

A Proposed Methodology for Measuring SME Innovation

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Abstract

Exploring a suitable methodology for measuring SME's innovation is critical to managing and directing economic growth. The Middle East countries such as Gulf Cooperation Councils GCC embarked on finding an innovative methodology to support economic sustainability and prosperity transformations, which has led to a rise in the services sector fields and the growth of small and medium-sized enterprises (SMEs) activities and its profit returns. This study aims to evaluate the innovation outputs of SMEs activities in the sport and fitness sector in particular, Kuwait & Bahrain for the period 2015-2019. In addition, it focuses on the Fuzzy Logic Set methodology used to benchmark the SMEs' innovation performance and to identify the degree of innovativeness in SMEs. The proposed assessment methodology consisted of three methods, i.e. innovation audit, mapping innovation, and Fuzzy Logic Set. The study applied Fuzzy Logic to measure innovation activities outputs in twenty SMEs in the fitness industry in Kuwait and Bahrain. Data was collected based on surveys and interviews with top managers of selected SMEs. The contribution of this research is the introduction of a new approach to measure innovation activities outputs based on an innovation audit, mapping innovation, and Fuzzy Logic Set.

The results show that the proposed assessment methodology is effective. In addition, it was discovered that there are some similarities between the innovation attributes of SMEs in Kuwait and Bahrain in the performance of innovation management. It been noticed that both countries were using innovations related to products and services in the fitness industry. However, it been observed that process innovation was limited. The study recommends applying this assessment methodology to measuring innovation activities outputs to other private and public sectors in SMEs or large factors to monitoring the profits growth and setting new strategies and policies that pave that way for innovation in the country.

Keywords: Innovation activities output measurement, SMEs, Assessment methodology

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Introduction

In the field of SMEs, innovation could be considered as an essential growth factor and has received high attention due to its significance in the success of SMEs and their strengthening as the main driver of economic growth in developed and developing countries. Likewise, innovation could play an important role in product design, enhancing processes, and developing business models. It is important for any organization to measure innovation to improve its performance and competitiveness (Potters, 2009). Nasierowski (2012) found that corporate innovation is important in promoting economic growth and exploring a valid and reliable metric for measuring innovation in small and medium-sized enterprises (SMEs). Moreover, Al Mubarak (2017), in addition to Hertog (2008), focused on the GCC region to



explore opportunities that support and enhance knowledge localization and economic growth. In similar context, Ahmed & Al Askari (2014) indicated that in the United Kingdom (UK), SMEs been interpreted as the main drivers of economic growth, product innovation, and job creation. OECD (2017) stated that its member countries' economic growth is due to innovative SMEs that participate in the sustainability of the global supply chain. In addition, the Arab-European Business Council for Small and Medium Enterprises conference (2016) indicated that SMEs are key drivers of economic diversification and global cooperation in the GCC countries. The World Bank consider SMEs to be the vehicle for advancing the global economy and achieving the Sustainable Development Goals (SDGs). In the other hand, some of the conducted literature review shows that several suggestions have been made concerning assessment method effectiveness and measurement and benchmarking innovation of SMEs which pave the way for SMEs to expand and enhance the economic growth.

According to Maravelakis et al. (2006), the level of innovation marketing orientation of 137 large firms in the manufacturing sector been examined using the Podlaskie county small and medium-sized enterprise assessment approach (SMEs) to show an overall context for the changes resulting from benchmarking. Ahmed and Al-Askari (2014) also developed an evaluation methodology to assess the performance of SMEs in the industrial sector to identify opportunities and benefits within small and medium-sized companies, explore performance gaps, and compare the current performance of enterprises with the highest performance in the world.

Research Problem

The authors employed three main methods in this paper: innovation audit, mapping innovation, and Fuzzy Logic method. The authors present a combined approach for measuring innovation activities outputs in SMEs in the fitness industry in Kuwait and Bahrain. An initial survey been undertaken to 20 SMEs (10 in Kuwait and 10 in Bahrain) to conduct the three-phased method for measuring innovation. This study aims to measure and benchmark the SMEs' innovation performance to identify the degree of rapid changes, comprehend these changes accurately, and to respond to market change appropriately. It seeks to explore a new systematic measurement of innovation activities outputs to promote best practices in SMEs' in the sports sector in Bahrain and Kuwait. Several methods have been used to measure SMEs' innovations activities inputs, processes, or outputs due to SMEs having to perform in a high and turbulent environment. The benchmarking methods that have been applied for various purposes and to different sectors that support SMEs aim to improve competitive values of productions (goods or services) and to identify the level of innovation in SMEs in the fitness industry.

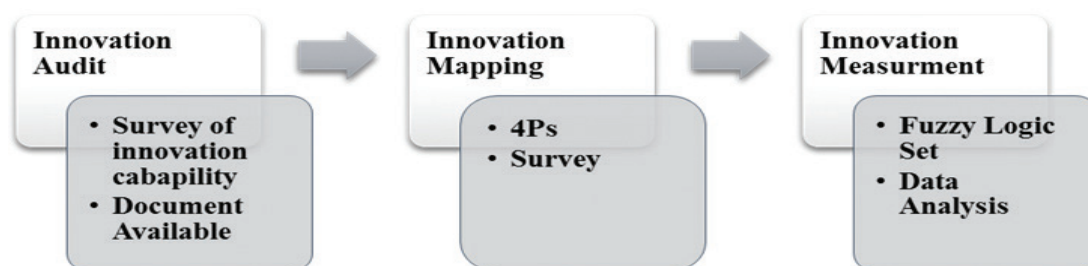


Figure 1. The research model adopted for the measurement of innovation (The Authors)

The Multi-Approach of Methods

The research, as indicated in Figure 2, used a combination of methods to measure the innovation dimensions of SMEs in fitness centers in Kuwait and Bahrain using mapping innovation, audit innovation, and fuzzy logic approach. The study methodology been based on qualitative and inductive research. It been based on surveys and interviews with top managers of SMEs in the sports industry in Kuwait and Bahrain.

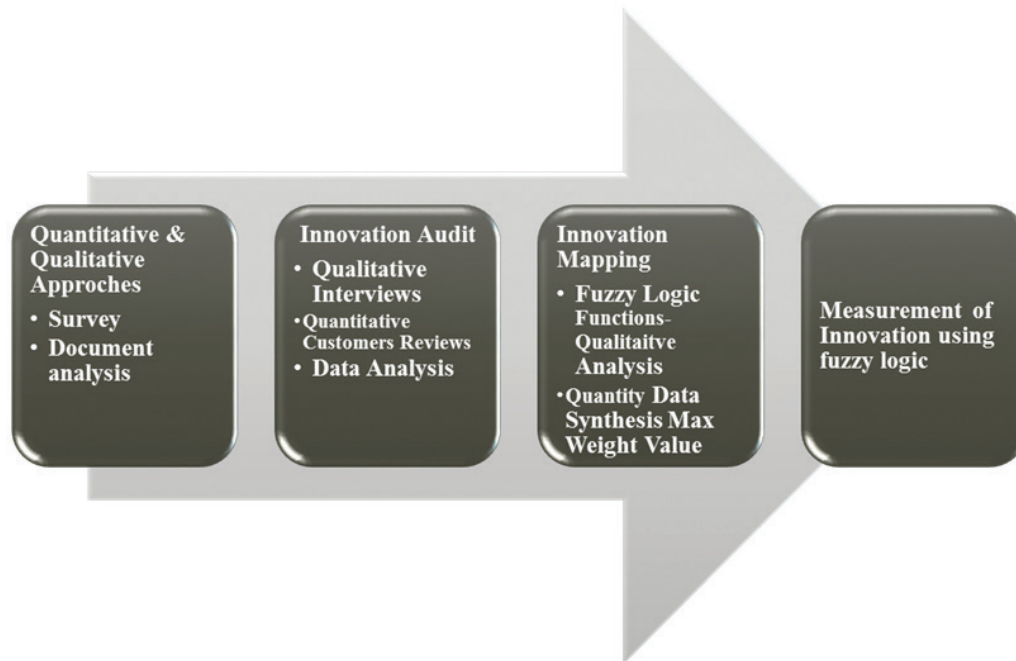


Figure 2. The overall proposed methodology for the measurement of innovation (The Authors)

The Multi- Methods in Details

I. Innovation Audit

Innovation audit is essential to managing and building on the innovation process in SMEs to be innovative and support the organization to discover barriers that stifle creativity and innovation. It promotes innovation in enterprise culture. Innovation auditing has also been used to evaluate the innovation value chain, examine knowledge flows, and capture customer feedback. The European Auditors Court (2019) reported an innovation audit approach in Europe SMEs to support managers to map and assess practice innovation capability. In this research, a survey based on the work of Ted and Bessant (2013) has been used to conduct an innovation audit based on a survey.

II. Mapping Innovation

After the innovation audit method was performed, the Innovation Space Method 4Ps (Product, Process, Position, and Model) were mapped using a survey of 20 SMEs. Tidd and Bessant (2015) stated that innovation mapping been used to define the space for innovation activities, in addition to, understanding the differences in innovation capabilities and then evaluating degrees of innovation in organizational form. Innovation in the

service sector been based on the value the service provider creates or is shared with the customer's experience (Innovate, 2020). Obaid et al (2019) indicated that companies use innovation maps to identify patterns of innovation, discover innovation, and explore new areas of business. Tidd and Bessant (2018) discussed that managing mapping innovation requires skills, knowledge, expertise, and a clear management strategy. Tidd and Bessant (2018) confirmed based literature review that only about 12% of companies manage innovation successfully. Mapping Innovation has enabled managers to gain insight into innovation trends, and help them devise appropriate strategies to increase the competitive advantage of SMEs. In this study, the 4Ps (product, process, position) model was performed to plan and define the innovation space in health and fitness centers (SMEs). The framework for mapping innovation shown in Figure 3.

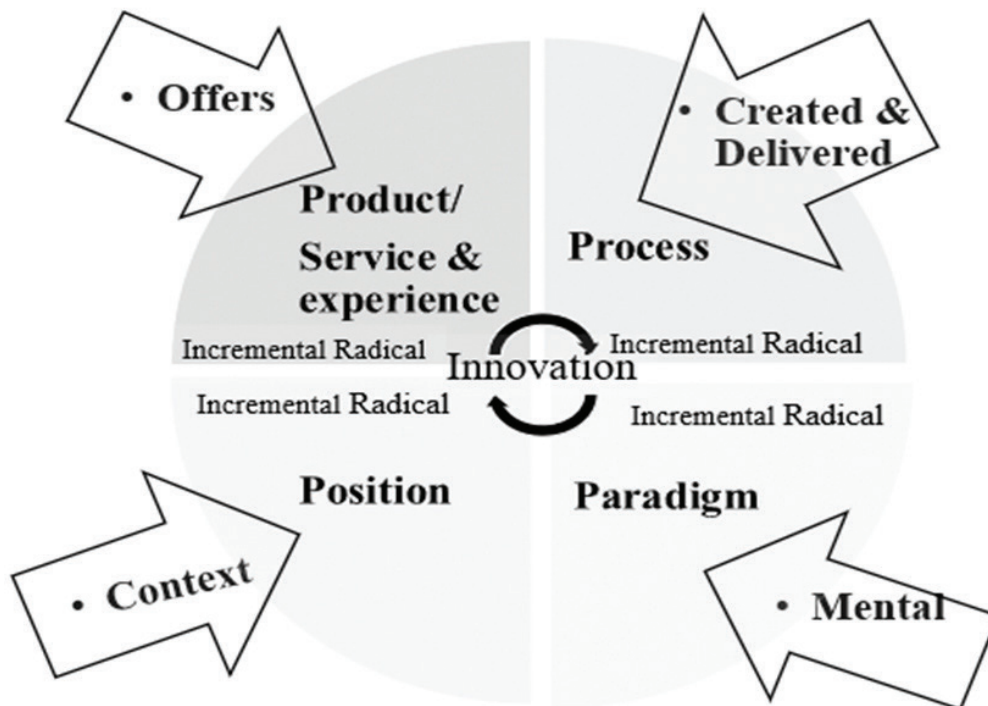


Figure 3. The 4Ps of innovation space (Source: Tidd and Bessant, 2013)

III. Fuzzy Logic Set

Fuzzy logic differs from classical logic in that statements are no longer black or white, true, or false, on or off. In traditional logic, an object takes on a value of either zero or one. In fuzzy logic, a statement can assume any real value between 0 and 1, representing the degree to which an element belongs to a given set. Fuzzy Logic Set used an enumeration system to effectively prove any truth-functional semantics. The fuzzy Logic set used numerically [0, 1] to define the truth and false of continuous functions. Abbas (2016) described the Fuzzy Logic Set as a precise problem-solving methodology. He added that Lotfi A. Zadeh, who developed the Fuzzy Logic sophisticated system in 1965, brings numerical data and linguistic knowledge techniques that deal with complicated systems and unknown mathematical knowledge. Abbas (2016) described the three steps of the Fuzzy control system as the Fuzzy inference process which included fuzzification (to translate input into truth values), rule evaluation (to computing output truth-values), and defuzzification (to transfer truth-values into

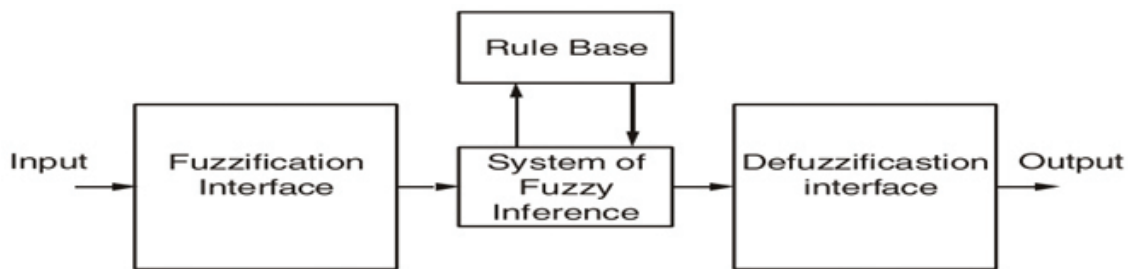


Figure 4. The Three Steps of the Fuzzy Inference Controller System (Source: Abbas (2016))

Abbas (2016) described the three steps of the Fuzzy control system as the Fuzzy inference process which included fuzzification (to translate input into truth values), rule evaluation (to computing output truth-values), and defuzzification (to transfer truth-values into output). Dhamakale and Patil (2011) stated that, the Fuzzy Logic rating system includes four steps using Fuzzy rules. The first step converted the input into organic values or scores between 0 and 1. In this stage, it defined the rules of Fuzzy sets. The second step converts the previous element, which contains more than one part, into a single degree between 0 and 1 and is applied to the output function. In this stage decision making to operate the fuzzy rules. The minimum score (AND) is selected, the maximum score is chosen (OR), and the ambiguous complement selects (NOT). The third step applied the combination method as formulated by the minimum operator (AND) to be performed for each rule. In this stage, the inputs of crisp fuzzification transform into degrees and match with the linguistic values. The fourth step is to aggregate each product of each law into a single fuzzy group using the maximum element (OR). In this last stage transform, the fuzzy results into a crisp output (convert the fuzzy values to the real values). Dhamakale and Patil (2011) describe the six steps of Mamdani's Fuzzy inference toolbox that is used to identify and compute the outputs of two variables using MATLAB application. The authors reported the six steps to compute outputs of two-dimensional functions/variables using the MATLAB Mamdani's Fuzzy inference application as follows: 1) Defining a set of fuzzy rules. 2) Fuzzifying the inputs using the input membership functions. 3) Collecting the fuzzified inputs based on the fuzzy rules to establish a rule strength. 4) Exploring the consequence of the rule by joining the rule strength and the output membership function. 5) Adding the consequences to get an output distribution. 6) De-fuzzifying the output distribution.

Data Analysis

The authors used the Tidd & Bessant (2013) framework that consisted of average scales from 1 to 7. Score 1 referred to "not at all true," score 2 referred to "not true," score three referred "somewhat not true," score four referred to "slightly true," score five referred to "moderately true," score six referred to "true," and score seven referred to "very true." Questions been grouped to address the innovation dimensions. For example, strategy innovation assigned with question survey number twelve, which consisted of paradigm innovation (goods& services). Process innovation was associated with questions nine, ten, and eleven. Organizational innovation been grouped into the question twenty-two. Linkage innovation referred to questions six, thirteen, fourteen, seventeen, eighteen, and nineteen. Learning innovation been directed to question fifteen. Table 1 below shows the maximum and minimum values of the five innovation dimensions and the Three-innovation axis.

Table 1: *The Maximum and Minimum Values of the Five Innovation Dimensions*

Case Study	Product/Service		Process		Organization/Management
	Strategy	Linkage	Process	Learning	Max Value = 7
	Max Value =7	Max Value =7	Max Value =7	Max value = 7	Min Value =4
	Min Value =4	Min Value =3	Min Value =4	Min Value = 4	
①	7	6	7	5	6
②	6	6	7	7	6
③	7	7	7	5	7
④	5	7	6.5	5	4
⑤	6	5	4	7	7
⑥	6	6	6	6	7
⑦	6	3	6	4	7
⑧	7	7	7	7	7
⑨	5	7	6	7	7
⑩	6	6	7	7	7
⑪	7	7	7	7	6
⑫	6	7	7	6	5
⑬	7	7	7	7	7
⑭	6	5	5	4	5
⑮	4	6	6	6	7
⑯	4	5	5	6	4
⑰	5	5	5	4	5
⑱	7	7	7	5	5
⑲	7	7	7	7	6
⑳	7	5	5	4	5

Mapping Innovation: Synthesis of the Case Study

Table 2 below shows the synthesis of data compiled from surveys and interviews to map innovation of the twenty fitness SMEs from Kuwait and Bahrain.

Table 2: Mapping the Space of Innovation of Twenty SMEs in Kuwait and Bahrain

Case Study #	Gym Ideas	Founder/ Owner	Cust. Review	Mapping Innovation Space			
				Product/ Service	Process	Position	Paradigm
1	Providing a healthy lifestyle, healthy food, building a resilient body	Fitness pruners is the owner and manager of the Gym	4.5: 5	Restaurant lab / Unique Mem. / Meals plan/ Open swimming pool/ Prayer room/ Outdoor class.	Online/ Feedbacks/ Home delivery services	Pub restaurant/ Women FC/ Pro & Matures	Multi-service (food, sports, entertainment)/ External collaboration/ Online App
2	Offering sports activities	An entrepreneur	4.5: 5	Unique Thai Boxing ring/ Calisthenics equipment/ Unique coaches/ Brazilian Jiu-Jitsu/ Zumba/ Strong man/ Power-lifting	International/ public/ tournament/ Online/ Indoor race	Kids, Mature, Senior, Female / Male/ MMA Bahrain National Team	External championships/ Local collaboration with Federation of MMA
3	Providing fitness services to support the level of fitness for public society	A master trainer and a physical fitness expr. is the manager of the Gym	4.5: 5	TABATA class./ Nutrition Bar/ Prayer room/ Charging Station/ Multi memberships	Online / Feedback/ Fit. Workshops / External expr.	Male & Fem./ Youth & Mature/ Social events	External collaboration/ Middle East Fitness/ Tournaments
4	Opening the second Branch to offering MMA services	Ex-professional fighter is the manager of the Gym	4.6: 5	Boxing ring/ Muay Thai (Kids)/ Unique packages/ Unique train.	Online /Feedback	Separate classes/Kids, Youth & Senior/ Men & Women	Multi fitness services/- External collaborations/ Open a new branch
5	International center, promote a range of different products and services, fitness clas. & machines	Sports Fitness Co.	4.1: 5	Innovative training/ International Access/ Corporate/ individual membership/ Free trail guest/ Various classes	Online/ My Zone/ Mid. East bloggers/ Feedback Shukran Rewards Card	Mix classes/ Separate ladies' hours/ Parents & Babies classes/ VIP & VVIP services	External collaboration/ Partners Collaboration/ International branches
6	Providing an elite group exercise fitness in the area	Fitness pruner is the owner	4.6: 5	Boot camp/ Outdoor classes/ Reasonable prices/ Multi classes/ Lse Mills train.	Feedback/ WhatsApp group/- Fit. workshops	Mix classes/ ladies only/ Kids / Mature/ Senior	External collaboration/ Multi fitness services/ Consultation/ Freelancers
7	Various classes in one place designed for the best experts to improve the performance of the participants	Fitness and wellness trainer (The owner)	4.8: 5	Multi fitness class./ Kids MMA/ Bollywood dance/ Flab to Fab/ Youth fit Boot camp	Online/ Fit. Tournaments/ Feedback	Family member/ ladies/ Kids/ Senior Male/Youth	Part-time trainers/ External collaborations
8	physical fitness contained a store for sportswear clothes and equipment store	A Holding Group Co.(the owner)	4.5: 5	Multi fit. class./ Sportswear/ Nutrition & food supplements	Online/Sportswear, Nutrition, Home delivery	Kids/ Youth/ Mature/ Senior/ Ladies/ Male (Mix and separate)	External collaboration/ Multi services/ Workshops

Table 2: Mapping the Space of Innovation of Twenty SMEs in Kuwait and Bahrain. (Cont.)

Case Study #	Gym Ideas	Founder/ Owner	Cust. Review	Mapping Innovation Space			
				Product/ Service	Process	Position	Paradigm
9	Providing Pilates, Gyro tonic, unique equipment, unit sex classes, Rehabilitation Pilates, and Booty barre lessons	2 owners (master coach & an engineering partner)	5	Unique equipment/ Social gathering& event/Training workshop	Fit. Work-shops/ Online reservation/ Feedback	Mature / Senior Men/Women/ Pregnant class.	External collaboration/ Wife & husband business/ 2 Branches
10	Unique mix classes, art boxing & fitness boxing training to prepare for participation in competitions mix classes, art boxing & fitness boxing training to prepare for participation in competitions	A head coach in boxing is the manager of the fitness center	5	Boxing Scholarship/ Olympic rings/ Unique membership	Mind body Online Boxing competition	Youth (girls & boys)/ Mums/ Boxing champs	External collaboration/ National & international
11	Offering fitness chains considered as an integrated sports academy	Businessman is the founder of the fitness center and nutrition chains	4.6: 5	Unique memberships/ Food delivery service/ Nutrition experts/ Physiotherapist & Rehabilitation specialist	Customers interaction/ Medical Treatment	Public nutrition stores/ Mature & Senior / Bodybuilding champs	Multi services/ External Collaboration/ Family businessman / International bodybuilding
12	Trend equipment & innovative programs, bodybuilding classes. Franchising	(Frenching) businessman	4.4: 5	Multi fitness training/ Unique memberships/ Free pass intern/ Multi equipment & programs/ Swimming class./ MMA mix classes	Cinema/Online/ Digital PT /Member App	Male (Kids, Youth, and Seniors)	External collaboration/ Multi services (sports, food, sportswear)/ Franchise / National Team
13	A fitness center offering wellness chains equipped with the highest level of fitness equipment	A holding company is the owner of the fitness chain	4.3: 5	Squash/Billiards, Bowling aisles, Indoor Olympic pool/ KIB ATMs/ Multi mem./ Oxygen bars/ Outdoor Class.	Online/Feed-back/ Staff Reward program.	Male & Female/ Children/ Senior/ youth/ Ministries employees	External collaboration/ Limited liability Co./ International championships/ Social competitions
14	A combination of dynamic/luxury/ entertainment.	A group of partners and initiatives	0 : 4.5	-Barber salon/ Library/ Juice bar/ Unique fitness class.	Online/ Bloggers/-Re-branding/ P. R/Feedback	Men /Women Youth/ Mature	External collaboration/ Partnership
15	Offering fitness services, massage, and nursery services for Mums and their babies,	A group of entrepreneurs owns the fitness center. one of them manage the place	4.4: 5	-Multi Fitness services/ Babies nursery/ Food bar/ Prayer room/ Mini-Salon/ Outdoor class.	Mum's care Fit. Work-shops/ Outdoor Class./ Ministries special offers	Youth/ Mature/ Senior/ Babies & Mums/ Health insurance Cardholders offers	External collaboration/ Online platform/ Social media

Table 2: Mapping the Space of Innovation of Twenty SMEs in Kuwait and Bahrain (Cont.)

Case Study #	Gym Ideas	Founder/ Owner	Cust. Review	Mapping Innovation Space			
				Product/ Service	Process	Position	Paradigm
16	New personal training program. Shred fat in a short time	Entrepreneur (owner of the fitness center)	4.8: 5	Two separate gyms (M&F) / Multi fitness Class./ Food Bar/ Outdoor Cycling/ Boxing/ Core, & Curve	Internal. Experts/ Outdoors ride/ New program./Online	Mature/Male/ Female/ Corporate Employees	External collaboration / Social Media.
17	Fitness services for women only in 30minutes	Businessman is the founder of the fitness studio	4.1: 5	Unique corporate Mem./ Various fitness Class./ Multi fitness devices/ Free massage	Discounted prices/ New program./ 30 Min. Train./ Consultations/ Feedback	Ladies (Youth/ Senior) Corporate/ Ministries	National collaboration/ Social events
18	Women and Men offered fitness classes in 30 minutes	Master fitness trainer is the manager of the fitness center	4.6: 5	Juice bar/ Two separate branches for (F & M)/Multi Mem./ Diff. Fitness class.	Nutrition Program./workshops/Feedback/ Online/ Bloggers	Female/Male/ Youth/ Senior	International champs tournaments/ Multi services
19	International center, promote a range of different products and services, fitness classes, & machines	Company Sports Fitness is the own fitness chain centers	4.3: 5	Unique mem./ Multi fitness classes & equip./ Multi facilities/ Intern. Access	My Zone/ Feedback/ Webpage/ 7 Fitness branches	4 Branches (Ladies) 3(Men) Children/ Youth/ Mature	External collaborations/ Digital innovation/ Social Media
20	a place for athletes, players, and competitors to train full time for both sexes	2 ntreprenurs (owners)	4.0: 5	Multi fitness services/ Food/ Multi quip./ Nutrition consultation	Online store for equipment/ sportswear/ Feedback	5 Branches Mix Separate Classes/ Facilities/Male/ Female/- Mature/ Youth	External collaboration/ Open new branches/ Multi-service

Fuzzy Logic Set to Evaluating the Twenty Case Studies values of Audit Innovation (IA)

In this paper, we used the Fuzzy Logic approach to compute the value of audit innovation to extract its weight. The weights of the Fuzzy Logic set consisted of the degree values that range from above 0 (> 0) and less or equal value 1 (≤ 1). It represented the Fuzzy Logic weight and statement bases on the audit innovation that appeared in Table 1. The value of the audit innovation 7, which is equal to Fuzzy Logic weight above 0.857 and less or equal to 1 ($0.857 > \text{to} \leq 1$). These values been referred to as the Fuzzy Logic statement (extremely significant). The value 6 of audit innovation, which is equal to Fuzzy Logic above 0.714 and equal or less to 0.857 ($0.714 > \text{to} \leq 0.857$). These values been referred to as the Fuzzy Logic statement (very strongly significant). Value 5, which is referred to as Fuzzy Logic weight above 0.571 and less or equal to 0.714 ($0.571 > \text{to} \leq 0.714$). These values symbolized the Fuzzy Logic statement (strongly significant). The value 4 is equal to Fuzzy Logic above 0.429 to less or equal to 0.571 ($0.429 > \text{to} \leq 0.571$). These values symbolized the Fuzzy Logic statement (moderately significant). The value 3 is equal to the Fuzzy Logic above 0.1 and less or equal to 0.429 ($0.1 > \text{to} \leq 0.429$). These values referred to the Fuzzy Logic statement (equally significant). In general, the values mentioned for confirming the value that the axis reached. Table 3 and Figure 5 below show the Fuzzy Logic computing from the values of audit innovation.

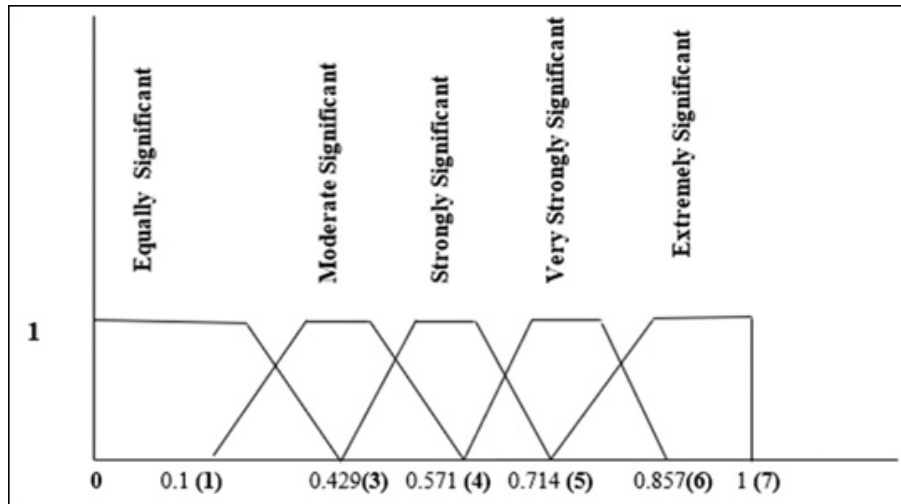


Figure 5. The Fuzzy Logic average score extracted from Audit innovation (Mamlook et al. 2001 and The Authors).

Table 3: The Fuzzy Logic Statement and its Weights of Audit Innovation Values (Table 1)

Case Study	Product/Service: (Strategy + Linkages)					Process: (Process + Learning)						Organization			
	Max =7		Min=4	Max =7	Min=3	Max =7		Min= 4	Min=4	Max =7	Max=7		Min=4		
	AVS Strategy	AVS/ Max F. Weight	F. Variable	AVL Link.	AVL/Max F. Weight	F. Variable	AVP Process	AVP/Max F. Weight	F. Variable	AVLE Learning	AVLE/Max F. Weight	F. Variable	AVO Organismal.	AVO /Max F. Weight	F. Variable
①	7	1	E. Sig.	6	0.857	V.S. Sig.	7	1	E. Sig.	5	0.714	S. Sig.	6	0.857	V.S. Sig.
②	6	0.857	V.S. Sig.	6	0.857	V.S. Sig.	7	1	E. Sig.	7	1	E. Sig.	6	0.857	V.S. Sig.
③	7	1	E. Sig.	7	1	E. Sig.	7	1	E. Sig.	5	0.714	S. Sig.	7	1	E. Sig.
④	5	0.714	S. Sig.	7	1	E. Sig.	6.5	0.929	V.S. Sig.	5	0.714	S. Sig.	4	0.571	Mod. Sig.
⑤	6	0.857	V.S. Sig.	5	0.714	S. Sig.	4	0.571	Mod. Sig.	7	1	E. Sig.	7	1	E. Sig.
⑥	6	0.857	V.S. Sig.	6	0.857	V.S. Sig.	6	0.857	V.S. Sig.	6	0.857	V.S. Sig.	7	1	E. Sig.
⑦	6	0.857	V.S. Sig.	3	0.429	Eq. Sig.	6	0.857	V.S. Sig.	4	0.571	Mod. Sig.	7	1	E. Sig.

Table 3: *The Fuzzy Logic Statement and its Weights of Audit Innovation Values (Table 1) (Cont.)*

Case Study	Product/Service: (Strategy + Linkages)						Process: (Process + Learning)						Organization		
	Max =7		Min=4		Max =7		Min= 4		Max =7		Min=4		Max=7		Min=4
	AVS Strategy	AVS/ Max F. Weight	F. Variable	AVL Link.	AVL/Max F. Weight	F. Variable	AVP Process	AVP/Max F. Weight	F. Variable	AVLE Learning	AVLE/Max F. Weight	F. Variable	AVO Organismal.	AVO /Max F. Weight	F. Variable
⑧	7	1	E. Sig.	7	1	E. Sig.	7	1	E. Sig.	7	1	E. Sig.	7	1	E. Sig.
⑨	5	0.714	S. Sig.	7	1	E. Sig.	6	0.857	V.S. Sig.	7	1	E. Sig.	7	1	E. Sig.
⑩	6	0.857	V.S. Sig.	6	0.857	V.S. Sig.	7	1	E. Sig.	7	1	E. Sig.	7	1	E. Sig.
⑪	7	1	E. Sig.	7	1	E. Sig.	7	1	E. Sig.	7	1	E. Sig.	6	0.857	V.S. Sig.
⑫	6	0.857	V.S. Sig.	7	1	E. Sig.	7	1	E. Sig.	6	0.857	V.S. Sig.	5	0.714	S. Sig.
⑬	7	1	E. Sig.	7	1	E. Sig.	7	1	E. Sig.	7	1	E. Sig.	7	1	E. Sig.
⑭	6	0.857	V.S. Sig.	5	0.714	S. Sig.	5	0.714	S. Sig.	4	0.571	Mod. Sig.	5	0.714	S. Sig.
⑮	4	0.571	Mod. Sig.	6	0.857	V.S. Sig.	6	0.857	V.S. Sig.	6	0.857	V.S. Sig.	7	1	E. Sig.
⑯	4	0.571	Mod. Sig.	5	0.714	S. Sig.	5	0.714	S. Sig.	6	0.857	V.S. Sig.	4	0.571	Mod. Sig.
⑰	5	0.714	Mod. Sig.	5	0.714	Mod. Sig.	5	0.714	Mod. Sig.	4	0.571	Mod. Sig.	5	0.714	Mod. Sig.
⑱	7	1	E. Sig.	7	1	E. Sig.	7	1	E. Sig.	5	0.714	S. Sig.	5	0.714	S. Sig.
⑲	7	1	E. Sig.	7	1	E. Sig.	7	1	E. Sig.	7	1	E. Sig.	6	0.857	V.S. Sig.
⑳	7	1	E. Sig.	5	0.714	S. Sig.	5	0.714	S. Sig.	4	0.571	Mod. Sig.	5	0.714	S. Sig.

The manual steps compute the values of the ten innovation attributes to extract the Fuzzy weights. The weight of the Fuzzy Logic set consisted of the degree values that range from above 0 (> 0) and less or equal value 1 (≤ 1). Table 4 represented the Fuzzy Logic weights and statement bases on the ten innovation attributes that shown in Table 5. The manual steps compute the values of the ten innovation attributes to extract the Fuzzy weights. The weight of the Fuzzy Logic set consisted of the degree values that range from above 0 (> 0) and less or equal value 1 (≤ 1). Table 4 represented the Fuzzy Logic weights and statements bases on the ten innovation attributes that shown in Table 5. The value of the ten innovation attributes 10, which is equal to Fuzzy Logic weight above 0.857 and less or equal to 1 ($0.857 > \text{to} \leq 1$). These values are referred to as the Fuzzy Logic statement (extremely significant) as well as the value 9, which is referred as the Fuzzy Logic weight above 0.714 and less or equal to 0.857 ($0.714 > \text{to} \leq 0.857$). The value 7 to Fuzzy Logic above 0.571 and less or equal to 0.714 ($0.571 > \text{to} \leq 0.714$). These values been referred to as the Fuzzy Logic statement (very strongly significant). The value 5, which is referred as Fuzzy Logic weight above 0.429 and less or equal to 0.571 ($0.429 > \text{to} \leq 0.571$). These values symbolized the Fuzzy Logic statement (strongly significant). The value 3 is the Fuzzy Logic value above 0.1 to less or equal to 0.429 ($0.0 > \text{to} \leq 0.01$). These values symbolized the Fuzzy Logic statement (moderately significant). The value 1 is referred as the Fuzzy Logic above 0.0 and less or equal to 0.01 ($0.0 > \text{to} \leq 0.01$). These values referred to the Fuzzy Logic statement (equally significant). Figure 5 shows the Fuzzy Logic computing its weights of the ten innovation attributes (Table 4). Table 4 below represented the Fuzzy Logic weights and statement of the ten innovation attributes.

Table 4: *The Fuzzy Logic Weight and Statement of the Ten Innovation Attributes*

Case Study	Product/Service		Process		Organization/Management
	Strategy	Linkages	Process	Learning	Organization
①	10	9	10	10	9
②	9	9	10	9	9
③	10	10	10	10	10
④	7	10	9.5	7	5
⑤	9	7	5	9	10
⑥	9	9	9	9	10
⑦	9	9	9	9	10
⑧	10	10	10	10	10
⑨	7	9	9	9	9
⑩	9	9	10	9	10
⑪	10	10	10	9	9
⑫	9	10	10	9	7
⑬	10	10	10	10	10
⑭	9	7	7	7	7
⑮	5	5	9	9	5
⑯	5	7	7	9	5
⑰	7	7	7	5	7
⑱	10	10	10	7	7
⑲	10	10	10	10	9
⑳	10	7	7	5	7

Figure 6 below shows the ten innovation attributes of the three innovation dimensions (product/service, process, and organization/management) to represent the innovation attributes and correlation relationship with the three innovation dimensions.



Figure 6. The Ten Innovation Attributes of the Three Innovation Dimension (Maravelakis et al. 2006 and the Authors)

Table 5 below shows the ten innovation attributes of the three innovation dimensions (product/service, process, and organization/management), the values, and the statement of the Fuzzy Logic for each innovation dimensions. The questions in the survey consisted of one to seven referred to (general questions) about SMEs. The answers will be by Yes or No or by selecting the proper answer from the displayed options. Table 6 shows the Likert scales between one and five. The scale from one to five determined the answers of respondents' degree, which was scaled as follows: Very important symbolized by a value 1, important expressed by a value 2, moderately important symbolized by a value 3, slightly important symbolized by a value 4, and unimportant symbolized by a 5. The selected questionnaire been designed to address the research questions, which will lead to gain insights on the innovativeness of fitness centers in Bahrain and Kuwait for the period 2015 to 2019.

Table 5: The Fuzzy Logic Set Statement and Weight to Evaluate the Ten Innovation Attributes (IA)

Case Study	Product/Service average score: (Strategy + Linkages)						Process Average Score: (Process + Learning)						Organization/ Management Average Score		
	IAS Strategy	IAS / Max F. Weight	F. Statement	IAL Linkages	IAL/ Max F. Weight	F. Statement	IAP Process	IAP/ Max F. Weight	F. Statement	IA LE Learning	IA LE/Max F. Weight	F. Statement	IAO Organiz.	IAO/Max F. Weight	F. Statement
1	10	1	E. signif.	9	0.857	E. Signif.	10	1	E. Signif.	7	0.714	V. S. Signif.	9	0.857	E. Signif.
2	9	0.857	E. Signif.	9	0.857	E. Signif.	10	1	E. Signif.	10	1	E. Signif.	9	0.857	E. Signif.
3	10	1	E. Signif.	10	1	E. Signif.	10	1	E. signif.	7	0.714	V. S. signif.	10	1	E. Signif.
4	7	0.714	V. S. Signif.	10	1	E. signif.	9.5	1	E. signif.	7	0.714	V. S. Signif.	5	0.571	S. Signif.
5	9	0.857	E. Signif.	7	0.714	V. S. Signif.	5	0.571	S. signif.	10	1	E. Signif.	10	1	E. Signif.
6	9	0.857	E. Signif.	9	0.857	E. Signif.	9	0.857	E. Signif.	9	0.857	E. Signif.	10	1	E. Signif.
7	9	0.857	E. Signif.	3	0.429	Mod. Signif.	9	0.857	E. Signif.	5	0.571	S. Signif.	10	1	E. Signif.
8	10	1	E. signif.	10	1	E. signif.	10	1	E. signif.	10	1	E. signif.	10	1	E. Signif.
9	7	0.714	V.S Signif.	2	0.285	Eq. Signif.	9	0.857	E. Signif.	7	0.714	V.S Signif.	10	1	E. Signif.
10	9	0.857	E. Signif.	9	0.857	E. Signif.	10	1	E. signif.	10	1	E. signif.	10	1	E. Signif.
11	10	1	E. signif.	10	1	E. signif.	10	1	E. signif.	10	1	E. Signif.	9	0.857	E. Signif.
12	9	0.857	E. Signif.	10	1	E. signif.	10	1	E. signif.	9	0.857	E. Signif.	7	0.714	V. S. Signif.

Table 5: *The Fuzzy Logic Set Statement and Weight to Evaluate the Ten Innovation Attributes (IA) (Cont.)*

Case Study	Product/Service average score: (Strategy + Linkages)						Process Average Score: (Process + Learning)						Organization/ Management Average Score		
	IAS Strategy	IAS / Max F. Weight	F. Statement	IAL Link-ages	IAL/ Max F. Weight	F. Statement	IAP Process	IAP/ Max F. Weight	F. Statement	IA LE Learning	IA LE/Max F. Weight	F. Statement	IAO Orga-niz.	IAO/Max F. Weight	F. Statement
13	10	1	E. signif.	10	1	E. signif.	10	1	E. signif.	10	1	E. signif.	10	1	E. signif.
14	9	0.857	E. Signif.	7	0.714	V.S. Signif.	7	0.714	V.S. Signif.	5	0.571	S. Signif.	7	0.714	V. S. Signif.
15	5	0.571	S. Signif.	9	0.857	E. Signif.	9	0.857	E. Signif.	9	0.857	E. Signif.	10	1	E. Signif.
16	5	0.571	S. Signif.	7	0.714	V. S. Signif.	7	0.714	V. S. Signif.	9	0.857	E. Signif.	5	0.571	S. Signif.
17	7	0.714	V. S. Signif.	7	0.714	V.S. Signif.	7	0.714	V. S. Signif.	5	0.571	S. Signif.	7	0.714	V. S. Signif.
18	10	1	E. signif.	10	1	E. signif.	10	1	E. signif.	10	1	E. signif.	7	0.714	V.S. Signif.
19	10	1	E. signif.	10	1	E. signif.	10	1	E. signif.	10	1	E. signif.	9	0.857	E. Signif.
20	10	1	E. signif.	7	0.714	V. S. Signif.	7	0.714	V. S. Signif.	5	0.571	S. Signif.	7	0.714	V. S. Signif.

Table 6: *Likert Scales Used in the Questionnaire for an Innovation Audit (IA)*

Very Important	Important	Moderately Important	Slightly Important	Unimportant
1	2	3	4	5

Moreover, the questionnaire has been designed to collect information about the innovation of fitness centers in Bahrain and Kuwait for the period from 2015 to 2019. The questionnaire questions have been formulated to fit the research objectives, which identified the five dimensions of innovation (strategy, process, organization/management, linkages, and learning). Survey questions 1 to 24 consist of six sections consisting of general information, product innovation (goods and services), process innovation, model innovation, site innovation, and innovation and expense management activities. Table 7 below the following questions explained in detail. The question number indicates the dimension of innovation (Strategy, process, organization/management, linkages, and learning) to be defined.

Table 7 reviews survey questions and the five innovation dimensions used in the interpretation of the twenty case studies.

Table 7: Survey questions and the five innovation dimensions

Innovation Dimension	Survey Questions & Number
Strategy	<p>Q12: Our organization introduced a new business model for fitness services</p> <ul style="list-style-type: none"> -Our organization used technology innovation to provide new services -Our organization benefit for open and user innovation -Our organization used media to produce fitness services Change from current idea to successful implementation -Our organization used media to provide fitness services at home or work -Our organization offered innovative fitness classes
Process	<p>Q 9: How important is it to your SME to introduce any new or significantly improved processes to your SME?</p> <p>Q 10: How important is the development of the process?</p> <p>Q 11: How important were each of the following effects of your product (good or service) and /or process innovations introduced?</p>
Organization	<p>Q22: Implementation of a new or significantly changed corporate strategy</p> <ul style="list-style-type: none"> -Implementation of advanced management techniques within your SME -Implementation of major changes to your organizational structure -Implementation of changes in marketing concepts or strategy
Linkages	<p>Q13: How important is it to your SME to make any changes in the targeting of offering or the storytelling about its products/services</p> <p>Q14: Our organization is good at understanding the needs of our customers/ end users</p> <ul style="list-style-type: none"> -Our staff know what the organization distinctive competence is and deliver fitness training -Staff are involved in suggesting ideas for improvements to products/services or processes -Our organization works closely with customers and seeks new customers segment -Senior management has a shared vision of how to serve the special needs group -Our organization works closely with lead users to develop the innovative position of new groups users <p>Q 17: How important to your SME's innovation activities Internal</p> <ul style="list-style-type: none"> -Market Source -Institutional sources -Other sources <p>Q 18: How important is it to your SME to co-operate on any of your innovation activities with other SMEs or institutes?</p> <p>Q19: How important were the following factors as constraints to your innovation activities or influencing a decision not to innovate?</p>
Learning	<p>Q 15: How important is it to your SME to engage in the following innovation activities?</p> <ul style="list-style-type: none"> -In-house research & development -Acquisition of research & development -Acquisition of machinery, equipment, and software -Acquisition of external -Training -All forms of design -Market introduction innovation

Discussion

Audit innovation has been used to evaluate management performance by addressing innovation dimensions including strategy, process, linkage, organization, and learning dimensions. Through the analysis of audit innovation, we were able to have a deeper insight into the directions and forms of innovation. Using a combination of three methods (audit, mapping, and fuzzy logic), the dimensions of innovation in SMEs were studied using qualitative methods and induction based on content and discourse analysis.

Innovation review is used to assess management performance by addressing innovation dimensions including strategy, process, linkages, organization/management, and learning dimensions using the three assessment approaches (audit, mapping, and fuzzy logic) using qualitative methods and extrapolation based on content and discourse analysis.

Moreover, a Fuzzy Logic Set has been applied to measure the degree of innovation, which in turn would help determine the degree of improvement in products and services. Fuzzy Logic approach has been used to measure innovation score for selected SMEs from Kuwait and Bahrain and it was insightful as it revealed areas of innovation that have the potential for radical innovation.

Fuzzy Logic is a new tool that uses the maximum and minimum values extracted from audit innovation to extract the weight of Fuzzy Logic. Furthermore, the Fuzzy Logic Set weighing results can be used to compare the processor that distinguishes two or more SMEs from innovation performance or related activities to improve innovation practices or to apply the best practices in innovation. In addition, the Fuzzy Logic Set range facilitates benchmarking that improves innovative work and maintains sustainable growth.

Therefore, this proposed methodology helps in measuring performance and enhancing the capacity for innovation and practice. Thus, enterprises can obtain customized competitive advantages among other SMEs in the same industry based on harnessing their dynamic innovation capabilities. Using a compound weight using the Fuzzy Logic Set with logical member option values ranging from 0 to less or equal 1, enables researchers to interpret these values into innovative dimensions and helps define innovation trends to follow.

Conclusion

The purpose of the research is to measure the extent of innovation in fitness centers in Bahrain and Kuwait for a period of five years (2015-2019). The study revealed the existence of a cooperative relationship between the first predictive statement of the hypothesis that there is a relationship between SME's innovation and the product. The twenty case studies showed statistically significant differences between each other due to differences in strategy and forms of innovation. The study confirms the following first hypothesis, that there is a relationship between SMEs' innovation and the product. It has also been concluded through the study that the incremental innovation of the product determines the nature of innovation in SMEs. The study confirmed the second predictive hypothesis that "there is a relationship between SME innovation and the process". Incremental process innovation characterizes forms of SMEs' innovation; however, limited signs indicate a trend towards radical innovation across 4Ps. The study confirmed the third predictive statement: There is a relationship between innovation and management of SMEs. The study confirmed the relationship between administrative (and organizational) innovation and the SMEs' innovation growth by using social media platforms, information and communication, technology, and its effect on SMEs expansion. Moreover, the study confirmed the fourth predictive statement: "What are the activities that affect SME's innovation in position". Similarly, the reviewed study mention that there is a strong link between the innovation expansions of SMEs with innovation activities

(target groups). The study highlighted the necessity of adopting a radical and exemplary innovation to be able to compete and enhance SMEs' innovation. Position innovation referred to connectivity innovation, which is part of product innovation, as well as history, and emphasized the relationships between the expansion of SMEs and the increase in their level of innovation with site innovation (product linking). The study showed that innovation allows environmental developments, reconfiguration, and creation of new SMEs' products of goods/services to market or their creation and target new user segments.

The study revealed the value of developing a new customer segment and harnessing social media as practices that been related to innovation to provide new services to SMEs. The study confirmed the fifth predictive statement: "What activities affect the creativity of SMEs in exemplary innovation?" The research emphasized the relationship between the innovation model and the increased level of innovation in SMEs, in addition to the fact that Model innovation encourages open, user-driven innovation and innovation root models. In the end, the study recommends validating this proposed methodology and disseminating it to other sectors to gain deeper insights into the innovation outputs, activities, strategy, and process context.

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المنهجية المقترحة لقياس الابتكار في الشركات الصغيرة والمتوسطة

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يعد استكشاف منهجية مناسبة لقياس ابتكار الشركات الصغيرة والمتوسطة أمراً بالغ الأهمية لإدارة وتوجيه النمو الاقتصادي. شرعت دول الشرق الأوسط مثل مستشاري التعاون الخليجي في إيجاد منهجية مبتكرة لدعم الاستدامة الاقتصادية وتحولات الازدهار ، مما أدى إلى ارتفاع في مجالات قطاع الخدمات ونمو أنشطة الشركات الصغيرة والمتوسطة وعائدات أرباحها. تهدف هذه الدراسة إلى تقييم مخرجات الابتكار لأنشطة الشركات الصغيرة والمتوسطة في قطاع الرياضة واللياقة البدنية على وجه الخصوص ، الكويت والبحرين للفترة 2015-2019. بالإضافة إلى ذلك ، يركز على منهجية مجموعة المنطق الضبابي المستخدمة لقياس أداء الابتكار في الشركات الصغيرة والمتوسطة وتحديد درجة الابتكار في الشركات الصغيرة والمتوسطة.

وتألفت منهجية التقييم المقترحة من ثلاث طرق ، وهي مراجعة الابتكار ، ورسم الخرائط الابتكارية ، ومجموعة المنطق الضبابي. وقد طبقت الدراسة المنطق الضبابي لقياس مخرجات أنشطة الابتكار في عشرين شركة صغيرة في صناعة اللياقة البدنية في الكويت والبحرين. وقد جُمعت البيانات استناداً إلى دراسات استقصائية ومقابلات أجريت مع كبار مديري المشاريع الصغيرة والمتوسطة الحجم المختارة. تتمثل مساهمة هذا البحث في إدخال نهج جديد لقياس مخرجات أنشطة الابتكار استناداً إلى تدقيق الابتكار ، ورسم خرائط الابتكار ، ومجموعة المنطق الضبابي.

وتبين النتائج أن منهجية التقييم المقترحة فعالة. بالإضافة إلى ذلك ، تم اكتشاف وجود بعض أوجه التشابه بين سمات الابتكار للشركات الصغيرة والمتوسطة في الكويت والبحرين في أداء إدارة الابتكار. وقد لوحظ أن كلا البلدين كانا يستخدمان الابتكارات المتعلقة بالمنتجات والخدمات في صناعة اللياقة البدنية. ومع ذلك ، غير أنه لوحظ أن الابتكار في العمليات محدود. وتوصي الدراسة بتطبيق منهجية التقييم هذه لقياس نواتج أنشطة الابتكار على قطاعات أخرى خاصة وعامة في المشاريع الصغيرة والمتوسطة الحجم أو عوامل كبيرة

لرصد نمو الأرباح ووضع استراتيجيات وسياسات جديدة تمهد الطريق للابتكار منهجية التقييم هذه لقياس مخرجات أنشطة الابتكار على القطاعات الخاصة والعامة الأخرى في الشركات الصغيرة والمتوسطة أو العوامل الكبيرة لرصد نمو الأرباح ووضع استراتيجيات وسياسات جديدة تمهد هذا الطريق للابتكار في البلاد.

الكلمات الدالة: قياس مخرجات أنشطة الابتكار ، الشركات الصغيرة والمتوسطة ، منهجية التقييم.

