

STRUCTURING ORGANIZATIONAL COGNITIVE ADAPTATION PATHWAYS: AN ORDERED NETWORK ANALYSIS OF HOW FORMAL PLANNING INTEGRATES ENTREPRENEURIAL TRAINING INTO STRATEGIC ACTION

Dr. Margaret Nganu

Machakos University

Publication Date: October 2026

ABSTRACT

This study investigates how formal planning structures the cognitive integration between entrepreneurial training domains and strategic adaptation pathways. Grounded in cognitive theory, we proposed that a proactive planning actively structures an entrepreneur's knowledge network, establishing both direct and indirect conceptual pathways that link training domains to adaptive business actions. Using Ordered Network Analysis (ONA), 198 coded dialog lines from nine aggregated units of micro, small, and medium-sized enterprises (MSMEs) were analyzed, categorized by planning adoption (planners vs. non-planners), business maturity, and environmental pressure severity. Results revealed a significant divergence in conceptual network structure along the primary dimension between planners ($Mdn = 0.29$) and non-planners ($Mdn = -0.39$), with a large effect size ($U = 0$, $p = .02$, $r = 1.00$). Planners exhibited a structured network where training domains connect to strategic adaptive actions through dual pathways. Direct linkages (e.g., business management $\rightarrow$ financial buffering) and mediated sequences through intermediate adaptive strategies (e.g., value addition $\rightarrow$ logistical innovation $\rightarrow$ financial buffering). In contrast, non-planners displayed fragmented, non-integrated networks with weak or absent directional ties. The findings demonstrate that formal planning acts as a cognitive disciplining mechanism that builds a layered, hierarchical architecture for strategic action. This architecture enables entrepreneurs to operationalize training into resilience through intertwined direct and mediated routes, centering on key outcomes such as financial buffering. This study advances organizational cognition theory by illustrating how planning facilitates non-linear, configurational knowledge integration and validates ONA as a robust method for modeling ordered conceptual relationships in entrepreneurial decision-making.

Keywords: *Entrepreneurship, Cognitive integration, Ordered Network Analysis (ONA), strategic adaptation, resilience.*

INTRODUCTION

Strategic adaptation and alignment have become a central focus in both academic research and organizational practice in recent years (Vayyavur, 2020; Alsayah, 2022; Gede & Huluka, 2023), yet as the pace of change accelerates, achieving and maintaining this has grown increasingly complex and challenging (Ghonim et al., 2020). This growing complexity underscores a critical need for establishing coherent pathways visibly connecting business activities and operational knowledge to high-level strategic choices, ensuring that daily executions demonstrably advance organizational priorities.

The concept of having coherent strategic pathways is fundamentally explained by cognitive theory, which posits that strategy is not a direct response to the environment but is filtered and constructed through a decision-maker's mental models and cognitive frames (Feinnudin & Wahno, 2025). The choice and quality of strategic action is thus inherently tied to the structure of an individual's internal knowledge network. Through cognitive integration, defined as “the processes of reproduction of knowledge” (Nurgaleeva, 2015, p. 18), disparate information is synthesized into a coherent mental map that guides behaviour by organizing a decision maker's understanding of pressures, capabilities, and potential pathways towards strategic outcomes (Feinnudin & Wahno, 2025). This cognitive process is further shaped by the interaction between endogenous abilities and the exogenous strategic environment (Zonca et al., 2025).

Based on this foundation, the present study hypothesizes that an entrepreneur's training domains cognitively determine the architecture of their strategic action choices/ domains. This relationship is influenced by cognitive integration, whereby formal knowledge is synthesized into mental models that outline potential strategic actions (Nurgaleeva, 2015; Feinnudin & Wahno, 2025). However, this cognitive linkage is moderated by organizational planning orientation with proactive planning strengthening and ordering the conceptual ties between knowledge and action, and reactive coping leading to weaker or more disparate connections.

In this context, formal planning is theorized to act as a critical engine for cognitive integration, actively structuring the links between acquired knowledge and potential strategic actions. Specifically, formal proactive planning is expected to create stronger associative pathways between an entrepreneur's foundational training domains and deliberate actionable responses by systematically strengthening the conceptual ties between them. In the absence of such a structured process, these distinct knowledge and action domains are likely to remain in isolated, reactive loops, leaving entrepreneurs to rely on instinct rather than an integrated strategy during a crisis. Proactive planning thus forces deliberate, pre-crisis connections, transforming actions into planned outputs of the management process rather than improvised reactions. Furthermore, the organization's maturity level and the severity of external environmental pressures are expected to contextualize and shape how these cognitive structures form and function, thereby influencing the overall relationship between planning, training, and strategic choices (Zonca et al., 2025).

RESEARCH QUESTION

This study is designed to empirically examine the hypothesized structuring effect by addressing three specific research questions through Ordered Network Analysis (ONA), a methodological approach uniquely suited to modelling directed conceptual linkages within sequential data:

- i. Does formal planning exhibit significantly stronger and more direct conceptual linkages with formal training domains?

- ii. Does formal planning exhibit significantly stronger and more direct conceptual linkages with specific strategic actions?
- iii. Does formal planning strengthen the conceptual ties between an entrepreneur's training domains and their specific strategic actions?

To investigate these questions, a detailed multi-level operationalization framework was developed. The core construct of training was decomposed into three measurable sub-constructs: (i) Business Management training, including business planning, bookkeeping and structured customer care; (ii) Market Intelligence training, including targeted marketing and market research; and (iii) Value Addition training, measured by the application of processing or enhancement techniques. The outcome construct was similarly broken down into three strategic sub-constructs: (i) Financial Buffering, observable through the maintenance of emergency cash reserves and enough stock; (ii) Market Adaptation, evidenced by shifts in sales platforms (e.g., online sales) or adoption of direct-to-customer models; and (iii) Logistics Innovation, gauged by the use of novel delivery services or acquisition of special market permits.

Recognizing that the process of cognitive integration does not occur in a vacuum, the study incorporates and measures two key contextual factors (firm maturity and severity of external pressures) derived from the theoretical literature (Odita et al., 2023; Dikhanbayeva et al., 2020; Saleba et al., 2023; Fatima et al., 2023). (i) Firm Maturity operationalized as a composite index reflecting a firm's developmental stage across three dimensions; temporal maturity (years in operation), scale maturity (number of employees), and strategic complexity (practice of value addition). Simultaneously, the (ii) Severity of business environment pressures quantified as a summative index, counting the number of specific operational and market challenges affecting the business such as limited market access, increased costs, and unreliable suppliers actively reported by the firm. This dual-context framework allows the analysis to account for the conditional nature of strategic cognition as suggested by theory.

LITERATURE REVIEW

The theoretical justification for this study is firmly anchored in the cognitive perspective of strategic management. As advanced by Feinnudin and Wahono (2025), strategic decisions are not purely rational but are fundamentally filtered through a decision-maker's cognitive frames and mental maps, making the firm's strategic choices essentially a reconfiguration of its epistemic knowledge network. This view is expounded by Zonca et al. (2025), who theorize the interaction between endogenous cognitive abilities (e.g., strategic sophistication, cognitive reflection) and the exogenous strategic environment in shaping how knowledge configurations are learned and reshaped. They imply that the effectiveness of a cognitive mechanism like planning is contingent upon both internal capacities and external pressures.

Providing the central integrative concept for the study, Nurgaleeva (2015) defines cognitive integration as "the processes of reproduction of knowledge," a dynamic process through which discrete knowledge domains are synthesized into a coherent mental model capable of guiding action. An entrepreneurs' training (knowledge) domain thus acts a precursor in strategic choices by facilitating cognitive mapping of institutional and policy landscapes to shape the type of strategic action choices to be made. These mental maps organize how actors understand external pressures, organizational strengths, and potential strategic pathways forward (Feinnudin & Wahono, 2025). Nonetheless, this mapping does not occur in isolation but rather influenced by organizational management orientations such proactive planning vs reactive coping. Thus, formal

planning is theorized here as a deliberate engine of this cognitive integration process and linkage between processes and strategic choice pathways.

Empirical literature, reveals significant gaps that this study is positioned to address. While foundational studies affirm the real-world impact of cognition on strategic coherence (Feinnudin & Wahono, 2025) and delineate micro-mechanisms of how cognitive structures change through learned procedures (Zonca et al., 2025), they leave critical questions unanswered. First, as noted in reviews by Narayanan et al. (2011), there is a scarcity of empirical research that explicitly models and measures cognitive “knowledge configurations” as integrated network structures, particularly the specific architecture of ties linking formal knowledge inputs to strategic action templates.

Second, much of the existing research, including the controlled laboratory experiments of Zonca et al. (2025) and the conceptual model of Nurgaleeva (2015), examines cognitive structures in abstract or static settings. This creates a gap in understanding how these structures dynamically form and function under varying, real-world contextual conditions such as differing levels of business maturity and environmental pressures severity. Third, a methodological gap persists; prior work often relies on self-reported surveys (e.g., Almulla & Al-Rahmi, 2023) or isolated lab tasks, lacking analytical techniques capable of capturing and quantifying the ordered, relational structure of an entrepreneur’s conceptual landscape as it naturally occurs in discourse about strategy and planning (Dunlosky et al., 2013).

This study is specifically designed to bridge these three interconnected gaps. By integrating the theoretical lens of cognitive integration with the novel methodological application of Ordered Network Analysis (ONA) to naturalistic data from MSMEs, it directly tackles the empirical and methodological shortcomings. Building on the premise that proactive planning signifies a fundamental cognitive reconfiguration (Feinnudin & Wahono, 2025; Nurgaleeva, 2015) shaped by contextual factors (Zonca et al., 2025), the study investigates the specific structural outcome of this process. It posits that formal planning acts as a disciplining mechanism that actively strengthens and orders the conceptual ties between acquired knowledge (training) and deployed action.

The ONA methodology moves beyond conceptual models and self-reports to quantify and compare the actual network structures of planners versus non-planners, thereby operationalizing the theoretical construct of "cognitive integration" into a testable model of network cohesion. Consequently, this study justifies its contribution by providing a contextualized, structural examination of how planned cognition under specific conditions of business maturity and external pressure organizes entrepreneurial thinking into a more integrated and presumably more adaptive strategic framework, thereby advancing theories of organizational cognition and strategic adaptation.

METHODOLOGY

This study adopts Ordered Network Analysis (ONA) as the primary analytical tool. ONA is a modelling technique extending theoretical and analytical advantages of Epistemic Network Analysis (ENA) to account for the order and importance of events by producing directed weighted networks rather than undirected models (Tan et al., 2023). Like Epistemic Network Analysis (ENA), ONA takes coded data as input, identifies and measures connections among items, and visualizes the structure of connections in a metric space that enables both statistical and visual comparison of networks (Shaffer et al., 2016; Shaffer & Ruis, 2017; Shaffer, 2017).

ONA provides a novel methodological approach for examining relationships by modeling directed connections in sequential data while accounting for temporal dependencies (Tan et al., 2023). This methodological approach is appropriate when modeling processes in ill-formed problem-solving scenarios, where collaborative interactions do not follow a prescribed sequence of steps but where the order of activities is still important. ONA models the connections among Codes by quantifying the co-occurrence of Codes within conversations (unit of analysis), producing a directed weighted network of co-occurrences, along with associated visualizations for each unit of analysis in the data (Bowman et al., 2021; Tan et al., 2023).

In this study, ONA was employed to model directed co-occurrences among six codes. Three training domains (business management, market analysis, value addition) and three strategic adaptation domains (financial buffering, market adaptation, Logistics Innovation). The original dataset comprised 198 lines of coded dialog from 198 MSMEs in Machakos County-Kenya, which were aggregated into higher-level *units of analysis*, defined by the intersecting factors of proactive planning (Planner vs. Non-Planner), business Maturity Level (Emerging, Intermediate, Mature), and level of severity of business environmental pressures (Low, Moderate, High).

The analysis aggregated data from nine individual units, comprising five planners and four non-planners for statistical comparison. For each participant, coded responses were compiled across nine distinct scenario contexts, which represented all combinations of three maturity levels (Emerging, Intermediate, Mature) and three severity levels (Low, Moderate, High). Within each of these scenario-based context windows (conversations/stanza), the presence or absence of code co-occurrences was identified. These data were then transformed into a directed network model per unit, using a binary summation process, resulting in one comprehensive network model for each individual planner or non-planner (unit- Primary object of comparison that gets one network point) that represented their aggregated responses.

Table 1: Data Structure

<i>Unit</i>	<i>Context/ Conversation (Scenario)</i>	<i>Maturity</i>	<i>Severity</i>	<i>Codes</i>					
				<i>Train_Biz Mgt</i>	<i>Train_Mar ket</i>	<i>Train_Valu eAdd</i>	<i>SA_FinBuff</i>	<i>SA_Markt_ Adapt</i>	<i>SA_LogInv</i>
<i>Planner</i>	Conv1	Emerging	Low	-	-	-	-	-	-
	Conv2		Moderate	-	-	-	-	-	-
	Conv3		High	-	-	-	-	-	-
	Conv4	Intermediate	Low	-	-	-	-	-	-
	Conv5		Moderate	-	-	-	-	-	-
	Conv6		High	-	-	-	-	-	-
	Conv7	Mature	Low	-	-	-	-	-	-
	Conv8		Moderate	-	-	-	-	-	-
	Conv9		High	-	-	-	-	-	-
<i>Non-planner</i>	Conv1	Emerging	Low	-	-	-	-	-	-
	Conv2		Moderate	-	-	-	-	-	-
	Conv3		High	-	-	-	-	-	-
	Conv4	Intermediate	Low	-	-	-	-	-	-
	Conv5		Moderate	-	-	-	-	-	-
	Conv6		High	-	-	-	-	-	-
	Conv7	Mature	Low	-	-	-	-	-	-
	Conv8		Moderate	-	-	-	-	-	-
	Conv9		High	-	-	-	-	-	-

To address variability in data quantity across units, networks were normalized by unit size before dimensional reduction. A singular value decomposition (SVD) was then applied to project each unit's high-dimensional network into a two-dimensional metric space, resulting in coordinate positions along the Mean Rotation 1 (MR1) and Singular Value Decomposition 2 (SVD2) dimensions.

Mean Rotation and Singular Value Decomposition are among the mathematical techniques ENA uses to reduce the many dimensions of co-occurrence data into a few key dimensions that capture most of the structural variation. The first two principal dimensions are, MR1 (Mean Rotation 1)-X-axis showing the most significant differences in network structure (primary latent dimension); and SVD2, which is usually the Y-axis, showing the secondary (residual) dimension. To ensure interpretability, an optimization routine minimized the difference between each unit's plotted point and its corresponding network centroid, thereby co-registering the statistical projection with the visualized network structure. Given the small and unequal group sizes ($n_1 = 5$, $n_2 = 4$), Mann-Whitney U tests were conducted to compare the distributions of unit positions between Planners and Non-Planners separately for the MR1 & SVD2 dimensions with the effect sizes being calculated as, r .

FINDINGS

In this study, we applied ordered network analysis (Tan et al., 2023) to our data using the ONA Web Tool (version 1.7.0) (Marquart, et al., 2018). We defined the units of analysis as all lines of

data associated with a single value of proactive plan adoption sub-setted by business maturity level and severity of business environmental pressures. For example, one unit consisted of all the lines associated with maturity level (Emerging) and severity level (low) within a given unit of analysis. A moving stanza window of four lines was used, to capture a local, meaningful segment of dialogue, allowing for the identification of directed co-occurrences between codes that are proximally related within the conversational flow (Tan et al., 2023). This length was sufficient in modeling immediate cognitive associations between knowledge (training) inputs and coping strategies, while remaining robust against spurious connections from distant parts of the conversation.

Descriptive Results

Descriptive statistics for the projected network positions are presented in Table 2. The results of the organizational network analysis (ONA) indicate a significant epistemic divergence in the structural positions of entrepreneurs based on their planning orientation. Descriptive statistics for projected network scores reveal that Planners and Non-Planners are systematically separated along the primary latent dimension towards planning (proactive vs reactive approaches), learning and strategic response (MR1-Xaxis). Planners exhibited positive mean ($M = 0.31$, $SD = 0.15$) and median (0.29) scores, whereas Non-Planners exhibited negative mean ($M = -0.39$, $SD = 0.15$) and median (-0.39) scores, with no overlap in their distributions. This consistent pattern suggests that the MR1 (primary latent) dimension functions as a key structural differentiator, effectively partitioning the network into two distinct epistemic communities.

In contrast, scores on the secondary orthogonal dimension (secondary/residual) - (SVD2-Y-axis) were distributed around zero for both Planners ($M = 0.00$, $SD = 0.56$) and Non-Planners ($M = 0.00$, $SD = 0.37$), with considerable overlap in their medians (0.21 and 0.08, respectively). This indicates that both groups occupy comparable positions on this secondary network feature (undefined commonality or a secondary behavioral pattern), which is unrelated to the primary planning-based divide.

Table 2: Descriptive Statistics for ONA Projected Scores by Entrepreneurial Planning Status

<i>Dimension</i>	<i>Group</i>	<i>n</i>	<i>Mean</i>	<i>SD</i>	<i>Median</i>
MR1	Planners	5	0.31	0.15	0.29
	Non-Planners	4	-0.39	0.15	-0.39
SVD2	Planners	5	0.00	0.56	0.21
	Non-Planners	4	0.00	0.37	0.08

Inferential Results

Statistical Comparisons

Mann-Whitney U test confirmed a statistically significant difference between groups on the MR1 dimension, $U = 0$, $p = .02$, with a large effect size ($r = 1.00$) at alpha level = 0.05. This indicates a near-complete separation of the groups, with Planner units scoring higher than Non-Planner units. In contrast, the test for the SVD2 dimension showed no significant difference, $U = 10.00$, $p = 1.00$, with a null effect size ($r = 0.00$) at alpha level 0.05.

Table 3: Non-Parametric Test Results for Network Position Differences

Dimension	U	p	Effect Size (r)
MR1	0	.02*	1.00
SVD2	10.00	1.00	0.00

Note. $p < .05$

Collectively, these findings imply that planning behavior is embedded within the network's epistemic architecture. The clear separation along MR1 suggests that knowledge and practices, associated with formal planning are likely to circulate within a structurally distinct subgroup, potentially creating a barrier for the diffusion of planning-related epistemic content to the Non-Planner cohort. Consequently, network-informed interventions aimed at spreading planning-oriented knowledge or practices should consider this structural segregation. Strategies may require targeting influential actors within each subgroup separately, rather than relying on bridging ties that may be sparse or absent due to the observed positional divergence.

Network Visualization

The comparative analysis of network structures (Figure 1) reveals meaningful differences in how Planners and Non-Planners conceptually integrate training domains with response strategies. Visual inspection of networks revealed that planners exhibited stronger directed connections between training domains and specific strategic actions. The Planners' network exhibits organized, hub-and-spoke clusters where core strategic adaptations are explicitly linked to relevant training domains. This suggests that proactive formal planning facilitates directed and actionable cognitive frameworks, where specific training domains informs corresponding adaptive strategies employed.

In contrast, the non-Planners' network appears diffused (fragmented) and loosely structured, with codes presented without clear directional ties, indicating that in the absence of planning, entrepreneurs may treat training and strategic choices in isolation, limiting applied integration.

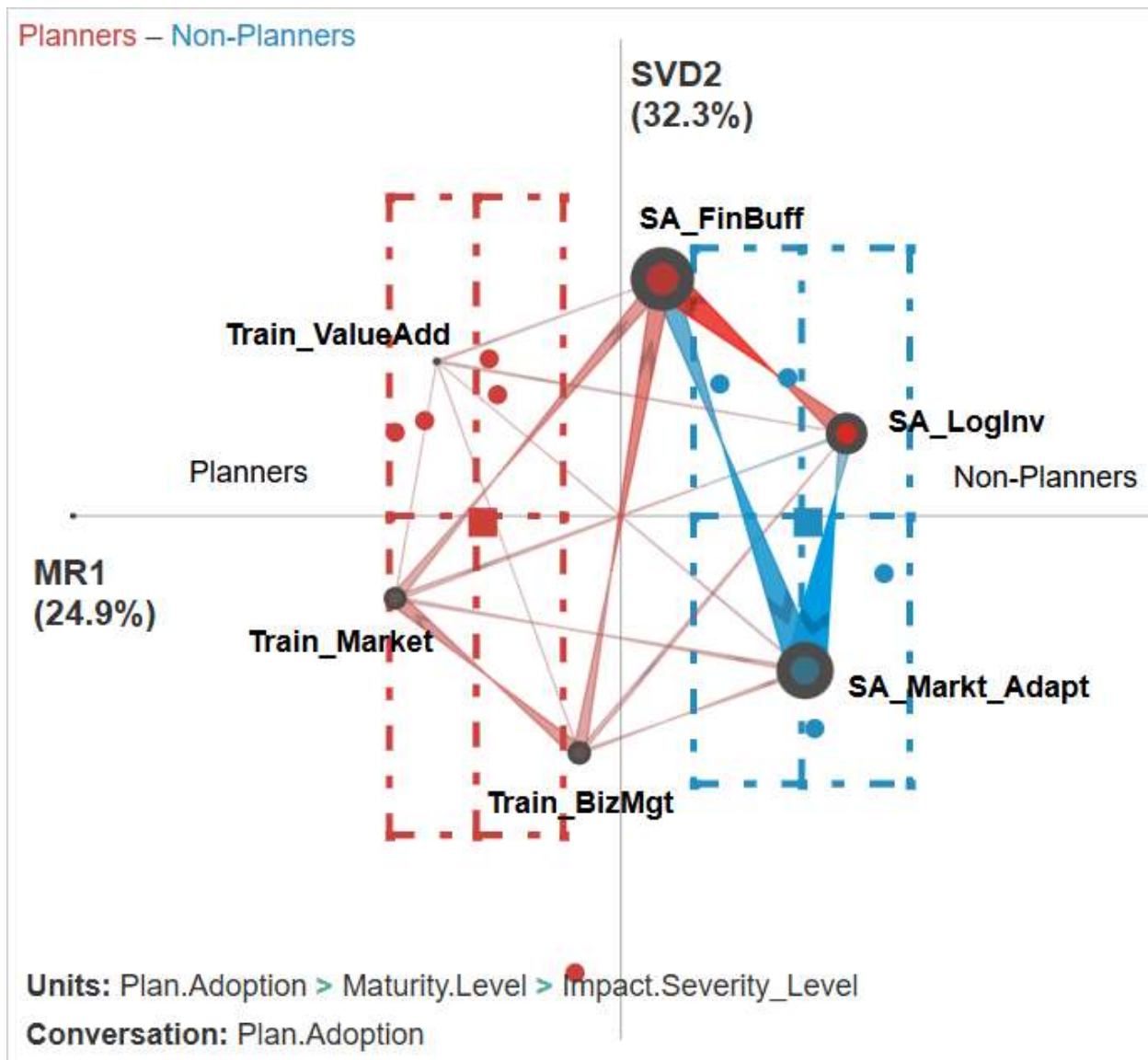


Figure 1: Combined Comparison Model

Figure 2 (Planners' network) depicted a structured network in which training domains are hierarchically and functionally linked to strategic business actions. Relationships within the network are conceptualized as *learning pathways*, where specific training inputs enable corresponding strategic adaptive outcomes. Each connection represents a direct, purposeful linkage, implying that competencies built through training are operationalized into applied strategic business capacities.

The network is organized around a central strategic outcome, *financial buffering*, suggesting it is perceived as a critical enabler in addressing environmental pressures and is supported by multiple other domains. This node is supported by multiple precursors, including both training domains (*Market intelligence*, *Business management*) and intermediate adaptive strategies (*Logistical innovation*, *Market adaptation*). Such multiplicity of inbound connections indicates that

institutionalization of financial buffering strategy is not the product of a single training intervention, but rather an integrated outcome dependent on several interconnected competencies.

Training on Value Addition occupies a foundational role, influencing the network through multiple nodes. It connects directly to *logistical Innovation*, *Market adaptation*, *financial buffering*, *training on market intelligence* and *training on business management*. This positioning suggests that value addition training provides cross-functional fundamentals that enable more specialized market, business management, and strategic skills. Meanwhile, *Training on market intelligence* directly supports both *market adaptation* and *financial buffering*, indicating that market-oriented training contributes simultaneously to specific market adaptive tactics and broader adoption of *financial buffering* behaviour.

Notably, two coping strategies (*Logistical innovation and market adaptation*) serve as mediating variables. They are outcomes of their respective training inputs but also act as secondary supports for adoption of *financial buffering* strategies. This mediation suggests a two-tiered process. First, training produces specific strategic skills (e.g., logistical innovation, market adaptation). Second, these skills collectively enhance higher-order for the desired financial buffering capacity.

Planners

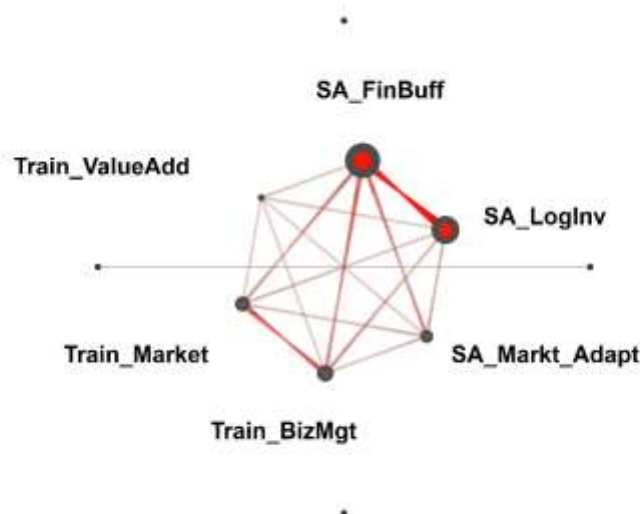


Figure 2: Planners Network

In all, the planners network shows a competency-based model with a coherent capacity-building sequence in which connections are strong, sequential (from training to coping), and cumulative, reflecting a capacity-building pathway from learning to adaptive action. The strength of these relationships is evidenced by the direct and explicit linkages, with no coping node existing in isolation from a training precursor. Thus, the structure reinforces the layered, interdependent competencies building with each training domain contributing uniquely to an integrated adaptive system. That is, training domains build specific capabilities; Adaptive strategies emerge from and are reinforced by these trainings with the financial buffering acting as a central and convergent node, suggesting it is perceived as a critical, integrative capacity that is supported by multiple other training and intermediate adaptive domains.

Table 4: Summary Table of Planners Connections

Training / Coping Node	Connects To	Strength & Role
Train_ValueAdd	SA_LogInv, Train_Market, Train_BizMgt	Foundational, multi-path influence
SA_LogInv	SA_FinBuff	Mediating coping → financial buffering
Train_Market	SA_Markt_Adapt, SA_FinBuff	Direct market skills → adaptation + financial buffering
SA_Markt_Adapt	SA_FinBuff	Adaptive skill → financial resilience
Train_BizMgt	SA_FinBuff	Direct management training → financial coping
SA_FinBuff	(None as source; is ultimate outcome)	Central outcome node, dependent on all others

The centrality of the financial buffering node establishes it as the primary enabler of entrepreneurial resilience. Each inbound connection to financial buffering node can be interpreted as representing a distinct cognitive or practical mechanism that increases the likelihood of its adoption. First, training in business management leading to mastery of business management principles (e.g., business planning, customer care) enhances an entrepreneur's analytical capacity to diagnose financial vulnerability. This training transforms abstract financial risk into a concrete, manageable problem, thereby increasing the perceived necessity and legitimacy of establishing dedicated financial buffers as a core strategic priority.

Second, training on market intelligence cultivates an understanding of customer value, competitive positioning, and revenue generation. This knowledge directly elevates the perceived opportunity cost of financial instability. Entrepreneurs learn that reactive financial distress can undermine brand equity and market opportunities, thus motivating the proactive adoption of buffering to protect and enable growth initiatives. Third, training focused on value addition, enhancing products or services to increase their worth to customers shifts the entrepreneur's focus from competing on price to competing on differentiated value. This reorientation reframes financial health as a prerequisite for innovation and quality investment, not just cost management. The entrepreneur understands that sustaining value-adding activities (e.g., R&D, premium materials, superior service) requires stable capital to avoid corner-cutting under pressure. Therefore, financial buffering is adopted as the strategic reserve that protects and enables the value-creation process itself, ensuring that quality and innovation are not sacrificed

Fourth, the development of logistical innovation by optimizing operations, supply chains, and resource use creates a heightened awareness of systemic inefficiencies and their financial impact. This operational mindset makes the cost of waste and disruption salient, framing financial buffering not merely as savings, but as an essential investment in operational resilience and continuity. Finally, successfully adapting to market shifts reinforces the temporal connection between environmental uncertainty and financial preparedness. Entrepreneurs who learn to pivot based on market feedback internalize the lesson that liquidity and reserves are what make such adaptive agility possible, thereby institutionalizing buffering as a non-negotiable enabler of strategic flexibility.

Thus, the network depicts financial buffering as a synergistic outcome of an integrated competency framework. Its central position and multiple precursors indicate that for Planners, this strategy is institutionalized through a compound logic. It is simultaneously a rational conclusion drawn from training and resilience necessity learned through operational and adaptive experiences. This finding moves beyond correlation to propose a testable model where the adoption of critical coping strategies is mediated by the specific knowledge structures and applied competencies developed through a coherent learning pathway.

Figure 3 shows that non-Planners' network appears largely disconnected or loosely structured, with individual codes listed without clear directional ties. This suggests that in the absence of formal planning, entrepreneurs' cognition may be more fragmented and coping strategies are not strongly or systematically linked. The lack of visible edges implies that non-Planners view these concepts in isolation or without consistent sequential relationships, which may hinder the application of training to adaptive action.

In this network, connections between nodes are implied rather than explicitly mapped, and there is no clear central outcome node analogous to *financial buffering* in the Planners' model. All elements (Training in business management, training in marketing, training in value addition, logistical innovation, marketing adaptation and financial buffering) appear as isolated entities at the same structural level. This absence of visible linkages implies that, for non-planners, training inputs and coping outcomes may operate in silos rather than as part of an integrated system.

Non-Planners

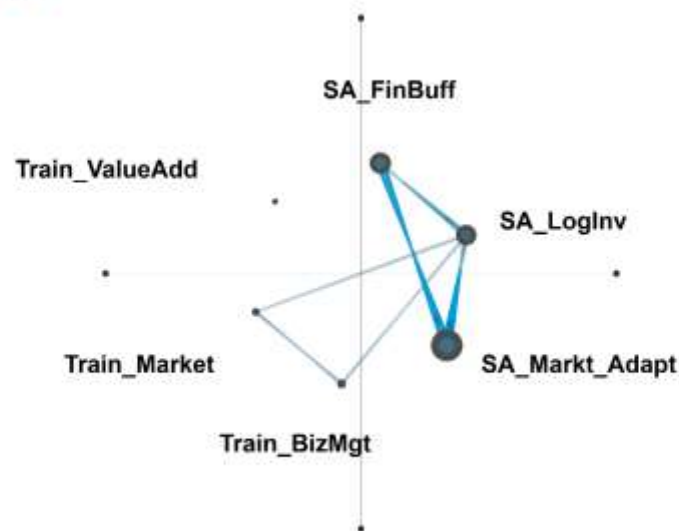


Figure 3: Non-Planners Network

In summary, the nature of connections in this network can be inferred as weak, indirect, or unstructured. Without clear pathways from training to adaptation, competencies may not be systematically translated into adaptive strategies. For instance, *Training on value addition* is not visually connected to any strategic action, suggesting that value addition knowledge may not be directly be effectively applied to adaptation practices in the absence of proactive formal planning. Similarly, *financial buffering* is not positioned as a convergent goal, indicating that *financial*

buffering may not be intentionally supported by the full suite of training and intermediate adaptation skills in the absence of formal plans.

Structurally, the lack of a central node and mediating relationships indicates that adaptation strategies among non-planners are likely reactive rather than strategic. Adaptation efforts may emerge in response to immediate pressures rather than as the result of coordinated capacity building. Consequently, the strength of connections between training and coping is diminished, implying that training interventions may have lower transfer value for non-planners compared to planners.

Table 5: Summary Table of Inferred Non-Planners Connections

Node	Inferred Connection Strength	Implied Role in Network
Train_ValueAdd	Weak / Unlinked	Isolated knowledge domain
SA_LogInv	Not visibly linked to training	Standalone reactive coping
Train_Market	Weak / Unlinked	Unapplied market training
SA_Markt_Adapt	Not visibly linked to training	Situational adaptation, not trained
Train_BizMgt	Weak / Unlinked	Disconnected management knowledge
SA_FinBuff	Not centralized	One of many coping outcomes, not a goal

Comparatively, when contrasted with the Planners' network, the non-Planner network reflects a lack of intentional design in competency development. The absence of clear linkages suggests that, for non-planners, training does not coherently build toward cumulative adaptive capacity, and adaptive strategies are not systematically reinforced by prior learning. This fragmented approach likely results in lower overall adaptive capacity, as competencies remain unintegrated and adaptive responses are not strategically aligned with training investments. In organizational contexts, this underscores the importance of not only providing training but also explicitly mapping its application to desired coping outcomes through planning, a step that appears missing in the non-planner paradigm.

Therefore, the role of proactive planning is to function as the integrative cognitive process that deliberately constructs and reinforces pathways between acquired knowledge and strategic action. It transforms isolated training inputs into a coherent, purpose-built competency architecture, enabling entrepreneurs to systematically convert learning into beneficial actions such as the central, well-supported strategy of financial buffering observed in the Planners' network. It is what transforms a collection of skills into a deliberate system for resilience.

For organizations, this implies that fostering resilience requires moving beyond the mere provision of training and having a supported framework on how to transition from learning to strategic action. It requires; (i) explicitly facilitating competency-pathway mapping by guiding individuals to visually connect specific training content to desired strategic outcomes, thereby building an integrated mental model of how knowledge is applied; (ii) intentionally designing interconnected curricula that embed planning exercises to scaffold the cognitive links between modules, ensuring that learning cumulatively builds toward integrated adaptive capacity, ensuring training investments culminate in a unified, actionable adaptive architecture.

Model Fit

Table 6 presents goodness-of-fit indices and variance estimates for the ONA model. The model fit, as indicated by co-registration correlations, was strong for the first (MR1) dimension (Pearson $r = .94$, Spearman $\rho = .82$) but weak for the second (SDV2) dimension (Pearson $r = .07$, Spearman $\rho = .07$).

Table 6: Model Fit Indices and Variance Estimates

	Pearson	Spearman	Variance
X Axis (MR1):	0.94	0.82	0.32
Y Axis (SDV2):	0.07	0.07	0.25

The strong goodness-of-fit for the MR1 dimension (e.g., Pearson $r = .94$, Spearman $\rho = .82$) indicates that the organizational network analysis (ONA) model accurately captured the underlying relational structure that cleanly separates Planners from Non-Planners. This confirms that the observed group differences along the MR1 axis, with Planners scoring positively and non-Planners negatively are well-explained by the modelled network pathways connecting training and coping variables. This implies that the latent construct of a “Proactive Planning vs. Reactive Coping” dimension is both empirically evident and theoretically well-represented by the specified model. The model has thus successfully mapped how training functionally link to adaptive outcomes.

Conversely, the weak fit for the SVD2 dimension (e.g., Pearson $r = .07$, Spearman $\rho = .07$) reinforce its role as a minor or residual factor. It suggests that while this secondary dimension captures some variance in the network (e.g., undefined differences or residual), it does not represent a coherent structural feature well-explained by the model. This would align with the descriptive finding that SVD2 does not differentiate between Planners and Non-Planners, further marginalizing its theoretical importance.

DISCUSSION

In response to research questions 1 and 2, the significant difference along the MR1 dimension indicates that formal planning is associated with significantly stronger and more direct conceptual linkages with both formal training domains and specific business adaptive actions. The large effect size ($r = 1.00$) suggests this is a substantial and meaningful difference in how planners cognitively integrate training and adaptive constructs. Furthermore, these findings directly support the third research objective, demonstrating that formal planning strengthens the conceptual ties between entrepreneurs’ training domains and specific adaptive strategies. The structured pathways observed in planners’ networks suggest that planning not only connects training to action but does so in a more purposeful and applicable sequence. The lack of significant difference along the SVD2 dimension suggests that certain structural or contextual aspects of conceptual networks are shared between planners and non-planners, possibly reflecting common entrepreneurial challenges or domain-general cognitive processes that are not influenced by planning alone.

The findings align with Ramirez (2024) suggestion that strategic cognitive development should become a formal component of leadership development plans. He underscores the role of planning in clarifying objectives and priorities to facilitate decision-making by ensuring that choices and practices align with overarching objectives. Similarly, while acknowledging that many organizations do not have a single, visible training plans characterized by multiplicity across divisions, target group, training types with budget that are often located centrally and locally, Hirsh

and Tamkin (2005) emphasize the need for organizations to align their plans and budgets for training and development activities with very clear business needs.

Secondly, the network analysis revealed that training domains are hierarchically and functionally linked to business coping strategies through structured learning pathways, where specific training inputs enable corresponding adaptive outcomes. For planners, each connection represents a direct, purposeful linkage, operationalizing competencies into applied coping strategies. This process follows a mediated, capacity-building sequence. The foundational training domains (e.g., business management, market intelligence, Value Addition) enables both direct and intermediate adaptive strategies. For instance, the foundational training domains have an indirect linkage to the ultimate adaptive strategy (financial buffering). These connections are mediated through intermediate adaptive strategies (Logistical Innovation, Market Adaptation), which in turn converge to support the central strategic outcome of financial buffering. Simultaneously, specialized training in Business Management and Market Intelligence provides direct cognitive and practical support for this ultimate strategic outcome. Thus, financial buffering emerges not from a single intervention, but as a synergistic product of an integrated competency framework, wherein planning constructs and reinforces the deliberate pathways from knowledge to action.

The finding that entrepreneurial adaptive capacity develops through layered, intertwined pathways is strongly echoed and substantiated by prior research on knowledge integration in complex organizational and network settings. The Kenney and Gudergan (2006) study establish that effective firm-level knowledge integration, which is a core adaptive capability, is not a linear output of a single structural input but a configurational outcome resulting from the specific combination of organizational form and combinative capabilities. This directly parallels the entrepreneurial process, where adaptive capacity emerges not directly from training but from the specific architecture of an entrepreneur's cognitive framework. Similarly, the socio-cognitive perspective of Digital Innovation Networks (DINs) by McCarthy et al. (2024) reveals that integrating distributed knowledge is a dynamic, non-linear process. This mirrors the entrepreneurial finding, as both contexts show that building capacity is a "heterogeneous" interplay of direct and mediated contributions, dependent on the social and cognitive status of actors within the system, rather than a predetermined, sequential plan.

This perspective is further reinforced by findings Ngo and Ngo (2025) on knowledge ecosystems, where anticipatory governance acts as a critical temporal orchestration mechanism, and where five distinct configurational pathways demonstrate equifinality challenging linear models and revealing multiple viable routes to achieving ecosystem resonance and transforming creative knowledge into value through a supportive digital culture. Together, these references substantiate that complex adaptive and innovative capacities, whether organizational, networked, or ecosystem-wide, develop through layered, mediated, and often equifinal sequences rather than direct, linear paths.

CONCLUSION

The study demonstrates that formal planning fundamentally reshapes entrepreneurial cognition by forging stronger, more direct, and deliberately sequenced conceptual links between training domains and business adaptive strategies. While planners and non-planners share some common structural network elements (e.g., reflecting universal entrepreneurial challenges), planners exhibit a distinct cognitive architecture characterized by purposeful integration.

Specifically, formal planning transforms abstract knowledge into a structured, actionable strategy through a mediated, capacity-building sequence. Foundational training enables intermediate adaptive strategies, which in turn converge to support ultimate strategic outcomes like financial buffering. This structured pathway signifies that planning does not merely create more connections, but constructs and reinforces a functional hierarchy where knowledge is operationalized into applied sequential resilience building.

Therefore, these findings confirm that planning strengthens the conceptual ties between learning and strategic action, providing a cognitive mechanism through which training translates into adaptive capacity. It also confirms that this transition (development of adaptive capacity) does not take a linear path but rather a layered sequency of intertwined (direct and mediated) pathways based on an entrepreneur's cognitive framework as facilitated by foundational training domains. The study advances theoretical understanding of entrepreneurial adaptability by highlighting the role of planning in developing a more integrated and applicable cognitive framework. It also validates Ordered Network Analysis (ONA) as a powerful method for modeling these complex, ordered conceptual relationships.

RECOMMENDATIONS

To cultivate resilience, entrepreneurial development should focus on building a planning-driven cognitive architecture, a structured mental model that functionally links knowledge to strategic action. Programs should be designed not just to impart knowledge, but to engineer the cognitive pathways that make knowledge applicable.

For Training Program Designers:

- i. Embed strategic planning as the core integrative skill: Position formal planning not as a separate topic, but as the central framework through which all other training is filtered and connected. Train entrepreneurs to use planning explicitly to map how specific skills (e.g., market intelligence) lead to specific actions (e.g., market adaptation) and ultimately to strategic outcomes (e.g., financial buffering).
- ii. Design training for cognitive integration, not just knowledge delivery: Structure training curriculum and activities to deliberately create and reinforce conceptual linkages. Use case studies, simulations, and mapping exercises that require participants to articulate and diagram the connections between training inputs, potential coping actions, and business goals.
- iii. Adopt a "coping-backwards" curriculum design: Identify the critical business coping strategies and resilience outcomes (e.g., financial buffering, logistical innovation) relevant to the target entrepreneurs. Then, explicitly design training modules to build the specific competencies (e.g., value addition, business management) that feed into those strategies via structured, planner-like pathways.

For Entrepreneurs & Practitioners:

- i. Formalize planning to operationalize training inputs: After any training engagement, conduct a structured planning session to explicitly document how the new knowledge connects to specific, anticipated business challenges and actionable coping strategies. This practice solidifies cognitive links and enhances the applied return on training investment.

- ii. Audit your cognitive network: Periodically use a simplified self-assessment to map your own understanding of how your skills relate to your business actions and goals. Identify and strengthen weak or missing links in your own strategic thinking.

Theoretical Implications

These findings align with theoretical perspectives positing that formal planning facilitates cognitive integration and strategic alignment (Shaffer & Ruis, 2017). The ordered and directed nature of connections in planners' networks supports the view that planning creates structured cognitive pathways that enhance the applicability of training to real-world coping scenarios. This is particularly relevant in entrepreneurial contexts, where adaptive response is critical.

The ONA methodology proved especially valuable for capturing these ordered and directed relationships, extending beyond the capabilities of traditional undirected network analysis (Tan et al., 2023). By modelling sequence and direction, ONA allowed for the examination of hypothesized causal and associative pathways from training domains to coping actions, offering a more subtle view of how planning shapes entrepreneurial cognition.

REFERENCES

- Almulla, M. A., & Al-Rahmi, W. M. (2023). Integrated social cognitive theory with learning input factors: The effects of problem-solving skills and critical thinking skills on learning performance sustainability. *Sustainability*, 15(5), Article 3978. <https://doi.org/10.3390/su15053978>
- Alsayah, A. (2022). Strategic alignment and its impact on creating an organization's reputation and image. *Problems and Perspectives in Management*, 20(1), 501–513. [https://doi.org/10.21511/ppm.20\(1\).2022.40](https://doi.org/10.21511/ppm.20(1).2022.40)
- Bowman, D., Swiecki, Z., Cai, Z., Wang, Y., Eagan, B., Linderoth, J., & Shaffer, D. W. (2021). The mathematical foundations of epistemic network analysis. In A. R. Ruis & S. B. Lee (Eds.), *Advances in quantitative ethnography* (pp. 91–105). Springer.
- Dunlosky, J., Rawson, K. A., Marsh, E. J., Nathan, M. J., & Willingham, D. T. (2013). Improving students' learning with effective learning techniques: Promising directions from cognitive and educational psychology. *Psychological Science in the Public Interest*, 14(1), 4–58. <https://doi.org/10.1177/1529100612453266>
- Fan, Y., Tan, Y., Raković, M., Wang, Y., Cai, Z., Shaffer, D. W., & Gašević, D. (2023). Dissecting learning tactics in MOOCs using ordered network analysis. *Journal of Computer Assisted Learning*, 39(1), 154–166.
- Feinnudin, A., & Wahono, P. (2025). Cognition-based strategy model: A cognitive approach to organizational strategy formulation and implementation. *Jurnal Informatika Ekonomi Bisnis*, 7(2), 328–333.
- Gede, U. D., & Huluka, T. A. (2023). The impact of strategic alignment on organizational performance: The case of Ethiopian universities. *Cogent Business & Management*, 10(2), Article 2247873. <https://doi.org/10.1080/23311975.2023.2247873>

- Ghonim, M. A., Khashaba, N. M., Al-Najaar, H. M., & Khashan, M. A. (2020). Strategic alignment and its impact on decision effectiveness: A comprehensive model. *International Journal of Emerging Markets*. <https://doi.org/10.1108/IJOEM-04-2020-0364>
- Hirsh, W., & Tamkin, P. (2005). *Planning training for your business*. Institute for Employment Studies.
- Ignacio, J., Chen, H.-C., & Roy, T. (2022). Advantages and challenges of fostering cognitive integration through virtual collaborative learning: A qualitative study. *BMC Nursing*, 21, Article 251. <https://doi.org/10.1186/s12912-022-01026-6>
- Marquart, C. L., Hinojosa, C., Swiecki, Z., Eagan, B., & Shaffer, D. W. (2021). *Epistemic network analysis* (Version 1.7.0) [Computer software]. <http://app.epistemicnetwork.org>
- Narayanan, V. K., Zane, L. J., & Kemmerer, B. (2011). The cognitive perspective in strategy: An integrative review. *Journal of Management*, 37(1), 305–351. <https://doi.org/10.1177/0149206310383986>
- Nurgaleeva, L. (2015). Cognitive integration as the dynamic aspect of modern educational practices. *Procedia - Social and Behavioral Sciences*, 166, 446–450. <https://doi.org/10.1016/j.sbspro.2014.12.551>
- Ramirez, G. C. J. (2024). The power of planning: How business plans drive effective management strategies. *Integrated Journal of Science and Technology*, 1(3).
- Shaffer, D. W. (2017). *Quantitative ethnography*. Cathcart Press.
- Shaffer, D. W., & Ruis, A. R. (2017). Epistemic network analysis: A worked example of theory-based learning analytics. In C. Lang, G. Siemens, A. F. Wise, & D. Gašević (Eds.), *Handbook of learning analytics* (pp. 175–187). Society for Learning Analytics Research.
- Shaffer, D. W., Collier, W., & Ruis, A. R. (2016). A tutorial on epistemic network analysis: Analyzing the structure of connections in cognitive, social, and interaction data. *Journal of Learning Analytics*, 3(3), 9–45.
- Tan, Y., Ruis, A. R., Marquart, C., Cai, Z., Knowles, M. A., & Shaffer, D. W. (2023). Ordered network analysis. In C. Damşa & A. Barany (Eds.), *Advances in quantitative ethnography* (pp. 112–126). Springer.
- Vayyavur, R. (2020). Strategic business alignment as the key to organizational efficiency and long-term success. *International Journal of Science and Research*, 9(1), 1963–1967. <https://doi.org/10.21275/SR24820064157>
- Zhao, L., Tan, Y., Gašević, D., Shaffer, D. W., Yan, L., Alfredo, R., & Martinez-Maldonado, R. (2023). Analysing verbal communication in embodied team learning using multimodal data and ordered network analysis. In *Artificial intelligence in education* (pp. 242–254). Springer.
- Zonca, J., Del Mauro, L., Rustichini, A., Polonio, L., & Reverberi, C. (2025). Learning in interactive decision-making: The interplay between cognitive abilities and the strategic environment. *Open Mind*, 9, 210–239. https://doi.org/10.1162/opmi_a_00186