

# Sustainable Balanced Scorecard for Kaizen Evaluation: Comparative Study between Egypt and Japan

Ola I. S. El Dardery, Ismail Gomaa, Adel R. M. Rayan, Ghada El Khayat, Sara H. Sabry

**Abstract**—Continuous improvement activities are becoming a key organizational success factor; those improvement activities include but are not limited to kaizen, six sigma, lean production, and continuous improvement projects. Kaizen is a Japanese philosophy of continuous improvement by making small incremental changes to improve an organization's performance, reduce costs, reduce delay time, reduce waste in production, etc. This research aims at proposing a measuring system for kaizen activities from a sustainable balanced scorecard perspective. A survey was developed and disseminated among kaizen experts in both Egypt and Japan with the purpose of allocating key performance indicators for both kaizen process (critical success factors) and result (kaizen benefits) into the five sustainable balanced scorecard perspectives. This research contributes to the extant literature by presenting a kaizen measurement of both kaizen process and results that will illuminate the benefits of using kaizen. Also, the presented measurement can help in the sustainability of kaizen implementation across various sectors and industries. Thus, grasping the full benefits of kaizen implementation will contribute to the spread of kaizen understanding and practice. Also, this research provides insights on the social and cultural differences that would influence the kaizen success. Determining the combination of the proper kaizen measures could be used by any industry, whether service or manufacturing for better kaizen activities measurement. The comparison between Japanese implementation of kaizen, as the pioneers of continuous improvement, and Egyptian implementation will help recommending better practices of kaizen in Egypt and contributing to the 2030 sustainable development goals. The study results reveal that there is no significant difference in allocating kaizen benefits between Egypt and Japan. However, with regard to the critical success factors some differences appeared reflecting the social differences and understanding between both countries, a single integrated measurement was reached between the Egyptian and Japanese allocation highlighting the Japanese experts' opinion as the ultimate criterion for selection.

**Keywords**—Continuous improvements, kaizen, performance, sustainable balanced scorecard.

## I. INTRODUCTION

**A**CHIEVING competitive advantage depends on continuous, incremental improvements, whether in production or services; to do so, there is a need for small teams or groups to support the continuous improvement projects

Ola I. S. El Dardery is with the Egypt Japan University of Science and Technology (E-JUST), School of International Business, Accounting and Information Systems department, Alexandria, Egypt (corresponding author, e-mail: ola.eldardery@ejust.edu.eg, olaeldardery@gmail.com).

Ismail Gomaa is with E-JUST, School of International Business, and Alexandria University, Faculty of Commerce, Accounting department, Alexandria, Egypt.

(CIPs), also known as kaizen events. CIPs are defined as “systematic team-based processes, typically with a different background or from different departments, working to improve a process performance metric during a short period, such as days, weeks, or months” [1]

Kaizen is a series of continuous incremental changes using the Plan, Do, Check, Act (PDCA) cycle to improve quality, efficiency and reduce cost. It also uses problem-solving tools to break down problems into smaller parts to solve them better, enhancing performance and productivity [2]. Kaizen is the key [3] as any continuous, incremental, small improvement is considered kaizen, thus, it is recommended an immense implementation of kaizen at all organizational levels.

As an improvement philosophy, kaizen is executed on a daily basis; to guarantee consistency, by everyone; as it includes all employees and managers, and everywhere; consists of all departments and work floor [4]. There are many tools under the kaizen umbrella, including quality control circles, total quality control, customer orientation, suggestion system, workplace discipline, total productive maintenance, zero defects, productivity improvement, automation, Kanban, robotics, quality improvement, product development, small-group activities, among others [5].

Whenever an improvement opportunity is found, kaizen is used, thus, it is essential to have feedback from kaizen event results, it is also important to measure those results to determine the effect of those events and guarantee its success [6]. Over the past decade, several studies were conducted e.g. [7]-[12] to implement and measure kaizen process and results; however, no precise measurement of kaizen activities was agreed upon.

Although it is imperative to evaluate kaizen performance, it is considered a very challenging process due to the multidimensionality of the kaizen practices and the fact that kaizen implementation may not be reflected directly on the financial performance in the short term, as it creates both tangible and intangible values, and does not exist separately from other activities. Therefore, its measurement is mainly done through an unbalanced or underspecified measurement tools, where traditional quantitative measures are not accurate.

Several studies point out that most lean and kaizen

Adel R.M. Rayan is with E-JUST, School of International Business, Alexandria, Egypt.

Ghada El Khayat, is with Alexandria University, Faculty of Commerce, Computers and Information Systems Department, Alexandria, Egypt.

Sara H. Sabry is with E-JUST, School of International Business, Accounting and Information Systems department, Alexandria, Egypt.

improvement projects fail to achieve their targets and keep the consistency of improvements [4], [8], [13]. Therefore, it is essential to identify and consider the kaizen critical success factors (CSFs) and consequently, be able to measure kaizen results. It is also noticed that some service sectors, such as hospitals, have a very complex nature when it comes to measuring kaizen due to the constant human interactions that make it challenging to perform kaizen events during work [4].

Thus, the main objective of this research is to propose a sustainable balanced scorecard (SBSC) framework for kaizen measurement, to measure both kaizen process represented by a 53 kaizen CSFs and results represented by a 23 kaizen benefits. The proposed measure resulted from the survey that was distributed in Egypt and Japan during the period from June to August 2021.

The rest of the research is organized as follows; Part II, discusses the literature review of kaizen; includes kaizen practices, CSFs, and benefits. Part III, SBSC for performance evaluation; includes identifying the five perspectives of SBSC and their related literature. Part IV, the research method; includes questionnaire design and data collection, analysis, and validation. Part V, results; includes preliminary analysis, descriptive analysis, and the main analysis of differences in allocating kaizen CSFs and benefits in SBSC between Egypt and Japan; Part VI, discussion and conclusion; includes discussing the research results, limitations, and future work.

## II. LITERATURE REVIEW OF KAIZEN

### A. Kaizen Practices

The Kaizen process is based on logical thinking, low cost, incremental progress, and low risk. It creates the right atmosphere for prosperity, creativity, and value-adding. Organizations that implement kaizen are advised to target idealism and not compete with others; alternatively, they should identify all non-value-adding activities and dispose of them [14].

The operational definition of kaizen is a Japanese word that symbolizes the philosophy where the management continuously encourages workers to implement minor improvements. In other words, it is the process of continuous improvement in small increments that make the operational process more efficient, effective, under control, and adaptable, as well as focusing on simplification by analyzing complex processes into parts and modifying each part separately [7].

The main objective of Kaizen is to achieve efficiency in quality, cost, and timely delivery in order to increase customer satisfaction and enhance the company's market performance [15], [16]. The quality here refers to the quality of the product during the production process until it is finished, meaning that quality needs to be maintained during all stages of production. At the same time, the cost refers to the cost of production, sales, and after sales services. Timely delivery means that the product is delivered at the right time, the right quantity, and meets customer expectations.

As for the characteristics of kaizen, previous studies [17]-[20] referred to some main characteristics including that kaizen

is continuous, participative, incremental as it depends on small constant steps for change, and requires a small amount of investment. For measuring kaizen, some studies [4], [7]-[10], [21] focused on measuring kaizen process, CSFs of kaizen; while others [2], [12], [18], [22]-[26] focused on measuring kaizen results (benefits). This research focuses on designing a measure for both kaizen process (CSFs) and results (benefits).

When it comes to focusing on kaizen results, it's worth mentioning that kaizen is based on three pillars, waste elimination, housekeeping, and standardization [16]. Achieving those pillars leads to achieving kaizen goals. For waste elimination, there are seven main types of waste, including; inventory, waiting or delay, motion, transportation, over-production, over-processing, defects [15], [16], [23], [27]. It's worth mentioning that [12], [28] added an eighth type of waste: loss of human potential. Maintaining a good housekeeping reduces the failure rate by 50% [15] housekeeping is achieved through the 5S technique, which includes; sort, straighten, sweep, sanitize, sustain [12], [16].

Standardization is related to having best practices to compare with to reduce variations between actual performance and the standard. The reviewing and improvement process is achieved using the Deming Cycle or the PDCA cycle [23], [28].

### B. Kaizen CSFs

Several studies focused on determining the success factors of kaizen process [4], [8]-[10], [18], [29], [8] analyzed the CSFs that lead to kaizen benefits to point out the importance of kaizen process and results, focusing on managerial commitment and professional development of employees to improve quality, productivity, and performance. Kaizen is based primarily on the efforts produced by employees and their suggestions.

Reference [29] presented some CSFs, including the structure of the organization, relationship management, governmental influence, technological superiority, risk management, communication, documentation, construction process, teamwork, and decision making. [10] added to the extant literature by using a systematic approach to gather CSFs from the literature for different CIP keywords which includes kaizen events, six sigma projects, and lean projects. The study gathered all related literature using different synonyms for each concept. For kaizen events, the different synonyms included; kaizen blitz, accelerated improvement, kaizen, and rapid improvement, some of the synonyms for CIP included; PDCA, PDSA (Plan-do-study-act), process improvement, improvement project, and continuous improvement.

Reference [10] extracted 53 CSFs from 98 different publications using different keywords and synonyms, it was followed by study [4] that tested those 53 CSFs in hospitals and found that those 53 CSFs can be generalized to hospitals also. Both studies [4], [10] categorized CSFs into four categories, including; task design, team design, organization, and CIP process; those factors are as follows:

1. Task design category, which includes the following factors;

Goal development process, goal clarity, goal difficulty, goal alignment, project duration, problem scope, target area routines,

target area commitment to change, target area understanding of continuous improvement.

2. Team design category, which includes the following factors;

Team member experience, team autonomy, stakeholder representation, cross-functionality, target area representation, internal team roles, external champion/sponsor, team size, team improvement skills.

3. Organization category, which includes the following factors;

General management support, management understanding of continuous improvement, project identification and selection, management involvement, CIP planning, CIP priority, financial resources, information from previous CIPs, team member time, materials and equipment, general resource support, software, data availability, facilitation, data trustworthiness, recognition and rewards, training, performance evaluation/ review, organizational policies and procedures, organizational culture, organizational structure, support from the continuous improvement program, lessons learned, follow-up activities, deployment of changes.

4. CIP process category, which includes the following factors;

Team commitment to change, team harmony, team communication and coordination, action-orientation, tool appropriateness, structured methodology, solution iterations, planning for institutionalization, CIP progress reporting, CIP technical documentation.

This research will use the CSFs gathered by [4], [10] since

53 factors are the largest, most general number of factors provided by the literature; it was also gathered from multiple sources and they include all the factors mentioned in other studies.

### C. Kaizen Benefits

It was pointed out that implementing kaizen results in benefits in both economic and human resource aspects; that's why kaizen is a fundamental technique used by companies for maximizing human potentials while reducing costs, among other benefits [8], [9].

The benefits of kaizen is mainly divided into qualitative; which is related to human resources motivation and self-esteem, etc., and quantitative; which is also known as economic benefits, and are related to time-savings in cycle time, wait time, setup time, reducing workplace accidents, overproduction, over-processing and so on.

Study [2] gathered the literature on implementing kaizen in healthcare sector and the benefits resulting from it, which includes; patient satisfaction, reducing patient stay time, reducing delay time, reducing cost, investment savings, improving the quality of service, improving the workflow, changing the culture among physicians, enhancing staff communications, improve knowledge, and personal skills, and increasing the value-added activities.

There is consensus among most of the previous studies [7], [9], [12], [18], [22]–[24], [26] that companies can achieve many benefits by implementing kaizen effectively, and these benefits are gathered in Table I.

TABLE I  
KAIZEN BENEFITS

Benefits From Previous Studies	Kaizen Economic Benefits	Kaizen Human Resources Benefits
[7], [9], [12], [18], [22]–[24], [26]		[8]
Waste reduction in time and effort.	Reducing the delivery time	Increasing customer satisfaction
Effective and systematic cost reduction.	Achieving better economic balance.	Employees responsibility and commitment became more visible
Eliminating non-value adding activities and improving productivity	Increasing profits	Reducing accidents resulting from the inappropriate work conditions
Increasing employees' satisfaction and desire for continuous improvement.	Reducing Production process stages	The attitudes of managers have improved to make continuous improvement changes
Increase in productivity and capacity.	Decreasing failures in equipment and machinery	Improving communication between administrative staff
Reduce management involvement and increase delegation to employees.	Cost reduction	Collaboration between all members of the company have increased
Give opportunity for leadership, promotions, which would reduce the needed manpower	Reducing operation cycles and design time	Improvement changes have a positive influence on Individuals
Enhance communications, teamwork, and time management.	Productivity increase	All members of the company participate in continuous improvement activities and/ or the construction of a new system
Instantly respond to issues and correct mistakes	Improving Cash inflows	Employees' turnover has decreased
Overall company development, cooperation, and motivate change.	Reducing defective products	employees' self-esteem has increased
Increase the care about performance metrics and standard benchmarks.	Reducing Movement distances	
Enhance employees' capabilities by training.	Reducing inventory waste	
Help technical departments develop their ideas.	Reducing waste in waiting times, and materials transport	

Study [8] focused on how CSFs such as management commitment; employees training; and development of human resources are related to qualitative benefits. Managers do not usually care about establishing a relationship with the rest of the

organization; however, management commitment is a major success factor for motivating employees to care for their work and generate kaizen suggestions. Training employees and developing their skills, are success factors for reducing work

stress, absenteeism, anxiety and increasing their productivity and suggestions to improve their work. Also, employees' satisfaction will reduce turnover, and motivate them to get promoted and care more about their work environment, saving the cost of recruiting and training new employees.

Reference [8] aggregated kaizen economic and human resources benefits as seen in table I, which is the most comprehensive collection of kaizen benefits. Thus, will be the main focus of this research.

When measuring kaizen, some studies focus on achieving CSFs, while others focus on measuring benefits. The measuring methods includes survey, measuring the cost before and after kaizen events among other ways. To our knowledge, none of the previous studies gathered kaizen CSFs and benefits in a comprehensive measure. This research introduces a measure by allocating CSFs (the process of kaizen) and results (the benefits of kaizen) into the five perspectives of SBSC to get a comprehensive, multidimensional, and extensive measurement tool.

### III. SBSC FOR PERFORMANCE EVALUATION

Balanced scorecard (BSC) is a well-known performance measurement that balances between qualitative and quantitative measures, taking into consideration the strategic objectives and intangible values, it also adapts to the needs of each organization [30]. BSC was introduced by Kaplan and Norton in the nineties as a replacement for financial measures which were no longer efficient as it tells organizations only about their past performance [30]–[32].

A strategy consists of a set of cause and effect relationship hypotheses, if the expected outcomes are not achieved then the strategic hypothesized cause and effect relationships need to be altered [33].

Kaplan and Norton identified five principles of using BSC for a strategy focused organization [33], [34]:

- Using balanced scorecards and strategic maps for translating strategic goals into operational terms.
- Arranging the scorecard in accordance with the business strategy from the heights level of the organization to the support departments and to external partners.
- Making the strategy everyone's job in order to create strategic awareness.
- Linking budgets to the strategy to make it a continuous process, and motivate people to adapt to it.
- Using leadership to become a strategic management system.

The 5 perspectives of SBSC are defined as follows [32]:

*Financial:* measures cost reduction, revenue growth, and return on investment by collecting data related to business performance and financial results.

*Customer/Stakeholder:* related to measuring the effects on external stakeholders' such as customer satisfaction, retention rate, and customer profitability.

*Internal Business Process:* measures the improvement in processes to achieve the organizational objectives.

*Learning and growth:* measures the development in employees' skills, capabilities and training, also the

development in routine processes to align with the organization's strategic goals.

*Sustainability:* related to the environmental and social developments of the organization to achieve its strategic goals without compromising the needs of future generations.

This research proposes a SBSC framework for kaizen evaluation by assigning kaizen CSFs and benefits to the five perspectives of SBSC, considering kaizen to be an essential activity level in any organization (fig. 1).

Recognizing the need for a comprehensive performance measurement tool for each decision making phase, is usually an added responsibility to the accounting department [33], the choice of the measurement metrics is subject to lots of factors related to strategic goals and cost/ benefit objectives of the organization. The SBSC reflects organizational strategic goals, and all the measures included in each of the five perspectives must align with those strategic goals [35] however, some measures might be unique to kaizen evaluation.

Using SBSC for kaizen evaluation means to find the combination of financial and nonfinancial measures that reflect the strategic objectives of the organization when implementing kaizen.



Fig. 1 SBSC developed by Kaplan and Norton, modified by authors

### IV. RESEARCH METHOD

To achieve the objective of this research a questionnaire was designed based on the literature review related to the CSFs and the economic and human resource benefits, with the purpose of allocating CSFs and benefits into the five perspectives of SBSC (fig.2). The research questions can be concise into the following:

**RQ1:** Is there a significant difference in the allocation of kaizen CSFs in SBSC between Egypt and Japan?

**RQ2:** Is there a significant difference in the allocation of kaizen benefits in SBSC between Egypt and Japan?

#### A. Questionnaire Design

To test the research questions, the questionnaire was divided into five sections: the first section displayed the general introduction to clarify the research purpose, defining the meaning of kaizen, and SBSC perspectives, the second section included some demographical questions about the respondents to determine their level of experience and kaizen knowledge, and to identify the country of the respondents. The third section was dedicated for allocating kaizen CSFs into the proper SBSC

perspectives, and the last two sections were dedicated for allocating kaizen economic and human resource benefits into the proper SBSC perspectives. The perspectives ranked from 1 for Financial Perspective, 2 for Customer/ Stakeholders Perspective, 3 for Internal Business Process Perspective, 4 for Learning and growth perspective, 5 for Sustainability perspective, and 6 for none of them (in case that a respondent did not want to allocate any of the CSFs or benefits into any of the 5 perspectives). Also, open ended questions were used to identify the measures for each kaizen benefit from each respondent's experience.

The questionnaire was translated from English to Arabic, and Japanese to accommodate the sample diversity. After validating the questions for relevance, adequacy, clarity, and structure, a pilot study was conducted and the feedback was used to make a few adjustments to the questions and to define some terminologies. Afterwards, the questionnaire was distributed among kaizen experts, an expert sample is defined as choosing a sample of people who have experience in the area of interest, familiarity with kaizen in this case [36]. Choosing an expert sample is to guarantee getting accurate results for CSFs and kaizen benefits allocation.

#### B. Data Collection, Analysis, and Validation

The questionnaire was distributed via various platforms; LinkedIn, emails, personal contacts, posting on kaizen institutes websites. The sample was not limited to a particular industry type, the questionnaire was distributed among different sectors including manufacturing, merchandising, banking, oil & gas, healthcare & medicine, real estates & construction, tourism and leisure, facilities, communications, media and information technology, transportation and shipping services, educational services, food, drinks and tobacco, textiles and durable goods, non-banking financial services, automobile industry. The respond collection period was for two months while the response rate was 25% (62 out of 250) which is considered an acceptable rate taking into consideration that the targeted sample is Egyptian and Japanese kaizen experts. Eight participant's responses were excluded based on a manipulation check question; if the answer to the question "Are you familiar with the term Kaizen?" was "NO", the reason for excluding those responses was because allocating the CSFs and benefits into the proper SBSC perspectives needed to be conducted by kaizen experts to guarantee that the respondents know kaizen and can identify and state kaizen benefits. Thus the final research sample was 54. Regarding data analysis, SPSS V20 was used for the preliminary analysis, descriptive statistics and main analysis of this research.

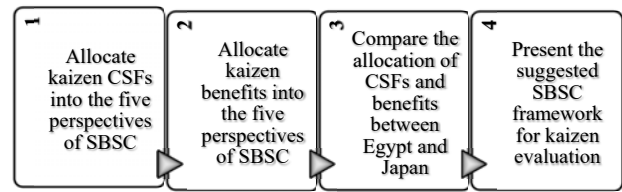


Fig. 2 Research stages, developed by the authors

## V. RESULTS

### A. Preliminary Analysis

#### i. Reliability

The internal consistency, reliability, and validity of the questionnaire items were tested using Cronbach's Alpha for the research variables, alpha was 0.957, which is considered highly reliable [37], [38].

#### ii. Sample Adequacy

As for sample adequacy the Kaiser-Meyer-Olkin Measure was performed to determine the proportion of variance in the variables (un-tabulated), and the values were 0.524, and 0.755 respectively for CSFs and benefits which indicates that the data are suitable for structure detection. The Bartlett's test of sphericity resulted in 0.000 significance level for both CSFs and benefits indicating that the variables are related and suitable for structure detection [39], [40].

#### iii. Normality Test

As for variables' normality, Kolmogorov-Smirnova and Shapiro-Wilk tests were conducted for the sample size 54, after deducting the 8 samples who answered NO for the familiarity with kaizen question, the tests result ranged between 0.001 and 0.004 confirming the non-normal distribution of the sample. Also, the visual inspection of Q-Q plot and histograms reveal non normal distribution for the research variables. Thus a non-parametric test was used to test the research questions.

### B. Descriptive Analysis

The sample Descriptive statistics are represented in table II. The results revealed that the sample consisted of 85% male while only 15% were females. As for the country, 52% of the respondents were from Egypt, and 37% were from Japan. For the educational level, 50% held their bachelor degree, 24% earned their masters' degree, and 22% were PhD holders. 81% of the respondents were from the private sector, and only 19% from the public sector. For the industry, 37% of the respondents were from the manufacturing, 20% from food, drinks and tobacco, and 19% from the educational services, and the rest are from various industries. For years of experience, 28% of the respondents had over 20 years of experience, and 24% had experience from 11 to 15 years. Also, 96% were familiar with kaizen terminology and 35% of the respondents participated in kaizen activities from 1 to 5 times<sup>1</sup>.

<sup>1</sup> 22% of the respondents who did not participate in kaizen activities before but remained in the sample due to the fact that they passed the manipulation check question, meaning that they have heard about the term kaizen but have

not participated in a kaizen activity, or are referring to kaizen through different terminologies such as 5S, lean, TQM, continuous improvement, etc.

TABLE II  
SAMPLE DESCRIPTIVE STATISTICS

Descriptive statistics		N	%
Gender	Male	46	85%
	Female	8	15%
	<b>Total</b>	<b>54</b>	<b>100%</b>
Country	Egypt	28	52%
	Japan	20	37%
	<b>Total</b>	<b>54</b>	<b>100%</b>
Education level	BSc.	27	50%
	MSc.	13	24%
	PhD	12	22%
	High school <sup>2</sup>	2	4%
	<b>Total</b>	<b>54</b>	<b>100%</b>
Sector	Public	10	19%
	Private	44	81%
	<b>Total</b>	<b>54</b>	<b>100%</b>
Industry	Manufacturing	20	37%
	Oil & Gas	1	2%
	Healthcare & Medicine	5	9%
	Real estates & Construction	2	4%
	Educational services	10	19%
	Food, drinks and tobacco	11	20%
	Automobile industry	1	2%
	Others	4	7%
	<b>Total</b>	<b>54</b>	<b>100%</b>
	Years of experience	1 to 5	10
6 to 10		11	20%
11 to 15		13	24%
16 to 20		5	9%
Over 20		15	28%
<b>Total</b>	<b>54</b>	<b>100%</b>	
Familiar with the term Kaizen	Yes	52	96%
	May be	2	4%
	<b>Total</b>	<b>54</b>	<b>100%</b>
How many Kaizen activities have you participated in?	1 to 5	19	35%
	6 to 10	8	15%
	More than 20	6	11%
	As a daily activity	9	17%
	Didn't participate before	12	22%
<b>Total</b>	<b>54</b>	<b>100%</b>	

### C. Main Analysis

#### i. Differences in The Allocation of Kaizen CSFs in SBSC Between Egypt and Japan:

*The first category;* Task Design which includes nine factors, Mann Whitney's test results revealed seven factors showing no significant difference between Egypt and Japan (p-value ranging from 0.082 to 0.847), with a mean value ranging from 2.9 to 3.5 for Japan, and 2.71 to 3.29 for Egypt, resulting in the allocation of those seven factors as shown in fig. 3. While, only 2 factors exhibited a significant difference (FTSK5 with p-value 0.012 and FTSK6 with p-value 0.006). Thus, the final allocation<sup>3</sup> of FTSK5 and FTSK6 are in the internal business process perspective (fig. 3).

*The second category;* Team Design which includes nine factors, Mann Whitney's test results revealed six factors showing no significant difference between Egypt and Japan (p-value ranging from 0.211 to 0.956), with a mean value ranging from 2.5 to 3.5 for Japan, and 2.43 to 3.54 for Egypt, resulting in the allocation of those six factors as shown in fig. 3. While, only 3 factors exhibited a significant difference (FTEM1 with p-value 0.001 and FTEM2 with p-value 0.039 and FTEM7 with p-value 0.005). Thus, the final allocation of FTEM1, FTEM2 are in the Learning and growth perspective and for FTEM7 is in the Internal Business Process perspective (fig. 3).

*The third category;* Organization which includes 25 factors, Mann Whitney's test results revealed 17 factors showing no

<sup>2</sup> High school refers to vocational schools where they apply kaizen at the operational level.

<sup>3</sup> In the light of the further investigation, Japan is the pioneer in Kaizen activities implementation where Japanese experts are expected to have more experience regarding kaizen activities.

significant difference between Egypt and Japan (p- value ranging from 0.155 to 1.0), with a mean value ranging from 1.5 to 3.85 for Japan, and 1.46 to 3.82 for Egypt, resulting in the allocation of those 17 factors as shown in fig. 3. While, only 8 factors exhibited a significant difference (FORG1 with p-value 0.004 and FORG5 with p-value 0.008 and FORG10 with p-value 0.030 and FORG13 with p-value 0.010 and FORG14 with p-value 0.037 and FORG15 with p-value 0.020 and FORG17 with p-value 0.000 and FORG23 with p-value 0.049). Thus, the final allocation of FORG1 and FORG5 and FORG10 and FORG13 and FORG14 and FORG15 are in the Internal Business Process perspective and FORG17 and FORG23 are in the Learning and growth perspective (fig. 3).

*The fourth category;* CIP process which includes ten factors, Mann Whitney's test results revealed that all factors are showing no significant difference between Egypt and Japan (p-value ranging from 0.075 to 0.991), with a mean value ranging from 3.0 to 3.7 for Japan, and 2.96 to 3.29 for Egypt, resulting in the allocation of those ten factors as shown in fig. 3.

*ii. Differences in The Allocation of Kaizen Benefits in SBSC Between Egypt and Japan:*

Kaizen benefits are divided into two categories, *the first category;* Kaizen economic benefits which includes 13 benefits, Mann Whitney's test results revealed 12 economic benefits showing no significant difference between Egypt and Japan (p- value ranging from 0.237 to 0.872), with a mean value ranging from 1.55 to 3.05 for Japan, and 1.46 to 3.0 for Egypt, resulting in the allocation of those 12 economic benefits as shown in fig. 3. While, only one economic benefit exhibited a significant difference (EB2 with p-value 0.034). Thus, the final allocation of EB2 is in the Financial perspective (fig. 3).

*The second category;* Kaizen Human Resource benefits which includes 10 benefits, Mann Whitney's test results revealed 9 Human Resource benefits showing no significant difference between Egypt and Japan (p- value ranging from 0.063 to 0.851), with a mean value ranging from 2.35 to 3.9 for Japan, and 2.36 to 3.39 for Egypt, resulting in the allocation of those 9 Human Resource benefits as shown in fig. 3. While, only one Human Resource benefit exhibited a significant difference (HB7 with p-value 0.049). Thus, the final allocation of HB7 is in the Learning and growth perspective (fig. 3).

Financial	FORG 8, EB2, EB3, EB6, EB8, EB9, EB12									
	FORG 11, EB1, EB10, HB1				Customer/Shareholder					
Internal Process	FTSK 1	FTSK 2	FTSK 3	FTSK 4	FTSK 5	FTSK 6	FTSK 7	FTSK 8	FTSK 9	FTEM 3
	FTEM 4	FTEM 5	FTEM 6	FTEM 7	FTEM 8	FORG 1	FORG 2	FORG 3	FORG 4	FORG 5
	FORG 6	FORG 7	FORG 9	FORG 10	FORG 12	FORG 13	FORG 14	FORG 15	FORG 19	FORG 20
	FORG 21	FORG 22	FORG 25	FCIP 1	FCIP 2	FCIP 3	FCIP 4	FCIP 5	FCIP 6	FCIP 7
	FCIP 8	FCIP 9	FCIP 10	EB4	EB5	EB7	EB11	EB13		
Learning and Growth	FTEM 1	FTEM 2	FTEM 9	FORG 16	FORG 17	FORG 18	FORG 23	FORG 24	HB2	
	HB4	HB7	HB9	HB10						
Sustainability										

Fig. 3 CSFs and Benefits Allocation into SBSC, Developed by the authors

VI. DISCUSSION AND CONCLUSION

This study responds to the limitations in measuring kaizen as it proposes a different methodology for kaizen performance evaluation using SBSC. First, kaizen CSFs were gathered from the literature review, where the most significant number of

factors were chosen; also, kaizen economic and human resource benefits were collected from the literature. Second, developing a SBSC measurement for kaizen through a survey questionnaire where participants allocated both CSFs and benefits into the five perspectives of SBSC. The questionnaire was distributed in Egypt and Japan among different industries; however, it was

distributed among those who have participated in kaizen activities before. Third, analyzing the questionnaire results to identify the differences in allocating kaizen CSFs and benefits in SBSC between Egypt and Japan.

The results of the questionnaire analysis showed some variations in allocating the CSFs, while there are insignificant differences in allocating the benefits between Egypt and Japan. It was considered that allocating a certain CSF and a certain benefit to the same SBSC perspective, means that these benefits reflect those factors, though the financial and sustainability perspectives reflects all other perspectives. Referring to the sustainability perspective (fig. 3), it is noticed that neither the Egyptian nor Japanese experts allocated any of the CSFs and benefits to this perspective. Those results can be contributed to the fact that kaizen is sustainable by nature thus, sustainability is reflected in all other four perspectives.

As the main purpose of the comparison was to reach to a comprehensive measurement taking into consideration the Japanese practices as a benchmark, it's worth mentioning that the organization category had some differences due to the culture differences between Egypt and Japan, as employees in Egypt perceive financial rewards as a sign of management acceptance of their work and as a result allocated the recognition and rewards factor to the financial perspective, while Japanese employees perceive rewards as a motivation for improvement, and as a result allocated it to the learning and growth perspective. Similarly, the performance evaluation/ review and follow up activities' factors would have different allocations, as Egyptian employees allocated those factors to the internal process perspective, while Japanese employees allocated them to the learning and growth perspective.

Even though, the suggested kaizen measurement was based on the questionnaire results, the research pertains some limitations such as testing the measure in different industries to prove its effectiveness in producing a more comprehensive kaizen evaluation scheme and enhancing kaizen implementation and wide adoption. Also, due to the nature of the research sample; kaizen experts, small number of responses were received.

Future studies may extend the current research by; First, testing the kaizen evaluation measurement in different industries. Second, investigating the measures of kaizen benefits to determine which of them is the best for measuring each benefit, in order to reach an acceptable accounting measure to facilitate the job of managerial accountants in measuring and recording kaizen results, thus in the decision making process of supporting kaizen activities and spreading it through organizational departments. Finally, the results of this SBSC measure could be compared with other methods used to measure kaizen.

APPENDIX  
 TABLE III  
 CSFS ALLOCATIONS

CSFs	Mean		P-value	
	Japan	Egypt		
<b>Task Design Category</b>				
FTSK1	Goal development process	3	2.89	.847
FTSK2	Goal clarity	3.3	2.82	.094
FTSK3	Goal difficulty	3.25	2.68	.082
FTSK4	Goal alignment	2.9	2.71	.265
FTSK5	Project duration	3.05	2.07	.012
FTSK6	Problem scope	3.3	2.43	.006
FTSK7	Target area routines	3.4	2.96	.175
FTSK8	Target area commitment to change	3.35	2.93	.384
FTSK9	Target area understanding of continuous improvement	3.4	3.29	.805
<b>Team Design Category</b>				
FTEM1	Team member experience	4.05	2.89	.001
FTEM2	Team autonomy	3.95	3.21	.039
FTEM3	Stakeholder representation	2.5	2.43	.211
FTEM4	Cross-functionality	2.85	2.68	.335
FTEM5	Target area representation	3.05	3.21	.711
FTEM6	Internal team roles	3.2	3.00	.373
FTEM7	External champion/sponsor	2.8	1.96	.005
FTEM8	Team size	2.8	2.93	.956
FTEM9	Team improvement skills	3.5	3.54	.367
<b>Organization Category</b>				
FORG1	General management support / Commitment	3.15	2.11	.004
FORG2	Management involvement	2.8	2.39	.173
FORG3	Management understanding of continuous improvement	3.45	3.04	.389
FORG4	CIP planning	3.1	3.36	.346
FORG5	Project identification and selection	3.1	2.21	.008
FORG6	CIP priority	3	2.57	.167
FORG7	Information from previous CIPs	3.2	3.36	.427
FORG8	Financial resources	1.5	1.46	.426
FORG9	Team member time	2.75	3.32	.355
FORG10	General resource support	2.85	2.07	.030
FORG11	Materials and equipment	2.35	1.86	.186
FORG12	Software	2.7	2.39	.523
FORG13	Facilitation	2.85	1.75	.010
FORG14	Data availability	3.55	2.75	.037
FORG15	Data trustworthiness	3.85	2.86	.020
FORG16	Training	3.6	2.89	.155
FORG17	Recognition and rewards	3.4	1.71	.000
FORG18	Performance evaluation/ review	3.15	3.21	.966
FORG19	Organizational policies and procedures	3.05	3.14	.850
FORG20	Organizational culture	3.2	2.93	.453
FORG21	Organizational structure	3.1	2.82	.352
FORG22	Support from continuous improvement program	3.4	2.96	.292
FORG23	Follow-up activities	3.65	3.00	.049
FORG24	Lessons learned	3.85	3.82	.703
FORG25	Deployment of changes	3.35	3.36	1.000
<b>CIP Process Category</b>				
FCIP1	Team commitment to change	3.4	3.25	.814
FCIP2	Team harmony	3.4	3.14	.519
FCIP3	Team communication and coordination	3.45	3.07	.251
FCIP4	Action orientation	3.25	2.96	.392
FCIP5	Tool appropriateness	3.4	3.11	.458
FCIP6	Structured methodology	3.7	3.04	.075
FCIP7	Solution iterations	3.4	3.25	.652
FCIP8	Planning for institutionalization	3.4	3.25	.652
FCIP9	CIP progress reporting	3	3.29	.398
FCIP10	CIP technical documentation	3.3	3.21	.991



TABLE IV  
KAIZEN BENEFITS ALLOCATIONS

Kaizen Benefits	Mean		P-value	
	Japan	Egypt		
<b>Kaizen Economic Benefits</b>				
EB1	Reducing the delivery time	2.05	2.00	.559
EB2	Achieving better economic balance	2.7	1.75	.034
EB3	Increasing profits	1.95	1.64	.680
EB4	Reducing Production process stages	2.55	2.36	.712
EB5	Decreasing failures in equipment and machinery	3.05	2.43	.237
EB6	Cost reduction	1.85	1.46	.241
EB7	Reducing operation cycles and design time	2.4	2.71	.425
EB8	Productivity increase	2.65	2.29	.403
EB9	Improving Cash inflows	1.55	1.54	.637
EB10	Reducing defective products	2.55	2.64	.872
EB11	Reducing Movement distances	2.75	3.00	.619
EB12	Reducing inventory waste	2.75	2.29	.388
EB13	Reducing waste in waiting times, and materials transport	2.85	2.43	.280
<b>Kaizen Human Resource Benefits</b>				
HB1	Increasing customer satisfaction	2.35	2.36	.851
HB2	Employees responsibility and commitment became more visible	3.7	2.96	.063
HB3	Reducing accidents resulting from the inappropriate work conditions	3.9	3.04	.066
HB4	The attitudes of managers have improved to make continuous improvement changes	3.55	3.21	.327
HB5	Improving communication between administrative staff	3.55	3.07	.112
HB6	Collaboration between all members of the company have increased	3.65	3.11	.093
HB7	Improvement changes have a positive influence on Individuals	3.95	3.11	.049
HB8	All members of the company participate in continuous improvement activities and/ or the construction of a new system	3.7	3.21	.305
HB9	Employees turnover have decreased	3.35	3.04	.474
HB10	Employees self-esteem have increased	3.6	3.39	.573

#### ACKNOWLEDGMENT

We would like to thank Mr. Koike Motoi and Ms. Kawazoe Tomomi from Egypt Japan university of science and technology JICA office for translating and enhancing the Japanese version of the survey, and for their valuable feedback. Also, we would like to thank the Japanese professors who contributed to this research either in the pilot study or in the later stages.

#### REFERENCES

[1] F. Gonzalez-Aleu, E. M. Van Aken, J. Cross, and W. J. Glover, "Continuous improvement project within Kaizen: critical success factors in hospitals," *TQM J.*, vol. 30, no. 4, pp. 335–355, 2018, doi: 10.1108/TQM-12-2017-0175.  
[2] J.-I. Ker and Y. Wang, "Kaizen Policies in Healthcare Governance: Reducing Patient-Flow Delays in Outpatient Surgery Setting through

Healthcare Information Technology," *Ssrn*, pp. 1–29, 2015, doi: 10.2139/ssrn.2624133.  
[3] Nihon H. R. Kyōkai, *Improvement Engine Creativity and Innovation Through Employee Involvement-The Kaizen Teian Approach*. CRC Press, 1995.  
[4] F. Gonzalez-Aleu, E. M. Van Aken, J. Cross, and W. J. Glover, "Continuous improvement project within Kaizen: critical success factors in hospitals," *TQM J.*, vol. 30, no. 4, pp. 335–355, Jun. 2018, doi: 10.1108/TQM-12-2017-0175.  
[5] M. Imai, *Kaizen: the Key to Japan's Competitive Success*. 1986.  
[6] O. I. S. El Dardery, "How Kaizen Costing Information Facilitates Decision Making Process," no. December, pp. 16–18, 2017.  
[7] P. Kumar and V. Pandey, "KAIZEN: A Case study in small scale organizations 1Prמוד." p. pp 133-136, 2013.  
[8] M. O. Vento, J. L. G. Alcaraz, A. A. M. Macías, and V. M. Loya, "The impact of managerial commitment and kaizen benefits on companies," *J. Manuf. Technol. Manag.*, vol. 27, no. 5, pp. 692–712, Jun. 2016, doi: 10.1108/JMTM-02-2016-0021.  
[9] J. A. Farris *et al.*, "An Empirical Investigation of Kaizen Event Effectiveness: Outcomes and Critical Success Factors Dissertation submitted to the faculty of the Virginia Polytechnic Institute and State University in partial fulfillment of the requirements for the degree of," *Screening*, 2006.  
[10] F. G. Aleu and E. M. Van Aken, "Systematic literature review of critical success factors for continuous improvement projects," 2015, doi: 10.1108/IJLSS-06-2015-0025.  
[11] J.-I. Ker and Y. Wang, "Kaizen Policies in Healthcare Governance: Reducing Patient-flow Delays in Outpatient Surgery Setting through Healthcare Information Technology."  
[12] P. Bartel, "Kaizen in Outpatient Services at Kishwaukee Community Hospital Prepared by :," 2011.  
[13] E. M. van Aken, J. A. Farris, W. J. Glover, and G. Letens, "A framework for designing, managing, and improving Kaizen event programs," *Int. J. Product. Perform. Manag.*, vol. 59, no. 7, pp. 641–667, 2010, doi: 10.1108/17410401011075648.  
[14] J. Singh and H. Singh, "Kaizen Philosophy: A Review of Literature.," *ICFAI Journal of Operations Management*, vol. 8, no. 2, pp. 51–72, 2009, [Online]. Available: <http://0-search.ebscohost.com.aupac.lib.athabascau.ca/login.aspx?direct=true&AuthType=url,ip,uid&db=bth&AN=39231631&site=ehost-live>.  
[15] R. Moore, "8-Kaizen. In: Selecting the Right Manufacturing Improvement Tools." Butterworth-Heinemann, Burlington, pp. 159–172, 2007.  
[16] M. Imai, *Gemba Kaizen: A Commonsense Low-cost Approach to Management*. McGraw-Hill Professional, 1997.  
[17] A. P. Brunet and S. New, "Kaizen in Japan: An empirical study," *Int. J. Oper. Prod. Manag.*, vol. 23, no. 11–12, pp. 1426–1446, 2003, doi: 10.1108/01443570310506704.  
[18] M. Nagaretinam, "Implementing Kobetsu Kaizen steps in manufacturing company Goodway Rubber Industries (M) Sdn Bhd." Kolej Universiti Teknikal Kebangsaan Malaysia. Faculty of Manufacturing Engineering, p. 87, 2005.  
[19] GRIPS Development Form, "Introducing KAIZEN in Africa," *Introducing kaizen in Africa*, no. October. GRIPS Development Forum, pp. 1–11, 2009, doi: 10.1039/9781849735575-00001.  
[20] W. D. Lawless, "Introduction to Kaizen Budgeting: Case Study." p. 9, 2006.  
[21] J. A. Farris, "An Empirical Investigation of Kaizen Event Effectiveness: Outcomes and Critical Success Factors," 2006.  
[22] W. J. Glover, E. M. Van Aken, J. A. Farris, T. L. Doolen, and J. M. Worley, "Kaizen event follow-up mechanisms and goal sustainability: preliminary results," *IIE Annual Conference and Expo 2008*. pp. 1154–1159, 2008.  
[23] THESSALONIKI, "Kaizen Definition & Principles in Brief a Concept & Tool for Employees Involvement." pp. 1–42, 2006.  
[24] M. Ghicajanu, "the Kaizen Philosophy in Romania," *Ann. Univ. Petrosani Econ.*, vol. IX, no. 1, pp. 275–278, 2009.  
[25] T. L. Doolen, E. M. Van Aken, J. A. Farris, J. M. Worley, and J. Huwe, "Kaizen events and organizational performance: A field study," *Int. J. Product. Perform. Manag.*, vol. 57, no. 8, pp. 637–658, 2008, doi: 10.1108/17410400810916062.  
[26] S. Kumar, A. Dhingra, and B. Singh, "Lean-Kaizen implementation: A roadmap for identifying continuous improvement opportunities in Indian small and medium sized enterprise," *J. Eng. Des. Technol.*, vol. 16, no. 1, pp. 143–160, 2018, doi: 10.1108/JEDT-08-2017-0083.

- [27] S. Taghizadegan, "Design for Lean/Kaizen Six Sigma," *Essentials of Lean Six Sigma*. pp. 59–101, 2006, doi: 10.1016/b978-012370502-0/50008-4.
- [28] S. Bell, *Lean Enterprise Systems: Using It for Continuous Improvement*. USA, Hoboken, New Jersey: John Wiley & Sons, Inc, 2006.
- [29] T. Omotayo, B. Awuzie, T. Egbelakin, and L. Obi, "AHP-Systems Thinking Analyses for Kaizen Costing Implementation in the Construction Industry," *Buildings*, vol. 10, no. 12, p. 230, 2020.
- [30] S. Jassem, Z. Zakaria, and A. Che Azmi, "Sustainability balanced scorecard architecture and environmental performance outcomes: a systematic review," *Int. J. Product. Perform. Manag.*, 2021, doi: 10.1108/IJPPM-12-2019-0582.
- [31] R. S. Kaplan and D. P. Norton, "The Balanced Scorecard  $\alpha$  Measures That Drive Performance—, in: Harvard Business Review, January-February 1992," 1992.
- [32] Z. T. Kalender and Ö. Vayvay, "The Fifth Pillar of the Balanced Scorecard: Sustainability," *Procedia - Soc. Behav. Sci.*, vol. 235, no. October, pp. 76–83, 2016, doi: 10.1016/j.sbspro.2016.11.027.
- [33] W. G. Bremser and N. P. Barsky, "Utilizing the balanced scorecard for R&D performance measurement," *R D Manag.*, vol. 34, no. 3, pp. 229–238, 2004, doi: 10.1111/j.1467-9310.2004.00335.x.
- [34] R. S. Kaplan and D. P. Norton, "The strategy-focused organization," *Strateg. Leadersh.*, vol. 29, no. 3, Jan. 2001, doi: 10.1108/sl.2001.26129cab.002.
- [35] R. S. Kaplan, "Conceptual Foundations of the Balanced Scorecard Conceptual Foundations of the Balanced Scorecard 1," 2010.
- [36] K. Singh, *Quantitative social research methods*. Sage Publications Inc, 2007.
- [37] M. Omoush, M. Moflih, and R. Almetrami, "Evaluating the Five Kaizen Success Measurements through Employees Work Improvement and its Effects on Overall Work and Quality of Services : Empirical Study of Insurance Companies in Jordan," vol. 10, no. 4, pp. 43–52, 2020.
- [38] L. Tsao, P. L. P. Rau, and L. Ma, "Development of a Quick Instrument Measuring Kaizen Culture (for Chinese)," *Procedia Manuf.*, vol. 3, pp. 4708–4715, 2015, doi: 10.1016/j.promfg.2015.07.567.
- [39] [39] H. F. Kaiser, "An Index of Factorial Simplicity," vol. 39, no. 1, pp. 31–36, 1974.
- [40] M. S. Bartlett, "A Note on the Multiplying Factors for Various Chi Square Approximations," *J. R. Stat. Soc.*, vol. 16, pp. 296–298, 1954.