Analyzing the Role of Generative Artificial Intelligence (GenAI) in Supporting Customer Discovery Activities in Early-Stage Software Startups

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Abstract

Early-stage software startups in Indonesia face a high mortality rate, predominantly driven by a "no market need" failure. While Customer Discovery is critical to mitigating this risk, it is often hindered by limited resources. This study identifies specific Customer Discovery activities supported by Generative Artificial Intelligence (GenAI) using a Systematic Literature Review (SLR) of 62 scientific articles. Through Thematic Analysis, the research identifies 20 primary Customer Discovery activities and categorizes them into the Early-Stage Software Startup Development Model (ESSSDM) stages: Idea Generation, The Backlog, and The Funnel. Utilizing the Human-AI Collaboration and Adaptation Framework (HACAF), the study reveals that while GenAI is a potent "Co-Creator" for analytical tasks like hypothesis formulation and learning analysis, it remains less relevant for social-centric activities requiring interpersonal trust. The study's primary contribution is the Strategic Integration Matrix, which provides a roadmap for founders to balance AI autonomy with human intuition.

1. Introduction

The software startup ecosystem in Indonesia has recorded significant growth, with approximately 1,600 active software startups, positioning the nation as a competitive software development hub in Southeast Asia [1]. The majority of these ventures are still in the early stage, a critical phase focused on idea validation and the search for a sustainable business model [2]. However, this phase is characterized by a high mortality rate. Data indicates that the predominant factor driving software startup failure is the inability to understand market needs, with 42% of failures attributed to "no market need" for the developed product. To mitigate this risk, the Customer Discovery process, popularized by Steve Blank's Lean Startup methodology, has become the gold standard for validating market hypotheses before significant resources are committed to development [3].

However, for many early-stage founders in Indonesia, the Customer Discovery phase presents a "validation dilemma." While essential, the process is notoriously resource-intensive, requiring extensive time for qualitative data gathering, synthesis, and iterative testing [4]. For startups with limited runways, the speed of

learning often fails to keep pace with the rate of cash burn. This has created an urgent need for tools that can accelerate discovery without compromising the depth of market insights.

The emergence of Generative Artificial Intelligence (GenAI), specifically Large Language Models (LLMs) like GPT-4, offers a potential solution to this dilemma [5]. In the context of early-stage software startups, GenAI is highly relevant as it can function as an assistant in identifying customer needs, formulating hypotheses, and generating solution ideas [6]. Yet, despite the rapid adoption of these tools, there is a lack of systematic research into exactly *which* activities within the discovery cycle are most suitable for AI intervention and *how* these tools interact with human intuition [7].

This research addresses this gap through a Systematic Literature Review (SLR) and Thematic Analysis. By examining 62 scientific articles, this study identifies a taxonomy of 20 primary Customer Discovery activities and maps them against the **Early-Stage Software Startup Development Model (ESSSDM)** stages: Idea Generation, The Backlog, and The Funnel. Furthermore, the **Human-AI Collaboration and Adaptation Framework (HACAF)** is utilized to analyze the extent of GenAI adoption, evaluating the technology through the lenses of compatibility, performance perception, and social factors [8], [9]. The objective of this study is to provide a comprehensive roadmap for founders and researchers alike. By integrating these theoretical frameworks, we propose a **Strategic Integration Matrix** that identifies the optimal roles for GenAI—ranging from an automated "Assistant" to a collaborative "Co-Creator"—while highlighting the critical "Human-in-the-Loop" requirements for high-stakes validation.

Consequently, this research seeks to answer the following research questions:
1. **RQ1:** Which Customer Discovery activities in early-stage software startups can be effectively supported by GenAI?
2. **RQ2:** To what extent does the HACAF framework explain the adoption levels and collaboration patterns between founders and GenAI across different discovery stages?

2. Literature Review

2.1 Customer Discovery in Software Startups

Software startups are distinct from traditional small businesses, serving as temporary organizations designed to search for a repeatable and scalable business model [3], [10]. These ventures typically operate in highly uncertain environments and are characterized by rapid growth orientation, limited resources, and a reliance on technology-based innovation [10], [11]. While the development lifecycle progresses through several stages, the "Early Stage" is particularly critical as it focuses on product launch and market validation. Research indicates that the primary cause of failure in this phase is not technical inability, but rather the lack of market need for the product [12]. Consequently, the ability to perform effective market validation is a decisive factor in a startup's ultimate survival.

2.2 Customer Discovery as a Strategic Imperative

To mitigate the risks of market failure, the Customer Development Framework was introduced to run parallel to product development [3]. The first step of this framework, Customer Discovery, is a dedicated process for turning founder assumptions into validated facts regarding customer problems and potential solutions [3]. This process consists of four iterative phases: (1) Stating Hypotheses, (2) Testing the Problem, (3) Testing the Solution, and (4) Verifying or Pivoting [3], [13]. This cycle emphasizes "getting out of the building" to engage directly with potential users to achieve a problem-solution fit [5], [14]. Despite its importance, the execution of Customer Discovery remains notoriously unstructured and resource-intensive, creating a significant barrier for resource-constrained founders [4].

2.3 Generative Artificial Intelligence (GenAI) in Startup Innovation

Generative AI (GenAI), particularly Large Language Models (LLMs), has emerged as a transformative tool for accelerating the validation cycle in software startups. Unlike traditional AI, GenAI can generate new content—such as text, code, and ideas—based on learned data patterns to support inception activities [15]. In the context of early-stage startups, GenAI serves not merely as a content generator but as a strategic assistant that accelerates the validation cycle [16].

Recent studies suggest that GenAI can support various inception activities, including ideation, needs exploration, and the creation of Minimum Viable Products (MVPs) [15],[16]. By simulating customer feedback and automating data analysis, GenAI allows startups to iterate faster and reduce the cost of exploration [16]. However, while adoption is increasing due to the technology's accessibility and cost-efficiency, the specific patterns of collaboration between human founders and AI during the sensitive Customer Discovery phase remain under-explored [7].

2.4 Theoretical Framework: Human-AI Collaboration and Adaptation Framework (HACAF)

To analyze the adoption of GenAI in this specific context, traditional models like TAM or UTAUT are insufficient as they fail to capture the collaborative nature of generative tools [8]. This study employs the Human-AI Collaboration and Adaptation Framework (HACAF), a theoretical model designed to predict the adoption of GenAI tools by synthesizing elements from TAM, DOI, and Social Cognitive Theory [9].

HACAF posits that the Intention to Use (IU) GenAI is influenced by four key determinants [8]:

1. Perceptions about Technology (PT): Evaluating perceived usefulness and ease of use.
2. Compatibility Factors (CF): The alignment of GenAI with existing workflows and needs, which is often a stronger driver than usefulness alone.
3. Social Factors (SF): The influence of peer pressure and organizational support.
4. Personal and Environmental Factors (PEF): Individual innovation and facilitating conditions.

By applying HACAF, this research moves beyond simple usage metrics to understand why and how founders integrate GenAI as a collaborator in the high-stakes process of Customer Discovery [17].

3. Research Method

This study employs a mixed-method research design to comprehensively analyze the role of Generative AI in software startups. The research process is systematically organized into four distinct phases, as illustrated in Fig. 1.
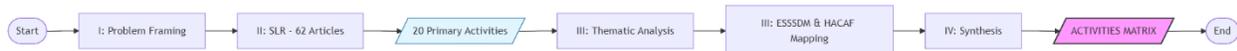

Fig. 1. Research Flow Diagram

The methodology is now structured as a four-phase systematic pipeline:

1. Problem Identification & RQ Formulation: Identifying the "validation dilemma" in Indonesian startups and formulating questions regarding GenAI's role in the discovery process.
2. Systematic Literature Review (SLR): A formal search of databases (e.g., Scopus) led to the selection of **62 scientific articles** based on strict inclusion/exclusion criteria.
3. Thematic Analysis & Framework Mapping:
   a. Distilling the 62 articles into **20 primary Customer Discovery activities**.
   b. Categorizing activities into stages (Idea Generation, The Backlog, Funnel 1 & 2) to ensure operational relevance.

      c. Evaluating the "extent of adoption" by analyzing the compatibility (CF), social factors (SF), and technical perceptions (PT) of GenAI for each activity.
4. Synthesis & Output: Integrating the thematic findings to develop the **Strategic Integration Matrix**.

4. Result and Discussion

4.1 The Activities Matrix

The systematic literature review and subsequent thematic analysis resulted in the identification of 20 primary Customer Discovery activities that define the early-stage startup journey. These activities span the entire validation spectrum, from initial internal ideation to high-stakes external verification with potential customers. As detailed in Table 1, the role of GenAI varies significantly depending on the nature of the task, ranging from a technical "Assistant" for structured data processing to a creative "Co-Creator" for developing personas and journey maps. This taxonomy highlights that GenAI is most effective when used to bridge the gap between abstract founder hypotheses and tangible testing artifacts like wireframes or landing pages.

Table 1. Taxonomy of 20 Customer Discovery Activities Supported by GenAI

Code	Activity	Description	Primary GenAI Role
Ac01	**Build Initial Solution**	Iteratively building wireframes, mock-ups, or MVPs to test value hypotheses.	**Assistant** (Coding/Design)
Ac02	**Co-Create with Early Adopters**	Informal collaboration with innovative users to generate feature ideas.	**Co-Creator** (Ideation)
Ac03	**Collaborate with Influencers**	Utilizing influencer audiences to test product assumptions pre-implementation.	**Consultant** (Strategy)
Ac04	**Collaborate with Customers**	Intensive interaction for requirements elicitation and ongoing feedback.	**Assistant** (Transcription)
Ac05	**Market Presence Building**	Creating social media content and pages to drive initial traffic.	**Co-Creator** (Content)
Ac06	**Brainstorming Sessions**	Sessions to define problems, discuss solutions, and design features.	**Sparring Partner**
Ac07	**Customer Interviewing**	Conducting direct interviews to validate specific customer pain points.	**Consultant** (Drafting)
Ac08	**Data Synthesis**	Processing qualitative field data into structured, actionable insights.	**Assistant** (Analysis)
Ac09	**Hypothesis Formulation**	Drafting critical assumptions regarding the problem/solution fit.	**Co-Creator**
Ac10	**Market Segmentation**	Identifying and grouping specific target customer segments.	**Assistant** (Research)
Ac11	**Persona Development**	Creating fictional archetypes representing target users.	**Co-Creator**
Ac12	**Problem Validation**	Verifying if the identified problem is genuinely felt by the market.	**Sparring Partner**
Ac13	**Value Proposition Design**	Formulating the unique value that differentiates the product.	**Consultant**
Ac14	**Competitor Analysis**	Mapping strengths and weaknesses of existing market solutions.	**Assistant**
Ac15	**Landing Page Validation**	Measuring interest through clicks or sign-ups on a landing page.	**Assistant**
Ac16	**Survey Distribution**	Collecting quantitative data from a wider audience.	**Assistant**
Ac17	**Feature Prioritization**	Determining the MVP roadmap based on urgency and impact.	**Consultant**
Ac18	**User Journey Mapping**	Visualizing the user's experience with the proposed solution.	**Co-Creator**

Code	Activity	Description	Primary GenAI Role
Ac19	**Pricing Strategy Testing**	Testing monetization models and price sensitivity.	**Sparring Partner**
Ac20	**Solution Validation**	Final testing to ensure the prototype solves the core problem.	**Consultant**

4.2 The Strategic Integration Matrix

To provide a prescriptive roadmap for founders, this study proposes the Strategic Integration Matrix (see Table 2), which maps discovery activities to specific GenAI roles and their corresponding **HACAF** determinants. During the **Idea Generation** stage, GenAI functions as a **Co-Creator** due to its high compatibility (CF) with rapid brainstorming and divergent thinking. However, as the process moves toward the **Backlog** and the **Funnel**, the role shifts toward an **Assistant** or **Sparring Partner** to prioritize performance (PT) and social factors (SF). This matrix emphasizes that while AI can lead in analytical synthesis, human oversight must increase exponentially as the startup approaches final market validation where cultural fit and interpersonal trust are paramount.

Table 2. Strategic Integration Matrix

ESSSDM Stage	GenAI Role	HACAF Determinant	Level of Human Oversight
Idea Generation	Co-Creator	High Compatibility (CF)	**Moderate**: Filter for cultural fit.
The Backlog	Assistant	High Performance (PT)	**Low**: Verify technical accuracy.
The Funnel	Sparring Partner	High Social Influence (SF)	**High**: Avoid "hallucinated empathy."
Final Validation	Consultant	High Social Risk (SF)	**Extreme**: Human-to-human required.

The Strategic Integration Matrix, grounded in the Human-AI Collaboration and Adaptation Framework (HACAF), provides a roadmap for balancing AI efficiency with human oversight across the startup development lifecycle. In the initial "Idea Generation" and "Backlog" stages, human intervention remains Moderate to Low as Generative AI serves as a Co-Creator and Assistant. During these phases, the technology's high Compatibility (CF) and Performance (PT) allow it to handle divergent brainstorming and technical execution with minimal supervision, provided the founder performs contextual filtering and basic quality checks.

Conversely, as the startup moves toward "The Funnel" and "Final Validation," the oversight requirement escalates to High and Extreme levels to manage the Social Factors (SF) inherent in market engagement. In these roles as Sparring Partner or Consultant, the AI supports data synthesis, but the founder must lead all interpersonal interactions to establish essential trust and mitigate the risk of "hallucinated empathy." This strategic shift ensures that while AI accelerates the discovery process, the founder remains the final arbiter of qualitative truth and human-centric relationships. Table 3 shows a selection of prompt templates designed to align with the **Strategic Integration Matrix** roles.

Table 3. GenAI Prompt Engineering Guide

Code	Activity	GenAI Role	Sample Prompt for Founders
Ac09	Hypothesis Formulation	**Co-Creator**	"Based on the problem of [Problem Statement], generate 5 'We Believe' hypotheses regarding our customer segment's willingness to pay for [Solution]."
Ac11	Persona Development	**Co-Creator**	"Create 3 detailed user personas for an Indonesian early-stage software startup focusing on [Target Industry], including their goals, frustrations, and digital habits."
Ac07	Customer Interviewing	**Consultant**	"Act as an expert user researcher. Draft 10 open-ended interview questions to validate the pain points of [Persona] regarding [Problem]."

Ac08	Data Synthesis	**Assistant**	"Summarize the following 5 customer interview transcripts into a table of recurring themes, categorized by 'Pain Point,' 'Feature Request,' and 'Emotional Trigger'."
Ac01	Build Initial Solution	**Assistant**	"Write the React code for a mobile-responsive landing page wireframe that includes a value proposition header, a 3-step feature list, and a waitlist sign-up form."
Ac19	Pricing Strategy	**Sparring Partner**	"Critique this subscription pricing model: [$ Price/Month] for [Features]. Identify potential friction points for [Target Segment] and suggest 2 alternative models."

4.3 Navigating the Validation Dilemma

The application of the **HACAF** framework reveals that the "validation dilemma"—the tension between speed and depth—is best resolved through a balanced human-AI collaboration. GenAI serves as a powerful catalyst for accelerating the preparation and synthesis phases, allowing founders to reach "the building" faster with more refined hypotheses. Despite these efficiencies, the analysis of social factors (SF) underscores that AI cannot fully replace human-to-human empathy, which is critical for avoiding "hallucinated" market needs. Ultimately, the success of this integration depends on the founder's ability to remain the final arbiter of qualitative truth while using AI to automate the heavy lifting of data organization and content generation.

5. Conclusions

This research provides a systematic taxonomy and a strategic framework to address the "validation dilemma" inherent in early-stage software startups. By identifying 20 primary Customer Discovery activities and mapping them across the ESSSDM stages, the study demonstrates how Generative AI can accelerate the validation cycle without sacrificing depth. The findings suggest that GenAI is particularly effective as a "Co-Creator" for analytical and generative tasks, such as hypothesis formulation and persona development, which typically consume significant founder time.

The application of the HACAF framework further clarifies that GenAI adoption is not a uniform process but a nuanced collaboration shaped by compatibility and social limitations. The proposed Strategic Integration Matrix serves as a prescriptive roadmap, allowing founders to strategically delegate high-volume data synthesis to AI while reserving high-stakes social validation for human-to-human interaction. This framework ensures that the speed of discovery is increased while maintaining the quality of market validation through essential "Human-in-the-Loop" oversight.

Ultimately, this study concludes that while GenAI significantly reduces resource barriers, the founder remains the final arbiter of social and cultural truth. Future research should focus on longitudinal studies to measure the long-term survival rates of startups that implement this Strategic Integration Matrix compared to traditional methods. As GenAI continues to evolve, the boundaries of human-AI collaboration will shift, necessitating continuous updates to the evaluative frameworks proposed in this work.

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