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Assessment of techno-entrepreneurship projects by using Analytical Hierarchy Process (AHP)

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ABSTRACT

Funding of techno-entrepreneurship projects has gained ground for the societies. Today, many governments support techno-entrepreneurship projects by using several policy tools such as incentives. Evaluating such projects is a very difficult task while a future perspective needs to be provided. In this paper, Analytical Hierarchy Process (AHP) has been used to determine to factors that should be used in evaluating the techno-entrepreneurship projects. AHP model was set up based on the experts' opinions. The model was tested with real data that contains attributes and outcomes (success/failure) of ten techno-entrepreneurship projects. Subsequently, projects were ranked. It has been seen that three already failed projects were ranked at the end of the list. Thus, the proposed AHP model was verified with these findings. We have seen that target marketing strategy in business technology markets is key to success. The proposed AHP framework in this study is expected to be useful to other societies as well.

1. Introduction

An entrepreneur is a person who at some point in time is self-employed, and who creates a completely new business [1]. In capitalist economies, entrepreneurs have played, and continue to play, a catalytic role in bringing technological innovations to market [2,3]. New jobs and new markets are created with values provided to the whole economy [4]. Therefore, entrepreneurship has been an important phenome of modern economies [5–7] and many economists claim that entrepreneurship is an important determinant of economic growth and development [8]. Nowadays, entrepreneurship has shifted to a new concept of "techno-entrepreneurship". Startups are predominantly stated as techno-entrepreneurship in official records [9]. Techno-entrepreneurship is broadly defined as the entrepreneurial and intrapreneurial activities of both existing and nascent companies operating in technology-intensive environments [10].

In this regard, several countries like Turkey ([5] [11] [12]) have initialized some policies to support techno-entrepreneurship mostly based on the level of novelty. Entrepreneurship incentives and support mechanisms lay at the center of these policies [13]. These incentives can be either direct (full or partial payment) or indirect (such as tax reduction). Direct incentive decisions are mostly taken upon the application of entrepreneurs with a business plan. The promising projects are shortlisted based on some criteria such as market targeting, budget, experience, staff, and etc. Due to the financial constraints, certain projects can be either completely or partially rejected [14]. While those projects are governmentally supported, it is critical to find the projects that will create real values for the societies.

While techno-entrepreneurship projects start with an initial plan or prototype for seeking further project's improvement [15], support decisions are made upon some factors given in those initial plans. The decision of support has not been an easy task while a method supporting the selection of projects should not only provide a fair evaluation by decreasing the subjectivity of decision making but also should shorten the time required for evaluation [16]. Analytical Hierarchy Process (AHP) has been one of the most popular and powerful methods for group decision making used in project selection for evaluating complex multiple criteria alternatives involving subjective judgment [17]. Many studies used the AHP to select R&D projects in the private sector; however, the selection process of government-sponsored R&D projects is discussed less [17]. This paper presents an AHP model for government-sponsored techno-entrepreneurship project selection. To the best of our knowledge, use of AHP for techno-entrepreneurship project selection has not been performed before.

A group of experts was employed to determine some important factors that should be considered during techno-entrepreneurship

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project selection. Experts also compared factors with each other to create the hierarchical decision model. A real data set containing ten projects has been used to test the model. Experts have also compared the projects with each other and a total score has been obtained for each of the projects. The scores were used to rank the projects. Since the database indicates the actual status of the projects as success and failure (still being operated or closed), the ranking was compared with these actual results. It was seen that the projects that failed were ranked at the end of the list provided by AHP.

This paper is organized as follows. Section 2 presents the literature on project selection and the use of AHP in the stated selection process. Section 3 describes the methodology used. The data collection process and the information regarding the project alternatives are given in Section 4. Results are presented in Section 5. Section 6 concludes the paper with the discussion section.

2. Literature review

In consequence of the complexity of the business environment, the available resource constraints, and the diversity of entrepreneurship project alternatives, funding correct project is important and time-consuming. The evaluation and selection of projects before an investment decision is customarily done using, technical information [18]. The main purpose of the project selection process is to analyze project viability and to approve/reject project proposals based on established criteria, following a set of structured steps and checkpoints [18]. A project selection framework should be flexible enough so that stakeholders can choose in advance the particular techniques or methodologies with which they are comfortable, in analyzing relevant data and making choices of the type of projects at hand [19]. Project selection and evaluation among several alternatives by considering several criteria have been investigated in several studies [14], [20–27]. There are certain difficulties in project selection. First of all a number of options are encountered to select the most appropriate projects [28]. The sheer volume of submission creates a significant challenge for project selection due to difficulties of assigning the most suitable reviewers to the most relevant project proposals [29]. The results are sensitive to reviewers while understanding the proposed project from the aspect of several stakeholder groups and analysis of alternatives in relation to a number of criteria, may end with different results [30]. Therefore, the most of these studies demonstrate a case study to validate the proposed selection approach.

Multi-criteria decision-making (MCDM) methods use a structured and logical approach to model complex decision-making problems [31]. Since its development, AHP has been one of the most widely used MCDM [32] because of its simplicity and flexibility [16]. AHP models are based on a comparative judgment of the alternatives and criteria [33]. Therefore, AHP is a useful approach for evaluating complex multiple criteria alternatives involving subjective judgment [17]. Since project selection problems mostly include several hierarchical criteria with several alternatives and a group of experts with different judgments, AHP models have been used effectively to optimize project selection in the research and development settings [33].

In 1987, [34] explored the applicability of an extension of the Analytic Hierarchy Process (AHP) for priority setting and resource allocation in the industrial R&D environment. An AHP modeling framework for the R&D project selection decision was presented and was linked to a spreadsheet model to rank a large number of projects.

[35] developed an AHP model for selecting a “new product development” policy, which is a specific R&D strategy. The AHP model was expanded to include a series of performance ratings for each criterion. The performance ratings and weights for each criterion were transferred to a spreadsheet program which produces the final project rankings. The resulting project priorities or scores were included in an integer programming model to support project funding decisions.

AHP was also used for information system project selection by Ref. [36]. The proposed AHP methodology adopted a multi-criteria approach to information system project selection which is dissimilar to the single criteria approach.

In 1991, [37] presented an improved Information System (IS) project selection methodology that combined the existing IS project selection methodologies of the AHP within a goal programming (GP) model framework.

[38] presented a fuzzy extension of the AHP for project selection. In their paper, they focused on the constraints that have to be considered within fuzzy AHP to take into account all the available information. They have demonstrated that considering all the information deriving from the constraints yields better results in terms of certainty and reliability.

[39] presented a framework for ERP system selection. The framework systematically constructed the objectives of ERP selection to support the business goals and strategies of an enterprise. It also identified the appropriate attributes and set up a consistent evaluation standard for facilitating a group decision process. Moreover, AHP method was applied in order to deal with the ambiguities involved in the assessment of ERP alternatives and relative importance weightings of attributes.

In one other study [40], AHP was employed to assist decision makers to select a proper project delivery.

[18] proposed a new methodology for project selection for oil fields development. The proposed methodology was comprised of both AHP and fuzzy TOPSIS. The structure of the project selection problem was analyzed and weights of criteria determined by employing AHP. However, final ranking was obtained by employing fuzzy TOPSIS. [41] constructed AHP-BP neural network model based on the traditional BP neural network that reduced the input dimensions of traditional BP neural network, significantly raised its learning speed, and improves the prediction accuracy.

3. Methodology

In an AHP hierarchy for choosing a techno-entrepreneurship project, the goal would be to choose the projects that can really be successful by creating value. Individual characteristics and project related factors are the two main criteria that are used in the selected database for selecting an entrepreneurship project. These criteria are often subdivided into several sub-criteria. In this study, the individual characteristics criterion is subdivided into gender, age, experience, and education. Experience grades are based on the previous workplaces and experiences. Education grading is performed based on the level of diploma that was attached to the project proposal. The project related factors criterion is subdivided into partnership, market, location, staff, and budget/requested capital. “Partnership” evaluation is performed according to the perceived power of partnership structure. “Market” sub-criteria are evaluated according to the availability in the targeted market. Barriers and competitors are both considered. “Location” criteria indicate the how business idea matches the location proposed for that business. Staff factor is evaluated according to organization chart and the job descriptions are given in the application file. Budget/requested capital factor covers the realism of the requested

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