



Journal of Applied Sciences

ISSN 1812-5654

science
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Influence of Culture on Innovation Barriers: The Case of Sri Lankan Food Processing Industry

Saliya De Silva and Jun Takeda

United Graduate School, Kagoshima University, Korimoto, Kagoshima, Japan

Abstract: This study presented the results of a survey designed to analyze the nature and significance of innovation barriers, using the Sri Lankan food processing industry as a case study. The study found that with regards to innovation, most of the firms experienced operational constraints, particularly with respect to internal resources such as finance, technology and knowledge base and inefficiencies in external institutional set up to provide the required services, coordination and cooperation. Most importantly, the majority of these constraints are influenced by the food processors' negative cultural orientation towards their external environment, novelty, risk and human competencies. This study proposes that Regional Innovation Centers be established in Sri Lanka for the provision of highly specialized services in research and development, innovation funding and management training and education, to strengthen innovation activities in the food processing industry.

Key words: Innovation, food processing industry, developing nations

INTRODUCTION

This study attempts to determine the factors hampering innovation activities in developing countries using the Sri Lankan food processing industry as a case study. The food industry is faced with a period of rapid change, driven by globalization, trade liberalization, development of genetic, processing and information technology, intellectual property rights, changes in family structure and health and food safety concerns. Innovation has been identified as the key strategic element if the food organizations are to compete successfully in this increasingly dynamic and chaotic world^[1]. Empirical studies reveal that innovative firms have generally enjoyed a higher growth in turnover, employment, exports and profits than their non-innovative counterparts^[2,3]. Disappointingly, food processors in underdeveloped countries like Sri Lanka, in contrast to those in developed countries, are seen to be lagging behind in innovation activities.

There is an apparent consensus supporting four general classes of explanatory variables underlying the innovation process; the economic, technological, institutional and socio-cultural variables^[4-7]. Debate within this consensus simply revolves around issues of the relative importance of each of these classes of explanatory variables in different contexts. Even though considerable

investigation has been done in the developed world on identifying these variables, such research has hardly been carried out in Sri Lanka where the concept of innovation is relatively new as a management strategy. Furthermore, determining the nature and significance of these variables to initiate and then sustain innovation and their interactions remains largely an unanswered research problem. To provide an alternative to the literature's general conceptualization of the innovation process, this study proposes the following innovation model based on fundamental economic and socio-psychological theories. This model hypothesizes that there are three sets of necessary conditions that must be met before a firm will choose to innovate. The conceptual framework is summarized in Fig. 1.

First, the firm must have adequate demand for product innovated by the firm. Economic theory emphasizes the necessity of consumer acceptance for the market success of any new product developed^[6]. Without effective demand and assurance for the imminent recovery of the cost involved in innovation quickly, there is little reason to believe that a firm should innovate.

Second, the firm must have the capacity to innovate. There should be sufficient resources and competencies, including funds, material, technology, infrastructure and personnel necessary to enhance the innovative capacity of the firm. For instance, scholars record the importance

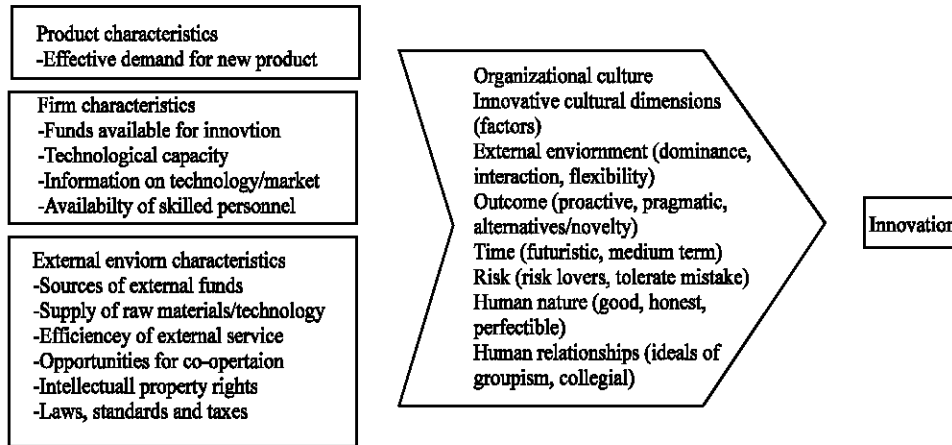


Fig. 1: Firm level innovation in the developing nations

of financial resources to support and to reap the benefits from innovative activities, particularly in terms of research and development (R&D) and the marketing of new product innovations^[5]. Cohen and Levinthal^[4] point to the need of ‘absorptive capacity’ (the ability to exploit external knowledge)-determined by inhouse R&D, existing manufacturing operations and the skill level of employees-as a critical factor in encouraging product innovation by a given firm.

Third, the firm must be able to obtain support and services from the external environment. The importance of a democratic and efficient institutional setup to encourage and nurture innovation has been highlighted in many studies^[8]. These services could be in the form of providing funds, cooperation in R&D, the supply of information, the protection of intellectual property rights, legislative assistance, etc.

These three sets of conditions will be the driving forces behind innovation in any given firm. The fourth condition that completes this set is the culture of the organization. Organizational culture can simply be defined as shared assumptions, values and norms that guide the behavior of the members of an organization. It represents common attitudes held by employees and governs to a large degree what employees see, think, and feel and how they respond to various situations^[7,9]. Therefore, the culture decides how the firm responds to consumer demand, how organizational strengths and weaknesses are treated and how it deals with external institutions.

MATERIALS AND METHODS

Although innovation includes both products and processes, due to unavailability of reliable data this study focuses only on product innovation, defined as the

commercialization of a new or a significantly changed product with improved and/or diversified performance characteristics^[10]. The study uses the cross-sectional data of 91 food processors (firms with employees between 10 and 500 and ones established before 2000) collected in a survey conducted between November 2003 and May 2004 in Sri Lanka. The survey was designed to determine if there are constraints to innovation within the food industry, either intra-firm and/or the external environment and determine their nature and significance. The sample firms are located in Central, Uva, Western and Northwestern provinces where the majority (83%) of the food processing firms are found in Sri Lanka^[11]. A structured questionnaire was used to interview the decision makers (the owner or a manager) of each enterprise. The questionnaire was developed by drawing information from a variety of published sources, while using the recommendations of the OECD Innovation Manual^[10]. Open-ended interviews were also carried out with key informants from the different stakeholder groups in the food industry; the government and non-governmental agencies involved in research, development, technical and financial services. The interviewers had to use visual observation to verify some of the statements of these respondents.

RESULTS AND DISCUSSION

Innovation in the food processing industry in Sri Lanka:

The food industry in Sri Lanka has a high potential to innovate and to introduce a stream of new products every year. Sri Lanka is historically famous for tea, exotic spices and tropical fruits. It has rich, untapped raw materials and traditional knowledge (e.g. ayurvedic food preparations) and can make use of the progress in processing

techniques for this purpose. In addition to these supply side factors, there is also the continuous change in consumer food behavior increasing the demand for healthier, more convenient and quality processed food. However, our sample study shows that the extent of innovation is insignificant, amounting to 108 new products annually (approximately one single new product per year per firm). Furthermore, 24.2% of the firms have not innovated even a single new product during the 2000 to 2003 period. The majority of firms (72.5%) have commercialized less than five new products during this same period.

The food processors studied in the sample survey are also known to focus their innovative efforts on 'incremental innovation' (referring to a previously manufactured product whose performance has been significantly improved) rather than 'radical innovation' (referring to a product whose intended use, characteristics and performance differ significantly to previously manufactured products). Out of the total new products, only 19.7% can be grouped into the radical innovations. Also, in spite of Sri Lanka being a country with comparative advantage in many agricultural products, only 2.5% of the new products (total of eight) produced by our sample industries during 2000-2003 can be classified as new to global consumers i.e. true innovations-a product introduced for the first time in the industry. Nevertheless, out of the total number of innovations, 47.1% are new either to a segment of or to the entire consumer population in Sri Lanka. The majority of products (50.3%) are new only for the firm. These findings reveal that most of the food processors rely on imitation (meaning a product copied from the competitors) rather than true innovation.

Imitation at a country level has been an element of adaptation to global changes. However, when too much imitation at the domestic level (market or firm) occurs, it can be a waste of scarce resources in an already saturated market, leading to the sharing of the total market profit, consequently affecting not only a firm's own growth but also that of the whole industry. Although many scholars^[12] have stressed the importance of radical and true innovation in obtaining better profits and success in global competition, this is not apparent among the sample firms. The reduced importance of Sri Lanka as a source of global food technology is further confirmed by the limited number of patents held by Sri Lankan food processors, although the Intellectual Property Act has been in place since 1979. In all of Sri Lanka there were only 21 patent applications from the food industry during the last two and a half decades and out of those only 12 patents have been granted.

Organizational culture of food processing enterprises in

Sri Lanka: In order to determine the attitudinal and behavioral patterns among the sample food processors the respondents were asked to identify their stand on six broad cultural dimensions: their orientation towards the external environment, outcome, time, risk, human nature and human relationships. Each of these dimensions had a scale consisted of two or more factors (Fig. 1).

External environment: One key value system of an innovative culture is that it assumes that the external environment can be influenced^[7] and recognizes it as a source of significant input of information for innovation i.e. open system focus^[13]. It allows the firms to efficiently monitor the external environment through customer surveys, market research, participation in trade fairs, exhibitions and seminars; and to process them through either their own R&D or partnerships with suppliers or research institutes and then respond to these environmental changes through innovation.

Nevertheless, a significantly higher proportion of our sample respondents (63%; $p = 0.026$) is characterized by antithetic cultural values i.e. closed system focus. Hannon and Freeman^[14] say that these kind of firms believe in environmental dominance and management can hardly do anything to adjust to these environmental uncertainties. Such organizations are short of the systems to collect, process and distribute information and to adapt themselves to changing demands of the environment. They tend to continuously depend on external agencies to provide support, or otherwise fail in a competitive arena.

Outcome: Depending on the cultural values held, organizations also differ in the way their outcomes are achieved. Senge^[15] in his generative learning theory says that rather than reacting to environmental changes with routine, standard responses i.e. adaptive learning, organizations should be ahead of and anticipate change i.e. creative learning. Such organizations tend to be proactive rather than reactive to environmental changes. Their activities are motivated by the ends (vision) rather than the means (way of achieving them). They tend to continually question and challenge the status quo and encourage novel ideas, options and suggestions to achieve their desired outcome. However, the results revealed that reactive firms that rely on senior advice and traditions are in significantly higher numbers among the sample food processors (64%; $p = 0.020$). The result is the continuation of traditional product lines, making only minor changes, which the firms are more familiar with.

Even if innovation occurs, it will be incremental or imitation, rather than radical or true innovation.

Risk: In order to generate novel ideas, a positive value must be placed on breaking traditions and trying new things even they involve a certain degree of risk. If the members were allowed to take risks and also accept their unsuccessful efforts or failures, they would think with more originality and come up with better solutions to their problems^[16]. However, a significantly higher proportion of our sample respondents (65%; $p = 0.009$) were seen to resist risks and penalize mistakes. These firms have not developed strategies for trying things out, or allowing employees to come up with new ideas and innovations, so that they continue to put up with unproductive, outdated and unprofitable conditions.

Human nature: In innovative organizations, employees are viewed as basically good, honest and perfectible (McGregor's Theory Y)^[7]. Consequently their decisionmaking will be more decentralized and accurate and honest information will be shared at all levels and external controls will be kept to a minimum. Such decentralized and more participative decision making systems are more likely to identify the relevant areas in which innovation is needed, air good ideas, stimulate creativity and produce conditions where everyone understands the idea so that it will be properly implemented^[7]. Nevertheless, the majority of our sample respondents (66%; $p = 0.004$) view employees as fixed and regard them with suspicion and distrust (McGregor's Theory X). They tend to ignore individual creativity and competencies and the minimum priority will be given to enhancing their creativity through training and development. The decision making style would be more autocratic rather than participative. Managers are given power to direct, evaluate, reward, or punish employees. This centralization of power may help the firm to function, but it also creates anxieties and frustrations that limit innovation.

The four cultural dimensions discussed above hamper the firms' innovative efforts. However, it is important to note that not all cultural dimensions characterized in the sample food processors are unfavorable for innovation. The majority of the firms (56%; $p = 0.320$) have a futuristic and medium term time orientation, which Schein^[7] stressed is very important to enhance innovation activities. Furthermore, the majority also have the ideals of groupism, thus if innovative ideas are generated, such firms will be far more effective in accepting those ideas and implementing them. However, these favorable cultural dimensions have been

overthrown by other unfavorable cultural assumptions, values and norms. For instance, in a previous study it was found that the groups (or the food processing firms) discourage socio-cultural diversity among their members^[2]. The homogeneous groups formed will not have an associated mass of ideas, thus these firms will have less synergy potential to initiate innovation.

Factors hampering innovation activities in the Sri Lankan food industry: This section looks into the factors hampering innovation activities by analyzing the three sets of necessary conditions for innovation. The respondents were asked to identify the barriers to innovation in a five point Likert scale ranging from 1, insignificant to 5, very significant. With regards to innovation, the majority of firms experienced some constraints. Some are operational constraints while others are cultural. Some occur less frequently while others are more frequent. Table 1 shows the food processors' view on the significance of various innovation barriers in the Sri Lankan food processing industry.

Product characteristics: Whether the effective demand for processed food is adequate to encourage innovation naturally creates doubts in one's mind, because of the tiny market in the presence of fresh products all year around in Sri Lanka, it is not seen as a highly significant barrier by the sample food processors. The demand for processed food has increased due to socio-economic and cultural changes in Sri Lanka, particularly in the last two to three decades. Some of these changes are a rise of per capita income (from US\$ 187 in 1971 to US\$ 947 in 2003), an increased urban population, the creation of nuclear and double income families with a more westernized lifestyle, the expansion of self-service super markets and the development of the mass media. Apart from an increase in local demand, international demand has also increased in the recent times. With the further transformation in the socio-economic structure of domestic and international markets, there is no doubt that demand will continue to grow in the future.

Given the existence of an effective demand, the lack of innovation observed among food processors, therefore, could be due to problems with other necessary conditions, as well as their risk averse behavior, as noticed under culture analysis. This in fact is paradoxical in nature; believing there is demand and at the same time having a highly perceived risk of failure. In innovation, the chances for failure from idea generation to commercialization, which could lead to huge financial and psychological losses, are generally high. In a country like Sri Lanka, where economic, social and political instability

Table 1: Barriers to innovate in food processors, perspective

Innovation barrier	n	Mean score*	Std. Deviation
Product characteristics			
- Perceived demand-customers unresponsive to new products	80	3.24	1.193
- Payoff period of new product too long	90	3.02	1.256
Firm characteristics			
- Lack of funds available for innovation	83	4.02	0.975
- Technology potential			
- Firms' manufacturing technology too weak	90	3.71	0.927
- Lack of appropriate in-house infrastructure	90	3.36	1.193
- Information-lack of information on technology	91	3.58	1.193
- Lack of information on markets	89	3.37	1.016
- Lack of skilled personnel	90	3.53	1.201
External characteristics			
- Lack of appropriate sources of external finance	87	3.39	1.071
- Scarcity of appropriate technology/raw materials	86	3.62	0.856
- Deficiencies in the available external services	87	3.79	1.080
- Lack of opportunities for cooperation	89	3.65	0.880
- Weakness of intellectual property rights	86	2.92	0.755
- Legislation, norms, regulations, standards, taxation	87	3.40	1.051

Note: n - number of respondents; * Mean scores were computed based on replies to each of the obstacles, presented to the firms; 1-'insignificant' to 5-'very significant'

is high, the risk of product failure will be much higher. Nevertheless, innovation is full of surprises and firms that tend to break traditions, try new things and take the inevitable risk will likely to succeed finally. If firms tend to believe that risk is a barrier, they will end up in a vicious circle, attempting less trial and error activities, be less creative and therefore less innovative.

Firm characteristics: Obviously Sri Lankan food processors differ significantly in terms of their financial and technological potential, managerial and knowledge generation capabilities and therefore their innovation capacities. Among the firm specific barriers, the lack of financial resources appears to be the most relevant barrier to innovation. Innovation is not a simple economic activity; it involves a great deal of expenditure for R&D, new technology, expert knowledge and management as well as for marketing, particularly for truly and radically new products. The survey found that most of the food processors are domestic firms (96%) operating with limited financial resources. It was also found that the proportion of turnover spent on R&D (R&D intensity) is also low (5.6%). Therefore, the question arises. Is the lack of funds a real operational problem or an attitudinal obstacle derived from, for example, their risk averse behavior.

The low technological potential has also been identified as a major innovation constraint. The survey found that the majority of firms are characterized by small, traditional types of manufacturing technology (43.2%) while only 19.3% have large-scale fully automated units. In-house infrastructure facilities, for example the availability of aseptic plants needed to adopt modern manufacturing technology, laboratory facilities, IT, uninterrupted power supply, etc., also restrict the firms' ability to engage in innovation activities. For instance,

the results revealed that 28.4% of the firms were, surprisingly, not using computers at all. While 51.1% of the firms are using IT for general purposes like word processing, accounting and e-mailing, only 20.5% are using IT for advanced manufacturing or marketing purposes like web advertising, e-business, computer aided manufacturing, etc. The lack of technological potential in the firms prevents them from assimilating new knowledge generated both in and out of the firm. This technological backwardness can be influenced by cultural values held by the food processors. The modernization of these facilities requires a positive cultural orientation towards change and novelty, which was not observed among the sample food processors.

The lack of information about technology also appears to be a relevant barrier for innovation. It can be attributed to the lack of internal resources, particularly with respect to finance, technology (e.g. IT) and the knowledge base as well as their negative cultural orientation. It was observed that food processors are significantly oriented towards a closed system focus, thus their interaction with the external environment will obviously be low. One firm even noted that "*yes, technology is there, but it doesn't come to you*". As Drucker^[17] pointed out "... firms must go out and look, ask and listen ...", they must go after information and put in place more efficient environment monitoring systems to learn about the technological and market opportunities as early as possible. There is no systematic and purposeful search for new knowledge. Rather the food processors tend to continuously be dependent on support institutes, a 'dependency syndrome' among industrialists, as some scholars put it. The lack of skilled personnel is also found to be seriously hampering innovation. The results of the survey revealed that the numbers of both skilled

personnel (science and engineering graduates) and R&D employees are very low among the sample food processors. There are only 1.65 science and engineering graduates per firm (1.43% of the total work force). The average number of R&D employees is as small as 1.59 persons per firm (2.0%), while 46.15% of them did not have even a single employee in R&D. As observed in the culture analysis, food processors have a pessimistic orientation towards the nature of human behavior. Their belief is that employees are lacking skills, knowledge and attitude and that this cannot be changed (i.e. human nature is bad), therefore training will be useless and they should be guided, supervised and controlled all the time. Maybe partly due to these cultural values, one frequently heard criticism against Sri Lankan university graduates is their lack of the right attitude, skills and practical knowledge. However an optimistic attitude towards human nature will rely on human skills and competencies, consequently enhancing their internal knowledge generation as well as their ability to assimilate new knowledge generated elsewhere.

External environment characteristics: Among the external environment characteristics, deficiencies in available external services appeared the most relevant factor. As most of the firms are constrained by limited internal resources, their dependence on external technical expertise will naturally be high. Ironically, there is a substantial number of public/government, private and non-governmental institutes established in Sri Lanka aimed at providing various services to the food industry. According to the industrialists' views, however, whether these institutes are involved in the services they are intended to provide to the industry is a serious question. Except for the dissemination of knowledge in some traditional food technologies, efficient and effective knowledge generation activities are not presently happening in most of these institutes. One firm noted, "... except ITI (Industrial Technology Institute), others are useless". Lack of awareness of the institutes or their services, service inappropriateness, their remoteness (as most of these services are concentrated in capital Colombo) and too much time and cost involved were quoted as major obstacles in obtaining such services. Furthermore, it was revealed that most of their services are overlapping rather than complementary in nature. The industrialists are in a dilemma as to where they should seek assistance with respect to their specific problems. These deficiencies are usually attributed to the lack of government funds. Yet, lack of motivation on the part of the staff appears very significant, as there are some researchers attached to these institutes who engage

in R&D using funds that they have found from external sources and disseminate their knowledge on an individual basis.

Lack of opportunities for cooperation has also been identified as a significant barrier. So far, there are no Science Parks, Business Incubators and Innovation Centers in Sri Lanka, linking research institutes with the industrialists, though they have long been established in other countries. In a developing country like Sri Lanka where both private and public sectors are constrained by limited resources, cooperation is very important in sharing expertise and laboratory facilities, as well as in training personnel. Recently, some initiatives have been taken (e.g. Nawabima at Katubadda, Appropriate Technology Research and Development Center at Pannala and Agribusiness Center at Peradeniya University, etc.) to make research and industry link and to provide business services. Most of these services and facilities are, however, either unknown or are seriously affected by inefficient bureaucratic procedures preventing effective cooperation. Another observation was that there was too much dependence on a few customary institutes for services and cooperation. It can seriously affect a firms' innovative performance if institutes fail to provide service in the required time and with good quality and affordable cost. The closed system focus among food processors could lead to limit its interactions with external organizations. Rather than rely on these institutions, the firms can find alternative sources for various assistance; for instance through the Internet and individual consultants, not only from local but also from foreign sources, as a few firms in the sample have shown.

From the supply side, the scarcity of technology and raw materials have been identified as major factors in the slowing down of firms' innovation. The limited supply of good quality local machinery and equipment forces the industry to heavily depend on costly foreign technology sources. Except for a few firms surveyed where locally produced simple machinery has been used (e.g. kerosene dryers for fruit and vegetables), most of them are using imported small and medium scale machinery. That is not to say that Sri Lankan food processors could rely exclusively on national sources for its technological development, but a noticeable movement to learn from the imported technologies and develop more appropriate local machinery cannot be observed among the local food processors.

As far as raw materials are concerned, in countries where food processing is widely practiced, farmers have been able to produce a market surplus, through the adoption of advanced technology and cultural practices. Food processors often use these cheaply available market

surpluses, especially the second grade fruits and vegetables otherwise dumped on farms. But in Sri Lanka there are no large-scale farms to produce such a surplus. The supply is further restricted due to the biological nature of raw materials that are affected by variations in environmental conditions. Another factor is the lack of a proper backward integration system, so producers or farmers are totally unaware of the quality, quantity and the time when the raw materials are required. The problem has been aggravated by the lack of an organized middlemen system in Sri Lanka. To operate such mechanisms, there is required a positive value orientation towards the external environment, risk, novelty, etc.

Another important finding was the lower scores given to lack of appropriate sources of funds by the firms constrained by the lack of funds for innovation. It indicates that although firms have limited funds, they are reluctant to use external sources to finance their innovation activities. The reluctance to depend on external funds can be attributed to the collateral required, high interest rates and cumbersome banking procedures when trying to obtain such funds. In Sri Lanka there is no special credit scheme for innovation, which should be characterized by low interest rates and long grace and pay back periods, because of the high risk involved in innovation activities. It could also be due to the negative attitude toward using external funds, derived from cultural values such as risk averseness, information opacity and a knowledge gap of the potential benefits of using external funds.

Interestingly, the failure of intellectual property rights has not been seen as an obstacle for innovation. As discussed earlier, in Sri Lanka and perhaps in many other developing countries, the copying of products and processes has been the rule of the game regardless of the size of the firm, especially those aiming to gain short-term benefits. The existing laws, standards and taxes are also not seen to severely discourage innovation in the food industry. Nevertheless, some firms are dissatisfied with the present tax policy in Sri Lanka, for example the application of the same tax rate of 15% for both locally produced and imported food products.

CONCLUSIONS

This study presented the results of a survey designed to analyze the barriers restricting innovation in Sri Lankan food processing firms. The analysis of product, firm and external environment characteristics has helped to shed light on the significance and the nature of innovation barriers. The results have revealed that the innovative efforts of the majority of food processors have

been bottlenecked with various operational constraints that in most cases have derived from their negative cultural assumptions, values and norms.

The limited internal resource base, institutional deficiencies and a culture unfavorable to innovation of the majority food processors, is a key rationale for the publicly subsidized provision of support in terms of funds, information, advice, training and consultancy by an organization specifically designed to promote innovation. Regional innovation centers in Sri Lanka are suggested, with a network of food processors and representatives of research, funding and training agencies available to provide the much needed coordination and cooperation opportunities and to supply highly specialized services and support to strengthen innovation. In order to overcome most of the innovation barriers, an attitudinal and behavioral change will be required. With top management understating, a more open system focus, a more proactive, pragmatic and novel approach, a commitment to customers and solutions, a greater allowance for risk and more optimistic assumptions towards human skills and competencies in a flexible entrepreneurial atmosphere, the necessary organization culture to support innovation will be provided. Better management education and training and socialization of the risks associated with innovation would lead the organizations to change their culture and consequently to overcome their attitudinal and behavioral weaknesses.

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