

Exploring Depth versus Breadth in Knowledge Management Strategies

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Assuming that employees represent scarce knowledge resources, how should firms organize project teams for maximum efficiency and effectiveness? Should managers focus on hiring and developing niche experts or well-rounded generalists? In this study, we examine the composition of knowledge in product development teams, focusing on breadth of knowledge (teams composed of generalists) versus depth of knowledge (teams composed of specialists). The setting for our study is a simulated product development environment where teams pursuing different knowledge management strategies design products to meet market demand. The primary theoretical foundations for our product team strategies are found in Grant's efficient integration of specialist knowledge (Grant, 1996) and Nonaka's redundant, cross-learning approach (Nonaka, 1990).

Perspectives on knowledge management are often categorized as either Eastern or Western. The former focuses on tacit knowledge and knowledge creation, while the latter emphasizes explicit knowledge and knowledge transfer. Our aim is to highlight several differences in these two perspectives by focusing on division of labor as presented in Grant (1996), Nonaka (1990), and Nonaka and Takeuchi (1995). With significant overlapping across functional areas, the Eastern view emphasizes breadth of knowledge and skills, while the Western model places greater attention on a strong division of labor with depth of knowledge in specialized areas.

Model Overview

Our goal is to determine which project team strategy (breadth of knowledge or depth of knowledge) performs optimally under varying degrees of market turbulence (see Figure). We present two knowledge management strategies: (1) a collection of specialists who each focus on different product dimensions, and (2) a collection of generalists with broader knowledge regarding all product dimensions. We also test several different approaches to within-team learning, a property of the generalist team strategy. Market turbulence represents the degree of market uncertainty associated with individual product components. Performance will be determined by measuring the degree to which the product designs match with market desires. The length of each product development is 100 time intervals, and we simulate the development of 50 products. This simulation program has been written in Visual Basic.

Model Dimensions

Product Type. In our simulation, the product is represented by a one-dimensional array composed of four elements, with each element representing one component in the overall product. The product architecture is modular with components separated by standard interfaces.

Market Turbulence. The turbulence dimension emphasizes the linkage between market demands and attributes of the development team's product. We operationalize turbulence as the probability that market desires for product components will change during product development.

Knowledge and Learning. Our study focuses on learning by team members, both from the environment directly and about the environment through other team members. The probability of learning what the market desires represents how knowledgeable a team member is in a particular component area. This rate of learning from the environment is fixed.

A fundamental assumption in our model is that knowledge resources are limited, and that a trade-off exists between breadth and depth of knowledge in product development team strategies. As such, each product development team is allocated an equal amount of knowledge, where knowledge is operationalized as the probability of correctly assessing what the market desires in a new product. Under both strategies, project team members are more knowledgeable in one component area, with each team member's knowledge concentrated in a different component area. Under the generalist strategy, knowledge is allocated more evenly across team members. In the specialist model, each team member is very knowledgeable about market desires in one component area¹ but possesses little knowledge about the other dimensions of the product². In the generalist model, each team member possesses a breadth of knowledge about market desires for all product components³ with slightly greater knowledge regarding his or her focal component area⁴. The team's product design is a compilation of what each component leader, representing the team member with decision authority for each component area, believes that the market desires for that particular component.

In the generalist model, in addition to learning directly from the environment, team members seek to learn about market desires from their fellow team members. When a component leader does not know what the market desires for the component, he or she will try to learn from other team members. Since the process of learning within teams is not well-defined, we offer three possible decision-making heuristics that guide component leaders in determining which team members to learn from: (1) the averaging rule, (2) the majority rule, and (3) the "hot hand" rule. The first rule, the averaging rule, is based on lab experiments of information sharing within groups (Gigone and Hastie, 1993). The researchers found that team members tend to either implicitly or explicitly average individual judgments into an overall team judgment. Using the second heuristic, the majority rule, a component leader will learn from his or her team members only when a majority of them hold the same belief about what the market desires for the component. Our third heuristic is the "hot hand" rule.⁵ Under this scenario, the component leader learns from the team member with the "hot hand." This rule is operationalized by the component leader comparing team member beliefs in the previous time period against market desires. The component leader will then adopt the current beliefs, in terms of the focal component, of the team member who has been correct most recently.

Performance. Performance is the degree to which the product design meets the desires of the market, and we define it by the number of product attributes for each team's product that match the attributes favored by the market.

Theory and Hypotheses

Our theoretical foundation is one of contingency theory. We hypothesize that the performance of each product development team is contingent upon market turbulence. Nonaka and Takeuchi (1995) highlight requisite variety, matching project team diversity with the environmental diversity, as an enabling condition for organizational knowledge creation. Further they suggest that information redundancy among team members is an advantage under conditions of unexpected environmental fluctuations (Nonaka and Takeuchi, 1995: 83).

¹ 0.6 probability of learning what the market desires for component

² 0.1 probability of learning what the market desires for remaining components

³ 0.2 probability of learning what the market desires for three of the components

⁴ 0.3 probability of learning what the market desires for component

⁵ In basketball, the player with the "hot hand" is the one who is currently converting a high percentage of his or her scoring attempts into points.

Therefore we expect the generalist team to perform better than the specialist team under conditions of high market turbulence.

Conversely, in environments with low market turbulence, we would expect specialist team members to perform better by utilizing their deep knowledge about a particular component area to solve relatively-certain problems.

H_{1A}: At high levels of market turbulence, products developed by the generalist team will outperform those developed by the specialist team.

H_{1B}: At low levels of market turbulence, products developed by the specialist team will outperform those developed by the generalist team.

Next we would like to compare the performance of the generalist team operating under the three decision heuristics: (1) the averaging rule, (2) the majority rule, and (3) the "hot hand" rule.⁶ Under the "hot hand" rule, an uncertain component leader seeks market knowledge from the team member who was correct during the last time period. Therefore, we would expect the "hot hand" rule to outperform the averaging and majority rules in conditions of low environmental turbulence, since market desires change infrequently. However, under conditions of high turbulence, the "hot hand" rule may not be the most effective. Under the majority rule, component leaders adopt team member beliefs only when there is some consensus as to a correct answer. Otherwise component leaders decide based on their own beliefs. Therefore we speculate that, with high turbulence, the majority rule will outperform the other rules.

H_{2A}: Under conditions of low turbulence, the "hot hand" rule will outperform the other rules.

H_{2B}: Under conditions of high turbulence, the majority rule will outperform the other rules.

Test of Hypotheses. We use a series of one-tailed t-tests to compare performance levels for the final product designs of each team and to compare generalist team performance under the three different learning heuristics.

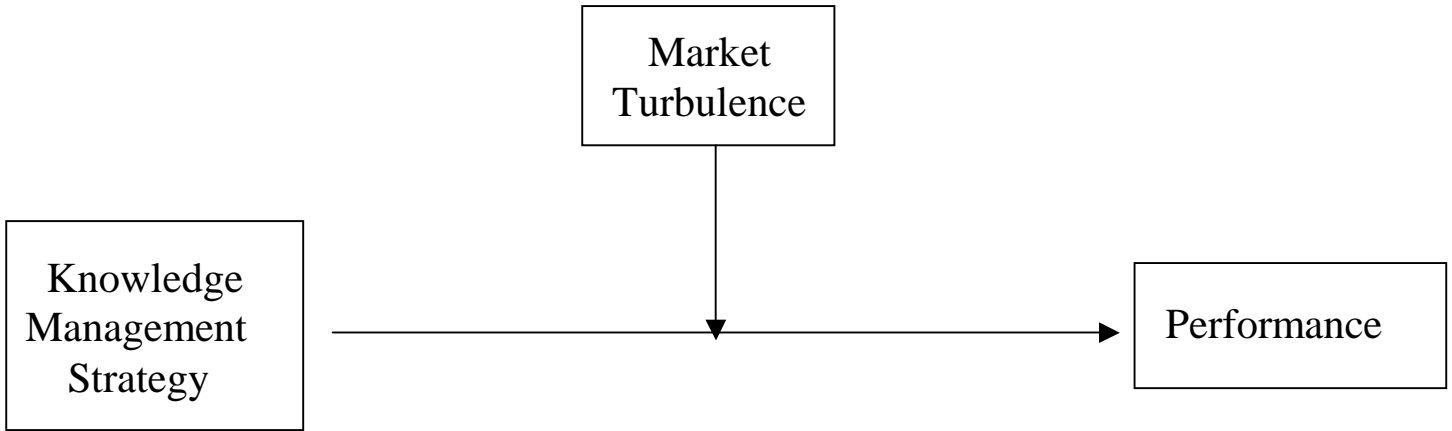
Preliminary Results. We find that the specialist team outperforms the generalist team under conditions of low and high turbulence (rejecting H_{1A} and supporting H_{1B}). However, with high turbulence, the performance difference between the specialist team and the generalist team, using the "hot hand" decision rule, is not statistically significant. Next, we compare the performance of the within-team learning rules for the generalist team. We find that the "hot hand" rule outperforms the averaging and majority rules under conditions of low and high turbulence (supporting H_{2A} and rejecting H_{2B}). Surprisingly, we find that within-team learning can be beneficial or detrimental depending on the heuristic in use.

Conclusion

According to the knowledge-based view of the firm, knowledge is the instrumental factor in determining organizational performance. While the importance of knowledge is seldom questioned, the difficulty in finding "where the rubber meets the road" restricts the utility of the knowledge-based view. In this paper, we hope to provide a piece of the puzzle by exploring how knowledge is managed within the context of product development teams.

⁶ Recall that cross-member learning is not a feature of the specialist knowledge strategy.

Figure



References

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