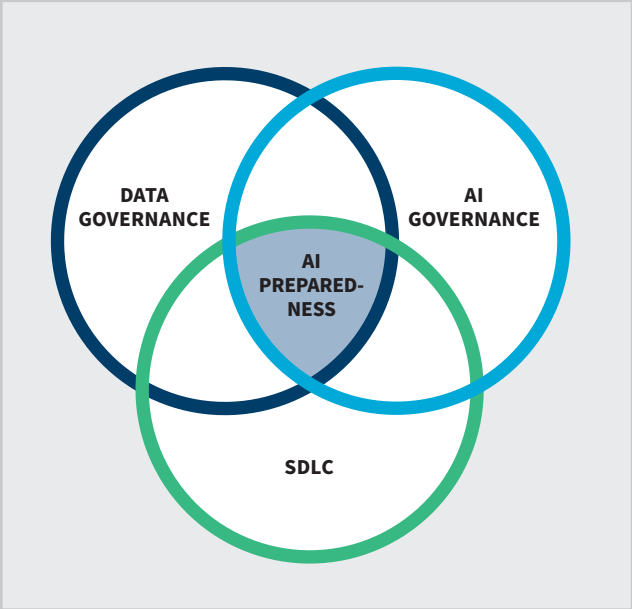
Practical AI readiness

In AI development, there are no simple answers. That said, there are straightforward questions that every aspiring AI leader should ask of themselves and their organization, including:

- Who "owns" AI governance and compliance in the organization?
- What are the business requirements?
- What does the firm expect from AI?
- Is the cyber/information security team engaged?
- Who "owns" the data required to train AI?
- Does the organization have of the right quality and quantity of data to make AI a useful endeavor?
- Is the data science team supporting or driving the effort?
- Is there sufficient data to train?
- Is there sufficient data to test?
- Does the firm have data governance in place?
- Is the firm treating AI development like software development (i.e., analyze, design, build, test, revise, test, revise, test, deploy, manage)?

There is so much basic blocking and tackling that needs to be in place to put an effective and compliant AI program in place. A Fortune 150 chief information security officer recently said, "The irony of the current state of AI and the difficulties surrounding it is that AI is supposed to make our business life easier, when in fact, it is the exact opposite."

Perhaps even more than prior technology and process implementations, as the complexity of the technology has grown, so have the prerequisites to achieve and maintain success.



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