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Driving Salesforce Testing Excellence with AI and Metadata-Driven Intelligent Automation

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ABSTRACT: Salesforce is the most well-known cloud application-based CRM solution, known for its scalability, analytics, and vast application ecosystem that allow companies to better understand their processes and relationships with customers. Despite the benefits, the CRM can be daunting and expensive for smaller teams, requiring a trained resource for upkeep and introducing challenges when integrating and managing other technologies. To overcome these limitations, the Robot Project is integrating Salesforce Smart Works 2.0. Smart Works 2.0 improves dependency mapping, detects changes, and does regression testing through a metadata-driven architecture. The Smart Work integration into Salesforce will streamline these initiatives by creating improved processes and enhancing testing coverage while also ensuring quality in released code for its users in highly regulated businesses (such as healthcare). Smart Works 2.0 also provides a comprehensive testing suite to accomplish these capabilities and ensures easily obtainable advanced automation features. The overall ROI and efficient delivery rates for continued developments in all automated and AI-driven testing and business release changes will include a metadata-centric DevOps pipeline, automated governance, and real-time analytics - connecting both robotic and AI agents in testing and development processes while assisting Autodesk development teams. In combination, the development of low-code or even no-code platforms will allow more business users to be able to maintain and complete intelligent testing initiatives for continuous innovation resources and process work through reduction or avoidance of traditional bottleneck development.

KEYWORDS: Salesforce, CRM solution, Smart Works 2.0, AI-driven, DevOps Pipeline, Real-time Analytics

I. INTRODUCTION

Salesforce implementations follow a systematic, multi-stage process to ensure that aspects of the implementation specifically align to the company's business needs. The steps include discovery to evaluate current practices and develop CRM goals, design to configure the platform, planning for the actual PROJECT, scope, and budget, customization to configure Salesforce functionality, integrate with legacy systems, validation through user testing, data migration to facilitate the reuse of legacy data, and on-going support for training and maintenance. Despite these changes, Salesforce may not be easy to implement due to its complexity, amount of customization, integration with many legacy systems, risk related to data transfer, and the necessity to ensure user and company buy-in. At the same time, having multiple stakeholders, change in direction, quality control, and managing disruption during project implementation, all contribute to the complexity of an implementation [1].

Several important components contribute to successful implementation of Salesforce. The first step is to establish clear goals and measurable objectives to help direct the process and get to the desired state. A strong project team made up of a diverse mix of people with good representation from the various functions of your organization can help both with your work and communication, with each one having clearly established roles and responsibilities. Then to begin the process of assessing current processes with a level of realism will help you to configure Salesforce to suit your organization more closely and will yield the highest level of acceptance from users. You also want to balance integrating in third-party systems and configuring Salesforce in such a way that ongoing scalability is ensured, while also ensuring the integrity and completeness of validated data. Furthermore, you will want to plan and test data migration to ensure the quality of your data does not deteriorate whilst deploying the CRM. You will also want to invest in training and ongoing support to help with adoption and provide as many engaging formats for learning as possible, such as interactive learning. As part of the phased implementation stage, feedback should also be collected in a way that you can take action on, assess and provide iterative improvement throughout the project. Testing and validating any custom builds, integrated transactions, and workflows must be conducted prior to going live so that any issues identified can be worked through and resolved. Effectively managing these elements will foster user acceptance, reduce risk and maximize expected return on investment (weekly, monthly) and prepare them for more advanced uses such as actionable AI-based analyses and quality assurance [2].

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When conducting a large-scale Salesforce project, it is critical to consider that setups and customizations are connected and therefore require impact analysis and quality assurance (QA) to limit any disturbances on the Salesforce environment. This in itself can help an organization assess the user experience, data quality, or compliance ramifications of those changes. Additionally, processes can provide assurance that the reporting and integrations related to business objectives are aligned with the changes. Also concerning QA, unfortunately, is next; QA's job is to determine if the changes - whether related to the set up or the logic - function as designed and in order to mitigate any risk to the environment while also providing assurance in the release process. Impact analysis and QA both provide users improved data security, data compliance and return on investment as a result. Using AI-enabled tools to assist with impact analysis and quality assurance can provide benefit to future operational maintenance and development when working with large scale and complex Salesforce platforms.

Salesforce is utilizing AI-enabled technologies to enhance its ability to make better and faster decisions by creating a layer of advanced intelligence into the use of the CRM workflow. These technologies combine predictive analytics, machine learning, and Natural Language Processing to decipher complex Salesforce data and surfacing the key aspects. They increase user engagement possibilities and can increase automation capabilities for repetitive work (such as lead scoring, case routing) without compromising data security in the Salesforce cloud architecture. Core add-on value like Salesforce Einstein and GPT-powered coproducts are at the forefront of the charge of predicting customer behavior to gain operational productivity. The implications of this technology will reduce implementation risks of a deployment of an organization and lengthy manual QA experiences while improving user adoption and organization agility. The bottom line is that evolved Salesforce into a proactive system will give all firms a competitive advantage in agile markets. [4]

Salesforce is an all-in-one cloud platform that helps companies with a variety of functions, including marketing, sales, and customer support. It provides no-code/low-code development tools that make it easy to develop secure applications that can be deployed at scale and can yield automated and AI-based solutions. Salesforce allows AI to perform the automation of manual tasks and decisions. Developers have the ability to use low-code applications to customize the robotic platform's capabilities. Testing in Salesforce benefits from intelligent automation, increasing test reliability and decreasing time to market with the help of AI and machine learning. Intelligent automation helps create and execute tests, detect defects early, and accommodate UI changes.

Using AI capabilities in Salesforce makes possible the development of intelligent agents that can perform sophisticated tasks across departments and drive efficiency and innovation. Automated testing increases coverage with automated testing capabilities across areas and processes, although Salesforce’s dynamic interface and frequency of release updates makes release testing complicated. We utilize a range of testing methodologies to problem-solve development so that testing aligns with the user’s requirements to make the system preferable. However, Salesforce’s complexity and potential for customization provide difficulty in terms of integrating testing related to security and performance, specifically due to privacy restrictions with compliance and varying standards across third-party systems. Performance testing must be realistic across various security profiles to represent actual utility, while the ongoing updates to the platform will need constant adjustments to remain compliant and to measure performance against real-time systems of use [6].

Salesforce is a comprehensive cloud platform that enables various tasks such as marketing, sales, and customer relationship management through its multiple API's and integration tools. The platform additionally supports advanced options for robotic process automation (RPA) and artificial intelligence-based capabilities. Users can use Salesforce to create applications that can scale with little coding. External robotic platforms interoperate with Salesforce through Salesforce REST API's or SOAP APIs. MuleSoft connects to Salesforce to assist in orchestrating a process and synchronizing data. Salesforce's API can use low-code technology for its development and artificial intelligence can also be used in conjunction with Salesforce's API to create custom bot and agent applications which can interact with clients or other systems. API's can change the data and context of the data into intelligent processes which can be used to automate activities.

Adding API integrations for regression verification and predictive diagnostics in automated test frameworks is practical for improving every aspect of testing and quality assurance. CI/CD methodologies utilize API requests to position for rapid and confident development and releases. Advanced API monitoring and management is critical for Salesforce due to complex connectivity most often related to system updates and security. Teams are capable of testing performance and security as real-world activity while protecting data and keeping accountability and compliance. All

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things considered, Salesforce's API-first architecture for development, as well as its integration with MuleSoft and AI-driven automation, provide a function for complex robotic AI solutions and enterprise automation. This co-function creates a safe flow of information with trusted innovation.

II. BACKGROUND AND CONTENT

Traditional Salesforce impact analysis utilizes the "Where is this used" button to find metadata references but only returns identifiers for the data. Staff must then examine flows or other code to understand the black/white relationships and indirect relationships to impact analysis. Such manual efforts are time consuming and prone to human error, often missing changes with complex systems. Conventional Salesforce quality assurance relies on scripted automation and manual verification such as user acceptance testing, regression testing, integration testing, and unit testing. The frequency at which your users encounter changes in user interfaces and frameworks can often increase the complexity of maintaining the various forms of quality assurance. Overall, Quality assurance, as well as either conventional or automated analysis of impact, often leads to omissions of potential impacts, delays in workflow or personnel productivity, and increased costs related to maintaining metadata. All of these factors illustrate the increasing need for intelligent quality assurance systems in addition to artificial intelligence automated analyses of impact to provide more accurate measurements of impact, as well as a decrease in required resource in analysis/QA, and faster release cycles [7].

Traditional methods of Salesforce impact analysis are largely manual and use tools focused on the direct and indirect effects of metadata, which may often be time-consuming and prone to human errors. Limited insight is gained from these methods regarding the complex relationships that exist within an organization, and even when done accurately there isn't considerable effort to manually vet impact. In addition, the context of scripted tests or static automation is complicated by the frequent updates made in Salesforce, oftentimes leading to regression issues. In contrast, impact analysis powered by AI makes use of machine learning and natural language processing to recognize indirect impacts and risks throughout Salesforce environments automatically. AI technologies provide increased accuracy and detail by analyzing data from many sources, thus improving the ability to find indirect effects, decrease the need for manual analysis. The use of AI within the automation of the quality assurance (QA) process provides reliability, while reducing the time taken to release by using dynamic-test case generation and changes to react to the issues, once a change happens, after the factual analysis takes place. In summary, the AI principles take risk analysis to a more automated, proactive, and scalable process, whereas traditional processes incorporate manual analysis and have limited settings. In complex Salesforce projects, AI reduces operational risks and human errors and builds confidence while providing faster time to value.

When Salesforce impact analysis and quality assurance are being performed manually or with a semi-automated process, there are practically eight challenges we face. For example, Change Sets require user selection of every component for transfer. This poses risks for non-delivery or non-re-purposing of existing components. Their inability to maintain proper version control of artifacts limits the management of parallel development efforts. Similarly, existing native impact analysis tools provide insufficient visibility to the work being performed when surfaces metadata, and does not allow you to understand the context (or indirect dependencies) thus increasing the likelihood of research oversight in complex organizations. The need to address constant updates and support needed due to the Salesforce behalf of the need to continue to deliver on the Salesforce platform and allows for a decrease of release cadence and diminishes regression test coverage. The limitation of API calls and nuances of third-party integrations does not allow for realistic performance, security testing. Issues regarding usability of the automation systems tend to cause friction within users, thus limiting its adoption within the organization. Additionally, manual often does not uncover defects until the end of a project phase, in which costs and effort have increased in retrospect and process time. An urgency for intelligent automation and AI tools improve upon traditional means by improving dependency mapping, predictive risk analysis, automated test generation, automation that allows for adaptive maintenance, facilitating accuracy, efficiency, reliability in Salesforce impact analysis and QA. [9].

The current state of business necessitates utilizing advanced automation and intelligent technology as advancements in Salesforce implementation are inherently complex, changeable, and have integration needs. It is impractical to use manual approaches for multi-faceted Salesforce updates and organizational design. The incorporation of higher-level automation will enhance our testing scale and coverage through artificial intelligence (AI) and machine learning (ML) that will optimize predictive analysis and the adaptive management of test cases, thus improving the speed of test execution and addressing maintenance. AI-enabled automation tools can identify the location of the problem, rank the tests by impact, and summarize situations for stakeholders to manage impacts across multiple scenarios between

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technical and the business. Using Salesforce as part of external automation and AI to automate workflows eliminates the need for programming. Using AI-enabled testing technology allows for regression testing, minimizes the impact on operational risk during performance testing, and enables continuous integration and testing to meet quality and manageability in scale. The technology allows teams to move from a reactive, ad hoc assistance practice to predictive quality and innovation and mitigates human error.

The Salesforce ecosystem is comprised of AI-enhanced platforms that expand customer relationship management (CRM) functionalities while allowing for automation, machine learning and AI to simplify business processes. The platforms support intelligent automation, natural language interface, autonomous agents, and predictive analytics with little interaction from humans. Some of the platform capabilities include deployable autonomous agents to qualify leads, resolve cases, and/or provide other value-add services; predictive analytics with Tableau CRM and Einstein Discovery for transforming data into insights; and natural language capabilities which enable end users to bevel into data (e.g., search) using natural language. Data and API integration is seamless into these systems leveraging MuleSoft and Salesforce Data Cloud or from metadata for flexibility in automation. The platforms have enterprise-grade security, compliance, and scalability incorporated into the design; enabling support for global enterprise operations that require growing and scaling.

Salesforce uses several essential AI technologies to augment its power. The starting point for Salesforce AI is machine learning (ML), which allows systems to learn from data and interpret trends, forecast results, and automate decisionmaking. Salesforce Einstein is an example of ML applied to predict customer behavior and rank leads. Natural language processing (NLP) delivers conversational AI to enhance the user experience through natural language querying, automating customer interactions. Anomaly detection applies ML to statistical approaches to recognize unusual trends that can provide early warning of problems. Predictive analytics are a way to predict future trends and customer needs, which are incorporated into Tableau CRM and Salesforce Einstein to deliver proactive recommendations to take action. Generative AI is a newer trend that uses an input prompt to generate new content, and to generate automation scripts that increase productivity. All of these technologies work together to automate processes and improve insight from data and transform Salesforce from a platform to an intelligent platform for business growth [10] is shown in below Table 1:

Table 1: AI Technologies Leveraged in Salesforce Testing and Automation

AI Technology	Description	Use Cases in Salesforce Testing	Benefits
Machine Learning (ML)	Algorithms that learn from historical data to make predictions and decisions	Automated test case generation, defect prediction, self-healing scripts	Reduces manual effort, improves test coverage, increases accuracy
Natural Language Processing (NLP)	Enables understanding and generation of human language	Natural language test authoring, conversational UI for test creation	Empowers business users to create tests without coding, faster scripting
Anomaly Detection	Identifies outliers and unusual patterns in data	Detecting unexpected application behavior and UI glitches	Early defect detection, reduces release risk
Predictive Analytics	Forecasts future outcomes based on trends and data	Risk assessment, test prioritization	Focuses testing effort, optimizes resource allocation
Computer Vision	AI interpreting visual content	Visual regression testing, UI layout validation	Detects UI inconsistencies beyond traditional DOM element checks
Reinforcement Learning	AI learns optimal testing strategies through trial and error	Adaptive test suites, autonomous test execution	Continually improves test effectiveness and efficiency
Metadata-Driven Automation	Uses Salesforce metadata (objects, fields, workflows) as the basis for AI automation	Change impact analysis, dependency mapping, environment synchronization	Ensures automation adapts dynamically to platform changes

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III. SYSTEM OVERVIEW

The steps involved in utilizing AI-supported effect analysis and quality assurance processes in a Salesforce project are as follows. First, organizations should outline use cases and scout their readiness by examining the business processes and defining the acceptance criteria for a successful use case. Second, a quality data backbone must be developed. This includes cleaning and managing data for input quality into AI models. This may involve or include breaking down a data silo and standardizing identifiers. It is essential that change visibility is possible. The Salesforce elements of metadata must be mapped and continuous change tracking must be developed to inform AI models to assess risks. AI systems will not only be used to assess logs and the metadata for grading risks but for mapping dependencies that can inform testing and change management.

Smart works 2.0 is a model designed to streamline and enhance application testing by fostering AI-driven test case development, a feature that allows for predictive defect management, and can be embedded into a CI/CD pipeline--giving users the opportunity to perform scalable regression testing. Pilot your first AI project, establishing clear foundational success metrics and developing a workplan that takes into consideration how to measure and report on the improvement of various business outcomes, and gather valued, additional insights from the various change stakeholders within your organization, to ensure the project stays on track towards enhancement of the business process. Finally, appropriate training and change management practice - that is applied early during the change process - is critical, in order to get the stakeholders to buy into the change, and to allow for possible cultural detours to implementation to be addressed. In short, we are improving release confidence, while reducing manual workload and driving innovation in our Salesforce projects through these combined efforts.

The architectural diagram describes the stakeholder collaborations associated with the metadata driven robot control described in Smart Works 2.0 in the mixed methodologies, the Smart Works 2.0 environment as shown in Figure 1. Smart Works 2.0 incorporates several recommended layers for data organization and robotic orchestration while defining the overall user experience.

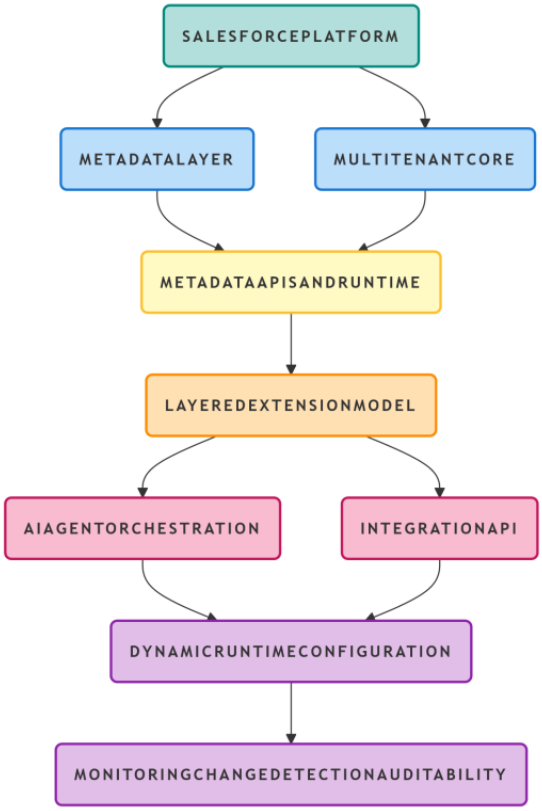

Figure 1: Metadata-Driven Robo Control Architecture in Salesforce

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1. **Metadata Layer:**
   A core repository of all structured definitions (sObjects, fields, workflows) allows reconfiguration at run time while maintaining data integrity, consistency, and multi-tenancy through Object-Relational Mapper (ORM).
2. **Layered Extension Model:**
   Diverse personas can modify programs in a predictable way that maintains backward compatibility by facilitating fast adaptations to ever-changing requirements.
3. **AI and Agent Orchestration:**
   Employing the metadata layer to enable autonomous AI agents to execute AI/ML protocols for robotic controls, reasoning, and real time impact evaluation using cross-agent protocols, such as Agent2Agent
4. **API Services & Integration:**
   Salesforce provides APIs (REST, SOAP, Bulk, Streaming) for third-party systems, and acts as a connective hub via MuleSoft for secure data coordination across both cloud and on-prem applications.
5. **Dynamic Runtime Configuration:**
   Multiple elements or engines of synchronization, and model-driven tools, support the metadata-driven configuration in the robot's state while allowing change without needing to reload the entire system.
6. **Auditability and Monitoring:**
   Audit is supported through metadata diffs or changes, logging useful for auditing while providing dashboards about system health for the health monitoring.

In constructing a low-latency telemetry flow between robots and Salesforce, the design must be reliable and scalable as it involves the capture, filtration, transmission, and processing of real-time data. The use of edge data processing ensures that the bulk of the telemetry data is processed locally by filtering and compressing the data before sending it to Salesforce. This process guarantees that only telemetry data that is valuable and applicable will be sent to Salesforce. A dependable messaging framework like Kafka will handle the telemetry data, ensuring reliability and a messaging framework for the action of the telemetry data. Event-driven, trigger-based serverless processing would allow for the ability to technically achieve real-analytics or trendy, anomaly detection in real-time leveraging fast response from smart caching for efficient telemetry performance which is also quick. Trusted transport should also ensure that telemetry data is sent reliably, allowing for regulatory compliance. It will also be important to have services and tools to help manage and service spikes in telemetry data flowing into the system. The infrastructure will also need to be able to be designed to contain failures, observability tools will allow us to monitor the state of health and performance of the system closely. We also want to allow for the ability to connect with Salesforce APIs and allow for automation and decision-making to become seamless. This architecture can grow into the low latency, high throughput, and resilience can because of edge and cloud-native computing power. The infrastructure will also be necessary in order to allow the robots to really capitalize on and utilize control and operation analytics.

In order to effectively implement AI in the Salesforce ecosystem, we will have to follow the steps of Data Preparation, to Model Training and Continuous Learning. Data Preparation is a broad way of depicting all of the activities to ensure you have sufficient good, organized data to gain insights from and test. It typically also means getting the data into a Data Model Object that will be stored in the denormalized storage of Salesforce DataCloud through either batches or the source integrations. The encrypted transport also ensures that telemetry data is able to move securely for regulatory compliance. Service and tools, as well as the infrastructure, will need to be scalable and reliable to accommodate spikes of telemetry data coming into the system to ensure that it can all be monitored and reliably served. Observability tools will help us to observe the health of our system and performance. Our desire is to create in reason at some point, the Salesforce APIs connecting there is no reason automation and/or decision making can't happen in a seamless way. This architecture is this achievable with low latency, high throughput, reliable service where it is applicable the edge and cloudnative infrastructures can continue to grow and provide processing power. The overall architecture must also enable and facilitate our robots to genuinely leverage the benefits of the analytics of control and operation. It takes Data Preparation, Model Training and Continuous Learning for AI to be optimally leveraged within the Salesforce Ecosystem.

Data preparation is an assortment of duties and responsibilities, but in essence, it is bringing quality and organization of mass amounts of data, so it can be assimilated for insights to investigate and develop solutions. This often includes finding a way to get the data into a Data Model Object, which is stored in the denormalized storage of Salesforce Data Cloud, either through batches or source integrations. The collaboration of data engineers and subject matter experts is crucial for selecting features and understanding how to contextualize data. During model training, data scientists will usually make use of low code interface to produce AI/ML models, and will typically use the Salesforce Einstein Model Builder. This low-code builder uses machine learning algorithms to systematically identify patterns in the training data.

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Performance metrics, usually accuracy or precision check in a testing cohort of the training set, are commonly used to determine if the model can be further refined and retrained. As you can note, models can be built iteratively for specific problem use cases, such as lead scoring or churn. After the model is trained, it can be implemented in the Salesforce ecosystem, and used as seamlessly as possible for the user to be integrated into the workflow of users with automation or process use-case. Using common metadata definitions and APIs allows these models to be implemented without sacrificing safety of the implementation with versioning and management capabilities to facilitate any changes would not disrupt or diminish stability or effectiveness.

Learning is a continuous process that is necessary to manage production data, which is constantly changing with the business landscape. The tracking of model predictions and evaluation of actual results enables the detection of drift and anomalies, which can be incorporated into retraining. This machine learning operations (MLOps) adage of close the loop automates data ingestion, retraining, validation, and redeployment thereby increasing the accuracy of the models over time. Additionally, Salesforce recognizes the importance of governance and covering ethical AI, by building frameworks that monitor AI compliance, transparency and explainability will be evident throughout the AI life cycle. This complete setup facilitates the acceleration of AI to inform decision making into CRM processes and robotic automations will consistently provide Salesforce AI models that are trustworthy, responsible, and adaptable.

When introducing AI to an organization that is implementing or already using Salesforce, one can expect favorable improvements in three areas: productivity, efficiency, speed and quality of software development with the implementation of AI-attached Salesforce. AI-embedded Salesforce applications provide real and measurable improvements in productivity such as, reducing time spent on tasks through the automation of repetitive tasks like scheduling meetings and retrieving information as well as measureable benefits like a 50,000 staff hours saved by using Salesforce Einstein Slack app in just one quarter. The introduction of AI improves efficiency by reducing defects by increasing test coverage and leveraging automated regression test cases while improving quality of the software and ultimately reducing defects in production. For example, Schneider Electric has reported a 30% improvement in time to close deals due to efficiencies resulting from their decision to use AI applications on their Salesforce installations. IT departments utilizing AI reports improving productivity (up to 26% improvement in productivity) while decreasing costs (about 25% decrease in IT costs), leading to faster innovation cycles while improving organizational efficiency. AI has allowed Salesforce not only to automate business processes, but also to automate the testing process to suggest improvement, better quality, speed and efficiency.

Salesforce environments that leveraged AI have actually performed better in many situations. Teams feel better coming out of a release simply knowing they have reduced risk, identified issues faster and more importantly feel confident about the quality of the release. AI also supports teams by having awareness of risk by watching for changes, prediction analytics to determine which relationships were significant, proactively managing risk, or maintaining visibility of system health. AI increases productivity by doing the repetitive work, which allows teams to focus on the big projects and supports collaboration. AI assists sales teams and marketers in making better decisions by providing more accurate information regarding customers and sales forecasts, allowing them to accomplish more. Overall, the changes above make customers happier and increase conversion and retention rates because they make it easier to customize and predict, as shown in Figure 2 below:

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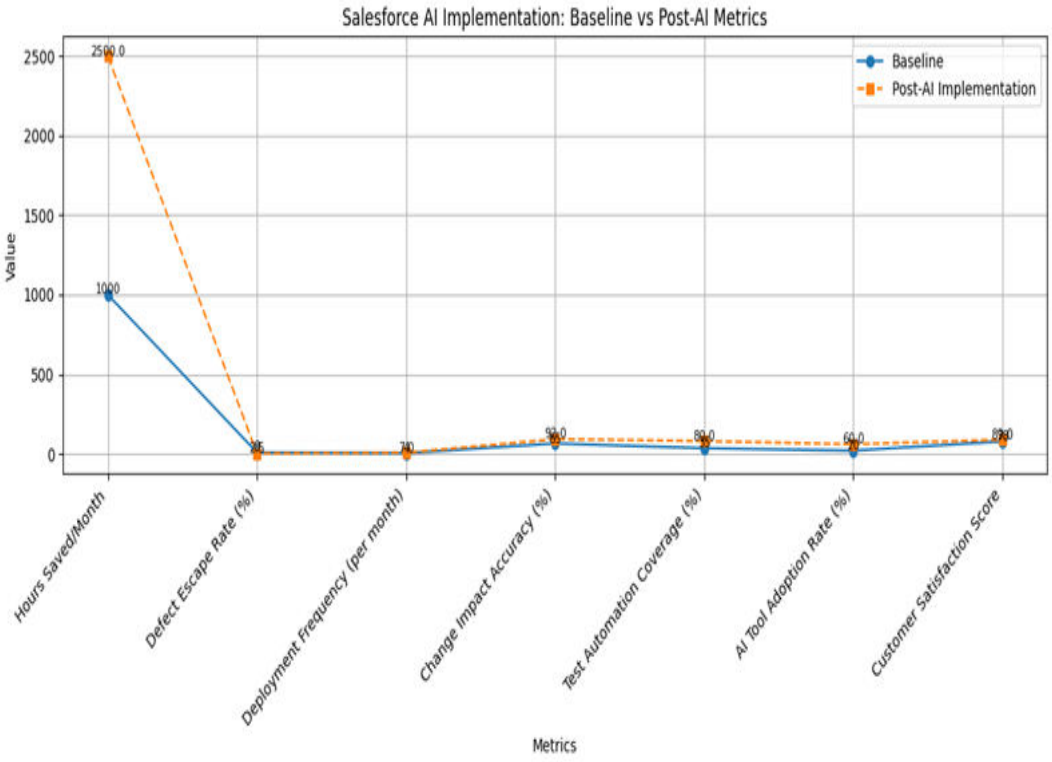

Figure 2: Salesforce AI Implementation: Baseline vs Post-AI Metrics

IV. CONCLUSION

The metadata-driven architecture of Salesforce contributes much to robotic automation projects like Smart Works 2.0. It does this by finding changes automatically, mapping dependencies intelligently, targeting testing, and giving real-time analytics. Also, advanced automation and AI further the level of operational excellence through easier tracking of performance metrics, such as time saved, defects reduced, and releases faster. Salesforce AI platforms help with sales forecasting and lead prioritization, and they make customer support better: allowing for customization, case routing, and many other features. It can also allow for more tests to be covered in automated testing and reduce manual effort. Predictive analytics allows individuals to gain insights for decision making; intelligent cross-platform automation provides simplicity in complex activities across multiple systems; Low-code and no-code platforms enable organizations to further additional business users and process improvements in an automated manner while encouraging flexibility and innovation. As a result, organizations across the board will experience qualitative (increasing confidence and productivity) and quantitative (decreasing time-to-market and defects) benefits by leveraging the suggested AI capability in their organizations providing a sustainable competitive advantage as the world moves digitally. An important feature of the future for Salesforce AI testing and automation will be to include predictive analytics, autonomous test generation and observability of performance to enable specific teams to continue benefitting from the new emerging technologies.

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