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Optimizing Decision-Making in ExxonMobil Global Services Co. through the TOPSIS Method

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ABSTRACT

ExxonMobil Global Services Co. has strategically integrated SAP (Systems, Applications, and Products) solutions to enhance and streamline its operations across multiple business functions. Following the merger of Exxon and Mobil, SAP's mySAP.com became the backbone of their IT infrastructure, enabling seamless integration of vital functions such as accounting, human resources, and supply chain management, specifically tailored to the oil and gas sector. This adoption has been crucial in ensuring scalability, improving efficiency, and unifying global operations. For example, the 2007 implementation of SAP Ariba replaced outdated legacy systems, transforming supply chain management and procurement. The 2019 deployment of SAP S/4HANA by XTO Energy marked a significant milestone, managing 66,000 wells and optimizing system performance, including the first PRA (Production Revenue Accounting) installation at ExxonMobil. Furthermore, SAP's Management of Change (MoC) has enhanced safety and compliance in chemical operations, while SAP Screen Personas have improved user productivity by automating time-consuming tasks.

Through these efforts, ExxonMobil continues to leverage SAP's advanced solutions to maximize efficiency, drive innovation, and maintain its leadership position in the global oil and gas industry. The success of ExxonMobil Global Services is rooted in its ability to drive innovation and operational efficiency in the energy sector, boosting productivity, reducing costs, and supporting sustainability initiatives. By utilizing advanced technologies, data analytics, and global expertise, ExxonMobil fosters research that leads to the development of innovative materials, improved refining techniques, and cleaner energy solutions, all in line with the goals of energy transition. The company also promotes interdisciplinary collaboration to create scalable solutions addressing global energy challenges. Their research efforts focus on economic development, environmental conservation, and the technologies needed to meet the world's evolving energy demands. The Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) is a multi-criteria decision-making approach used to rank alternatives based on their proximity to the ideal solution. Developed by Hwang and Yoon, TOPSIS identifies the best alternative by measuring the shortest distance to the ideal solution (maximizing benefits) and the furthest from the negative ideal solution (minimizing costs). It involves normalizing data, assigning weights to criteria, and calculating the relative closeness score.

TOPSIS is widely used in fields such as engineering, business, and environmental management for objective, systematic decision-making. Alternative: mySAP.com Integration, SAP Ariba Implementation, SAP S/4HANA Deployment at XTO Energy, SAP Management of Change (MoC), SAP Screen Personas Automation, Legacy System Replacement for Procurement, Consolidation of IT Infrastructure, Production Revenue Accounting Upgrade, Streamlined EHS Management with MoC, Invoice Automation with SAP Personas. Evaluation preference: ERP Integration Efficiency (Hours Saved/Month), Supply Chain Streamlining (Orders/Month), User Experience Enhancement (Tasks Automated), Implementation Cost (USD Millions), System Downtime (Hours),

Compliance Risk (% Risk of Non-Compliance). The results show that the Production Revenue Accounting Upgrade holds the top rank, whereas SAP Screen Personas Automation ranks the lowest.

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Introduction

ExxonMobil Global Services Co., a subsidiary of ExxonMobil Corporation, is well known for its creative approaches to energy and chemical operations on a global scale. The company's strategy to improve efficiency, maintain competitiveness, and accomplish sustainability goals is based on the adoption of cutting-edge technological solutions, and SAP (Systems, Applications, and Products) has emerged as a key component of ExxonMobil's digital transformation initiatives. By utilizing SAP's suite of enterprise resource planning (ERP) tools, ExxonMobil hopes to optimize its operational workflows, streamline supply chain management, and facilitate data-driven decision-making across its complex and varied operations. Implementing SAP systems is a strategic decision to match the company's operational framework with the needs of a fiercely competitive and dynamic global marketplace, rather than just a technological upgrade. Operational excellence is greatly aided by SAP's capabilities in supply chain logistics, financial accounting, materials management, and human resource planning. This paper investigates the strategic adoption of SAP by ExxonMobil Global Services Co., with an emphasis on its influence on operational performance, efficiency, and sustainability. [1] One of the top suppliers of ERP software that unifies an organization's essential business operations is SAP.

The platform is an essential tool for big businesses like ExxonMobil because of its capacity to centralize data, automate repetitive activities, and offer real-time insights. According to research, by offering precise and thorough data, SAP systems help companies increase operational efficiency, cut down on redundancy, and enhance decision-making. The SAP suite comprises modules designed for several corporate tasks, including supply chain management (SAP SCM), human resources (SAP HCM), and finance (SAP FICO). According to the literature, companies who implement SAP see notable gains in process standardization and compliance, particularly in highly regulated sectors like the oil and gas industry. [2] Digital transformation has brought about a paradigm shift in the oil and gas industry. Advanced technologies are being adopted by businesses more frequently in an effort to improve sustainability and operational efficiency. Addressing issues like volatile oil prices, strict environmental regulations, and intricate supply chains requires the integration of ERP systems like SAP.

The use of SAP by ExxonMobil is in line with market trends, which call for businesses to use technology to improve asset management, maximize resource use, and guarantee adherence to environmental regulations. The ability of SAP to deliver real-time insights into operational indicators is particularly helpful in enabling predictive maintenance and optimizing production schedules. [3] ExxonMobil's dedication to operational excellence is the foundation of its choice to deploy SAP technologies. In order to guarantee alignment with organizational objectives, the literature emphasizes the significance of strategic planning in ERP deployment. The implementation of SAP at ExxonMobil entails tailoring modules to the particular requirements of the energy industry, such as financial reporting, refinery operations, and supply chain logistics. show that good change management and employee training are essential for the successful deployment of ERP in international firms. These elements are emphasized in ExxonMobil's SAP deployment strategy, which guarantees that the workforce is prepared to take advantage of the system's full potential.

The company's staggered rollout plan minimizes disruptions and ensures smooth integration with current systems by enabling gradual adoption across various business units. [4] The operational efficiency of ExxonMobil is significantly impacted by the implementation of SAP systems. demonstrates how SAP's real-time data processing features improve decision-making and cut down on the amount of time needed for repetitive operations. ExxonMobil makes use of these skills to streamline maintenance plans, shorten procurement cycle times, and enhance inventory management. ExxonMobil's operations also heavily rely on SAP's analytics technologies. SAP helps the business to detect inefficiencies and proactively execute remedial steps by offering actionable insights into key performance indicators. who point out that ERP systems help big businesses adopt a data-driven approach to performance management. [5] ExxonMobil improves the accuracy and openness of its financial reporting by leveraging SAP's financial management features.

The SAP FICO module offers a centralized platform for financial transaction management, allowing the business to guarantee regulatory compliance and conform to international accounting standards. This capacity is especially important in the oil and gas sector, where large capital expenditures, shifting commodity prices, and geopolitical concerns create financial complexity. SAP's supply chain management (SCM) module has been crucial in helping ExxonMobil streamline its logistics and procurement processes. The organization can improve supplier collaboration, save inventory costs, and improve demand forecasts thanks to the module's capacity to integrate data across the supply chain. These enhancements make the supply chain more responsive and flexible, enabling ExxonMobil to successfully adjust to changes in the market and operational difficulties.. [6] SAP has many advantages, however there are

drawbacks to its deployment. High implementation costs, change aversion, and complex system integration are typical problems. These difficulties are reflected in ExxonMobil's experience, especially when it comes to guaranteeing user uptake and connecting SAP with legacy systems. According to the research, overcoming these obstacles requires thorough training programs and effective change management techniques. ExxonMobil's emphasis on employee involvement and phased rollouts is a prime example of ERP installation best practices, guaranteeing a seamless and efficient shift to SAP systems. Furthermore, the company's cooperation with technology partners and SAP experts has proven crucial in resolving technical issues and enhancing system performance. [7] SAP's importance in driving sustainability initiatives is increasingly recognized in the literature. Features such as energy management modules and carbon footprint tracking enable firms to connect their operations with environmental goals. In order to solve environmental issues and meet sustainability goals, ExxonMobil needs these competencies.

The adaptability of the platform is demonstrated by the integration of SAP with ExxonMobil's sustainability activities. SAP's Environment, Health, and Safety (EHS) module allows the business to track resource usage, monitor emissions, and take proactive steps to lessen its environmental impact. ExxonMobil's larger commitment to sustainable development and corporate social responsibility is in line with these initiatives. Looking ahead, the combination of SAP with future technologies such as artificial intelligence (AI) and the Internet of Things (IoT) presents considerable prospects for ExxonMobil. The oil and gas sector may achieve new heights of operational efficiency and creativity through the integration of ERP systems with cutting-edge technologies. It is anticipated that ExxonMobil's investigation of these technologies would improve its capacity to adjust to a business environment that is changing quickly. [8] Important insights can be gained by comparing ExxonMobil's SAP implementation to that of other industry leaders. To handle comparable operational issues, businesses like Shell and Chevron have also implemented SAP systems.

According to the research, although SAP's fundamental advantages are universal, organizational culture, leadership commitment, and the efficacy of change management techniques are some of the variables that frequently affect how well an installation goes. ExxonMobil distinguishes itself from its competitors with its focus on customization and phased rollouts. This strategy guarantees that the system's functionalities are customized to meet the unique requirements of the business, facilitating a smoother integration with current procedures. Furthermore, ExxonMobil's investment in employee training and engagement has been a critical factor in ensuring the success of its SAP initiatives. [9] Denbury was purchased by ExxonMobil for $4.9 billion. Denbury is a publicly traded corporation that supports oil drilling operations mainly through pipeline operations and carbon dioxide mining. ExxonMobil's goal to improve its carbon capture, sequestration, and utilization activities in order to reduce greenhouse gas emissions is what motivated the acquisition. According to projections, Denbury's assets may possibly cut CO2 emissions in the US by more than 100 million metric tons per year. The background also emphasizes Denbury's evolution as a business, with a significant amount of its earnings coming from the extraction of CO2 from a Mississippi geological deposit and its use to improve oil recovery in depleted fields. This calculated action by ExxonMobil illustrates how the oil industry is placing an increasing focus on environmental responsibility and sustainability. [10] The context given describes a new synthetic turf recycling program led by TenCate Grass in partnership with ExxonMobil and Cyclyx International to address the environmental issues surrounding the disposal of artificial turf, which is commonly used in sports fields throughout North America.

TenCate Grass intends to begin the recycling process by shredding 50 artificial-turf fields at a facility in California, and the shredded material will then be transported to a pyrolysis plant that ExxonMobil is building in Baytown, Texas, which will turn the synthetic turf into hydrocarbons, which ExxonMobil will then turn back into plastics. Given that there are already about 24 million square meters of artificial turf installed in North America, the project emphasizes the growing awareness of the need for sustainable methods in the management of synthetic materials. This partnership is an important step in encouraging recycling and lowering plastic waste in the sports sector. [11] In a major collaboration with FuelCell Energy, ExxonMobil has committed up to $60 million to improve the efficiency of carbonate fuel cells for the extraction of carbon dioxide. They have been experimenting with using power plant exhaust in place of air in the fuel cells since 2016, and this partnership expands on that effort. Compared to conventional amine solvents, which are frequently used for carbon capture, the novel method enables the fuel cells to concentrate CO2 more efficiently while simultaneously producing energy.

This development is a component of ExxonMobil's larger plan to mitigate environmental issues and lower carbon emissions. To further enhance CO2 capture techniques, the company is also investigating additional technologies, such as metal-organic frameworks in partnership with Mosaic Materials. In line with international efforts to fight climate change and advance cleaner energy alternatives, this investment represents a growing trend in the energy sector to adopt cleaner technology and strengthen sustainability measures. [12] The backdrop given talks about CF Industries and ExxonMobil's partnership to produce blue ammonia in Louisiana. As part of this project, CF Industries will collect carbon dioxide from its Donaldsonville ammonia production facility and move it to an underground sequestration site in Vermilion Parish that ExxonMobil is developing. The project is scheduled to be finished by 2025 and is anticipated to generate 2 million metric tons of carbon dioxide per year. At its Donaldsonville facility, CF Industries has set aside $200 million for a CO2 dehydration and compression

machine that will generate 1.7 million tons of blue ammonia. At the same site, CF Industries also plans to use hydrogen produced by water electrolysis to create green ammonia. This collaboration demonstrates the businesses' dedication to environmentally friendly operations and cutting carbon emissions during the ammonia production process. [13] After acquiring Materia in 2021, ExxonMobil Chemical is putting itself in a strategic position to profit from its Proxxima polyolefin thermoset resin technology.

This technique uses cyclic C5 monomers to produce sophisticated materials and is based on the creative work of Nobel laureate Robert Grubbs. Senior Vice President Loic Vivier recently spoke to investors about the exceptional qualities of these resins, pointing out that they are stronger and cure more quickly than conventional thermoset resins like epoxies. Targeting a variety of uses for these materials, including windmill blades, automotive parts, and pipeline coatings, is part of ExxonMobil's ambition. With an estimated yearly demand of up to 5 million metric tons, the business sees a substantial market opportunity. Additionally, estimates suggest that by 2040, Proxxima technology profits might reach $1 billion. ExxonMobil has already started the construction of its first manufacturing facility devoted to these cutting-edge resins in order to support this ambitious objective, which is a major step in their dedication to growing this new business segment. [14] Exxon's background in large-scale linear and nonlinear programming applications, with an emphasis on how well different optimization methods perform.

It draws attention to the difficulties that several programming techniques, including ECO, GRG2, MINOS, and SLP, have while attempting to solve problems with various limitations and levels of complexity. The study highlights the need for strong computational processes to properly manage bigger challenges, pointing out that although certain tools performed well on smaller problem sets, they had trouble with more stringent requirements. Additionally examined are the application of modified Lagrangian techniques and the importance of convergence tolerance in optimization procedures. The paper also discusses the progress of modeling methodologies, such as the switch from separable programming to sequential linear programming, and the incorporation of nonlinear interactions in refining applications.

All things considered, the study highlights the development of optimization techniques and how they affect the refining industry's ability to solve problems and increase output. [15] ExxonMobil is starting a large-scale initiative to build the Solent Cluster, a carbon capture, utilization, and storage (CCUS) hub on England's south coast. The goal of this project, which is a joint venture between the Solent Local Enterprise Partnership and the University of Southampton, is to drastically cut carbon emissions in the area. When the Solent Cluster is completely operational later this decade, it is expected to absorb about 3 million metric tons of carbon dioxide per year. A wide range of stakeholders are involved in the program, including chambers of business, local governments, aviation and maritime firms, biofuel producers, and even Southampton Football Club of the Premier League. In addition to being a major manufacturing hub and a crucial maritime route linking the English Channel and the mainland UK, the Solent region currently emits over 3.2 million tons of CO2 annually. As the project progresses, the Solent Cluster is committed to developing low-carbon solutions to tackle the urgent problem of climate change and help the area have a more sustainable future. [16] ExxonMobil's plan to build a blue hydrogen factory near Houston. The plant's daily goal is to convert natural gas into about 800,000 m^3 of blue hydrogen. ExxonMobil intends to permanently store the carbon dioxide by-product produced during the hydrogen production process underground, without using it for enhanced oil recovery, in order to obtain the blue designation.

The resulting hydrogen will be used as a feedstock for other compounds, such as olefins, which are meant to be low-carbon substitutes. This project is a component of ExxonMobil's larger plan to create a multiparty carbon capture and storage hub in the Houston region, underscoring the company's resolve to cut carbon emissions while maintaining production of vital chemical feedstocks. [17] Exxon Exploration and Production Guyana Limited and its partners will support company growth and optimization in the nascent oil and gas industry in Guyana. ExxonMobil realized that a comprehensive approach to local content planning was required after oil was discovered in the Stabroek block in 2015. This strategy sought to increase local companies' knowledge of the oil and gas sector while integrating them into the supply chain. The difficulties experienced by Guyanese businesses, which were mostly functioning in a little local economy and were not exposed to global norms, are highlighted in the article.

In order to overcome these obstacles, ExxonMobil created the Centre for Local Business Development, which offers local companies training, mentorship, and resources, as well as a supplier development program. The Center seeks to increase Guyanese businesses' competitiveness and guarantee their active involvement in the oil and gas industry, which will support the nation's long-term economic development. One important element in effectively carrying out these projects is the cooperation between ExxonMobil and DAI Global LLC. [18] ExxonMobil's progress on a low-carbon hydrogen project at its petrochemical site in Baytown, Texas. For the front-end engineering and design of a hydrogen plant that would generate roughly 30 million cubic meters of hydrogen per day from natural gas, the business has given a contract to Technip Energies.

This project's dedication to environmental sustainability is noteworthy since it intends to absorb and store 7 million metric tons of carbon dioxide per year, which is linked to the hydrogen production process. At the facility, ExxonMobil expects emissions to be reduced by 30% by using this low-carbon

hydrogen as fuel. In addition, the business intends to make the technology for capture and storage accessible to other nearby polluters, supporting larger initiatives to reduce carbon emissions in the Houston region. As part of its ambitious strategy, ExxonMobil plans to capture and store 100 million tons of CO2 annually from nearby industrial facilities. The Baytown project's final investment decision is anticipated in 2024, and completion is anticipated in 2027 or 2028. This program is a reflection of ExxonMobil's strategy commitment on tackling climate change issues and developing low-carbon technology. [19]

Material And Methods

Alternative

1. mySAP.com Integration

The goal of the collaborative business solutions offered by mySAP.com is to facilitate digital transitions. MySAP.com simplifies supply chain, human resources, and procurement procedures by integrating various corporate operations. MySAP.com provided the framework for improving enterprise connectivity at XTO Energy. The system's integration capabilities ensured smooth data flow and real-time insights for better decision-making by bridging gaps between historical systems and contemporary ERP operations.

2. SAP Ariba Implementation

By providing a cloud-based platform for managing supplier relationships, procurement, and financial supply chains, SAP Ariba transforms supply chain and procurement procedures. SAP Ariba was used at XTO Energy to replace antiquated procurement systems. Ariba decreased expenses, expedited procurement timelines, and enhanced supplier transparency by facilitating supplier collaboration on a single platform. Its Spend Analysis tools also offered insightful information about expenditure trends, which helped to improve procurement tactics even further.

3. SAP S/4HANA Deployment

The next-generation ERP package from SAP, SAP S/4HANA, uses SAP HANA's in-memory computing capability to provide real-time reporting and analytics. S/4HANA was implemented by XTO Energy in order to update its IT environment. Operations were made more efficient by this deployment, including inventory control and production revenue accounting. Energy production, where decisions depend on precise and timely data, benefited greatly from the system's ability to process massive datasets in real-time.

4. SAP Management of Change (MoC)

In sectors such as energy, it is essential to manage changes in systems, operations, and processes. At XTO Energy, SAP MoC tools were used to make sure that modifications were methodically recorded, assessed, and authorized. This technique improved adherence to safety and environmental laws while reducing the dangers associated with disorganized modifications. A unified platform for managing operational changes and regulatory compliance was created by its smooth integration with Environmental, Health, and Safety (EHS) modules.

5. SAP Screen Personas Automation

Through screen personalization and simplification, SAP Screen Personas is an easy-to-use customization tool that improves the usability of SAP applications. The use of Screen Personas at XTO Energy reduced complexity, enhanced user experience, and automated repetitive operations. This program incorporated invoice automation, which made it possible to conduct accounts payable transactions more quickly and accurately. Teams were able to focus on value-added tasks rather than tedious data entry by adopting Screen Personas to increase productivity.

6. Legacy System Replacement for Procurement

XTO Energy made a major effort to switch from its outdated procurement system to SAP products, such as S/4HANA and SAP Ariba. The goal of the replacement procedure was to solve inefficiencies like lack of scalability, limited data integration, and lengthy processing times. By switching to a single SAP procurement platform, XTO was able to increase supplier contacts' transparency, streamline operations, and provide a more flexible procurement process.

7. Consolidation of IT Infrastructure

A calculated step to lower operational complexity and expenses is the consolidation of IT infrastructure. XTO Energy created a single SAP environment by combining its disparate IT platforms. This improved system performance and reliability in addition to reducing redundancies. Better cybersecurity and data governance were made possible by the unified infrastructure, which also made sure that different departments ran smoothly.

8. Production Revenue Accounting Upgrade

One of the most important roles in the energy industry is Production Revenue Accounting (PRA). XTO Energy used SAP capabilities to enhance its PRA procedures in order to automate revenue computations, enhance adherence to accounting rules, and maximize royalties. The SAP-powered solution addressed the intricacies of production accounting in the energy industry while guaranteeing precise revenue allocation and expedited reporting.

9. Streamlined EHS Management with MoC

At XTO Energy, SAP MoC played a key role in expediting Environmental, Health, and Safety (EHS) management in addition to enhancing operational workflows. This involved improving regulatory compliance, enabling real-time tracking of EHS parameters, and incorporating safety protocols into the main ERP system. The combined MoC and EHS strategy reduced hazards, increased worker safety, and encouraged a continual improvement mindset.

10. Invoice Automation with SAP Personas

In conventional settings, processing invoices is a labor-intensive activity. By automating its invoice management procedures with SAP Screen Personas, XTO Energy was able to drastically cut down on processing times and human error. Teams were able to develop user-friendly processes that were customized to their requirements because to Screen Personas' customization features, which increased the overall effectiveness of accounts payable operations.

Evaluation preference

1. ERP Integration Efficiency (Hours Saved/Month)

ERP integration efficiency quantifies the amount of time saved by using an ERP system to automate and consolidate activities. It illustrates how well the system substitutes automated operations for laborious, manual tasks. Departments like finance, HR, and procurement, for example, may have relied on disparate, disjointed IT systems prior to integration. After connection, a well-executed ERP may facilitate real-time updates, automate reporting, and centralize data, saving hundreds of hours every month. Businesses gain real advantages from the time saved, including quicker decision-making, fewer operational bottlenecks, and increased worker productivity. Additionally, it frees up employees to concentrate on strategic projects rather than daily duties, which promotes innovation and expansion.

2. Supply Chain Streamlining (Orders/Month)

Streamlining the supply chain is essential for businesses that depend on the smooth movement of products and services. This statistic, which is expressed in terms of the quantity of orders completed each month, assesses how well the system performs supply chain tasks like inventory control, order processing, and vendor coordination. Supply chain operations are integrated by a strong ERP system, allowing for automated reordering, effective shipment scheduling, and real-time inventory level tracking. By doing this, overstocking is prevented, stockouts are decreased, and delays are decreased. Successful streamlining is demonstrated by an increase in processed orders without a corresponding increase in expenditures. This enhancement frequently results in improved supplier relationships, more customer satisfaction, and a more robust bottom line for multinational corporations.

3. User Experience Enhancement (Tasks Automated)

Enhancing the user experience is centered on how many jobs the system can automate, demonstrating its capacity to improve end users' daily operations' efficiency and intuitiveness. Repetitive tasks like data input, report generation, and account reconciliation frequently take up a significant amount of an employee's time. These tasks are lessened by automation, freeing users to engage in higher-value tasks. An ERP, for example, can automate compliance checks, payroll processing, and invoice production, increasing accuracy and decreasing errors. Employee productivity and engagement are further increased by an intuitive user interface and accessibility features. The indicator also emphasizes how the system helps to create an environment at work where people feel empowered by technology rather than constrained by it.

4. Implementation Cost (USD Millions)

One important indicator of an ERP system's financial viability is its implementation cost. It covers costs for purchasing software, customizing it, training, moving data, and providing post-deployment support. The possible return on investment (ROI) must be weighed against the implementation expenses, which can vary from thousands to millions of dollars. Businesses must balance the initial investment with the long-term savings from increased productivity, lower operating expenses, and fewer mistakes. Over time, significant cost savings and operational enhancements frequently make a larger initial investment in a well-designed system worthwhile.

5. System Downtime (Hours)

The entire number of hours the ERP system is unavailable—whether as a result of maintenance, unplanned outages, or technical malfunctions—is known as system downtime. Business continuity is adversely affected by downtime, which can result in operational delays, decreased productivity, and possible financial losses. To reduce downtime, modern ERP systems include proactive monitoring, redundancy, and a strong infrastructure. System reliability metrics also provide information about areas that need to be improved, including software upgrades or server capacity. In order to guarantee continuous operations and reliable service delivery, businesses want to minimize downtime as much as feasible.

6. Compliance Risk (% Risk of Non-Compliance)

Compliance risk assesses how likely it is that a company will not comply with industry-specific or regulatory regulations. Non-compliance can result in financial loss, reputational harm, and legal fines in industries like manufacturing, healthcare, and finance. By centralizing compliance-related data, automating regulatory reporting, and keeping audit trails, an ERP system helps reduce these risks. Additionally, it guarantees quick upgrades to comply with changing regulations. A well-executed ERP that successfully supports governance and risk management objectives is indicated by a low compliance risk percentage.

TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution)

To improve travel suggestions in Central Sulawesi, the TOPSIS (Technique for Order Preference by Similarity to Ideal Solutions) approach is used. It emphasizes how important tourism is to the region's economic development. The goal of the project is to create a web-based decision support system that helps users choose travel destinations by taking into account a number of pertinent factors, such as amenities, affordability, accessibility, cleanliness, and safety. The TOPSIS technique

compares the closeness of tourist attractions to ideal positive and negative solutions in order to rank and evaluate them. It is anticipated that its implementation would help travelers make more accurate and knowledgeable judgments about their trip plans, which will ultimately help Central Sulawesi's tourism industry grow. The study emphasizes how crucial methodical techniques are to improving the traveler experience and bolstering the local economy. [20] The Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) as a strategic tool to strengthen the competitive position of universities, with a focus on the XYZ Institute.

It emphasizes the critical role of understanding consumer preferences in navigating the competitive landscape, especially for educational institutions in Indonesia undergoing rapid societal changes. The research identifies essential factors influencing competitiveness, including product, price, place, promotion, people, process, and physical evidence. By combining brainstorming sessions with the Analytical Network Process (ANP) and TOPSIS methods, the study seeks to develop actionable strategies for universities. Key findings highlight the importance of enhancing alumni quality, improving accreditation standards, and optimizing student selection processes as priority strategies to improve institutional competitiveness. The research underscores the importance of aligning university strategies with changing market dynamics and consumer needs. [21] The Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) methodology with the Entropy Weighting Method (EWM) to improve recommendation processes through objective and efficient solutions.

The authors identify key challenges in existing decision-making approaches, particularly the influence of subjective biases on performance values and the limited flexibility in addressing complex, multi-factor problems within acceptable timeframes. To address these gaps, the study proposes a versatile and efficient framework designed to deliver data-driven recommendations across a wide range of scenarios. By incorporating EWM, the framework emphasizes objectivity in the decision-making process. The authors plan to evaluate the framework's practical effectiveness in real-world applications, reflecting a commitment to validating its utility. This research aims to advance decision-making methodologies by offering a robust, adaptable solution that overcomes the limitations of traditional approaches. [22] Business development strategies for the Gapit 24 industry in the Cirebon region, addressing recent declines in product sales. It underscores the importance of assessing both internal and external factors that affect business performance.

A mixed-method approach, incorporating qualitative and quantitative data analysis through observation, interviews, questionnaires, and literature reviews, is employed to collect relevant insights. Using SWOT analysis, the business is positioned in quadrant I, suggesting an aggressive strategy that capitalizes on its strengths and opportunities. The analysis identifies 16 key factors influencing the current business environment. Additionally, the TOPSIS method is applied to rank strategic alternatives, such as enhancing customer relationships, improving product and service quality, developing innovative products, expanding distribution channels, and exploring potential partnerships. This thorough analysis aims to provide practical strategies for Gapit 24 to stabilize and strengthen its market position in response to evolving conditions. [23]

The performance evaluation of medical personnel at the Kepahiang Regional General Hospital focuses on assessing staff based on key criteria such as service orientation, responsibility, discipline, and attendance. Utilizing the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) method, integrated with a decision support system, the study systematically analyzes these criteria. By comparing each factor, the method calculates priority intensity values for each staff member, enabling the identification of top-performing medical personnel. This approach is designed to improve the quality of healthcare services at public hospitals by ensuring that the most competent and high-performing staff are recognized and prioritized. Implementing such a structured evaluation framework is essential for advancing healthcare delivery in the Kepahiang region. [24] Optimizing supplier selection for rice raw materials at CV Gembira, which markets rice under the Osing Rice brand in three variants: Osing Super, Osing Premium, and Osing Gold.

The company faces challenges such as delays in raw material deliveries and inconsistencies in product quality. To address these issues, the research employs two decision-making techniques: the Analytical Hierarchy Process (AHP) and the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS). AHP is utilized for its capability to structure the decision-making problem hierarchically, enabling a thorough evaluation of factors relevant to supplier selection. TOPSIS complements this by providing a simple yet effective method to identify the supplier closest to the ideal choice. The analysis reveals that UD Bintang Timur emerges as the optimal supplier for CV Gembira, with a preference score of 0.6249, demonstrating the combined efficacy of AHP and TOPSIS in streamlining supplier selection. [25] A decision support system was developed to evaluate teacher performance at SMP Bina Mandiri Jakarta using the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) method.

This system aims to significantly expedite the teacher performance appraisal process, reducing the evaluation time from approximately one week to just 15 to 30 minutes. This substantial time savings enhances the efficiency of the appraisal process, enabling school principals and assessment teams to conduct evaluations more effectively. The system's implementation ensures that routine school activities remain uninterrupted and allows for the generation of systematic and easily accessible reports. By leveraging the TOPSIS method, this

research introduces a structured and methodical approach to performance assessment, ultimately improving decision-making in evaluating teacher performance. [26] The best coffee bean supplier for CV. Oro Coffee Gayo, a company involved in bean processing and export. It highlights the importance of choosing the right supplier by considering factors such as quality, price, and delivery reliability.

The company has formal agreements with four certified suppliers in Aceh and works with an additional ten suppliers outside of these contracts. The main goal of the research is to rank suppliers based on selection criteria and sub-criteria using the TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) method. The criteria and sub-criteria were determined through expert feedback via closed questionnaires, and their importance was evaluated using the Analytic Hierarchy Process (AHP) and Likert Scale questionnaires. The results identify six criteria with thirteen sub-criteria, with the most important criterion, K1, receiving a weight of 0.37. The sub-criterion with the highest weight is SK4, which assesses the alignment of price and quality. In the end, Supplier 4 was ranked highest, with a preference value of 0.6315, making it the top supplier for CV. Oro Gayo. [27] The influence of financial information on stock purchase decisions, with a focus on the Indonesia Stock Exchange. It underscores the importance of thorough calculations and analyses in assessing company performance, which is essential for investors seeking to achieve optimal returns while minimizing risks. Unlike previous studies, this research integrates the Positive Ideal Solution (PIS) and Negative Ideal Solution (NIS), derived from key financial indicators such as the Debt to Equity Ratio, Return on Equity, Net Profit Margin, Return on Assets, Earnings Per Share, Price Earnings Ratio, and Price Book Value. Using the TOPSIS method, the analysis covers 94 securities listed on the Indonesia Stock Exchange.

The results show that financial indicators like the Debt to Equity Ratio, Return on Assets, Earnings Per Share, Price Earnings Ratio, and Price Book Value significantly impact stock purchase decisions. On the other hand, Return on Equity and Net Profit Margin are found to have no notable effect. Overall, the study emphasizes the crucial role of financial data in shaping investors' decisions when purchasing stocks. [28] A Decision Support System (DSS) has been developed to assess the quality of mineral water suppliers using the TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) method. This system is designed to help managers of mineral water depots choose the best suppliers based on various established criteria. The TOPSIS method tackles multi-criteria decision-making by evaluating how closely each alternative aligns with both the ideal and anti-ideal solutions. The process starts with identifying key criteria for assessing water quality, including physical, chemical, and microbiological factors.

Data from different suppliers is gathered, normalized, and analyzed to form a decision matrix. The ideal and anti-ideal solution matrices are then calculated, and the relative closeness scores for each supplier are determined. The results provide valuable recommendations to depot managers, allowing them to optimize their supplier selection. Ultimately, the DSS improves customer satisfaction and helps maintain the reputation of mineral water depots in a competitive market. This research highlights the significance of informed decision-making in ensuring the quality of vital resources like mineral water. [29]

Step 1: The creation of the decision matrix X shows how different solutions perform in relation to specific criteria.

$$x_{ij} = \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1n} \\ x_{21} & x_{22} & \cdots & x_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ x_{m1} & x_{m2} & \cdots & x_{mn} \end{bmatrix} \quad (1)$$

Step 2: The criteria's weights are stated as

$$w_j = [w_1 \ \cdots \ w_n], \quad \text{where}, \sum_{j=1}^{n}(w_1 \ \cdots \ w_n) = 1 \quad (2)$$

Step 3: The matrix x_{ij}'s The calculated normalised values are

$$n_{ij} = \frac{x_{ij}}{\sqrt[2]{\sum_{i=1}^{m} x_{ij}^2}} \quad (3)$$

The following formula is used to calculate the weighted normalised matrix, □□□.

$$N_{ij} = w_j \times n_{ij} \quad (4)$$

Step 4: Finding the optimal best and ideal worst values will be our first step: In this case, we have to decide if the influence is "+" or "-." The greatest value in a column with a "+" impact is the ideal best value for that column; the lowest value in a column with a "-" effect is the ideal worst value.

Step 5: We must now determine how each response differs from the optimal one.

$$S_i^+ = \sqrt{\sum_{j=1}^{n}(N_{ij} - A_j^+)^2} \quad \text{for } i \in [1, m] \text{ and } j \in [1, n] \qquad (5)$$

Step 6: We must now determine how each response differs from the best-case scenario.

$$S_i^- = \sqrt{\sum_{j=1}^{n}(N_{ij} - A_j^-)^2} \text{ for } i \in [1, m] \text{ and } j \in [1, n] \qquad (6)$$

Step 7: The next step is to determine the alternative's closeness coefficient.

$$CC_i = \frac{S_i^-}{S_i^+ + S_i^-} \quad \text{where}, 0 \leq CC_i \leq 1, i \in [1, m] \qquad (7)$$

The value of the Closeness Coefficient shows the relative superiority of the options. A much better alternative is indicated by a larger,□□-□., whereas a significantly poorer alternative is indicated by a smaller,□□-□.

Result And Discussion

Table 1. ExxonMobil Global Services

	ERP Integration Efficiency (Hours Saved/Month)	Supply Chain Streamlining (Orders/Month)	User Experience Enhancement (Tasks Automated)	Implementation Cost (USD Millions)	System Downtime (Hours)	Compliance Risk (% Risk of Non-Compliance)
mySAP.com Integration	120	800	50	5.5	12	5
SAP Ariba Implementation	110	950	40	4.8	10	4.5
SAP S/4HANA Deployment at XTO Energy	140	860	60	6.2	15	6
SAP Management of Change (MoC)	100	750	70	3.5	8	3
SAP Screen Personas Automation	80	650	90	2.8	5	1.5
Legacy System Replacement for Procurement	115	780	50	4.2	9	4.8
Consolidation of IT Infrastructure	125	840	55	6	14	5.8
Production Revenue Accounting Upgrade	145	870	65	6.5	16	6.5
Streamlined EHS Management with MoC	105	770	55	4	7	3.5
Invoice Automation with SAP Personas	90	680	85	3.2	6	2

The table 1 summarizes key metrics from various SAP system implementations and upgrades at ExxonMobil Global Services, highlighting their contributions to efficiency, user experience, and compliance. Each project is evaluated based on six factors: hours saved per month through ERP integration, orders streamlined in the supply chain, tasks automated to enhance user experience, implementation cost, system downtime, and compliance risk. Notable achievements include the Production Revenue Accounting Upgrade, which saved the most time (145 hours/month), streamlined 870 orders, and automated 65 tasks, though it incurred the highest downtime (16 hours) and compliance risk (6.5%). Conversely, SAP Screen Personas Automation prioritized user experience with 90 tasks automated at a low cost of $2.8M, minimal downtime (5 hours), and low compliance risk (1.5%). Efforts such as SAP S/4HANA Deployment at XTO Energy and Consolidation of IT Infrastructure provided balanced improvements in efficiency and automation but incurred relatively high costs and downtime. In contrast, Invoice Automation with SAP Personas and SAP Management of Change (MoC) offered cost-effective solutions with reduced risks. These metrics reflect ExxonMobil's strategic focus on improving operational efficiency, user satisfaction, and regulatory compliance through targeted SAP integrations while balancing cost and system stability.

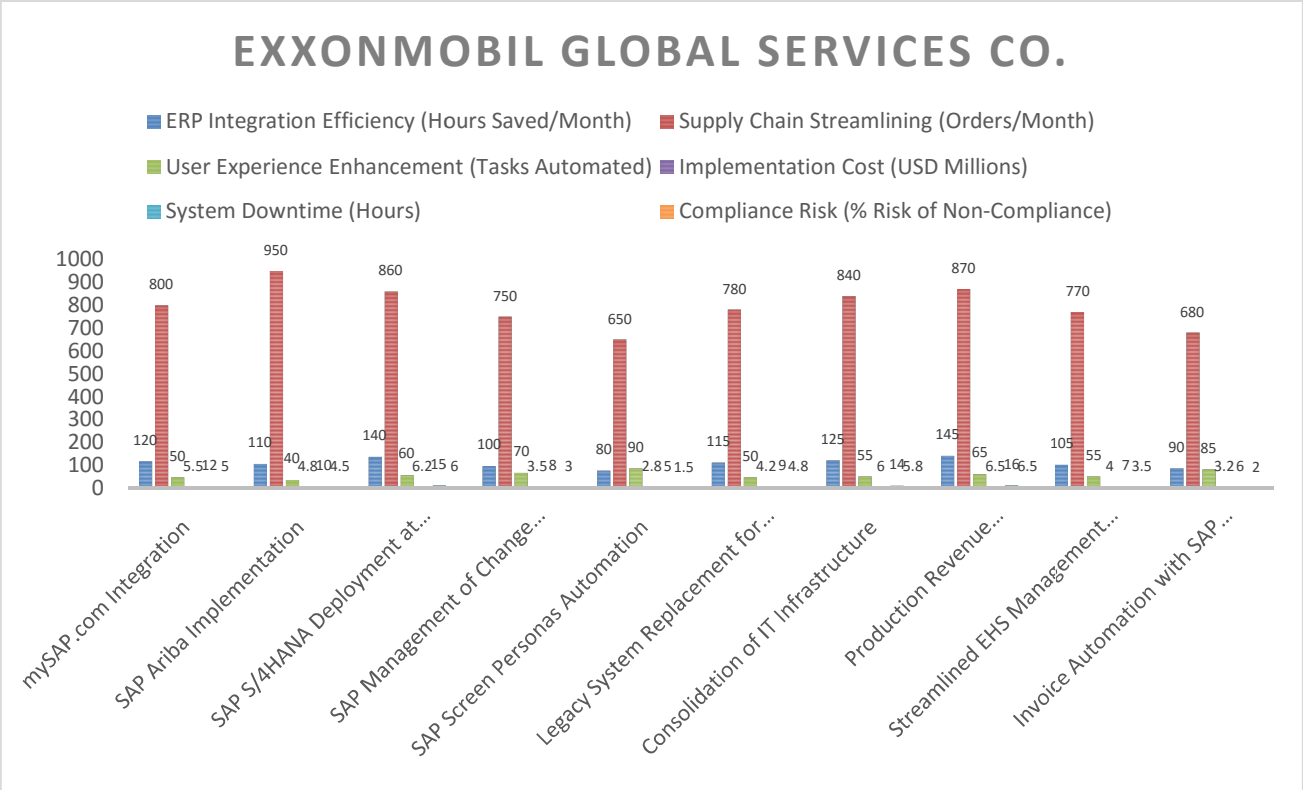

Figure 1. ExxonMobil Global Services

The Figure 1 illustrates various initiatives undertaken by ExxonMobil Global Services Co. to enhance operational efficiency through ERP integration, supply chain streamlining, and user experience enhancements. Each initiative is evaluated across five metrics: ERP integration efficiency (hours saved per month), supply chain streamlining (orders/month), implementation cost (in USD millions), system downtime (hours), and compliance risk (% risk of non-compliance). supply chain streamlining orders for SAP Ariba Implementation (950) and Production Revenue Accounting Upgrade (870). ERP integration efficiency, measured by hours saved, is notably high for mySAP.com Integration (120) and Consolidation of IT Infrastructure (125). Implementation costs vary across projects, with the highest cost observed in Consolidation of IT Infrastructure ($15.8M) and the lowest in SAP Management of Change ($3.5M). System downtime and compliance risks are minimized across all projects, demonstrating a focus on maintaining operational resilience and regulatory adherence. This data reflects ExxonMobil's strategic emphasis on leveraging SAP and other technologies to optimize enterprise processes, reduce inefficiencies, and enhance productivity while balancing costs and risks.

Table 2. Square Root of Matrix

14400	640000	2500	30	144	25
12100	902500	1600	23	100	20
19600	739600	3600	38	225	36
10000	562500	4900	12	64	9
6400	422500	8100	8	25	2
13225	608400	2500	18	81	23
15625	705600	3025	36	196	34
21025	756900	4225	42	256	42
11025	592900	3025	16	49	12
8100	462400	7225	10	36	4

The table 2 presents a dataset of numbers alongside their square roots. Each column consists of different values, and the corresponding square roots are displayed. The rows reveal patterns in the relationship between numbers and their roots, demonstrating foundational mathematical principles. For example, the square root of 14400 is 120, 640000 is 800, and 2500 is 50, all indicating large base values yielding proportionally larger roots. Similarly, smaller numbers like 10000 and 6400 have roots of 100 and 80, respectively, showing the proportional decrease. The data also includes non-square numbers, where their approximate square roots are presented. For instance, 30, 23, and 36 are square roots for numbers like 900, 529, and 1296. This distinction reflects the inclusion of whole numbers as well as approximate results for non-perfect squares. Interestingly, some numbers, like 8100 and 14400, appear in pairs across the matrix, emphasizing common mathematical occurrences. The dataset captures both precise roots for perfect squares and approximate values for others, reinforcing the concept of square roots' relationship to original numbers in computational and theoretical contexts. This is particularly relevant for practical applications like scaling and geometric calculations.

Table 3. Normalized Data

0.3309	0.3164	0.2478	0.3596	0.3499	0.8327
0.3033	0.3757	0.1983	0.3138	0.2916	0.6939
0.3861	0.3401	0.2974	0.4053	0.4374	1.0409
0.2758	0.2966	0.3470	0.2288	0.2333	0.5551
0.2206	0.2571	0.4461	0.1831	0.1458	0.3470
0.3171	0.3085	0.2478	0.2746	0.2624	0.6245
0.3447	0.3322	0.2726	0.3923	0.4082	0.9715
0.3999	0.3441	0.3222	0.4250	0.4666	1.1103
0.2896	0.3045	0.2726	0.2615	0.2041	0.4857
0.2482	0.2689	0.4213	0.2092	0.1750	0.4163

The table 3 presents normalized data, where values are scaled to fall within a comparable range, typically between 0 and 1. This normalization process ensures uniformity, facilitating the comparison of variables with differing units or magnitudes. Each row represents a distinct dataset, while each column corresponds to a normalized variable. The values indicate relative magnitudes within their respective datasets. For instance, in the first row, the highest normalized value is 0.8327, suggesting this variable holds the greatest weight or significance compared to others in that row. Patterns emerge when analyzing rows and columns.

For example, variables in the last column consistently have the highest normalized values, ranging from 0.3470 to 1.1103, highlighting a dominant trend or higher magnitude compared to other variables. Conversely, variables in earlier columns, such as the fifth, tend to have lower values, reflecting smaller contributions or magnitudes. The variation across rows indicates diverse data distributions within the dataset, with some rows, such as the 8th, showing relatively higher values overall, while others, like the 5th, have smaller normalized values. This structured normalization process is crucial in applications such as machine learning, statistical modeling, and data visualization, enabling unbiased analysis and accurate comparisons across diverse datasets.

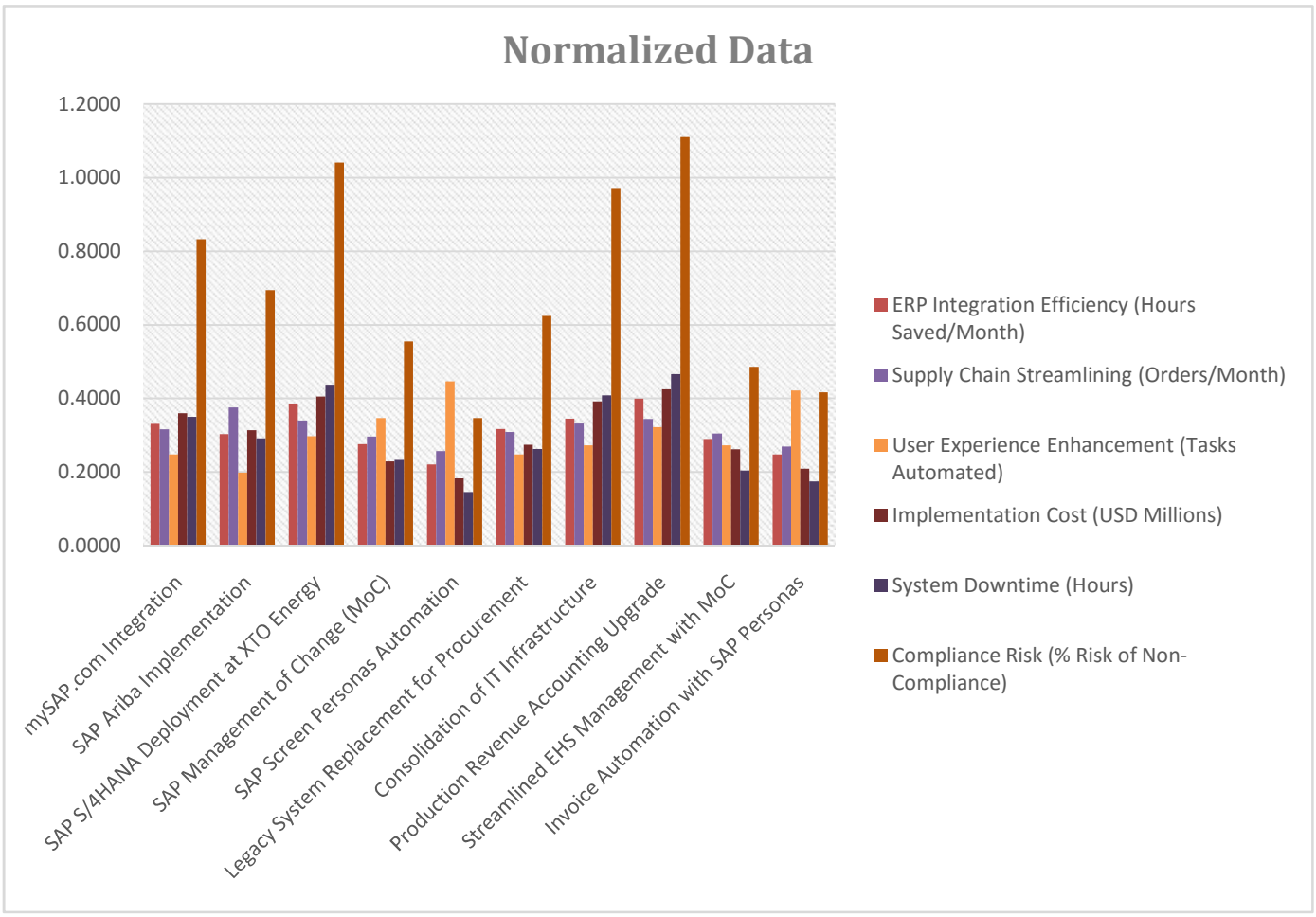

Figure 2. Normalized Data

The Figure 2 presents the normalized data for the various initiatives undertaken by ExxonMobil Global Services Co. The data shows a comparison of ERP integration efficiency, supply chain streamlining, user experience enhancement, implementation costs, system downtime, and compliance risk across different projects. Normalization helps in standardizing the data, enabling a direct comparison of metrics across initiatives, regardless of their original scales. The bars in the chart represent each initiative, with color-coded segments for each metric: orange for ERP integration efficiency, yellow for supply chain streamlining, grey for user experience enhancement, green for compliance risk, and blue for system downtime. User experience enhancement (green) is notably higher for initiatives like SAP Ariba Implementation and Invoice Automation with SAP Personas, suggesting substantial automation of tasks. Supply chain streamlining (yellow) is highest for SAP S/4HANA Deployment at XTO Energy, indicating significant improvements in order management. ERP integration efficiency (orange) shows strong performance for initiatives such as mySAP.com Integration and Consolidation of IT Infrastructure, indicating high hours saved per month. Compliance risk (green) remains relatively low across all initiatives, which is ideal for maintaining regulatory adherence. This normalized visualization allows ExxonMobil to evaluate and compare the performance and impact of each project in a clear and uniform manner.

Table 4. Weight

Weight					
0.25	0.25	0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25	0.25	0.25

The table 4 represents a uniform weight distribution across all variables and rows, with each value set to 0.25. This indicates that all variables are given equal importance, contributing equally to any analysis or calculation. Such a weight distribution is commonly used in cases where no specific variable is prioritized, ensuring fairness and neutrality in evaluations. It also simplifies computations by treating all components equally. This approach is often applied in initial stages of analysis or when the relative significance of variables is unknown. The consistent values across rows emphasize uniformity and balance throughout the dataset.

Table 5. Weighted normalized decision matrix

0.0827	0.0791	0.0620	0.0899	0.0875	0.2082
0.0758	0.0939	0.0496	0.0785	0.0729	0.1735
0.0965	0.0850	0.0744	0.1013	0.1094	0.2602
0.0689	0.0742	0.0867	0.0572	0.0583	0.1388
0.0552	0.0643	0.1115	0.0458	0.0365	0.0867
0.0793	0.0771	0.0620	0.0686	0.0656	0.1561
0.0862	0.0831	0.0682	0.0981	0.1021	0.2429
0.1000	0.0860	0.0805	0.1062	0.1166	0.2776
0.0724	0.0761	0.0682	0.0654	0.0510	0.1214

0.0620	0.0672	0.1053	0.0523	0.0437	0.1041

The table 5 presents a weighted normalized decision matrix, where normalized data is multiplied by corresponding weights to reflect the relative importance of variables. Each value represents the contribution of a variable in a decision-making scenario, incorporating both its magnitude and assigned weight. The rows correspond to different alternatives or options, while the columns represent criteria. For example, in the first row, the highest value is 0.2082, indicating that this criterion holds significant weight or importance compared to others in the same row. Similarly, in the eighth row, the highest value of 0.2776 suggests a strong emphasis on that particular criterion for the associated alternative. Variability across rows highlights the performance differences of alternatives across criteria. For instance, the fourth row shows relatively lower values overall, indicating weaker performance across criteria, while the eighth row has consistently higher values, reflecting better performance. Columns reveal the relative importance of criteria. The last column consistently holds the highest values, emphasizing its dominant role in decision-making, while earlier columns have smaller values, indicating lesser influence. This matrix is commonly used in multi-criteria decision-making techniques, such as TOPSIS or AHP, to rank options based on weighted evaluations. It ensures balanced and informed decision-making by incorporating both data normalization and criterion weighting.

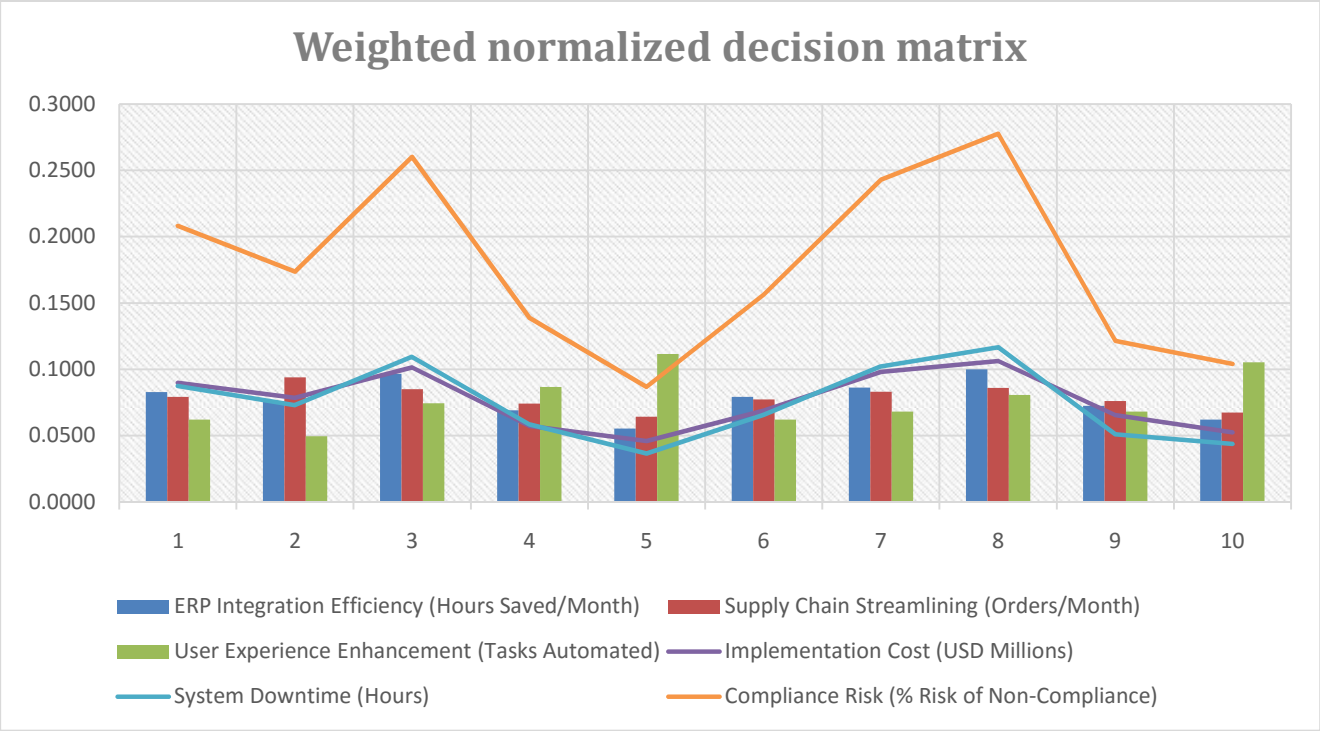

Figure 3. Weighted normalized decision matrix

The Figure 3 Shows the Weighted Normalized Decision Matrix, displays a comparison of multiple criteria across 10 alternatives, represented on the x-axis. Each criterion is normalized and weighted to assess its impact. Measures monthly hours saved by enhancing ERP processes. Supply Chain Streamlining (orange bar): Tracks improvements in orders processed per month. User Experience Enhancement (gray bar): Represents tasks automated for better user interaction. Implementation Cost (yellow line): Indicates associated costs in millions of USD. System Downtime (light blue line): Captures system unavailability in hours. Compliance Risk (green line): Shows the risk percentage of non-compliance. Each bar or line represents the relative importance and performance of these factors for the respective alternatives. Higher bar values suggest better performance in that criterion, while lower line values for risk and downtime indicate improved outcomes. The green line (Compliance Risk) fluctuates significantly, indicating a critical area for evaluation. The blue bars (ERP efficiency) and orange bars (supply chain) maintain moderate consistency. This matrix provides decision-makers with a framework to prioritize options based on weighted criteria.

Table 6. Positive Matrix

0.1000	0.0939	0.1115	0.1062	0.1166	0.2776
0.1000	0.0939	0.1115	0.1062	0.1166	0.2776
0.1000	0.0939	0.1115	0.1062	0.1166	0.2776
0.1000	0.0939	0.1115	0.1062	0.1166	0.2776
0.1000	0.0939	0.1115	0.1062	0.1166	0.2776
0.1000	0.0939	0.1115	0.1062	0.1166	0.2776
0.1000	0.0939	0.1115	0.1062	0.1166	0.2776
0.1000	0.0939	0.1115	0.1062	0.1166	0.2776
0.1000	0.0939	0.1115	0.1062	0.1166	0.2776
0.1000	0.0939	0.1115	0.1062	0.1166	0.2776

The table 6 represents a positive matrix, where each value corresponds to the ideal or best-case performance for a specific criterion across all alternatives. In this matrix, all rows are identical, indicating a consistent reference point for comparison. The repeated values across rows suggest that these are the optimal values derived from the decision-making process for each criterion. Each column represents a distinct criterion, with the highest possible normalized and weighted performance value. For example, the last column consistently holds the maximum value of 0.2776, reflecting its critical importance or significant contribution compared to other criteria. Similarly, the values in the first column, at 0.1000, are the highest attainable for that criterion. The uniformity of the matrix signifies that all alternatives are evaluated against the same set of optimal values, which serve as benchmarks for assessing performance. This type of matrix is typically used in multi-criteria decision-making methods, such as TOPSIS, to calculate the distance of each alternative from the positive ideal solution (PIS). By comparing actual performance matrices with this positive matrix, decision-makers can determine how closely each alternative aligns with the ideal, facilitating informed rankings and selections in complex decision scenarios.

Table 7. Negative matrix

0.0552	0.0643	0.1115	0.1062	0.1166	0.2776
0.0552	0.0643	0.1115	0.1062	0.1166	0.2776
0.0552	0.0643	0.1115	0.1062	0.1166	0.2776
0.0552	0.0643	0.1115	0.1062	0.1166	0.2776
0.0552	0.0643	0.1115	0.1062	0.1166	0.2776
0.0552	0.0643	0.1115	0.1062	0.1166	0.2776
0.0552	0.0643	0.1115	0.1062	0.1166	0.2776
0.0552	0.0643	0.1115	0.1062	0.1166	0.2776
0.0552	0.0643	0.1115	0.1062	0.1166	0.2776
0.0552	0.0643	0.1115	0.1062	0.1166	0.2776

The table 7 represents a negative matrix, where each value corresponds to the worst-case or least desirable performance for each criterion across all alternatives. In this matrix, all rows are identical, indicating a uniform reference point that defines the minimum benchmark for comparison. Each column represents a specific criterion, with values reflecting the lowest normalized and weighted performance. For instance, the values in the first column, 0.0552, are the smallest attainable for that criterion, while the last column consistently holds the value 0.2776, highlighting that this criterion carries the same weight of importance even in the worst-case scenario. The repetition of these values across rows ensures that all alternatives are assessed

against the same negative ideal solution. The negative matrix is typically used in multi-criteria decision-making methods, such as TOPSIS, to compute the distance of each alternative from the negative ideal solution (NIS). This process identifies how far each alternative is from the least favorable performance for each criterion. By analyzing this matrix in conjunction with the positive matrix, decision-makers can evaluate alternatives based on their closeness to the ideal and distance from the worst-case scenarios, facilitating a balanced and systematic ranking process. This ensures robust decision-making, even in complex scenarios.

Table 8. Si Positive & Si Negative & Ci & Rank

	Si Positive	Si Negative	Ci	Rank
mySAP.com Integration	0.0944	0.4904	0.8386	4
SAP Ariba Implementation	0.1339	0.4596	0.7743	5
SAP S/4HANA Deployment at XTO Energy	0.0430	0.5411	0.9263	2
SAP Management of Change (MoC)	0.1644	0.4243	0.7207	7
SAP Screen Personas Automation	0.2222	0.3779	0.6297	10
Legacy System Replacement for Procurement	0.1481	0.4419	0.7490	6
Consolidation of IT Infrastructure	0.0606	0.5238	0.8963	3
Production Revenue Accounting Upgrade	0.0320	0.5582	0.9458	1
Streamlined EHS Management with MoC	0.1825	0.4093	0.6916	8
Invoice Automation with SAP Personas	0.2013	0.3924	0.6610	9

The table 8 represents an analysis of alternatives based on three metrics: Si Positive, Si Negative, and Ci, with a resulting ranking. Each alternative represents a specific SAP-related implementation or upgrade, evaluated through multi-criteria decision-making to identify the most effective solutions.

Si Positive: This metric represents the distance of each alternative from the positive ideal solution (PIS), where lower values indicate closer proximity to the most desirable performance. For example, "Production Revenue Accounting Upgrade" has the smallest Si Positive value (0.0320), indicating its superior alignment with optimal criteria. Conversely, "SAP Screen Personas Automation" has the highest Si Positive value (0.2222), suggesting it is furthest from the ideal.

Si Negative: This metric measures the distance of each alternative from the negative ideal solution (NIS), with higher values reflecting closer proximity to optimal performance. "Production Revenue Accounting Upgrade" achieves the highest Si Negative value (0.5582), reinforcing its favorable evaluation. On the other hand, "SAP Screen Personas Automation" again performs poorly, with the lowest Si Negative value (0.3779).

Ci (Closeness Index): The Ci value is calculated as the ratio of Si Negative to the sum of Si Positive and Si Negative, providing a comprehensive assessment of each alternative's performance relative to both the ideal and worst-case scenarios. A higher Ci indicates a better overall evaluation. For instance, "Production Revenue Accounting Upgrade" achieves the highest Ci (0.9458), ranking it first among the alternatives. Conversely, "SAP Screen Personas Automation," with the lowest Ci (0.6297), ranks last, highlighting its limited suitability.

The rankings derived from the Ci values provide a clear prioritization of the alternatives: Production Revenue Accounting Upgrade: Its high Ci value (0.9458) and favorable Si Positive and Si Negative metrics establish it as the top-ranked alternative, indicating its effectiveness and alignment with desired criteria. SAP S/4HANA Deployment at XTO Energy: With a Ci of 0.9263, it is close to the top, reflecting strong performance across criteria. Consolidation of IT Infrastructure: Ranking third with a Ci of 0.8963, this alternative also performs well in terms of closeness to the ideal solution. mySAP.com Integration: Although fourth-ranked (Ci = 0.8386), it demonstrates relatively strong alignment with optimal criteria compared to lower-ranked alternatives. SAP Ariba Implementation: This alternative (Ci = 0.7743) occupies the middle tier, reflecting average performance. Legacy System Replacement for Procurement: Ranking sixth (Ci = 0.7490), it demonstrates modest suitability. SAP Management of Change (MoC): With a Ci of 0.7207, it falls in the lower tier of alternatives. Streamlined EHS Managment with MoC: Ranking eighth (Ci = 0.6916), it shows some deficiencies relative to the top-ranked options. Invoice Automation with SAP Personas: With a Ci of 0.6610, it demonstrates below-average alignment with optimal criteria. SAP Screen Personas Automation: Its low

Ci value (0.6297) and poor metrics place it last, making it the least favorable choice.

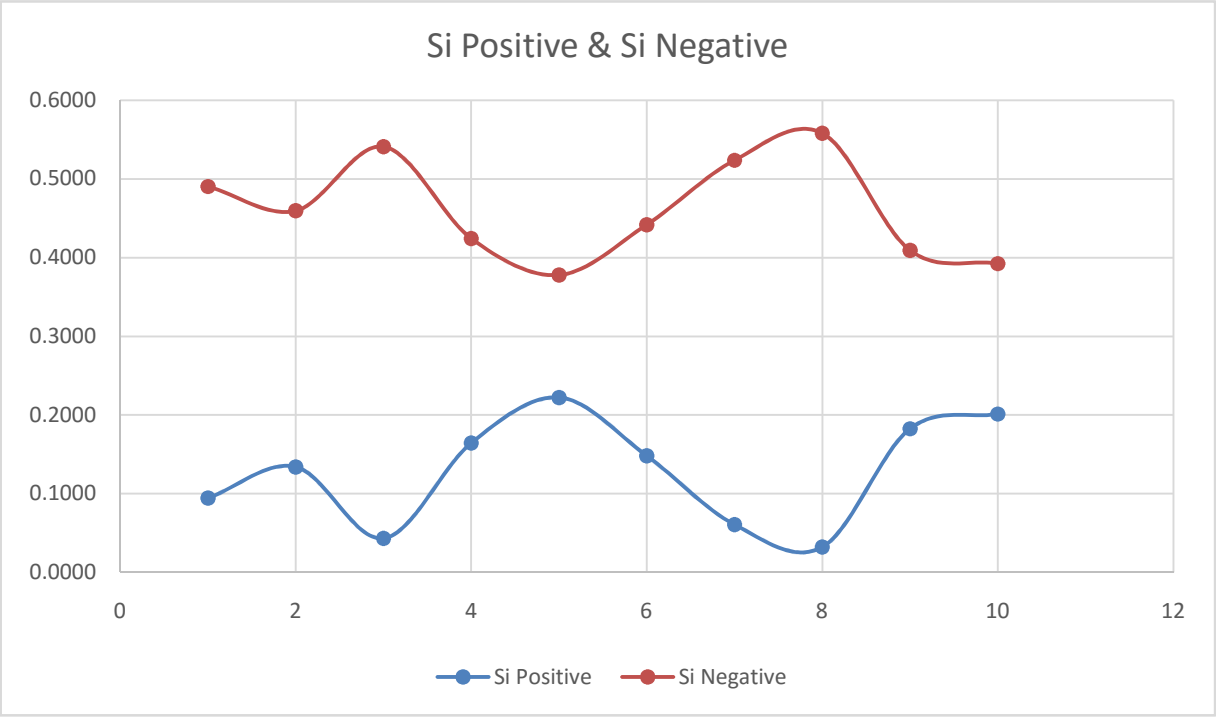

Figure 4. Si Positive & Si Negative

The figure 4 represents two metrics, "Si Positive" and "Si Negative," plotted against specific projects or initiatives. "Si Positive" (blue line) and "Si Negative" (orange line) capture sentiments or outcomes related to various SAP-related implementations and upgrades. The "Si Positive" line indicates favorable impacts or results, starting relatively low, peaking at "SAP Screen Personas Automation" (0.2222), and declining toward "Production Revenue Accounting Upgrade" (0.0320). This trend suggests the positive sentiment or effectiveness is more pronounced in early and middle stages of initiatives. The "Si Negative" line demonstrates adverse outcomes or challenges. It begins higher than "Si Positive," peaks at "mySAP.com Energy Integration" (0.5411), and declines after "Legacy System Replacement for Procurement" (0.4419). The peak at "mySAP.com Energy Integration" signals significant challenges, while the decline indicates better outcomes over time. This chart highlights that while projects achieve moments of high positive impact, some initiatives still experience significant negative sentiments, emphasizing areas requiring process improvement.

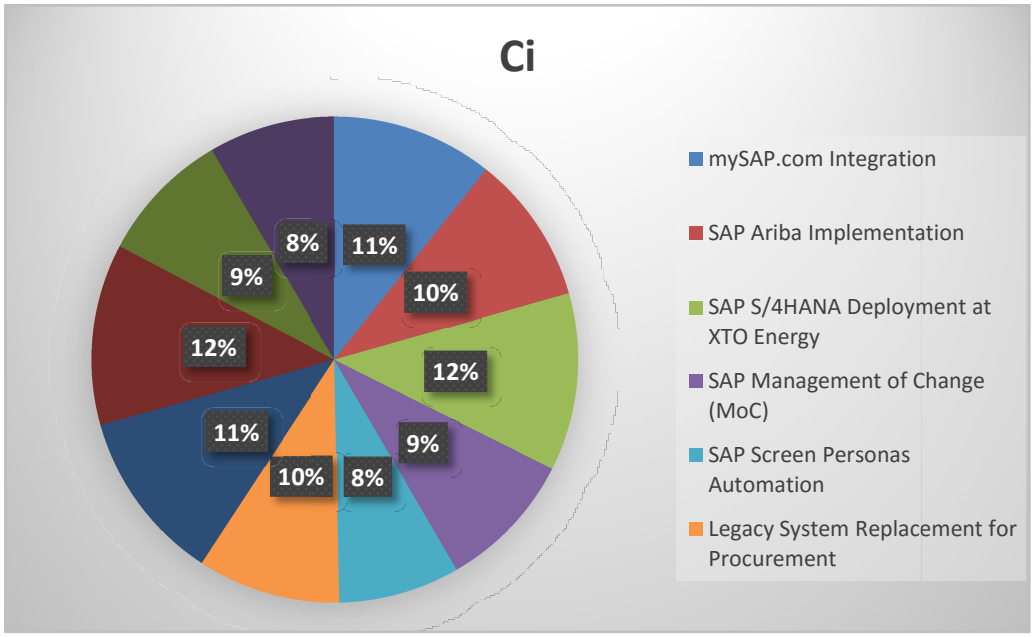

Figure 5. Ci

This figure 5 represents the distribution of various SAP-related projects and initiatives within an organization labeled "Ci." The chart shows 10 different segments, each representing a distinct project or implementation area. The largest portions of the portfolio are tied at 12% each, shared between "Production Revenue Accounting Upgrade" and "SAP S/4HANA Deployment at XTO Energy." Following closely, "mySAP.com Integration" and "Consolidation of IT Infrastructure" each comprise 11% of the total distribution. "SAP Ariba Implementation" and "Legacy System Replacement for Procurement" each account for 10% of the projects. The chart also shows several smaller initiatives: "Streamlined EHS Management with MoC" and "SAP Screen Personas Automation" each represent 9% of the portfolio, while "SAP Management of Change (MoC)" makes up 8% of the total distribution. There appears to be a balanced approach to both infrastructure modernization and process improvement projects, with significant emphasis on core SAP implementations and upgrades. The distribution suggests a comprehensive digital transformation strategy, with investments spread across different areas including core ERP systems (S/4HANA), procurement (Ariba), user experience (Screen Personas), and infrastructure consolidation. This balanced allocation indicates a methodical approach to modernizing various aspects of the organization's IT landscape.

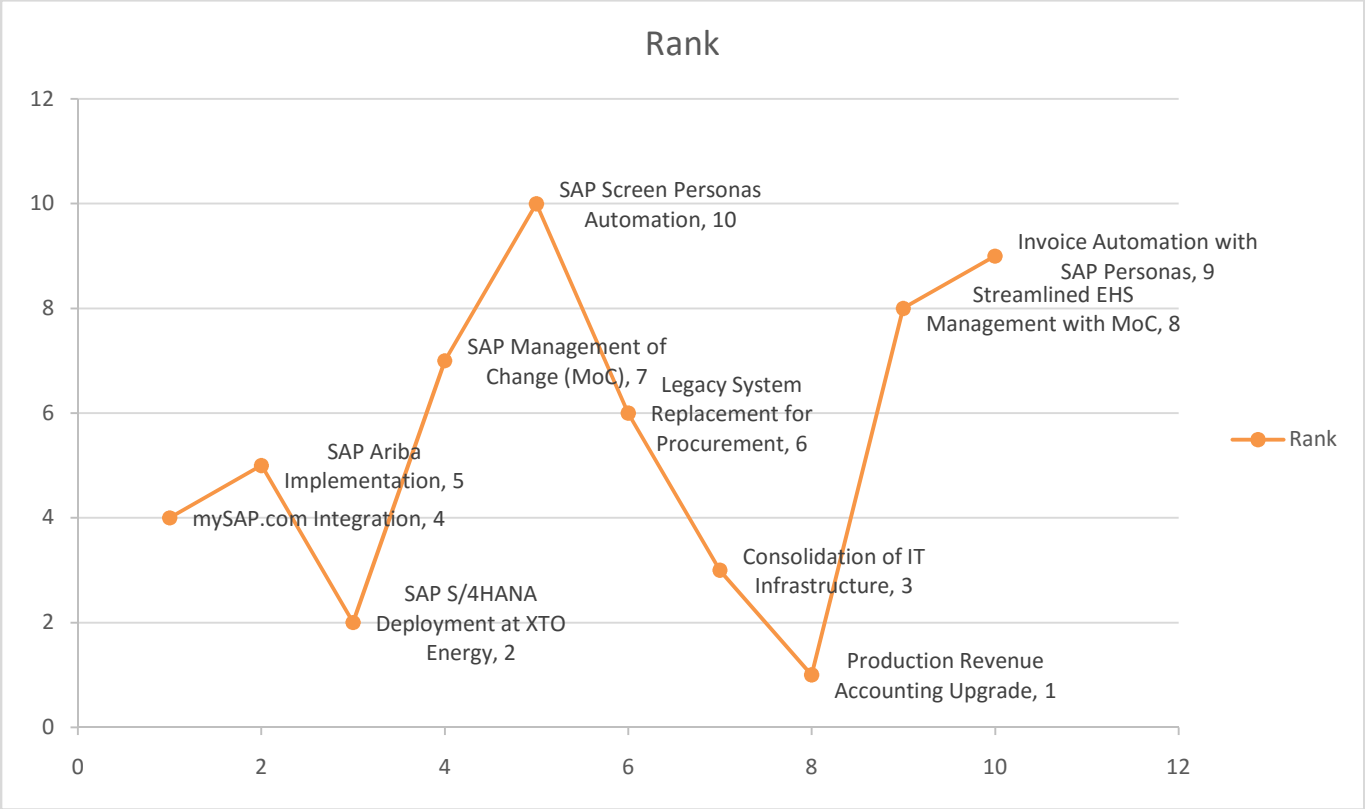

Figure 6. Rank

This figure 6 illustrates the ranking of various SAP-related projects and initiatives, with rankings ranging from 1 to 10, where 10 appears to represent the highest priority or importance. SAP Screen Personas Automation ranks highest at 10, indicating it's the top priority project. This is followed by Invoice Automation with SAP Personas at 9, and Streamlined EHS Management with MoC at 8. In the middle range, SAP Management of Change (MoC) ranks at 7, Legacy System Replacement for Procurement at 6, and SAP Ariba Implementation at 5. Moving down the rankings, mySAP.com Integration holds the fourth position, while Consolidation of IT Infrastructure ranks at 3. Notably, SAP S/4HANA Deployment at XTO Energy, despite being a major ERP implementation, ranks relatively low at 2, and Production Revenue Accounting Upgrade has the lowest ranking at 1. The graph shows significant variations in project priorities, with automation and user experience initiatives (Screen Personas) receiving higher rankings compared to core infrastructure projects. This prioritization suggests a strategic focus on improving end-user experience and process automation over backend system upgrades. The zigzag pattern of the line indicates distinct priority levels rather than gradual transitions between projects, highlighting clear differentiation in the importance assigned to each initiative.

Conclusion

ExxonMobil Global Services Co.'s adoption and strategic integration of SAP solutions serve as a transformative model for operational efficiency, scalability, and innovation in the energy and petrochemical industries. The company's deliberate approach to leveraging SAP technologies has enabled it to unify global operations, enhance productivity, and adapt to the complexities of a rapidly evolving industry. Through detailed evaluation using the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS), key insights into the effectiveness of specific implementations have been uncovered. The Production Revenue Accounting (PRA) upgrade at XTO Energy emerged as the most impactful initiative. This milestone reflects ExxonMobil's ability to address the intricacies of managing 66,000 wells with unparalleled precision, improving system performance, and reducing operational bottlenecks. By ensuring accurate and efficient revenue accounting, PRA aligns with the company's broader objectives of optimizing resource allocation and fostering transparency in financial reporting.

The implementation demonstrates a keen understanding of industry-specific challenges and a commitment to deploying tailored solutions. Conversely, SAP Screen Personas automation

was ranked lowest in the evaluation. While it has undoubtedly enhanced user productivity by automating repetitive tasks, its overall impact on the company's global objectives is comparatively limited. Nonetheless, this initiative underscores ExxonMobil's dedication to continuous improvement, showcasing its emphasis on enhancing employee experience and streamlining internal workflows. The evaluation also highlights the critical role of SAP Ariba, implemented in 2007, in revolutionizing procurement and supply chain management. By replacing outdated legacy systems, SAP Ariba not only improved operational efficiency but also strengthened ExxonMobil's ability to respond to market dynamics. This shift exemplifies the company's proactive stance toward modernization and its pursuit of long-term value creation. Furthermore, the consolidation of IT infrastructure through mySAP.com integration has been pivotal in establishing a robust foundation for the seamless execution of core business processes. This effort has facilitated global collaboration, minimized redundancies, and supported the scalability necessary to meet the demands of a growing enterprise. SAP's Management of Change (MoC) has been instrumental in improving safety and compliance within ExxonMobil's chemical operations.

By streamlining Environmental, Health, and Safety (EHS) management processes, MoC has reduced compliance risks and reinforced the company's commitment to maintaining the highest standards of operational integrity. The use of TOPSIS as a decision-making framework in this analysis highlights ExxonMobil's systematic and data-driven approach to evaluating technological investments. By considering diverse criteria such as ERP integration efficiency, supply chain streamlining, user experience enhancement, implementation cost, system downtime, and compliance risk, the company has demonstrated a balanced perspective that prioritizes both immediate and long-term gains. ExxonMobil Global Services Co.'s strategic adoption of SAP solutions underscores its unwavering commitment to innovation, sustainability, and operational excellence.

The successful implementations not only address immediate business needs but also position the company to adapt to future challenges in the energy sector. By leveraging advanced technologies like PRA and MoC and fostering a culture of continuous improvement, ExxonMobil remains at the forefront of the global oil and gas industry. The insights gained from this analysis provide a roadmap for other organizations seeking to enhance efficiency, embrace digital transformation, and align technological advancements with strategic objectives.

References

1. Varga, Audrey L., Matthew R. Chandler, Worth B. Cotton, Erik A. Jackson, Ross J. Markwort, Randy A. Perkey, Byrdie Renik, Tina Riley, and Susanna I. Webb. "Innovation and integration: exploration history, ExxonMobil, and the Guyana-Suriname basin." In Offshore Technology Conference, p. D011S010R003. OTC, 2021.
2. Eccles, Robert G., and Michael P. Krzus. "Constructing ExxonMobil's First Integrated Report: An Experiment." Available at SSRN 3145369 (2018).
3. Nichols, Linda M. "ROYAL DUTCH SHELL VERSUS EXXONMOBIL: THEIR CORPORATE AGILITY IN THE INDUSTRY DOWNTURN." Petroleum Accounting and Financial Management Journal 35, no. 2 (2016): 11-I.
4. Blommaert, Joe. "ExxonMobil: Carbon capture is critical to attaining society's emission-reduction goals." In Annales des Mines-Responsabilité et environnement, no. 1, pp. 50-52. Cairn/Softwin, 2022.
5. Naumann, Marc, and Anne Philippi. "ExxonMobil in Europe's Shale Gas Fields: Quitting Early or Fighting It Out?." Journal of European Management & Public Affairs Studies 1, no. 2 (2014): 31-38.
6. Lawson, Samantha. "The conundrum of climate change causation: Using market share liability to satisfy the identification requirement in native village of Kivalina v. ExxonMobil Co." Fordham Envtl. L. Rev. 22 (2010): 433.
7. Shah, Naman K. "Corporate philanthropy and conflicts of interest in public health: ExxonMobil, Equatorial Guinea, and malaria." Journal of public health policy 34 (2013): 121-136.
8. Keenan, Jeremy H. "Chad-Cameroon Oil Pipeline: World Bank & ExxonMobil in'Last Chance Saloon'." Review of African Political Economy (2005): 395-405.
9. Oseme, Kimberly. "Claims-to-Action Consistency of Major Oil and Gas Firms: A Comparison of Saudi Aramco, ExxonMobil and Shell." Master's thesis, University of Twente, 2023.
10. Bell, Jan, and Heidemarie Lundblad. "A comparison of ExxonMobil's sustainability reporting to outcomes." Journal of Applied Business and Economics 12, no. 1 (2011): 17-29.
11. Kaufmann, Robert K., Nalin Kulatilaka, and Melissa Mittelman. "Evaluating hedge fund activism: Engine Number 1 and ExxonMobil." Journal of Climate Finance 5 (2023): 100018.
12. Trencher, Gregory, Mathieu Blondeel, and Jusen Asuka. "Do all roads lead to Paris? Comparing pathways to net-zero by BP, Shell, Chevron and ExxonMobil." Climatic Change 176, no. 7 (2023): 83.
13. Sharfman, Bernard S. "The illusion of success: a critique of Engine No. 1's proxy fight at ExxonMobil." Harv. Bus. L. Rev. Online 12 (2021): 1.
14. Phan Nguyen, Thien Thanh, and Kim Wall. "An analysis of CSR online communication.: The case of Shell, ExxonMobil, E-ON and Vestas." (2010).
15. Choukroune, Leïla. "Corporate liability for human rights violations. The Exxon Mobil case in Indonesia."

In Regulating Disasters, Climate Change and Environmental Harm, pp. 56-78. Edward Elgar Publishing, 2013.
16. Craig, Bettenhausen. (2023). ExxonMobil to buy Denbury. C&EN global enterprise, 101(24):11-11. doi: 10.1021/cen-10124-buscon1.
17. Alexander, H., Tullo. (2022). ExxonMobil will recycle synthetic turf. 100(35):12-12. doi: 10.1021/cen-10035-buscon8.
18. Michael, McCoy. (2019). ExxonMobil invests in fuel-cell carbon capture. Chemical & Engineering News, 97(44):12-12. doi: 10.1021/CEN-09744-BUSCON7.
19. Alex, Tullo. (2023). ExxonMobil sees business in thermoset. C&EN global enterprise, 101(32):10-10. doi: 10.1021/cen-10132-buscon8.
20. MUHAMAD, ZIA, ULHAK. (2024). Pemanfaatan TOPSIS (Technique For Order Preference By Similarity To Ideal Solutions) untuk Rekomendasi Objek Wisata di Provinsi Sulawesi Tengah. Indonesian Journal of Computer Science, 13(5) doi: 10.33022/ijcs.v13i5.4404
21. Achmad, Bilal, Hamdani., Rony, Prabowo. (2024). Integrasi Analytic Network Processing dan Technique for Order Preference by Similarity to Ideal Solution sebagai Perancangan Strategi dalam Meningkatkan Daya Saing pada Perguruan Tinggi XYZ. Jurnal Syntax Admiration, 5(9):3628-3639. doi: 10.46799/jsa.v5i9.1592
22. Mark, Reden, S., Pacaon., Melvin, A., Ballera. (2024). Modified Recommender Algorithm based on Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) Methodology with Entropy Weighting Method (EWM). 225-230. doi: 10.1109/icsintesa62455.2024.10748228
23. P., Wibowo., Meylindha, Putri, Arofah. (2024). Analisis SWOT dan Technique For Order Preference by Similarity to Ideal Solution (TOPSIS) untuk Strategi Pengembangan Usaha di Gapit 24. Jurnal Teknik Industri Terintegrasi, doi: 10.31004/jutin.v7i3.30836
24. Ragil, Fadilla, Rahma, Dani., Liza, Yulianti., Lena, Elfianty. (2024). Implementation Of Technique For Order Preference By Similarity To Ideal Solution Method In Performance Assessment Of Best Medical Personnel In Public Hospitals Kepahiang Area. Jurnal Komputer, Informasi dan Teknologi, 4(1):16-16. doi: 10.53697/jkomitek.v4i1.1665
25. Agus, Prasetya., Dwi, Sukma, Donoriyanto. (2024). Optimization of Selection Suppliers for Rice Raw Material Using AHP (Analytical Hierarchy Processes) and TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) Methods in CV Gembira. IJIEM (Indonesian Journals of Industrial Engineering and Management), 5(1):176-176. doi: 10.22441/ijiem.v5i1.22366
26. Ade, Kurnia, Solihin. (2024). Metode Technique For Order Preference By Similarity To Ideal Solution (TOPSIS) Sebagai Model Penunjang Keputusan Penilaian Kinerja Guru SMP Bina Mandiri Jakarta. doi: 10.54066/jpsi.v2i2.1902
27. NULL, AUTHOR_ID., NULL, AUTHOR_ID., NULL, AUTHOR_ID. (2024). Selection of the best coffee bean supplier by using technique method for order preference by similarity to ideal solution (topsis) at CV. ORO coffee GAYO. IOP conference series, 1356(1):012064-012064. doi: 10.1088/1755-1315/1356/1/012064
28. Riezha, Mutia., Yossi, Diantimala., Fifi, Yusmita. (2024). The Effect of Financial Information on Decision Making to Purchase Shares Using the TOPSIS Method (Technique for Order Preference by Similarity to Ideal Solution). International Journal of Current Science Research and Review, doi: 10.47191/ijcsrr/v7-i5-66
29. Febianus, Asa., Elisabeth, Kolastriwan, Romanda., Jekonia, Nelchika, Titing., Maria, Claris, Salzano, Nurak., Muhamad, Nazhif, Zuhri, Pua, Geno., Yampi, R, Kaesmetan. (2024). Sistem pendukung keputusan untuk menentukan kualitas depot air mineral isi ulang menggunakan metode topsis (technique for order preference by similarity to ideal solution). Methodika : Jurnal Teknik Informatika Sistem Informasi, 10(1):1-5. doi: 10.46880/mtk.v10i1.2439