

# **Application of the Fuzzy Logic in Explanation of Effective Factors on Commercialization of Products (Empirical Evidence: Knowledge-Based Business of Incubators Centers of Iran North Region)**

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<b>Keywords</b>	<b>Abstract</b>
Commercialization	In today's globalized economy, companies are facing ever increasing competitive pressures. A commonly adopted strategy for remaining competitive is to commercialize Products. Commercialization activities play an important role in bringing to market new t Products is the knowledge based companies. The goal of the current Research is the show Effective factors on Commercialization of Products in Knowledge-Based Business. The sample of this study is all managers of knowledge based companies in development centers which established in the northern regions of Iran. The data are collected by questionnaire with the reliability coefficient 86% of the sample. Data analyzed by using fuzzy hypothesis testing approach. The results of this work provide
Knowledge-Based Business	
Fuzzy Logic	
Incubators Centers of Iran North Region	

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useful insights for improving the commercialization decisions of product for managers of knowledge based companies in competitive markets.

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## **1. Introduction**

According to studies APEC1 Knowledge Based Economies is the most stable economies in the world. In the economics based on knowledge, the knowledge based Business have important role in the economic growth. Knowledge-based companies and knowledge-based institutions are private institution or cooperative in order to synergy of science and wealth, development of knowledge based economy, realizing scientific and economic goals and commercialization of research and development in the areas of superior technologies, The abundant added value especially in producing software[6]. Commercialization means marketing an innovation with the aim of converting it into a profit-making position in the marketplace; it entails both marketing strategy planning and subsequent implementation[4]. As successful new product commercialization is associated with growth in market share, greater learning from customers, and improved performance and profitability [16]. Commercialization activities play an important role in bringing new technology the market place, particularly high-technology firms [13]. Successful commercialization allows the company to satisfy its customers' needs in terms of the cost, speed, quality [22]. Commercialization ensures that the technology in question meets not only the performance but also the consumers' demands. In the Context of an interdependent global economy, new technology Commercialization is important for domestic Production, competitive market advantages, opportunities for trade, and growing standards of living [3].

The paper is organized as follows. Section 2 reviews the relevant Literature. Section 3 describes Hypotheses. Section 4 describes the research method. Section 5 Analysis and Findings, and section6 present the results. Finally, the last section concludes the paper.

## **2. Literature review**

### **2.1. New product commercialization**

New product commercialization can be considered as the top of the NPD process where in the product is launch to the target market(s). During commercialization, business develops a marketing plan, determines how the product will be supplied to the market, and estimate barriers to its success. It encompass several important activities such as deciding the timeliness of the new product introduction, the locations where the new product should be introduced, the market segments to be targeted, promotional strategies for the new product introduction, and the budget preparation. New product commercialization demands significant amount of Business's resources and top management commitment for its success [20].

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<sup>1</sup> . Asia-pacific economic cooperation

## **2.2. Knowledge based businesses**

There is no commonly accepted definition of a knowledge-based industry (KBI) or a knowledge-based business (KBBs), although there does seem to be agreement that knowledge-based firms have a high proportion of intangible assets and rely heavily on innovation as an important source of competitive advantage. The problem, as shown by Howitt (1996; 10), is that “we have no generally accepted empirical measures of such key theoretical concepts as the stock of technical knowledge, human capital, the resource cost of knowledge acquisition, the rate of innovation or the rate of obsolescence of old knowledge.” Industry Canada concentrates on the scientific research and use of information or other new technology to define knowledge-based segment [7]. Bank of England (2001) in the UK explains technology-based innovative SMEs as companies heavily dependent on scientific and technology-based products or as companies providing services which adopt new technology or existing technology in an innovative way, or as companies generating competitiveness significantly from technological activities [10].

According to Gorman and McCarthy (2006) most banks and government agencies agreed that KBBs possess some, if not all, of the following attributes: highly skilled/highly educated workforce, high level of research and development, strong export orientation, high percentage of intangible assets, and products/services with short life expectancies and high gross margins. In addition, KBBs were considered more likely to use and/or develop advanced technologies and to be innovative in their products, services or processes.

New technology-based institutions have some different attributes [2]. Their innovation is less systematized and organizational and depends more on CEO's ingenuity and skill (Peterson, 1988). They adapt more to technical change than market change [15].

## **2.3. Previous Research**

In today's competitive and dynamic business world, entrepreneurial ability and management skills are needed if innovation is to be successful in the market place [23]. The ability to manage a multi-functional team is vital to get a successful new technology commercialization [1]. The recent increase in studies exploring the corporate level is perhaps reflective of the growing awareness of the importance of top management in new product development. Top managers can be useful in the future growth of their business by providing valuable input to guide the assessment and improve of their business' capabilities [14]. They also play an important role in the strategic planning process of their company, determining the new products their company will introduce, the types and levels of investments, and the company's research and development (R&D) agenda [8].

According to Kang, (2012), management commitment is one of the important factors for technology-oriented SMEs business successes or failures. Poolton and Barclay (1998) identified critical success factors for new product development that included: top management support for innovation, long-term strategy with innovation focus, long-term commitment to major projects, flexibility and responsiveness to change, top management acceptance of risk and support for an entrepreneurial culture.

A strong emphasis on new technology mobilizes a company's entry into new market niches, renovates its presence in existing ones, and fosters its capability to answer to customers' preferences in an efficient way. It has been assumed that consumers select technologically superior products and services. As well as, a company's technical skills, R&D resources, and technological base appear to be central in bringing innovative, better designed products into the market [18]. Capabilities in R&D refer to firm's systemic activities whereby they use the knowledge they already have to innovate or to utilize knowledge improved by an internal independent agency or external agency. Studies show that the impact of R&D capabilities grows with the success of business innovation. It has been studied stated that the increase of R&D investment has a positive effect on sales revenue, profit, productivity and research, as well as on how R&D capabilities influence new technology and new products are developed[10]

Kang (2012) his study found that technology factor are included: market-oriented technology; timely innovative technology; technology innovation capability; patents.

The Korpp & Zolin (2005) based on Dess and Lumpkin (1996) study, have claimed that environmental factors are one of the effective factors on commercialization. The study results show that government role is the critical factors.

Kimura (2010) his study stated several factors resulting in the success or failure of commercialization/diffusion are identified, such as long-term R&D support by the government, a marketing strategy to respond to and influence market demand, and combination of R&D and deployment policy.

Chung-jen &Chin-Chen (2004) have done a study with the purpose of assessing Taiwan's government policy in economic growth. According to their study, the market potential is the most important factor and then technology level and government policy are placed in second and third positions respectively.

O'Brien, Blauand Rose (2004) point out barriers to commercialization and deployment of IGCC technology and classified these into legal/regulatory, environmental, financial, economic, cultural, and technological factors.

### **3. Hypotheses**

Effective Factors on Commercialization of Products include variables of Management acceptance of risk, Management commitments, Management skill, Market-oriented technology, Timely innovative technology, R&D capabilities, Competition Strategy, Pricing Policy, Advertising, Customer need, brand, Government support, Legal/regulatory, Government legislation.

### **4. Research Method**

The research method is description analysis and the purpose is applied research one. For collecting data in this study, two methods were used; library method and field method, for writing the research literature the library method, scientific journals, and various scientific data base were used. The sample of this study is all managers of knowledge based companies in development centers which established in the northern regions of Iran. Questionnaire was prepared

$$F(d, m) = \begin{cases} \frac{\log(d/m)}{\log(b)} + 1 & \text{if } d > m/b \\ 0 & \text{otherwise} \end{cases}$$

to determine the importance of each variable based on the five-point Likert -type range (from very low to very high importance). To calculate the amount of the fine sample, indicating the degree of satisfaction of the good faith of the sample was used. This function can be defined by the researcher and the research subject, consider the following function:

$$F(d, m) = \begin{cases} \frac{\log(d/m)}{\log(b)} + 1 & \text{if } d > m/b \\ 0 & \text{Otherwise} \end{cases}$$

Where d represents the size of the sample, m represents the population size and m / b indicates the sample size with the degree of satisfaction zero (point of intersection with the x-axis function).

In this paper, according to the degree of satisfaction function, the number of samples and degree of satisfaction from zero to 10 = b (at least 13sample), the degree of satisfaction of 0.7 is the number 62 sample is suitable. The questionnaire was distributed among 123 companies, 70 questionnaires were received that have been analyzed by using fuzzy theory. In this study, the validity of questionnaire is appropriate, in design of the questionnaire questions cases is considered such as, understandable and unambiguous statements. After design, for increasing the validity, the opinions of supervisor, advisor and experts has been used. Due to these measures, we can say questionnaire has acceptable content validity. To determine the reliability of the questionnaire, Cronbach's alpha for this study using the software SPSS16 was calculated and 0.8value show the high reliability of research tools

## 5. Analysis and Findings

### 5.1. Data Conversion

The verbal statements of the respondents of the statistical sample regarding fourteen variables of the research which have been gathered based on the Likerete range having five choices can be convertible to triangular fuzzy numbers in various methods [21]. In the current study, this has been done based on the following guiding table:

Table 1: Conversion of the verbal statements into triangular fuzzy numbers

Very little			Little			Medium			Much			Very much		
a	b	c	a	b	c	a	b	c	a	b	c	a	b	c
1	1	3	1	3	5	3	5	7	5	7	9	7	9	9

### 5.2. Calculation of Fuzzy Mean and Standard Deviation

The fuzzy mean for each one of the triangular triple numbers associated with data gathered from the questionnaire, and fuzzy standard deviation related to each one of the sextet variables of the study have been calculated

$$\tilde{X} = \left( \frac{\sum_{i=1}^n X_i^a}{n}, \frac{\sum_{i=1}^n X_i^b}{n}, \frac{\sum_{i=1}^n X_i^c}{n} \right)$$

$$\tilde{S} = \sqrt{\frac{\sum_{i=1}^n \left[ \frac{(X_i^a - \bar{X}^a)^2 + (X_i^b - \bar{X}^b)^2 + (X_i^c - \bar{X}^c)^2}{3} \right]}{n-1}}$$

The special evaluation of the fuzzy mean for each one of the research's fourteen variables of the research and also the low limit of acceptance of a theory have been estimated by making use of the following relations:

$$\bar{X}_\alpha = \{x \in R : \mu_{\tilde{X}}(x) \geq \alpha\}$$

$$\bar{X}_\alpha^U = \text{Sup}\{x \in R : \mu_{\tilde{X}}(x) > \alpha\}$$

$$\pi = (-\infty, \pi^*) \quad \pi^* = \bar{X}_\alpha^U + Z_\alpha \frac{\tilde{S}}{\sqrt{n}} \quad Z_{0.95} = 1.64$$

### 5.4. Determining Minimum Numerical Standard of Hypothesis Confirmation

By considering the range (1-9) being used for the current study in order to convert the verbal statements of the Likert range to the triangular fuzzy numbers, the minimum fuzzy mean observed and acceptable has been taken into account for accepting the assumptions of 70 percent of scale.

### 5.5. Determining Degree of Membership for Hypothesis Confirmation

By due consideration of the estimations for the two recent cases, the following relation has been calculated for the degree of membership ( $\alpha$ ) for accepting or rejecting the theory of research.

$$\bar{X}_\alpha^U + Z_\alpha \frac{\tilde{S}}{\sqrt{n}} = 7$$

### 5.6. Analysis of Hypothesis Confirmation Membership Degree

The following table demonstrates the manner of analysis about the degree of membership for acceptance of one theory in a fuzzy environment. The higher membership degree shows that the tested theory will be approved by higher and more powerful confidence.

**Table 2:** Membership degree of confirmation or rejection of hypothesis a fuzzy environment

<b>membership degree</b>	<b>Analyzing confirmation of hypothesis</b>
<b>1.0</b>	Complete confirmation of hypothesis
<b>0.9 – 1</b>	Very high probability for confirmation of hypothesis
<b>0.7 – 0.9</b>	High probability for confirmation of hypothesis
<b>0.5 – 0.7</b>	Medium probability for confirmation of hypothesis
<b>0.0 – 0.5</b>	Low probability for confirmation of hypothesis
<b>0.0</b>	Rejection of hypothesis

## **6. The Results of Hypotheses Testing**

In this section of paper we present analysis the results of research hypothesis.

### **6.1. Hypotheses Testing**

The table no. three shows the summary of fulfilled estimations regarding the above-mentioned steps taken for determination of effective factors on commercialization of products at the examined statistical sample.

**Table 3:** Summary of the fulfilled calculations

Variables=Hypothesis	Fuzzy mean			Fuzzy standard deviation	Interval estimation of Fuzzy mean		minimum limit of hypothesis confirmation	minimum numerical	degree of membership for hypothesis confirmation $\alpha$	Analysis of hypothesis confirmation
					$\tilde{X}_L$	$\tilde{X}_U$				
Management acceptance of risk	5	6.64	8.54	1.27	5-1.64 $\alpha$	8.54-1.90 $\alpha$	8.87	7	0.94	Very high probability for confirmation of hypothesis
Management commitment	5.74	7.74	8.74	1.21	5.74-2 $\alpha$	8.74-1 $\alpha$	8.89	7	1	Complete confirmation of hypothesis
Management skill	6.14	8.14	8.85	1.06	6.14-2 $\alpha$	8.85-0.71 $\alpha$	9.06	7	1	Complete confirmation of hypothesis
Market-oriented technology	5.64	7.65	8.74	1.24	5.64-2 $\alpha$	8.74-1.09 $\alpha$	8.98	7	1	Complete confirmation of hypothesis



Timely innovative technology	5.88	7.88	8.74	1.27	5.88-2 $\alpha$	8.74-0.86 $\alpha$	8.99	7	1	Complete confirmation of hypothesis
R&D capabilities	5.31	7.31	8.62	1.34	5.31-2 $\alpha$	8.74-1.31 $\alpha$	8.89	7	1	Complete confirmation of hypothesis
Competition Strategy	5.62	7.62	8.68	1.35	5.62-2 $\alpha$	8.68-1.06 $\alpha$	8.95	7	1	Complete confirmation of hypothesis
Pricing Policy	4.62	6.51	7.71	2.11	4.65-1.86 $\alpha$	7.71-1.20 $\alpha$	8.16	7	0.97	Very high probability for confirmation of hypothesis
brand	4.02	6.14	8.2	2.76	4.02-2.12 $\alpha$	8.2-2.06 $\alpha$	6.74	7	0.47	Low probability for confirmation of hypothesis
Advertising	6.11	8.11	8.94	0.92	6.11-2 $\alpha$	8.94-0.83 $\alpha$	9.12	7	1	Complete confirmation of hypothesis

										sis
Customer need	6.34	8.28	8.97	0.83	6.34-1.94 $\alpha$	8.97-0.69 $\alpha$	9.13	7	1	Complete confirmation of hypothesis
Government support	5.62	7.54	8.62	1.5	5.62-1.92 $\alpha$	8.62-1.08 $\alpha$	8.9	7	1	Complete confirmation of hypothesis
Legal/regulatory	4.74	6.48	7.71	2.38	4.74-1.74 $\alpha$	7.71-1.23 $\alpha$	8.18	7	0.96	Very high probability for confirmation of hypothesis
Government legislation	5.68	7.65	8.4	1.49	5.68-1.97 $\alpha$	8.4-0.75	8.89	7	1	Complete confirmation of hypothesis

As it is observed in the last line of the above table, Government legislation, Government support, Customer need, Advertising, Competition Strategy, R&D capabilities, Timely innovative technology, Market-oriented technology, Market-oriented technology, Management skill and Management commitments have been completely approved, Legal/regulatory, Pricing Policy, Management acceptance of risk have been Very high probability approved and brand has been completely rejected.

### 7. Discussion and Conclusion

The existing research was in the track of application of the fuzzy logic in explanation of effective factors on commercialization of Products. but here a vital point arises which is that in research process, most of the variables are mentioned in the form of nominal, quality and verbal variables and their evaluation by decisive methods and digital mathematics numbers seems to be impossible. The outstanding matter about this research is its innovation in use of Fuzzy Logic the fuzzy environment for eradicating this problem. In fact researchers with usage of fuzzy conceptual applied verbal phrases as phrases with natural and colloquial language for evaluating the factors and also for more appropriate and precise analysis they applied some changes on them.

According to the results of the research are suggested Managers of Knowledge Based Companies have comprehensive and systematic look at the factors mentioned for success in commercializing products, to by receiving benefits of commercialization provide the resources necessary to sustain life of these companies. Because technological products will be create a competitive advantage for companies. The managers of the companies recommended that use business intelligence tools which possible concepts underlying the business information through the discovery process and information analyze. It is essential for knowledge-based Companies rather than follows the innovation linear process, communicate with different sections of companies, laboratories and scientific research institutes and consumers and get feedback from technical knowledge of product development, production and marketing. The government can allocate funds for the creation of knowledge base business clusters help these companies to solve their problems in terms associated with the risks with sharp decline in demand and market information.

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