

تحلیل و مقایسه شاخصهای عملکردی کلیدی (KPI)

مراکز رشد واحدهای فناور کشور

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چکیده

نوآوری و کارآفرینی به عنوان مؤلفه های اساسی توسعه اقتصادی مبتنی بر دانایی محسوب می شوند. به دلیل ابهام در شناخت و تعریف جامع از بازار یا محصول در اقتصاد مبتنی بر دانایی، محصولات تولید شده در این رویکرد جدید اقتصادی با پیچیدگیها و عدم اطمینانهای فراوانی مواجه هستند. در دهه های اخیر، پارکها و مراکز رشد با هدف توسعه بنگاههای اقتصادی کوچک زود بازده، حمایت از نوآوران و کارآفرینان جوان، ارائه پاسخی مناسب به مشکل بیکاری در جامعه و گسترش تعاملات میان سه نهاد تأثیرگذار دولت، دانشگاه و صنعت پا به عرصه وجود گذاشته اند. شاخصهای عملکردی کلیدی ابزارهای اندازه گیری کارآمدی هستند که عوامل کلیدی موفقیت سازمان را تعیین و اهداف و راهبردهای آتی آن و شیوه های سنجش میزان تحقق این اهداف و راهبردها را شناسایی می کنند.

هدف از ارائه مقاله حاضر معرفی جایگاه شاخصهای عملکردی کلیدی در فرایند سنجش عملکرد و موفقیت مراکز رشد و همچنین، تحلیل و مقایسه این شاخصها در پنج مرکز رشد واحدهای فناور کشور است. در این خصوص، ابتدا تعاریف، مفاهیم و تاریخچه پارکها و مراکز رشد کشور بررسی و سپس فرایند طراحی و تدوین شاخصهای عملکردی کلیدی مناسب برای سنجش عملکرد مراکز رشد واحدهای فناور کشور بیان و شاخصهای عملکردی کلیدی پنج مرکز رشد مورد مطالعه در این پژوهش تحلیل و مقایسه شده است و در نهایت، راهکارهای پیشنهادی به منظور بهبود عملکرد مدیران مراکز رشد واحدهای فناور کشور ارائه شده است.

کلید واژگان: شاخصهای عملکردی کلیدی، پارکها و مراکز رشد و شرکتهای مستقر در مراکز رشد.

Analysis and Comparison of the Key Performance Indicators (KPIs) of Iranian Technology Incubators

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Entrepreneurship and innovation are essential elements for the success of knowledge based economy development. In its commercialization phase, new technology based product, faces difficulties and uncertainties, because either the product or the market is unknown and undefined. During the past decades, incubators are appeared as tools to help strengthening small business performance, support young entrepreneurs and innovators, a response to the problem of unemployment and relation between government, university, and industry. On the other hand, key performance indicators are quantifiable measurements that reflect the critical success factors of organizations and identify future strategies and ways to measure progress toward those goals.

This article has been prepared as an attempt to introduce the reader to the role of key performance indicators in the performance measurement and success of incubators and compare and analyze the key performance indicators of five Iranian technology incubators. It consists of three parts: The first part is designed to give the reader an analytical and historical insight into science and technology parks and incubators of five Iranian technology incubators. The second part of the article, studies the process of identifying the adequate key performance indicators for performance measurement of Iranian technology incubators. In the final part, the main

body of the article, the key performance indicators of five important technology incubators are compared and analyzed and recommendations are proposed to incubators' managers for better performance.

Keywords: Key Performance Indicators, Science and Technology Parks, Technology Incubators, and Tenant Companies.

Introduction

Today we are facing a fast movement from traditional economy towards knowledge-based digital economy and countries are concentrating their efforts on producing high-tech products. In these situations science and technology parks and incubators, as one of the most important factors in economic growth and regional development, should be an interface in using advanced technologies to satisfy their tenants' requirements (Chan, ۲۰۰۱). In developed and populous societies, employment is one of the most important issues that affects different aspects of the society. The educated, job creating individuals compose a significant part of the unemployed people who have not been provided with the essential facilities for job creation. In the recent two decades, science and technology parks and incubators have played an important role in many countries by reducing self-employment problems. They accelerate the process of development through establishment of a collection of small and middle sizes

companies (Webb, ۲۰۰۶). Founded on the basis of novel ideas, these companies can contribute outstandingly to job creation.

Key Performance Indicators (KPIs) are financial and non-financial metrics used to quantify objectives to reflect strategic performance of an organization. KPIs are used in Business Intelligence to assess the present state of the company and to prescribe a course of action. KPIs are general indicators of performance that focus on critical aspects of outputs and their impact. There is increasing recognition that KPIs help an organization define and measure progress toward organizational goals. KPIs are quantifiable measurements, agreed upon in advance, that reflect the critical success factors of an organization. Once an organization has defined its mission, identified all its stakeholders, and defined its goals, it needs a way to measure progress toward those goals. KPIs are the output of those measurements.

In this study, first seven key performance areas of the Shahid Beheshti University (SBU) Technology Units Incubator are identified and the primary KPIs of the SBU Technology Units Incubator was defined with the help and participation of specialists, board of directors, and other stakeholder of the incubators. The areas are instructive and consultative, administrative, research and technology, finance, entrepreneurship, environment, and tenant companies. Then the board of directors and internal and external customers (employees and directors of tenant companies) evaluated

primary KPIs by questionnaire and SWOT analysis, in the process of developing strategic plan of SBU Technology Units Incubator. After that, using intensive interview, we applied the Delphi Method Survey to the experts and the incubator managers and ۲۶ KPIs were identified. Finally the ultimate KPIs data are collected and compared for five incubators of Iran, including: SBU Technology Units Incubator, University of Tehran (UT) Technology Incubator, Fars Technology Incubator, Khorasan Technology Incubator, and Isfahan Science and Technology Town (ISTT) Technology Incubator. These were selected out of all incubators of the country by random sampling.

Science and Technology Parks and Incubators in Iran

Government at all levels, has pursued programs to improve economic, social, and cultural conditions of Iranian people. These programs are under the umbrella of economic development strategies in which policymakers enact programs and procedures to create new jobs, decrease unemployment, enhance science and technology growth, and improve the quality of life for the people. One tool, referred to as business incubation, is being used throughout the country as an economic development tool for local economy. Vizard and Grygo (۲۰۰۴) discovered that business incubators have developed a response to declines in manufacturing employment, plant closure, and regional

economic crisis. Campbell and Allen (۲۰۰۳) suggest that this response to a new industry was accomplished by the use of business incubators as "change agent" in the economy. Business incubation can be an instrument for stimulating entrepreneurship and development of technology-based activities. It consists of programs to help small businesses in the management of the business.

Small businesses have received considerable attention from policymakers and economic developers in the past several years (Woodside, ۲۰۰۵). The small business environment is full of risk. A commonly cited problem with small businesses is the ۸.۰% failure rate within the first four years, with several common reasons cited for failure, e. g. poor marketing, poor management, and lack of capital. Business incubation programs address this failure rate with a basic purpose to "reduce the probability of failure and increase the chances of survival for new start-up businesses" (Segal and Borgia, ۲۰۰۵).

In other words, in today's global economy, it is vital for nations and regions to maintain their competitiveness. A major factor toward this aim is the development of innovative products and services which in turn depends significantly upon the efficiency of the transfer of technology from academic and research institutions into industries. Indeed, many industrialized nations now talk of a knowledge-based economy. To be successful in these situations, countries should pay more attention to science and technology parks and incubators which

are one of the most important factors in transferring the technology from academia to industries (Siegel et al, ۲۰۰۳).

The term, “Science and Technology Parks and Incubators”, has been used to refer to schemes under various similar names such as, Techno-Pole, Science/Research Park, Cyber Park, Hi-Tech Park, Science City, Center of Excellence, Technology/Business Incubator, Techno Polis, and Innovation Center (AURRP, ۱۹۹۸; IASP, ۱۹۹۸; McQueen, ۱۹۹۸). Around half a century has passed since the first business incubator was established in ۱۹۵۹ in Batavia, New York (Brown et al, ۲۰۰۰), but the thousands of incubators now operating across the globe have emerged and developed only during the last three decades.

The definition by National Business Incubation Association (NBIA) of an incubator goes as follows: “Business incubation is a dynamic process of business enterprise development. Incubators nurture young firms, helping them to survive and grow during the start-up period when they are most vulnerable. Incubators provide hands-on management assistance, access to financing and orchestrated exposure to critical business or technical support services.” Most also offer entrepreneurial firms shared office services, access to equipment, flexible leases and expandable space – all under a single roof. An incubation program’s main goal is to produce successful graduates – businesses that are financially viable and freestanding when they leave the incubator, usually in two to three years.

Incubators are consulting firms that are specialized in new firm creation. In the last twenty years, many developed and developing countries have started large systems of public business incubators to encourage and assist entrepreneurship. In many cases, public incubators are designed to stimulate the development of new products and services in high-tech industries. For science-based business incubators, an effective collaboration with universities and research institutions is essential to motivate researchers to take the risk of initiating a company (Neamati and Jamshidi, ۲۰۰۶).

Incubators are organizations that support the entrepreneurial process, helping to increase survival rates for innovative start-up companies. Only entrepreneurs with feasible project are admitted into the incubators, where they are offered the specialized menu of support resources and services. The resources and services open to an entrepreneur include: provision of physical space, management coaching, help in making and effective business plan, administrative services, technical support, business networking, advice on intellectual property and empowerment by financing, training, consulting and other necessary services. Incubators have gained wide reputation in most countries as efficient institutions contributing to regional development and economic growth. They assist their clients to their value-adding services and a wide range of support services and facilities that can not be easily procured from other sources. The content of these services and the way they are supplied will have

important impacts on the success of the incubates, and thereby, on the incubators' performance.

In recent years, on the basis of the requirements of development and the framework for the national innovation system in Iran, the science and technology parks and incubators are rapidly growing across the country. Along with formation of science and technology parks and incubators, by direct support of Ministry of Science, Research and Technology and Ministry of Industries and Mines and other ministries and organizations, authorities in Iran decided to develop further incubators; this resulted in establishment of more than ۴۰ more incubators, with technical fields of activity (Maddah et al., ۲۰۰۶). The incubators investigated in this article and their critical information is summarized in table ۱.

The KPIs as a Performance Measurement Tool

Traditional methods usually focused on a single quantitative or qualitative indicator (Emmanuel et al., ۱۹۹۵; Eccles, ۱۹۹۶; Brown and McDonnell, ۱۹۹۸; Kaplan and Norton, ۱۹۹۹). As result, methods of performance measurement proliferated. KPI method has the advantage of looking at many indicators at the same time (Shank and Govindarajan, ۲۰۰۳). The fundamental point, however, is that whatever happens in an organization, it is the effect of a variety of different causes – such as competitiveness, quality of products and services, and resource utilization – and that these causes are

prompted by customers (internal and external) and other stakeholders (e.g. shareholders, suppliers and investors). The literature suggests using key performance indicators (KPIs) to consider all of these different aspects in a single step (Dixon et al., ۲۰۰۲; Rappaport, ۲۰۰۴).

KPIs help organizations achieve organizational goals through the definition and measurement of progress. On the other hand, they help an organization to measure progress towards their organizational goals (Davidson, ۲۰۰۶). KPIs are agreed upon by an organization and are indicators which can be measured that will reflect success factors. They are specific measurements of an organization's performance in some area of its business. KPIs are typically tied to organization's strategies. It is a very general concept, with different applications depending on the type of business and goals of the organization. KPIs also differ depending on the nature of the organization. They should not be confused with a critical success factor. Whatever KPIs are selected, they must reflect the organization's goals, they must be key to its success, and they must be quantifiable (i.e. measurable). Selecting practical KPIs requires thoughtful consideration of the message behind measurements and their corresponding effect on the organization. The definition of what they are and how they are measured do not change often. The goals for a particular Key Performance Indicator may change as the

organization's goals change, or as it gets closer to achieving a goal (Levine, ۲۰۰۲).

A KPI is a key part of a measurable objective, which is made up of a direction, benchmark, target and time frame (Shahin and Mahbod, ۲۰۰۷). Key Performance Indicators usually have long-term perspectives. The purpose of KPIs is to give a business quantifiable measurement of things it has determined important to its long-term success. Identifying the most important KPIs is the first step towards realizing increased profitability and efficiency for most businesses. For KPIs to be useful, they must be consistently quantifiable, have an established correlation to the area of the business in need of improvement. Many things are measurable. That does not make them a key to the organization's success (Neamati and Jamshidi, ۲۰۰۶). In selecting KPIs, it is critical to limit them to those factors that are essential to the organization reaching its goals. It is also important to keep the number of Key Performance Indicators as small as possible in order to keep everyone's attention focused on achieving the same KPIs (Rawley and Lujan, ۲۰۰۷).

The Key Performance Indicators of Five Important Iranian Technology Incubators

KPIs are financial and non-financial metrics used to quantify objectives to reflect the strategic performance of an organization. The aim of the

present study was to identify adequate KPIs for analyzing and comparing the performance of Iranian incubators. In this study, first a committee for identifying KPIs of Shahid Beheshti University Technology Units Incubator (SBUTUI) is organized. The members of this committee are specialists, board of directors, representatives of employees and directors of tenant companies (TC) and other stakeholders. Then this committee identified seven Key Performance Areas (KPIAs) of SBUTUI. The main areas are instructive and consultative, administrative, research and technology, financial, entrepreneurship, environment, and tenant companies.

This committee collected ۸۴ primary KPIs in relation to key performance areas of SBUTUI. After that ۱۶ primary KPIs were omitted by questionnaire that was distributed among the board of directors, internal and external customer, and other stakeholder. Next in the process of developing strategic plan of SBUTUI, critical factors of strengths and weaknesses of internal environment and opportunities and threats from external environment (SWOT) were recognized and their interaction with primary KPIs was computed in KPIs matrix. On the basis of means and standard deviations resulted from the SWOT Analysis in KPIs matrix, ۳۴ primary KPIs were further omitted. Then on the basis of using the Delphi Method Survey among experts and interview results of other incubator managers, ۸ KPIs were also eliminated and ۲۶ ultimate KPIs were

identified and fixed. So as figure \ shows, four factors affect identifying ultimate KPIs.

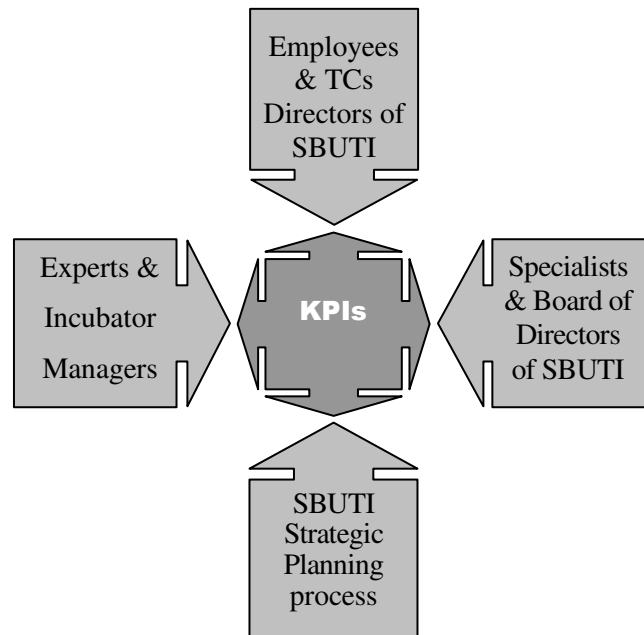


Figure ۱. Effective Factors in Identifying Ultimate KPIs

For selecting the samples, first all Iranian incubators are divided into four groups including: ۱) Tehran state as capital (because of its special situation), ۲) north of Iran, ۳) central part of Iran, and ۴) south of Iran. Then five incubators including SBU Technology Units Incubator, University of Tehran(UT) Technology Incubator, Fars Technology Incubator, Khorasan Technology Incubator, and Isfahan Science and Technology Town(ISTT) Technology Incubator are selected by using random sampling. Finally the ultimate KPIs data were collected from these incubators and compared. Table ۲

demonstrates ۲۶ KPIs of these incubators in seven Key Performance Areas (KPIAs).

Table ۲. The KPIs Measures of Five Important Iranian Incubators

KPIAs	KPIs	SBU Technology Incubator	UT Technology Incubator	Khorasan Technology Incubator	Fars Technology Incubator	ISIT Technology Incubator
Instructive and consultative	۱. Ratio of evaluated workshops to total workshops	۰.۳	۰.۴	۰.۵	۰.۳	۰.۶
	۲. Ratio of the hours of scientific and professional consultancy to total TCs	۰.۸	۱.۲	۳.۲	۱.۷	۴.۱
	۳. Ratio of the hours of instructive workshops to total TCs	۱.۲	۰.۹	۱.۴	۱.۱	۳.۸
	۴. Ratio of the mean of participants in workshops to total members of TCs	۰.۳	۰.۲	۰.۴	۰.۲	۰.۵
Research and Technology	۵. Ratio of the number of innovations of TCs to total TCs	۰.۴	۰.۱	۰.۳	۰.۱	۰.۷
	۶. Ratio of the number of published papers of TCs to total TCs	۰.۲	۰	۰.۱	۰.۱	۰.۱
	۷. Ratio of the number of web connected TCs to total TCs	۱	۱	۱	۱	۱
	۸. Ratio of attendance in International Fairs to total attendance in the fairs	۰.۱	۰.۳	۰.۲	۰.۲	۰.۴
financial	۹. Ratio of the credits of TCs to total TCs	۳۵*	۳۰	۳۰	۲۹	۳۸
	۱۰. Ratio of non-government income to government credits	۰.۱	۰.۱	۰.۲	۰	۰.۴
	۱۱. Ratio of employees payroll costs to total costs	۰.۳	۰.۳	۰.۵	۰.۴	۰.۲
	۱۲. Ratio of Instructive and consultative costs to total costs	۰.۱	۰.۲	۰.۱	۰.۱	۰.۳

Table ۲. The KPIs Measures of Five Important Iranian Incubators

KPIs	SBU Technology Incubator	UT Technology Incubator	Khorasan Technology Incubator	Fars Technology Incubator	ISTT Technology Incubator	
administrative	۱۳. Ratio of board of directors to the total employees	۰.۲	۰.۳	۰.۳	۰.۲	۰.۳
	۱۴. Ratio of experts to the total employees	۰.۴	۰.۴	۰.۵	۰.۳	۰.۶
	۱۵. Ratio of official faculty to the total employees	۰.۲	۰.۱	۰	۰.۱	۰.۲
	۱۶. Ratio of the total employees to total TCs	۱.۱	۰.۷	۰.۳	۰.۶	۰.۴
entrepreneurship	۱۷. Ratio of total members of TCs to total TCs	۶.۳	۳.۷	۵.۹	۸.۱	۵.۹
	۱۸. Ratio of female members of TCs to total TCs	۰.۴	۰.۲	۰.۲	۰.۲	۰.۵
	۱۹. Ratio of students outside of the university to total members TCs	۰.۳	۰.۴	۰.۵	۰.۹	۰.۸
	۲۰. Ratio of Ph.D and MA students to total members of TCs	۰.۵	۰.۶	۰.۳	۰.۲	۰.۶
environment	۲۱. Ratio of official space to total space	۰.۱	۰.۱	۰.۱	۰.۱	۰.۲
	۲۲. Ratio of allocated space to TCs to total space	۰.۶	۰.۸	۰.۴	۰.۴	۰.۲
	۲۳. Ratio of Instructive and consultative space to total space	۰.۱	۰.۱	۰.۱	۰.۲	۰.۳
Tenant companies	۲۴. Ratio of start-up TCs to total TCs	۰.۱	۰	۰.۵	۰.۲	۰.۲
	۲۵. Ratio of admitted TCs to total applications	۰.۱	۰.۱	۰.۵	۰.۱	۰.۷
	۲۶. Ratio of faculty members in TCs to total members TCs	۰.۲	۰.۲	۰.۱	۰	۰.۲

* Million Rials

Overview of the results

As table ۲ shows, Isfahan Science and Technology Town Technology Incubator in all KPIs of instructive and consultative and financial

areas and in two KPIs of research and technology, administrative, and entrepreneurship areas and in one KPI of environment and tenant companies areas has the highest ratios among other incubators. Shahid Beheshti University Technology Units Incubator and Fars Technology Incubator in two KPIs and University of Tehran Technology Incubator and Khorasan Technology Incubator in one KPI have the highest ratios among other incubators.

In other words, ISTT Technology Incubator in relation to workshops evaluation, the hours of scientific and professional consultancy and instructive workshops, participants in workshops, the number of innovations, attendance in International Fairs, the allocated credits to tenant companies, non-government income, employees payroll costs, Instructive and consultative costs, the number of official experts and female members of tenant companies, Instructive and consultative spaces, and admitted tenant companies have worked more efficiently in comparison with other technology incubators. In general, as key performance indicators show, ISTT Technology Incubator has better performance than other incubators in ۲۰۰۵-۰۶. We conjecture that this is because ISTT Technology Incubator is close to the Isfahan Science and Technology Town and uses its resources and facilities. The KPIs in seven key performance areas are described bellow:

۱- Instructive and Consultative

۱-۱- Ratio of evaluated workshops to total workshops:

The ISTT Technology Incubator in this ratio has the best performance. The measures of this KPI in all of incubators are nearly low and in order to improve effectiveness and quality of workshops, we suggest that the number of workshops and their evaluations to be increased.

۱-۲- Ratio of the hours of scientific and professional consultancy to total tenant companies:

The ISTT Technology Incubator has the highest hours of scientific and professional consultancy among other incubators. Expanding and enriching consultancy services lead to improving the performance of tenant companies; so we propose that the hours of scientific and professional consultancy to be increased.

۱-۳- Ratio of the hours of instructive workshops to total tenant companies:

The ISTT Technology Incubator has the highest hours of instructive workshops among other incubators too. As mentioned before, increasing the quantity and quality of instructive workshops helps to rapid growth of tenant companies.

۱-۴- Ratio of the mean of participants in workshops to total members of tenant companies:

The mean of members participation of tenant companies in workshops in the ISTT technology incubator is the highest among other incubators. Through improving the effectiveness of workshops and adjusting to tenant companies needs, their members participation in workshops would increase.

۲. Research and Technology

۲-۱- Ratio of the number of innovations of tenant companies to total tenant companies:

The highest number of innovations in the ISTT technology incubator is observed. Supporting entrepreneurship and creative ideas result in increasing the number of innovations of tenant companies.

۲-۲- Ratio of the number of published papers of tenant companies to total tenant companies:

The SBU Technology Units Incubator in this ratio has the highest performance. Today, the processes of identification, sharing and creation of knowledge for maintaining and expanding of the incubators are critical factors. These goals are achieved through implementing knowledge management strategy in the incubators. This would result in an increase of the published papers and books.

۲-۳- Ratio of the number of web connected tenant companies to total tenant companies:

Fortunately, all of these incubators tenant companies are connected to world wide web and the performance of total incubators in this ratio were all high.

۲-۴- Ratio of attendance in international fairs to total attendance in the fairs:

The number of ISTT technology incubator attendances in national/international fairs is the highest among the remaining incubators. The tenant companies through attendance in national/international fairs communicate and interact with other companies. Therefore we propose that the number of incubators attendances at fairs specially at international fairs to be increased.

۳. Financial

۳-۱- Ratio of the credits of tenant companies to total tenant companies:

The ISTT technology incubator in this ratio has the best performance. The tenant companies are main and critical part of incubators and the incubators in order to improve their performance should pay more attention to credit provision for tenant companies.

۳-۲- Ratio of non-government income to government credits:

The ISTT technology incubator was observed to have the highest non-government income. In recent years, governmental financial supports of incubators have been decreased. Therefore, incubators in order to maintain and expand themselves should try to attract more non-government of income.

۳-۳- Ratio of employees payroll costs to total costs:

The ISTT technology incubator has the less ratio of employees payroll costs to total costs of incubator. The employees payroll costs in successful organizations is not too high in comparison with other costs

and so we recommend that incubators decrease the number of their official employees and increase the efficiency of them.

۳-۴- Ratio of Instructive and consultative costs to total costs:

The highest amount of Instructive and consultative costs are observed in the ISTT technology incubator. Instructive and consultative services are critical to the mission of incubators and paying more attention to these areas are necessary.

۴. Administrative

۴-۱- Ratio of board of directors to the total employees:

The SBU Technology Units Incubator and Fars incubator have the less ratio of board of directors to the total employees. The board of directors are considered as staff employees and successful organizations try to decrease the ratio of their staff employees to their line and operational employees.

۴-۲- Ratio of experts to the total employees:

The number of ISTT technology incubator experts are the highest among other incubators. Most often, increasing the number of experts and specialists in organizations result in improving their performance. Therefore, we recommend that the incubators try to attract more experts and specialists.

۴-۳- Ratio of official faculty to the total employees:

The highest ratio of official faculty to the total employees in SBU technology units incubator and ISTT technology incubator are observed. The participation of effective faculties lead to incubators

achievement. we recommend any attempt to attract more faculties to participate in incubators achieving.

۴-۴- Ratio of the total employees to total tenant companies:

The Khorasan technology incubator has the less ratio of the total employees to total tenant companies. The measure of this ratio shows that Khorasan technology incubator provide supporting services to tenant companies with less employees among other incubators. Therefore, we recommend that incubators decrease the number of their official employees and increase their efficiency.

۵. Entrepreneurship

۵-۱- Ratio of total members of tenant companies to total tenant companies:

The Fars incubator in this ratio has the highest performance and could attract the most number of members in every tenant company. Providing the essential facilities for job creation and decreasing the unemployment problem are critical missions of incubators. Hence, it is better that the incubators managers try to attract more educated entrepreneurs and researchers.

۵-۲- Ratio of female members of tenant companies to total tenant companies:

The highest number of female members of tenant companies was observed in the ISTT technology incubator. On the basis of increasing the rate of female students admission in universities and higher education institutions in recent years, the incubators managers

naturally should attract more female students and graduates in tenant companies.

۵-۳- Ratio of students outside of the university to total members tenant companies:

The Fars incubator has the highest performance in this ratio. It is better that university incubators allocate some of the firms to external entrepreneurs and researchers. This decision results in raising diversity and quality of incubator firms.

۵-۴- Ratio of Ph.D and MA students to total members of tenant companies:

The highest number of Ph.D and MA students collaborate with University of Tehran and ISTT technology incubators. Often, increasing the number of graduate students in technology incubators firms lead to the improvement of their performance. Hence, we recommend that the incubators managers try to attract more graduate students in incubators firms.

۶. Environment

۶-۱- Ratio of office space to total space:

Except ISTT technology incubator, the measures of this ratio are the same in all incubators. The incubators managers should try to decrease not only staff employees but also office space of technology incubators.

۶-۲- Ratio of allocated space to tenant companies to total space:

The highest allocated space to tenant companies is observed in the University of Tehran technology incubator. The main mission of incubators is providing services to tenant companies. Therefore, we propose that the incubators managers allocate more space to tenant companies.

۶-۳- Ratio of instructive and consultative space to total space:

The ISTT technology incubator has more instructive and consultative space among the other incubators. Increasing the size and efficiency of instructive and consultative space result in faster growth of tenant companies.

۷. Tenant Companies

۷-۱- Ratio of start-up tenant companies to total tenant companies:

This ratio indicates a better performance for University of Tehran technology incubator than other incubators. One of the main goals of technology incubators is helping tenant companies to go beyond start-up phase. Low number of start-up companies represent the incubators managers capacity in achieving this goal.

۷-۲- Ratio of admitted tenant companies to total applications:

The highest number of applications for an established company is observed in the ISTT technology incubator. Perhaps the reason for this fact is providing high services and facilities in the ISTT technology incubator.

۷-۳- Ratio of faculty members in tenant companies to total members

tenant companies:

The SBU technology units incubator and the ISTT technology incubator and the University of Tehran technology incubator could provide desirable condition and facilities for attracting faculties in their incubators. Faculties collaboration lead to quality improvement of products/services of incubators firms.

Conclusion and recommendations

The incubators nurture young firms, helping them to survive and grow during the start-up period when they are most vulnerable. Incubators provide hands-on management assistance, access to financing and orchestrated exposure to critical business or technical support services. On the other hand, key performance indicators are general indicators of performance that focus on critical aspects of outputs or outcomes and they help an organization define and measure progress toward organizational goals. This article has been prepared in an attempt to introduce the reader, the role of key performance indicators as a performance measurement tool in order to evaluate the success and improvement of incubators. We compared and analyzed the key performance indicators of five important Iranian technology incubators and as the results of this study demonstrate the Isfahan Science and Technology Town Technology Incubator has better performance among other incubators.

On the basis of findings, we recommend that incubators managers pay more attention to ۱) Training and development of human resource of technology units of incubators, ۲) Developing the creative, innovative, and competitive culture in tenant companies, ۳) Continuous evaluation and improvement of programs and processes, ۴) Diversifying the governmental and nongovernmental incomes of technology incubators, ۵) Helping the tenant companies to become independent of governmental support, ۶) Increasing the number of specialist and official faculty, ۷) Increasing the quantity and quality of attendance in international and national fairs, ۸) Preparing and developing research and laboratory spaces, ۹) Developing scientific, professional, and technological relations with national and international organization associations, ۱۰) Identifying and utilizing environmental opportunities in IT area with attention to strengths of technology incubators, ۱۱) Facilitating the process of product distribution and using the knowledge and information of technology incubators, ۱۲) Assuming the request-oriented approach in instructive, research and technological processes, ۱۳) Supporting the development and usage of new technologies in technology incubators, ۱۴) Investing in the markets of knowledge-based products, ۱۵) Supporting and creating national innovative and intellectual property rights systems, ۱۶) Increasing the interactions with organizations outside the technology incubators, ۱۷) Increasing the scientific and professional interactions between the tenant companies, ۱۸) Preparing facilities for increasing the number of contracts of tenant companies, ۱۹) Increasing the quantity and quality of Instructive and consultative courses,

۲۰) Developing project and financial management and administrative skills of tenant companies directors.

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