

SWE598 - FINAL REPORT - AIRP -
AI-POWERED RESOURCE PLANNING FOR
SMES

Mehmet Eyüpoğlu

Instructor: Prof.Dr. M. Oguz Tosun

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1. Motivation and Problem Definition

1.0.1. Most Businesses Are Small, But Big Problems Hold Them Back

Small and medium-sized businesses (SMEs) are the lifeblood of most countries, making up a whopping **98%** of all companies [Source: OECD [1]]. But even though they're so important, they often struggle because they don't have a lot of money or people to keep things running smoothly.

1.0.2. Data? What Data? Businesses Don't Always Use Numbers to Make Decisions:

These days, successful businesses use information (data) to make smart choices. Unfortunately, most SMEs don't do this because they don't have the tools or know-how to collect and understand their data. Without this knowledge, they miss out on chances to improve their work, understand their customers better, and make good decisions for the future.

1.0.3. One-Size-Fits-All Doesn't Work: Traditional Business Software is Too Complicated:

Ready-made software for managing businesses (ERP) was often designed for giant companies. This means it's too hard to use or too expensive for smaller businesses. These generic systems don't address the specific needs and ways of working that small businesses have, leaving a gap in the market.

1.0.4. Smartphones Rule, But Business Software Still Stays Stuck at Desks:

Being able to access important business information on your phone or tablet is no longer a bonus, it's a must-have. However, traditional ERP software often doesn't

work well on mobile devices. This limits SMEs, whose teams are often on the move, from seeing real-time data and managing tasks when they're not in the office.

1.0.5. The Bottom Line: Small Businesses Need Help to Compete:

The limitations faced by SMEs leave them exposed in a competitive market. They lack the tools and resources to use data, improve their work, and make good decisions. This is where our next-generation ERP solution comes in. It's specifically designed to address the unique challenges of SMEs and empower them to succeed.

2. Literature Survey

2.1. Past Solutions and State of the Art:

The world of Enterprise Resource Planning (ERP) systems has traditionally been dominated by large players like SAP, catering primarily to the needs of major corporations. While regional solutions like Logo and Mikro have emerged as national players, the overall market for ERP software has become somewhat saturated.

However, existing solutions often lack key advancements. Integration with automation technologies, although prevalent in large corporations, is rarely a seamless feature in existing ERP systems. This forces smaller businesses to manage separate systems or forgo automation altogether due to complexity and cost.

Furthermore, the potential of Artificial Intelligence (AI) remains largely untapped in the current ERP landscape. While AI has revolutionized various industries, its integration with ERP systems is still in its early stages. This presents a significant opportunity to develop a next-generation ERP solution that leverages AI to empower SMEs with data-driven insights and automated workflows.

In essence, the current ERP market lacks a solution that specifically addresses the needs of SMEs. Existing systems are often complex, expensive, and fail to integrate seamlessly with automation and AI technologies. This is where our innovative ERP solution comes in, designed to bridge the gap and empower SMEs for success.

2.2. Proposed Solution and Innovative Aspect

Our proposed solution disrupts the traditional ERP landscape by offering a system specifically designed to empower Small and Medium-sized Enterprises (SMEs). Here's what sets us apart:

2.2.1. Effortless Data Collection:

Gone are the days of manual data entry. Our system integrates seamlessly with built-in data collection solutions, such as forms and automated data capture tools. This eliminates errors and streamlines the process, allowing you to focus on running your business.

2.2.2. Industry-Specific Expertise:

We understand that every industry has unique challenges. That's why we offer domain-specific solutions that address the biggest pain points faced by your specific sector. This ensures you have the tools and features you need to optimize operations and gain a competitive edge.

2.2.3. Mobility on the Move:

Real-time access to your business data is crucial in today's fast-paced environment. Our mobile-friendly solution allows you to access critical information, manage tasks, and make informed decisions from anywhere, anytime.

2.2.4. AI-Powered Insights:

We harness the power of Artificial Intelligence (AI) to empower you with data-driven insights. Our AI engine analyzes your company data, identifies trends, and offers predictive recommendations. This allows you to automate routine tasks, optimize workflows, and make strategic decisions with greater confidence.

In essence, our next-generation ERP solution provides you with the tools and functionalities you need to:

- **Effortlessly collect and manage data.**

- **Benefit from industry-specific expertise.**
- **Access information and manage tasks on the go.**
- **Leverage AI for smarter decision-making and automation.**

By bridging the gap between traditional ERP systems and the needs of SMEs, our solution empowers you to streamline operations, gain valuable insights, and achieve sustainable growth.

2.3. Enabling Breakthrough Technologies

Our proposed solution goes beyond traditional AI, incorporating a revolutionary technology known as Large Language Models (LLMs). LLMs are a type of artificial intelligence trained on massive amounts of data, allowing them to understand and process information with exceptional capabilities.

Here's why LLM technology is a breakthrough in the ERP landscape:

Unprecedented Data Insights: LLMs can analyze vast amounts of data from various sources within your ERP system, including customer interactions, financial records, and operational metrics. This comprehensive analysis goes beyond traditional AI, uncovering hidden patterns, correlations, and trends that might be missed by human analysts.

Hyper-Personalized Automation: LLMs can personalize automation rules and workflows based on the specific context and historical data of your business. This goes beyond simple automation scripts, creating a dynamic and intelligent system that adapts to your evolving needs.

Enhanced Decision-Making: By processing and interpreting complex data sets, LLMs can generate insightful recommendations and forecasts, empowering you to make data-driven decisions with greater confidence. This can help you predict customer

behavior, optimize resource allocation, and identify potential risks before they arise.

By integrating LLMs within our next-generation ERP, we usher in a new era of intelligent business management for SMEs. This breakthrough technology empowers you to unlock the full potential of your data, automate tasks with greater accuracy, and gain a significant competitive advantage.

3. The Team and Capabilities

While I, Mehmet Eyupoglu, currently spearhead this project, our vision extends beyond a one-person team. To bring this innovative solution to life, we will strategically assemble a team with the following expertise:

- **AI Specialist:** An AI specialist is crucial for harnessing the power of Large Language Models (LLMs). This individual will be responsible for training and fine-tuning the LLM to extract valuable insights from your business data.
- **Software Developer:** A skilled software developer will be instrumental in building the core ERP platform and integrating it seamlessly with the LLM technology. Their expertise will ensure a user-friendly and robust system.

4. Innovative Product / Process Development

Only the rapid prototyping activities are handled in this document. Software development activities for MVP will be planned later on.

4.1. Requirements Definition and Analysis

4.1.1. User Management

- REQ-PM-001: User Signup - Allows users to create new accounts.
- REQ-PM-002: User Signin - Enables users to log in to the system.
- REQ-PM-003: Update Business Information - Permits users to modify company details (name, address, contact information).

4.1.2. Financial Management

REQ-PM-004: Update Operating Expenses - Allows users to record and update ongoing business expenses.

4.1.3. Product Management

- REQ-PM-005: Add Product - Enables users to create new product entries in the system.
- REQ-PM-006: Update Product - Permits users to modify existing product information.
- REQ-PM-007: Delete Product (Optional) - Allows users to remove products from the system (consider archiving instead of permanent deletion).
- REQ-PM-008: List Products - Provides users with a list of all products in the system with filtering and search capabilities.
- REQ-PM-009: Add Recipe - Enables users to create new recipes for product

Application Architecture

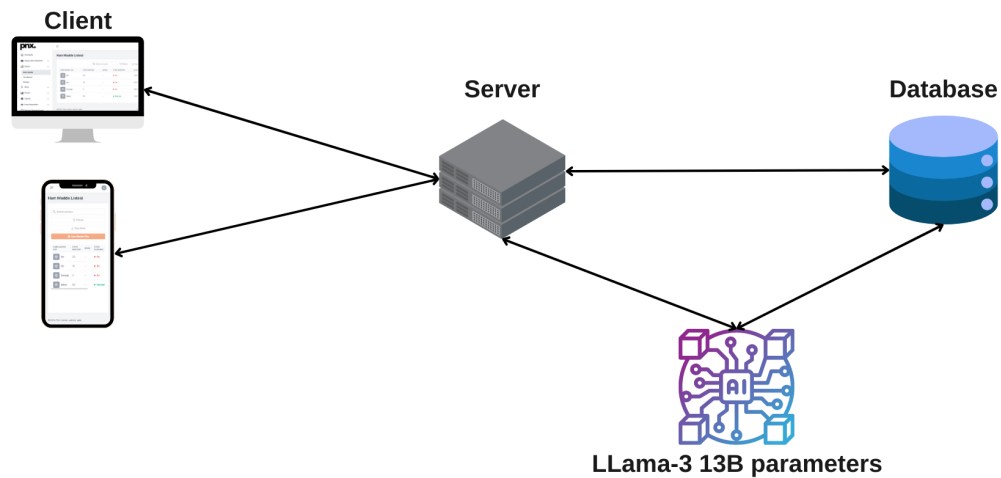


Figure 4.1. High level system architecture

production.

- REQ-PM-010: Associate Recipe with Product - Allows users to link recipes to specific products, defining production requirements.

4.1.4. Inventory Management

- REQ-PM-011: Add Raw Material - Enables users to create entries for raw materials used in production.
- REQ-PM-012: Update Raw Material - Permits users to modify existing raw material information (e.g., cost, quantity).
- REQ-PM-013: Delete Raw Material (Optional) - Allows users to remove raw materials from the system (consider archiving instead of permanent deletion).
- REQ-PM-014: List Raw Materials - Provides users with a list of all raw materials in the system with filtering and search capabilities.

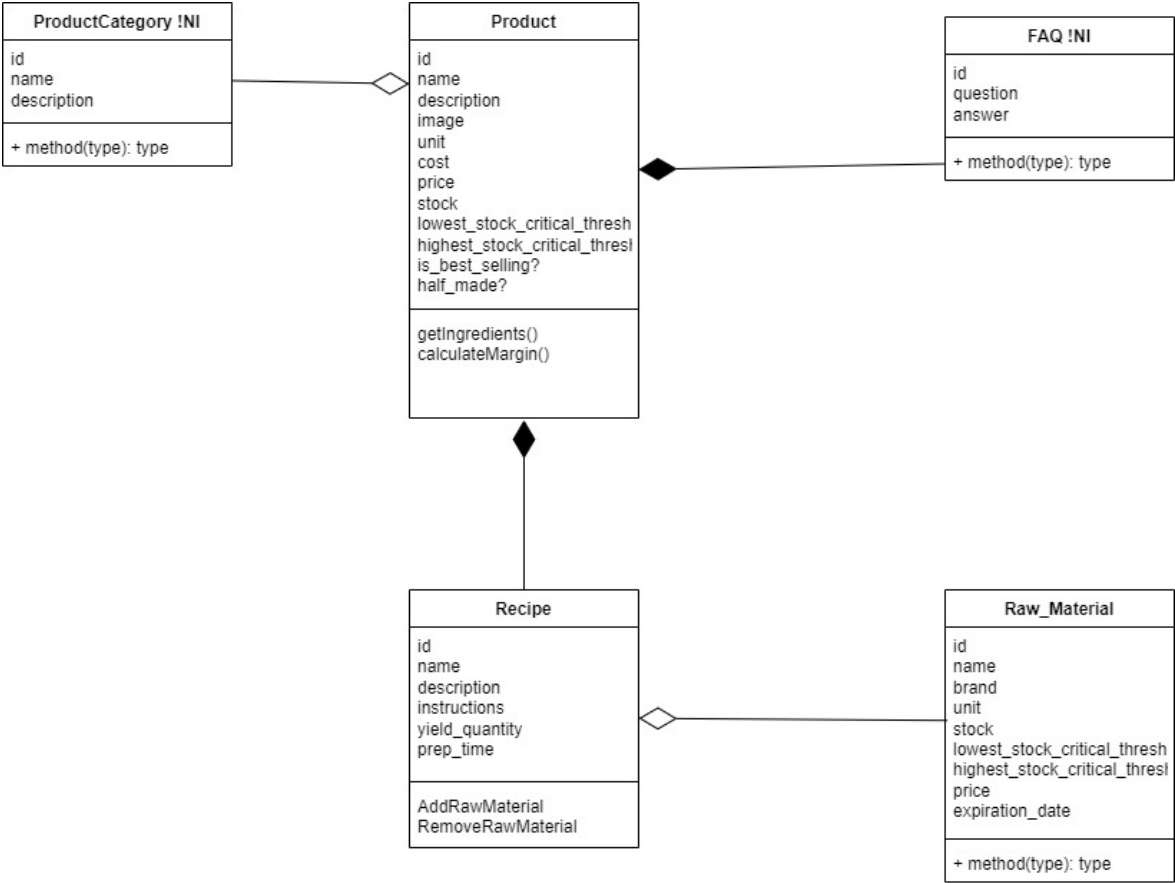


Figure 4.2. Product-Oriented Class Diagram

4.2. High Level System Architecture

4.3. Design, Implementation and Testing

Focus: This document outlines the core functionalities for the production module prototype, prioritizing features that demonstrate core value proposition for initial user testing and feedback.

This approach ensures an efficient development process for the prototype stage, focusing on core functionalities that demonstrate the production module’s value proposition to potential users. Feedback gathered during testing will then guide the further development and expansion of features for future versions.

Technology Stack and Domain-Specific AI

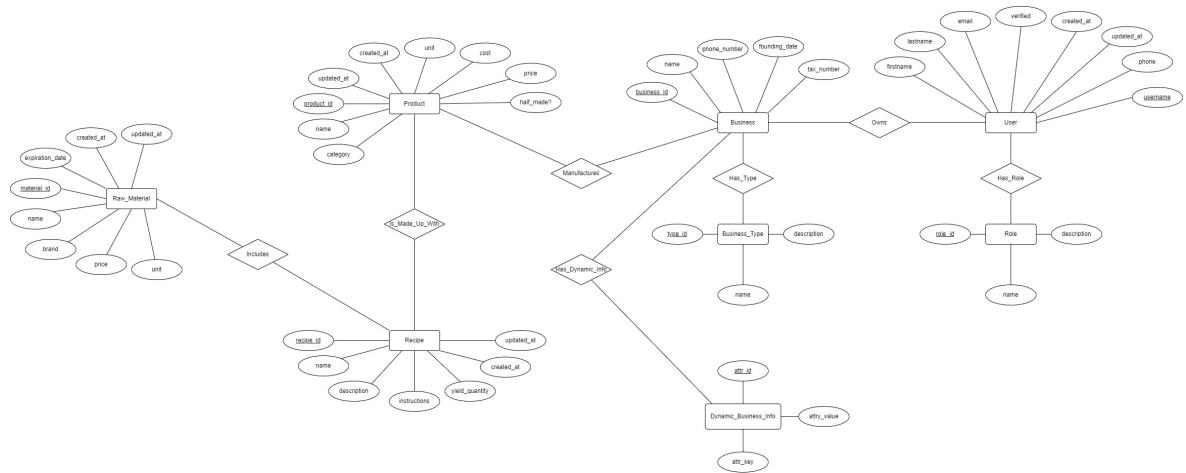


Figure 4.3. Database Design for prototype

To bring our vision to life, we'll leverage a powerful combination of technologies:

Front-End: React, a popular JavaScript library, will ensure a user-friendly and interactive experience.

Back-End: Express.js, a robust framework built on Node.js, will power the server-side logic and handle data communication.

Database: MySQL, a reliable and widely used database solution, will securely store and manage our application data.

Containerization: Docker will streamline development and deployment by packaging our application into portable containers, ensuring consistent performance across different environments.

AI Engine: LLaMA-3, a cutting-edge AI model from Facebook, will provide the foundation for our intelligent features. We've chosen the 8 billion token version of LLaMA-3 to balance performance and computational efficiency.

Domain-Specific AI Support:

This includes the implementation of a technique called Retrieval-Augmented Generation (RAG). **RAG essentially helps the AI model focus on the specific needs of our target users by retrieving relevant information from the existing data.** For example, if an SME user asks a question about managing inventory levels, RAG would surface relevant data points, allowing the AI to generate a more accurate and insightful response.

Balancing Power and Efficiency:

While RAG unlocks powerful functionalities, it does require some computational resources. This is why we've selected the 8 billion token version of LLaMA-3. It offers a good balance between performance and efficiency, ensuring our platform remains scalable and cost-effective.

This technology stack, combined with our domain-specific AI approach, lays the foundation for a future-proof solution that empowers SMEs with intelligent and insightful support.

5. Roadmap / Project Plan

Agile scrum will be used. Prototype will be delivered with 2 sprints by 15.06.2024. MVP will be delivered by 15.08.2024 with 4 sprints.

5.1. Milestones, Deliverables, Work Packages

5.1.1. AIRP Development Roadmap (Agile Scrum) - Prototype Phase

Project Focus: Deliver a functional prototype of the AIRP production module within two sprints (2 weeks each), starting May 13, 2024.

Target Delivery Date: June 27, 2024

Scrum Process:

- (i) **Product Backlog:** The following user stories will be the focus for the prototype phase:
 - REQ-PM-001 (Prototype): User Signup (Simplified)
 - REQ-PM-002 (Prototype): User Signin
 - REQ-PM-005 (Prototype): Add Product (Essential)
 - REQ-PM-008 (Prototype): List Products (Essential)
- (ii) **Sprint Planning:** Each sprint will begin with a planning meeting to define specific tasks associated with user stories, ensuring completion within the two-week timeframe.
- (iii) **Sprint Development:** The development team will work on the assigned tasks during the sprint, adhering to daily Scrum meetings for progress updates and issue resolution.
- (iv) **Sprint Review:** At the end of each sprint, a review meeting will showcase the completed user stories and demonstrate Prototype functionalities. Feedback from

stakeholders will be gathered.

- (v) **Sprint Retrospective:** Following the review, a retrospective meeting will be held to analyze the sprint's efficiency, identify areas for improvement, and adapt the process for the next sprint.

Detailed Project Plan:

Sprint 1 (May 13 - May 27, 2024):

- **User Stories:**

- REQ-PM-001 (Prototype): User Signup (Simplified) Tasks:
 - * Design and implement a user registration form.
 - * Validate user input (email format, password strength).
 - * Store user information securely in the database.
- REQ-PM-002 (Prototype): User Signin Tasks:
 - * Develop a login interface for registered users.
 - * Implement user authentication and session management.
 - * Redirect users to the appropriate dashboard upon successful login.
- REQ-PM-005 (Prototype): Add Product (Essential) Tasks:
 - * Design a product creation form with essential fields (name, description, unit type).
 - * Enable users to add new product entries into the system.
 - * Store product information securely in the database.

- **Deliverables:** Functional prototype demonstrating user signup, login, and basic product creation functionalities.

Sprint 2 (May 28 - June 10, 2024):

- **User Stories:**

- REQ-PM-008 (Prototype): List Products (Essential) Tasks:
 - * Design a user interface to display a list of all products in the system.

- * Implement functionality to retrieve and display product information from the database.
- * Include basic search and filtering options (optional).
- Additional considerations (time permitting):
 - * User interface enhancements for signup, login, and product creation.
 - * Basic error handling and user feedback messages.
- **Deliverables:** Enhanced prototype with a product listing functionality and potential UI improvements.
- **User Testing:** Conduct initial user testing sessions to gather feedback on the prototype's usability and functionality.

Note: This is a detailed plan for the prototype development phase. Flexibility is maintained to adjust tasks or features within each sprint based on team progress and potential challenges. User feedback from Sprint 2 will be crucial in refining the prototype and informing the roadmap for future development iterations.

5.2. Task Allocation, Timeline

Considering the team size and the deliverables, an additional task allocation and timeline is not needed, allowing the development team to focus their efforts on delivering a high-quality functional prototype within the established two-sprint timeframe.

6. Commercialization and Business Model

6.1. Market Analysis: Target Market, Customer Profile and Bureaucracy, Market Size, Marketing and Growth Strategy

Small and Medium-sized Enterprises (SMEs) are the backbone of the global economy, representing a staggering **90% of all businesses worldwide**. This vast network of companies employs a significant portion of the global workforce, contributing **over 50% of total employment**. Furthermore, SMEs are a powerful economic engine, generating an impressive **40% of global GDP (Gross Domestic Product)** according to the World Bank [2]. With an estimated **300 million SMEs operating worldwide** (as reported by Statista [3]), this market segment presents a tremendous opportunity for our product/service. By focusing on the needs of SMEs, we can empower a significant driving force in the global economy.

6.1.1. Marketing: Building the Foundation for Future Growth

Low-Profile Approach with Targeted Brand Recognition:

- **Rationale:** Given the competitive landscape, a low-profile marketing strategy will be adopted initially. This allows us to focus on product development and refinement based on user feedback before launching a full-scale marketing campaign.
- **Targeted Brand Recognition Efforts:** While maintaining a low profile, strategic efforts will be made to build brand recognition within our target market of SMEs. This might involve:
 - **Industry-specific publications:** Articles or advertisements placed in relevant trade journals or online publications frequented by SMEs.
 - **Targeted online advertising:** Pay-per-click campaigns focused on keywords relevant to SMEs and their pain points.

- **Content marketing:** Developing valuable content (e.g., white papers, blog posts) that addresses SME challenges and subtly introduces our solution.

Leveraging Sales Channels for Initial Growth:

- **Sales Strategy via Established Distributors:** By capitalizing on our existing network of regional sales distributors with established relationships within specific regions, we can ensure an initial sales push without heavy marketing investment.
- **Distributor Training and Resources:** Equipping sales distributors with in-depth product knowledge and compelling sales materials will maximize their effectiveness in reaching and converting SMEs.
- **Metrics and Feedback Loop:** Closely monitor sales performance through each distributor to identify areas for improvement and optimize the sales strategy.

6.1.2. Growth Strategy: Refining, Expanding, and Monetizing

Year 1 Focus: Product Refinement and Growth Through Sales:

- **Continuous Improvement:** Utilize feedback from early customers and ongoing market research to refine the product and ensure it remains competitive and addresses the evolving needs of SMEs.
- **Data-Driven Product Development:** Leverage user data and analytics to identify trends and guide future product features and functionalities.

Year 2 and Beyond: Market Penetration and Diversification

- **Shifting from Low-Profile to Targeted Penetration:** With a solid product foundation and established brand recognition, a more aggressive market penetration strategy can be implemented. This might involve attending industry trade shows, participating in webinars, and developing case studies showcasing successful customer implementations.

	SAP	Logo	DIA	Monday.com	LIOX	Mikro
Industry Specific Solutions	No	No	Partly	No	Yes	Yes
AI trained on company specific data	No	No	No	No	No	No
Industry Specific News	No	No	No	No	No	No
SMEs as target group	No	Yes	Yes	No	No	Yes
Cloud Solution	Yes	Yes	Yes	Yes	Yes	Yes

Table 6.1. Market Research

- **Industry Expansion:** While focusing on the initial target market, consider expanding into adjacent industries where the core product features can be adapted to address similar pain points.
- **AI Module as a Separate Revenue Stream:** Explore the possibility of offering the AI module as a standalone product or add-on service to existing customers and new markets. This could create a lucrative recurring revenue stream.

Overall, this approach utilizes a low-profile initial phase to ensure a solid product foundation while building brand awareness. By leveraging existing sales channels and then transitioning to a more targeted marketing strategy, we can achieve sustainable growth, market penetration, and explore revenue diversification through the AI module.

6.2. Competitor Analysis: Competition and AIRPs Competitive Advantage

6.2.1. Competitive Landscape in Turkish SME Solutions: A Gap for AI-Powered Solutions

The Turkish SME solutions market exhibits a mix of global and local players, but a clear opportunity exists for an innovative AI-powered offering.

Market Landscape:

- **Global Giant: SAP** reigns supreme as the global leader in business solutions,

with a presence in Turkey as well. However, their solutions may cater more to larger enterprises and might not be specifically tailored for the needs of Turkish SMEs.

- **National Powerhouses: Mikro and Logo** are well-established players in the Turkish SME market, offering solutions that resonate with local businesses. However, their offerings might lack the cutting-edge AI functionalities that can significantly enhance efficiency and decision-making.

The Gap: A Need for Integrated and Localized AI Despite the presence of established players, the national market in Turkey lacks a comprehensive solution that integrates the following functionalities:

- **Built-in AI Features:** No current competitor seamlessly integrates AI capabilities into their core product. Our solution aims to differentiate itself by leveraging AI to automate tasks, improve forecasting, and provide valuable insights.
- **AI Assistant for Turkish Businesses:** Existing offerings lack AI assistants specifically designed for the Turkish market. Our solution will train AI assistants on company-specific data, allowing for personalized support and insights tailored to local business practices.
- **Domain-Specific Solutions with AI Enhancement:** Current solutions might offer generic functionalities across industries. We plan to cater to specific industry needs by customizing functionalities for various business domains, further enhanced by AI capabilities.
- **Mobile Access and Real-Time Data:** Existing solutions may not prioritize on-the-go access. Our platform offers mobile access and ensures users have real-time data at their fingertips for informed decision-making.

Capitalizing on the Opportunity: By addressing this gap in the market, we have the potential to become a leader in the Turkish SME solutions space. Our integrated AI platform, combined with domain-specific functionalities, localized AI support, and a focus on mobile accessibility, will offer a compelling value proposition

to SMEs seeking a future-proof solution for success.

6.3. Budget, Pricing, and Monetization

Sales & Development:

- **Early Sales & Customer Feedback Loop:** Launch with a focused sales effort to generate initial sales and gather valuable customer feedback. This feedback will be critical in refining the product and ensuring it meets the evolving needs of SMEs.
- **Agile Development:** Utilize an agile development methodology to continuously iterate and improve the product based on customer feedback and market trends. This ensures a product that remains competitive and addresses real user pain points.

Sales Operations:

- **Leveraging Regional Distributors:** Partner with established SME-focused regional distributors who have strong relationships within specific regions in Türkiye. These partnerships will provide a strong sales force with local market knowledge and existing customer networks.
- **Distributor Training and Onboarding:** Provide comprehensive training to distributors on the product's features, benefits, and value proposition. Equip them with compelling sales materials and resources to effectively convert leads into customers.
- **Performance Monitoring and Optimization:** Continuously monitor sales performance through each distributor. Analyze data to identify areas for improvement and optimize the sales strategy for regional variations or specific industry needs.

6.3.1. Pricing Model: Tailored to SME Needs

Base Package (20,000 TL): One-time upfront payment for the core product with basic functionalities. This low initial cost reduces the barrier to entry for budget-conscious SMEs.

Data Transfer Fees (20% annual): A tiered pricing structure for data storage and transfer incentivizes efficient data usage. This aligns with the needs of smaller businesses who might not require extensive storage capacities.

Scalable User Fees: Additional fees based on the number of users accessing the platform. This allows SMEs to scale their investment as their business grows and requires additional user licenses.

Optional Add-Ons: Offer additional features or industry-specific modules as paid add-ons. This provides flexibility for SMEs to tailor the solution to their specific needs and generates additional revenue streams.

Overall, this pricing model offers an attractive entry point for SMEs with a scalable cost structure that caters to their growth.

6.3.2. Revenue Target: Setting Ambitious Growth Goals

20 Million TRY ARR (Annual Recurring Revenue):

- This ambitious target of 20 million TRY ARR within the next 12 months following the initial sales cycle translates to approximately 800-1,000 sales.
- Achieve this target by leveraging the regional distributor network, effectively converting sales leads, and offering a compelling value proposition to the SME market.

6.3.3. Investment Strategy: Reinvesting for Sustainable Growth

(Profit Distribution):

- **25% Product Development:** A significant portion of profits will be reinvested in ongoing product development to maintain a competitive edge. This ensures the platform remains technologically advanced and caters to evolving customer needs.
- **15% Customer Support & Domain-Specific Content:** Invest in expanding customer support resources and developing localized content tailored to specific industries. This fosters customer satisfaction, reduces churn, and attracts new customers from diverse sectors.
- **10% Marketing Activities:** Allocate resources for targeted marketing activities to raise brand awareness within the SME market. This can involve online advertising, attending industry events, and collaborating with relevant media outlets.

6.4. Challenges and Business Risk

Developing a Cutting-Edge Solution: AI Integration Hurdles While AI integration promises significant advantages, incorporating this technology presents several challenges:

- **Technical Complexity:** Seamlessly integrating AI functionalities with the core platform requires overcoming technical hurdles. This includes ensuring smooth data flow between AI modules and the user interface, as well as optimizing performance for real-time processing.
- **Data Quality and Training:** The effectiveness of AI relies heavily on high-quality data. Gathering, structuring, and cleaning data from SMEs can be a complex endeavor, especially for smaller businesses with less robust data management practices. Training AI algorithms on this data also requires careful

consideration to avoid biases and ensure accurate insights.

Balancing Efficiency and Sustainability: AI's Energy Consumption The power of AI comes at the cost of computational resources. Here are some potential hurdles to address:

- **Optimizing AI Algorithms:** We need to develop efficient AI algorithms that can deliver valuable results while minimizing energy consumption. This might involve exploring cloud-based solutions or leveraging new energy-efficient hardware technologies.
- **Transparency and Sustainability Initiatives:** Communicate the environmental impact of the solution transparently to customers. We can explore opportunities to offset our carbon footprint or partner with sustainable energy providers, demonstrating our commitment to responsible business practices.

Data Acquisition: Overcoming SME Data Collection Challenges Obtaining valuable data from SMEs can be challenging due to:

- **Limited Resources:** Smaller businesses may lack dedicated data management teams or robust data infrastructure. We must design our solution to be user-friendly and minimize the burden of data collection on SME users.
- **Data Security Concerns:** SMEs might be hesitant to share sensitive data. Building trust and implementing robust data security measures are crucial. We can offer clear data ownership policies and ensure all data is anonymized and used exclusively for improving the platform's functionality.

6.4.1. Business Risks

Addressing Replication Threats from Large Competitors While large competitors entering the space is a potential threat, proactive strategies can mitigate this risk:

- **Maintaining a Competitive Edge:** Continuous product development and innovation will be essential. By focusing on cutting-edge AI functionalities, domain-specific customization, and an exceptional user experience, we can retain a competitive advantage.
- **Building Strong Customer Relationships:** Establishing strong relationships with our customer base fosters loyalty and reduces the likelihood of customers switching to a competitor's offering. This can be achieved through exceptional customer support, offering dedicated account management for larger SMEs, and fostering a community around our platform.

Scaling Customer Support for Sustainable Growth

As our customer base grows, providing adequate customer support becomes increasingly important. We need to address potential hurdles:

- **Building a Scalable Support Infrastructure:** Invest in developing a scalable customer support infrastructure. Explore offering multi-channel support options (phone, email, live chat) and building a knowledge base of self-help resources to empower users.
- **Investing in Customer Support Team:** Recruit and train a talented customer support team equipped to handle inquiries and resolve issues efficiently.

Team Building: Assembling the Right Talent Building a strong team is essential for any successful startup. Here's how we can navigate the challenge of not yet having a full team in place:

- **Identifying Key Positions:** Prioritize the most critical roles needed to launch and scale the business. This might include engineering talent to manage AI integration, sales representatives to target the SME market, and customer support specialists.
- **Strategic Hiring and Talent Acquisition:** Develop a strong employer brand

and leverage recruitment strategies to attract top talent. Consider outsourcing some non-core functionalities or partnering with agencies to fill resource gaps temporarily.

By proactively addressing these challenges and risks, we can navigate the path to success, establishing our AI-powered solution as a leader in the SME market.

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