

The impact of the knowledge base on the performance of agents and organizations:

academic track

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Extended abstract

We study the knowledge-creating process in a company using a model of distributed, self-adapting (learning) agents. Starting without any knowledge, the agents (a marketing and a production agent) observe a limited number of prototypes in each period and use this data to learn real-world relationships between production processes, (technical) product features and product attractiveness. The agents then use their knowledge about the environment for new product development decisions. The agents consist of several neural networks modeling the process of learning by experience and can be seen as a model of long-time learning exhibited by humans.

We analyze the agents' and the organizations ability to learn and the factors that influence their learning behavior.

Defining the agents' knowledge as their generalization ability (measured as the deviation between their estimates (about production costs and product attractiveness) and the real-world outcomes, we hypothesize the knowledge to depend on the knowledge base (prototype database) as well as on the area of knowledge (the new product decision).

To study the effects arising from the knowledge base, different prototyping strategies are applied and analyzed using a computational simulation model. New prototypes differ from their predecessors in the number of changed production processes and in the degree of change measured in their distance from the previous prototype. In addition, the number of new prototypes available for further improving the knowledge available in each period is varied.

To analyze the impact of the area of knowledge, different methodologies for the generation of new product concepts are considered.

We use two guided search procedures and compare them to a trial-and-error based search for new products. The guided methods are either a hierarchical search where the marketing agent searches for new products and passes the requirements on to the production agent or they are team-based. Team-based methods use either the House of Quality, a wide-spread quality function deployment technique, where new product development simultaneously endeavors to find attractive and cost-effective variants, or a trial-and-error search.

Both the knowledge base and the search procedure prove to have a significant impact on the agents' generalization ability.

Several managerial implications can be derived.

First, a higher number of prototypes can significantly improve the organizations knowledge. However, as the building of prototypes is costly and time-intensive, management should carefully consider a higher variance in prototypes through experimentation, even if the prototypes are not close to the existing products.

Secondly, if methods like the House of Quality are applied, one should be aware that such a method can propose good products in terms of expected profit but may ignore the agents' actual level of knowledge. In the case of the House of Quality we, therefore, suggest a further enlargement of the product and marketing databases supported, e.g., via CRM applications.

Third, allowing for a small error - which is analogous to accepting a small percentage of worse solutions - increases new product success as it permits to avoid local minima.