# ABSTRACT

Asare J. Fuzzy estimating of the risks of financing business projects of small and medium enterprises based on provisions of behavioral economy – Qualification scientific dissertation manuscript.

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In recent years, project financing has become an important part of national development; this result of the changing nature of project administration and financing can be attributed to the advancement in technology and the complex competitive global marketplace. Every project requires a substantial amount of capital outlay from individuals, sponsors / investors, organizations and or governments. This therefore calls for the development of a methodology, models or tools to aid the estimation of the risk of financing business-project in other to guarantee the delivery of value for money.

Developing Economies are faced with unprecedented challenges in the current knowledge economy, as they strive to attain sustainable development through the implementation of short and long term business-projects. These challenges have been caused by the current knowledge economy, currently defined: a knowledge economy is characterized with the generation and adoption of new knowledge created by scientific research, technological development, investments in intangible assets, adoption of best practices, and openness to socio-economic, and cultural innovations [1]. This characteristics of Knowledge economy has caused new and a more complex risks to manifest itself in business-projects finance. Most small and medium enterprises in developing economies are face with the challenge of insufficient funding, poor financial management, weak administration processes and procedures, lack of quality materials, lack of skilled personnel needed to run business-projects and legal and political concerns. These challenges not only cause poor business-project quality and less output but it also impact negatively on achieving national, economic and global development. Developing economies implementing business-projects through SMEs support need finance to meet their requirements in the current knowledge economy. Also, any kind of business-project

activity depends on finance. Hence, finance is the lifeblood of every business-project. Whether the business-project's concerns are big or small, they need finance to fulfill all activities involved.

The significance of business-project finance in economic development is enormous. In developing economies governments are expected to implement projects that are believed would contribute to the attainment of the desire level of development. The actual contribution of finance to business project success is considered to be more critical than the project other factors since it aid in shaping the entire project environment to achieve success. To be able to provide lasting solutions to the identified challenges as indicated in the problem stamen, this study will try to find answers to the following questions: 1. To what extent does behavioral economics and fuzzy logic rule ensures the effective estimations of the risks of financing business-projects? 2. What are the prime risks factors of financing business-projects? 3. What are the prime risk indicators of financing business-projects? 4. What is the relationship between risk and financing of business-projects in developing economies? 5. What financing risk model is the most effective in identifying and controlling the risks of financing business-projects?

*Object* of this study is the prime risks of financing business-projects. This is what frames the research question, articulates all claims, formulates and generate information, facilitates techniques that will produce new knowledge, models and information through the research.

*Subject* of this research is the human beings the study targeted for observation by the researcher. The subject includes NYEP program coordinators; project / model managers and participants.

The dissertation is aimed to ground scientific approach to estimating the risks of financing small and medium enterprises (SMEs) business-projects. As a result the following scientific tasks were resolved:

- to use fuzzy logic rule and integral estimation approach to estimate the risks of financing business-projects;
- to identify the risk factors and prime risk indicators of financing business-projects through behavioral economics approach and fuzzy logic;

- to prove the relationship among the prime risk indicators of financing business-projects graphically through
- to propose business-project financing risk estimation and control system model;
- to develop a new business plan template as the basic step to identify business-project financing risk factors.
- to carry out investigational verification of all proposed models and approaches.

Executing the above-mentioned tasks helped to achieve scientific results, that is the development of a methodological and holistic system model for estimating and controlling the prime risks of financing business-projects, and a graphical model showing the relationship among the prime risks of financing business-projects. The novelty of the scientific result of this study is following.

This study first developed a business template gave it out to business-projects stakeholders to complete. Through that the following twelve (12) primary risks factors that could create threats or opportunities when estimating the risks of financing business-projects ware identified as: innovation / uniqueness risks; acceptability / adoptability risk; technology risks; set-up / operation risks; technical / creativity risks; management risks; comprehension risks; social / environment risk; financial risk; economic risk, political and legal risks; and culture / tradition risks.

Base on the above identified twelve (12) risk factors, the study also developed what is termed as the dodecagon model of business-project financing risks. Also, the identified twelve (12) risk factors were further grouped into three main risk indicators namely: idea risk, competency risk and return on investment risk. The results also proved that the three risk indicators constitute what can be used to develop another model called the business-project financing risk triangle. The composition of the prime risk of financing business-projects are as follows: Business Idea Risk = Originality / Uniqueness risk (OU), Acceptability / Adoptability risk (AA), Technology Risk (TR), and Operation / Set-up risk (OS). Whereas competency Risk = Creativity/Insight risk (CI), Management risk (M), Comprehension risk (C), and Social and Environmental risk (SE). And Return on Investment Risk = Financial Risk (FR), Economic Risk (ER) Political and Legal Risks (PLR), and Culture and

Tradition Risks (CTR).

Further, this study coded all risk factors and indicators as scientific research to test the potency of all the identified risks factors and indicator through the use of the developed business plan template. The business plan template was given to respondents to match each item in the template to the appropriate risk factors and or indicator. The study further counted the number of times each code was recorded against each factor by respondents. This was to enable this research to record the frequency / points / weight of impact each risk factor has on financing of business-projects. The cumulative frequency points of each prime risk indicator turn out as follows: Competency Risk - R2A+R2B+R2C+R2D = 550 score. This is ranked 1st by this study as having very high risk impact on business-project financing. This was followed by Business Idea Risk - R1A+RAB+R1C+R1D = 474 score. This is also ranked 2nd as having high risk medium impact on business-project financing. Lastly, Return on Investment Risks - R3A+R3B+R3C+R3D = 390 score was rank 3rd as having moderate risk impact on business-project financing.

It is not unanticipated in this study that competency risk had the highest score in this study. This is because humans are the manager of every business-project, therefore, higher competencies will result in less idea and return on investment risk and vice versa. As Pajarinen et al. (2015) puts it entrepreneurs with higher academic background are more innovative and will use modern techniques and models to do business. Also, idea risk came second according to this study. This is also affirmed in the works of Lin Tom C. W., (2012), Lin belives that it is very important to understand the effects of psychological, cognitive, emotional, cultural and social factors of the economic decisions of individuals or institutions and how those decisions vary from those implied by classical theory. Lastly return on investment came third and Virlics A., (2013) studies throws more light on this score by stating that investment decisions are made after a complete analysis of the investment project. This shows that the score points of return on investment risk is dependent of the first two risks indicators.

This study has also revealed that there is no zero risk (risk free) business-project / investment. To prove this a further analysis of the accumulated points of the risk

indicators was done to equate to all the individual scores to one (1) using integral estimation method. This was done to allow for possible application of fuzzy logic rule. Also, a further analysis of data was also done in SPSS and excel. Suing Fuzzy logic matrix scale from 0.1 to 1, idea risk had a score of 0.33; competency risk scored 0.4; while ROI risk also scored 0.27. This give an aggregate total risk score of 1 or 100%.

The study also resulted in the development of business-project financing risk graph model. On the graph the following points could be identified: the risk curve, financing curve, stability point, stability zone, and risk and return zone. Also, there is a zone on the graph which indicates other factors this study identified them as destabilizing factor. Those factors are what constitutes the *'no zero'* risk zone. In drawing the graph the resultants of fuzzy logic rule was used as the scale for plotting the three prime risks indicator on the graph. The graph showed that high risky business-projects in developing economies are less to attract funding. However, above the stability point some investors may invest more funds regardless of the risk score.

Further, the curve reveal that as risk reduces investors are more likely to put more funds in a business-project. Thus, as risk reduces more project and or activities will be undertaken. Additionally, idea risk zone is below the investment line and risk line, this means that investors losses nothing and no funds are lost or required when there is no intention to implement a business idea. Once the intention to convert business idea into action is born, competency and return on investment risk becomes active. Competency risk and return on investment risk line are above the investment line because acquiring high competent team to aid good management and higher return comes at a cost, thus, the two factors (competency risk and return risk) increases as risk also increase. The intersection point of the risk line and investment line is termed as the Stability point, thus, at that point there is no loss nor gain from investment. This point also mean that the project has the potential of generating enough revenue to cover all capital invested. However, the stability point does not generate any profit from investment. Another important part of the curve is risk and return which lies above the intersection of both the risk curve and funding curve. The risk and return zone indicates that for a business project to generate the expected return; idea risk, competency risk and return on

investment risk must lie above the stability point. Thus, risk and return always fall above the stability point.

This study results also proved that there is a strong connection among the three identified risks indicators. To test this the study plotted the scores of all indicating factors on a bar graph. The bar graph brought to the fore that the impact of the identified risk factors of financing business projects rises and fall at and increasingly high rate. The R-squared value is 0.92 which is approximately 1, a revelation that the line fit the data perfectly. The tread line also proves that the exponential function obeys the basic exponentiation identity, $\exp(x) = \lim_{n\to\infty}\left(1+\frac{x}{n}\right)^n$ this justifies the notation $e^x$ is equal to 1 when x = 0, $\frac{d}{dx}e^x = e^x \quad \text{and} \quad e^0 = 1$. thus, a confirmation that the influence of the risk factors (*F*) on risk indicators (*RI*) is a 100% or 1. Therefore, idea risk, competency risk and return on investment risk impact on business-projects financing is greater than zero (0) and can be express as: *RF* = RI, where, RI > 0 ≤ 1.

Additionally, this study through careful analysis of the fuzzy logic rule has developed five golden rule for estimating business-project financing risks. These are as follows:

Rule 1: if the business-project was developed by a person/team with sound psychological, cognitive and high emotional intelligence Or All economic, finance, cultural, social and environmental factors are considered at every decisions stage, then risk is Very Low.

Rule 2: if the business-project was developed by a person/team with sound psychological, cognitive and high emotional intelligence Or All economic and finance factors are considered then Risk is Low.

Rule 3: if the business-project was developed and is being managed by highly educated, experienced and well-informed person / team Or Incorporates modern technology in its operation, then Risk is Average.

Rule 4: if the business-project was developed by a person/team with poor psychological, cognitive and high emotional intelligence Or Ignores most economic / finance factors in decision making, then Risk is High.

Rule 5: if business-project was developed by a person / team with little or no

finance and economics knowledge Or Being managed by low or uneducated, inexperience and ill-informed person / team, and does incorporate modern technology in its operation, then Risk is Very high.

Further, this study has developed a comprehensive business-project financing risk estimating and control system model that represent the three risk indicators. And has further developed the need for a project model. These developed base on the detailed analysis of both behavioral economics theories and fuzzy logic rule. The prime fact is that a major activity in business-project finance is decision making which requires strong psychological capabilities as indicated in the studies of behavioral economics. The fact is that many aspects of observed human decision-making differ from the 'rational' behavior assumed in economic models. Also, humans apply simplest of decisions and people generally do not attempt to find the optimal solution, but rather apply simple decision-making strategies. This cause people to settle for something that is good enough, rather than searching for the best, the more complex the decision, the less well equipped people are to deal with it. As a result, people often make decisions which do not appear to be in their best interests. It is for this reason that this study has developed the business-project financing risk model facilitate effective estimation of financing risks.

Testing how the identified risks are applicable in real business case and how the developed models fit into other earlier developed models, this study did a test on the famous business case life cycle – need for a project model. The result showed that the first phase of every project (step one on the model) is dominated by idea risk. However, the ability to reduce / control this risk is highly dependent on the competency of all parties involved in the project, any lack will lead to high competency risk through from step three on the model to step five of the model. This will eventually affect return on investment, however, with high competent team idea risk, competency risk and ROI risk could be minimal

*Structure and scope of work.* The dissertation consists of introduction, five chapters, conclusions, list of references and attachments, placed on 236 pages. The text body is

presented on 141 pages, it contains 9 tables and 18 figures. The list of references includes 404 sources and placed on 40 pages, 5 attachments placed on 47 pages.

*Key words:* idea, competency, investment, risk estimation, risk, financing, small and medium enterprises, business-projects, behavioral economics, fuzzy logic

## List of candidate's publications

*Articles in scientific periodical foreign editions (including in the specialized editions of Ukraine, which are indexed in the international science-based databases)*

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