

## Integrated Fuzzy PROMETHEE and Fuzzy Linear Program for Functions Evaluation in Convergent Products: Case for Digital Products

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### Abstract

**Background/objectives:** Recently, convergent products are introduced in digital products. Fast assembly and new product development and dynamic product configuration are all considered in convergent product concept. The fast technology development and dynamic customer demands require a more efficient and flexible system for new product development. This paper proposes an integrated decision making model for convergent product evaluation under fuzzy environment.

**Methods/statistical analysis:** First the fuzzy decision matrix is formed and using fuzzy PROMETHEE the pairwise comparison is performed. Then, by fuzzy linear programming (FLP) the weights of the functions with respect to attributes pairwise matrices are obtained. Finally, the fuzzy output is transformed to crisp one employing fuzzy analytic hierarchy process (FAHP). The contribution are in developing a new fuzzy linear program, integrate it with PROMETHEE and using them in convergent product function evaluation.

**Findings:** The results are helpful in business plan and road map of businesses for obtaining competitive advantage and profit maximization. Some of the products are considered and customers' views are collected to form a new product converging the requirements asked by customer's altogether. The dynamic customer views make the system responsive to different convergent products.

**Application/improvements:** The applicability and the validity of the proposed method are evaluated in a case study. The case study is conducted in a pioneering digital online shopping company. The model is a decision aid for managers of the company to promote to a fast automation assembly system being able to provide product functions integrated to deliver customers' desired products.

### Keywords

Convergent product; fuzzy PROMETHEE; full fuzzy linear program

### Introduction and Literature Review

The paradigms of digital convergence place more emphasis on strategic gravity of convergent products that are formed by adding new functions to an existing base product, multiple functions are integrated together in one device to work better rather than they would be delivered separately. Representative examples of this shifting trend are the cases of Apple's iPhone and Microsoft's Xbox. Such convergent products have created new business opportunities for companies to gain or maintain a competitive edge, bringing about immense changes in a wide array of industries. Consequently, design of convergent product concepts (CPCs) has likewise become an integral part of business concerns. This is of particular importance in the recent business environments where markets shift rapidly, technologies proliferate unceasingly, thus making business life cycles ever shorter. The distinctive characteristics of convergent products, vis-à-vis other types of products, stem from functionality. The functionality has been considered to be the most crucial design basis, directly influencing the product cost, customer satisfaction, and companies' differentiation strategies. In this respect, although the analysis of CPCs has subsequently been extended to various perspectives on functionality so as to provide design implications,<sup>3</sup> a lacuna still remains in the literature as to systematic design of CPCs based on functionality. In particular, a trade-off that exists in functionality is an urgent issue that should be dealt with because many functions of CPCs may increase the possibility of meeting the customer needs, but at the same time could cause some problems such as increase of cost and complexity. It has been noted that methodological implications have rarely been discussed despite its importance to the overall process. Most firms have also been observed to use informal procedures and

qualitative methods which primarily hinge on human intuition and individual experience. Such methods (e.g. brainstorming and intuitive thinking) could be useful for gaining insights, but have become extremely time-consuming and labour-intensive as the complexity of convergent products mounts. Hence, researchers and industrial practitioners need the support of productive and well-organized information that can reduce uncertainty and risk in the concept design stage, and serves as a base for competence development.

### Conclusions

In this work a new integration between PROMETHEE and linear programming in fuzzy environment was proposed. The decision making problem is of convergent product. First the fuzzy decision matrix was formed and using fuzzy PROMETHEE the pairwise comparison was performed. Then, by fuzzy linear programming the weights of the functions and attributes pairwise matrices were obtained. Finally, the fuzzy output was transformed to crisp one employing fuzzy analytic hierarchy process. The applicability and the validity of the proposed method were tested in a case study

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