

Supplier Evaluation Framework Based on Balanced Scorecard with Integrated Corporate Social Responsibility Perspective

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Abstract—In this research a supplier evaluation framework based on Balanced Scorecard (BSC) with integrated Corporate Social Responsibility (CSR) has been developed from literature review of 76 related papers. It was found that quality, delivery, and cost are the most significant criteria. Moreover, some criteria are changed according to shorten product life cycle, technologies, improvement of service, evolution of production system, and emergence of supply chain management (SCM). Based on BSC and CSR, 5 perspectives namely financial, customer, internal business process, learning and growth, and corporate social responsibility are proposed for categorizing supplier selection criteria. Measures for each criterion are also collected for decision makers. This framework is presented in the form of a table in which both criteria and measures are contained, this would be facilitated to use. Moreover, its BSC basis verifies suitability of a supplier with the corporate strategies. As a consequence, evaluating supplier using the proposed framework can be helpful for decision makers to qualify the most eligible supplier who can meet qualifications and buyer's strategies as well as environmental and social responsibility issues.

Index Terms—Balanced Scorecard (BSC), Corporate Social Responsibility (CSR), Strategic Supplier Selection, Supplier Evaluation, Supplier Selection Criteria

I. INTRODUCTION

Supplier selection and evaluation is one of the most critical activities in purchasing or procurement process [1]. This evaluation process consists of 4 stages i.e., defining objective, formulating the selection criteria, qualifying the suitable alternatives, and final selection. To qualify the prospective suppliers, the effective defining of selection criteria is necessary [2],[3]. Beyond the high significance on the product cost and partners relationship, it has considerable impacts on the buyer's corporate competencies [4],[5].

The early research by Dickson (1966) conducted a questionnaire and sent to 273 purchasing agents and managers selected from the list of the National Association of Purchasing Managers, cover USA and Canada. There are 170 mails regarding the 23 important criteria that were ranked

with respect to the observation. He found that quality, delivery, performance history, and warranty policies are the most critical criteria for 1960s [6]. Afterward, there are many of researchers have conducted their research in this domain. In Weber *et al.* (1991) [2], based on 74 reviewed papers they found that price, delivery, production capacity, and location are the most often treated criteria. In other researches, many of them found that the cost, quality, and delivery are the most important criteria [2],[6]-[11]. Some paper noted that the choice of criteria may differ as a result of one culture to another [12]. However, it has been found that the 23 criteria presented in [6] still cover the majority of those presented in the literature until nowadays though some of them have been changed according to time [2],[13],[14].

The Balanced Scorecard (BSC) model was presented by Robert S. Kaplan and David P. Norton since 1992. It has been proposed to be a strategic approach and an organizational performance evaluation which can be used for strategy and policy implementation [15]. It is included by 4 perspectives i.e., financial, customer, internal business process, and learning and growth. Nevertheless, some authors recommend to charge the Corporate Social Responsibility (CSR) perspective, in term of environmental viewpoint, in a supplier selection process as a result of recent massive emergence of global warming and social responsibility issues [16]-[18].

To obtain the supplier whose strategies and qualifications harmonize with the buyer's objectives, an intensive study of criteria is needed. So, the 76 existing research papers are studied and compared. Next, BSC and CSR are used to create a proposed framework of a supplier evaluation for categorizing supplier selection criteria.

In this research, the 23 criteria in [6] are served as a principal for categorizing criteria. Some criteria those are not exactly match with the principal but hereabout relevant would be adopted into implicated categories and proper renamed e.g., formerly the communication systems criterion was renamed to information technology and communication systems likes the attitude criterion was changed as attitude and strategic fit and so on. Other criteria which could not be classified in any category of the principal will be added into the principal as new criteria namely, safety awareness, environmental and social responsibility, economical factors, terrorism risk, domestic political stability, quality system, innovation and R&D, customer relationship, product reliability, and cultural congruence. For this research, there are 76 relevant research papers containing "Selection criteria", "Supplier evaluation", "Supplier selection", and "Vendor selection" in their titles or keywords.

Manuscript received December 30, 2008.

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Table I Rank of supplier selection criteria

Criteria	Abbr	No. of Papers	%
Quality ^[6]	QLT	74	97.37
Delivery ^[6]	DLV	72	94.74
Cost ^[6]	CST	72	94.74
Production facility and capacity ^[6]	PFC	52	68.42
Flexibility and reciprocal arrangement ^[6]	FLX	52	68.42
Technical capacity and support ^[6]	TCS	49	64.47
Repair services and follow-up ^[6]	RSF	45	59.21
Information technology and communication systems ^[6]	ITC	41	53.95
Financial status ^[6]	FNS	40	52.63
Innovation and R&D	INV	38	50.00
Operating controls ^[6]	OPR	34	44.74
Quality system	QTS	33	43.42
Management and organization ^[6]	MGT	32	42.11
Personnel training and development ^[6]	PTD	24	31.58
Product reliability	PRT	24	31.58
Performance history ^[6]	PMH	23	30.26
Geographical location ^[6]	GEO	23	30.26
Reputation and references ^[6]	REP	21	27.63
Packaging and handling ability ^[6]	PKG	18	23.68
Amount of past business ^[6]	PSB	18	23.68
Customer relationship	CTR	18	23.68
Warranties and claim policies ^[6]	WCP	15	19.74
Procedural compliance ^[6]	PCC	15	19.74
Customer satisfaction and impression ^[6]	CSI	15	19.74
Attitude and strategic fit ^[6]	ATD	14	18.42
Labor relations record ^[6]	LRR	9	11.84
Economical aspect	ECN	9	11.84
Desire for business ^[6]	DFB	8	10.53
Environmental and social responsibility	ENV	6	7.89
Safety awareness	SFT	5	6.58
Domestic political stability	DPS	5	6.58
Cultural congruence	CTC	4	5.26
Terrorism risk	TRR	2	2.63

Note: Abbr: Abbreviation

No. of Papers: Number of papers that appeared the criterion

%: Counted fractions of the criterion to the overall in percentages

^[6]: The criteria relating to those 23 criteria which appeared in [6]

II. SUPPLIER SELECTION CRITERIA

The papers related to supplier selection criteria were conducted in various contexts. Some were studied in global supplier selection context [19]-[21]. Meanwhile, some were conducted under advanced technology manufacturers [22],[23], developing country [9],[24], supply chain management system [5],[11],[25]-[29], buyer-supplier relationship and integration [30]-[36], and other conditions so far [1],[37]-[41]. These contexts are different in both criteria and their priorities. The basic criteria are quality, delivery, cost, systems, processes, flexibility, and service. Risk factors including domestic political stability, economical aspects, and terrorism risk should be also included [19],[20]. In the developing country scene, it is necessary to focus on product reliability and the supplier's capacity in both technical and production [9],[24]. Whereas the advanced technology manufacturing increases emphasizing on supplier's flexibility and capability in the field of R&D [22],[23]. Moreover, there are many of other contexts that affect the selection of criteria e.g., type of industry, corporate strategy, etc. Another approach of study is an empirical study, most of them usually consider in quantitative criteria based on operations research and computational techniques for finding out the numerical solutions that prioritize the selection criteria such as Activity

Based Costing Approach (ABC) [42],[43], Linear Programming (LP) [7],[29],[44], Linear Mixed Integer Programming (LMIP) [30],[45], Fuzzy Multiple Objective Linear Programming (FMOLP) [46],[47], and Genetic Algorithm (GA) [48] as well. The approaches that applied to determine the qualitative criteria namely, Analytic Hierarchy Process (AHP) [22],[35],[49]-[56], Fuzzy-AHP (FAHP) [26],[48],[57] Analytic Network Process (ANP) [4],[58], weights assessment approach [59], and Multi-Attribute Utility Theory (MAUT) [60],[61] are used in supplier evaluation process to figure out the best alternative.

In this research, 76 relevant papers were reviewed and summarized as shown in Table I. It is shown the rank of selected criteria by the number of paper counted in percentages. It indicates that the most considered criteria in the high level ranking with the percentages over 90 are quality (QLT), delivery (DLV), and cost (CST). This result is similar to existing works [2], [6]-[11]. The medium level ranking range from 50 to 70 percentages contains production facility and capacity (PFC), flexibility and reciprocal arrangement (FLX), technical capacity and support (TCS), repair services and follow-up (RSF), information technology and communication systems (ITC), financial status (FNS), and innovation and R&D (INV), respectively. The criteria in which fall between 10 and 50 percentages are considered as the low level ranking criteria. They are operating control (OPR), quality system (QTS), management and organization (MGT), personnel training and development (PTD), product reliability (PRT), performance history (PMH), geological location (GEO), reputation and reference (REP), packaging and handling ability (PKG), amount of past business (PSB), customer relationship (CTR), warranties and claim policies (WCP), procedural compliance (PCC), customer satisfaction and impression (CSI), attitude and strategic fit (ATD), labor relations record (LRR), economical aspect (ECN), and desire for business (DFB). The remainders of those criteria are 5 criteria that their percentages are less than 10. These are environmental and social responsibility (ENV), safety awareness (SFT), domestic political stability (DPS), cultural congruence (CTC), and terrorism risk (TRR), resulting from the emersion of new issues i.e., global warming, safety, CSR, and stability.

Table II Comparison of selection criteria

Abbr	[6]	[2]	New Rank	Abbr	[6]	[2]	New Rank
QLT	1	3	1	REP	11	8	18
DLV	2	2	2	PKG	18	13	19
CST	6	1	3	PSB	21	22	20
PFC	5	4	4	CTR	-	-	21
FLX	23	19	5	WCP	4	23	22
TCS	7	6	6	PCC	9	16	23
RSF	15	11	7	CSI	17	20	24
ITC	10	18	8	ATD	16	12	25
FNS	8	9	9	LRR	19	17	26
INV	-	-	10	ECN	-	-	27
OPR	14	14	11	DFB	12	21	28
QTS	-	-	12	ENV	-	-	29
MGT	13	7	13	SFT	-	-	30
PTD	22	15	14	DPS	-	-	31
PRT	-	-	15	CTC	-	-	32
PMH	3	10	16	TRR	-	-	33
GEO	20	5	17				

Note: Abbr : Abbreviation

[2] : Criteria ranking from [2]

[6] : Criteria ranking from [6]

Afterward, all of criteria were compared with two distinguish papers of Dickson (1966) and Weber *et al.* (1991). Reference [6] is the pioneer paper on supplier selection. Whereas in [2], the 74 related papers are classified and investigated the change during twenty years after [6]. Both [2] and [6] also have been cited by many researchers [5],[10],[19],[45],[46],[63]-[86].

Then, the rank from the investigation is compared with [2] and [6] as shown in Table II. There are several remarkable points that should be noted.

Firstly, the QLT, DLV, CST, PFC, TCS, and FNS are basic significant criteria that have been generally used for last four decades. Secondly, the FLX criterion has been massively increased significant from prior, from the rank of 23rd in [6], 19th in [2], and 5th in the new rank. That might resulting from a shorten product life cycle, obsolescence speed, change of production system, and emergence of supply chain management (SCM). Thirdly, increasing of customer service and customer's bargaining power cause the RSF criterion more importance. In addition, ITC criterion has also increased more meaning as a result of the IT era. Then, there are 10 criteria that have not been taken into account before. Those criteria can be classified into two groups. The first ones contained the criteria which have cooperated in the other criteria. These criteria are PRT, ECN, ENV, and SFT. Another is the criteria that have emerged in the latter time. There are INV, QTS, CTR, DPS, CTC, and TRR criteria. In contrast, the 8 criteria are apparently diminished significance on account of advanced in production and SCM together with global quality standard equality i.e., PMH, GEO, REP, PCC, CSI, ATD, LRR, and DFB. Anyway, there are 6 criteria, OPR, MGT, PTD, PKG, PSB, and WCP, which have a steady significance on supplier evaluation process for range of time.

III. BALANCED SCORECARD AND CORPORATE SOCIAL RESPONSIBILITY

A. *Balanced Scorecard (BSC)*

The Balanced Scorecard (BSC) model was first introduced and proposed to be a framework for performance evaluation by Robert S. Kaplan and David P. Norton in 1992 [15],[87]. It can be used for strategy and policy implementation. The BSC represents a translation of business strategy into set of measures by defining long term strategy, objectives, and the mechanism for achieving and obtaining feedback regarding those objectives. It is composed of 4 perspectives that can be briefly expressed as follows: [15],[88]-[90].

Financial Perspective: To indicate whether firm strategy, implementation, and execution contribute to bottom line improvement. The measures are profits, Return on Investment (ROI), and Economical Value Added (EVA).

Customer Perspective: To identify the outcomes associated with delivering differentiate value to satisfy the source of business profit. The customer satisfaction, customer retention, new customer acquisition, market position, and market share are considered as measures.

Internal Business Process Perspective: To satisfy shareholders and customers by excellence at some business internal process. Generic measures are quality, response time, cost, and new product to market lead time.



Fig.1 BSC with integrated CSR

Learning and Growth Perspective: To capture the ability of resources to manage a business and adapt to change and provide the infrastructure for achieving the objectives of the other three perspectives. Common measures are including employee satisfaction and information system availability.

B. *Corporate Social Responsibility (CSR)*

Corporate Social Responsibility (CSR) aspects are rapidly emerging as a substantial issue for business and management. Legal and public pressures on the attainment of good environmental practice are mounting [16],[17],[91].

These reasons cause some business and public sectors to include the CSR into its consideration framework. Although the CSR related criterion that is ENV criterion which has a fraction of 7.89 percentages, under the low level ranking, it cannot be disregarded to take CSR perspective into the consideration caused by those continual increased pressures of both conscience and legislation [17],[18].

IV. SUPPLIER EVALUATION BASED ON BSC WITH INTEGRATED CSR

The results from reviewing of supplier selection criteria are extracted into BSC framework which CSR perspective is integrated as shown in Fig.1. This proposed framework composed of 5 perspectives which are financial, customer, internal business process, learning and growth, and corporate social responsibility. It is a supplier evaluation framework based on BSC with integrated CSR. Even though significance of CSR is lower than those 4 exists perspectives, the CSR perspective is still necessary to be satisfied because of the civil and legislative enforcements. The measures for each perspective can be shown as Table III, IV, V, VI, and VII in an alphabetical order of criteria.

From observation, it was found that the internal business process perspective contains maximum number of criteria and all of the high level ranking criteria. However, the medium level ranking was contributed to financial, customer, internal business process and learning and growth perspectives. Although the CSR perspective contains the low level ranking, it cannot be eliminated because of expanding realization of environmental and social responsibility aspects as well as civil and legislative enforcements.

The subsequent processes to complete the framework consist of 5 steps: Firstly, weighting of the importance among perspectives. Then, assigning the weight between those criteria contained in each perspective and set as the performance measures. Thirdly, selecting the significant criteria (or measures) and then identifying the Key Performance Index (KPIs), targets and initiative activities to

Table III The Proposed BSC for supplier evaluation: Financial

FINANCIAL PERSPECTIVE		
Criteria	Measures	
Economical aspect (ECN)	- Currency fluctuation - Economical policies - GDP growth	- Growth deferring - Local price control - Tax and custom duties
Financial status (FNS)	- Annual profit and growth - Annual revenue and growth	- Financial stability - Fiscal outlook - Market share

Table IV The Proposed BSC for supplier evaluation: Customer

CUSTOMER PERSPECTIVE		
Criteria	Measures	
Amount of past business (PSB)	- Core competency - Customer base - No. of customers	- Renowned customers
Attitude and strategic fit (ATD)	- Management viewpoint	- Strategic compatibility
Customer relationship (CTR)	- Customer database - CRM activities - Customer retention	- Marketing campaign
Customer satisfaction and impression (CSI)	- Brand royalty - Customer reliance - Customer feedback	- Market position - Market share
Geographical location (GEO)	- Accessibility - Information - technology	- Distance - Trade barrier and tariff
Packaging and handling ability (PKG)	- Product carrying - Standard package compliance	
Performance history (PMH)	- Awards and expertise - Commercial Ability - Production schedule	- Response to market
Repair, services and follow-up (RSF)	- Convenience - Problems solving - Response to change	- Satisfaction on service - Service speed
Reputation and references (REP)	- Customer references - Firm prestige	- Position in industry
Warranties and claim policies (WCP)	- Warranty time range - Satisfaction on claims	

evaluate the score for alternative suppliers. The comparative process is the fourth step, benchmarking with the standards or best practices and the alternative suppliers performance. Finally, selecting the best supplier whose specifications meet the buyer's requirements.

V. CONCLUSION

The 76 research papers which containing corresponding keywords of supplier selection were reviewed, investigated and reclassified into the framework based on BSC with integrated CSR. It is required a judgment effort to classify the selection criteria those often not clear regarding categories and they have been categorized and renamed.

From investigation, it was found that quality, delivery, and cost are the most considered criteria with percentages over 90. Quality, delivery, cost, production facility and capability, technical capability and support, and financial criteria are significant basic criteria generally used for last forty years. And the flexibility and reciprocal arrangement criterion has massively increased significant in the same time. That might resulting from a shorten product life cycle, obsolescence speed, and change of production system, whereas some

criteria are diminished significant. Then, all of related criteria are classified in the framework of BSC with integrated CSR. All of the high level ranking criteria are contained in the internal business process perspective. Meanwhile, the medium level ranking criteria were contributed to financial, customer, internal business process, and learning and growth perspectives. Only CSR perspective contains the low level ranking criteria, which is the necessary condition for an organization.

Further researches are recommended to extensively consider which criteria are significant for a specific context or area of industry. Then, identify the tangible Key Performance Index (KPIs), targets and initiative activities. And set as a framework for evaluating supplier for a particular condition.

Table V The Proposed BSC for supplier evaluation: IBP

INTERNAL-BUSINESS-PROCESS PERSPECTIVE (IBP)		
Criteria	Measures	
Cost (CST)	- Circumstantial cost change - Compliance with Cost Analysis system (CCA) - Compliance with sector price behavior	- Cost reduction activity - Cost structure - Cost consistency - Low initial cost - Reasonable cost
Delivery (DLV)	- Conformance receipts - Consistent delivery - Delivery speed	- On time delivery - Quantity compliance
Flexibility and reciprocal arrangement (FLX)	- Conflict resolution - Flexibility of production system - Order change response - Responsibility to volume change	- Short setup time
Innovation and R&D (INV)	- Design capability - Expenditure on new technology - Invention lead time	- Product development capability and time - Technological support
Management and Organization (MGT)	- Level of command and compatibility - Management attitude - Organization structure	- Vision, mission, and policy
Product reliability (PRT)	- Conformance functions - Product life	
Production facility and capacity (PFC)	- Capacity flexibility - Capacity planning - Development speed - Production planning	- Responsibility to market demand
Quality (QLT)	- Conformance quality - Incoming rejection - Prompt response - Rejection rate	- Remedy for quality problems - Quality philosophy - Quality staff capability
Quality system (QTS)	- Database and traceability - QC and QA system	- System Certification
Technical capacity and support (TCS)	- Future technology - Technology deployment - No. of technical staff	- Technological capacity - Technology utilization - Technical expertise

Table VI The Proposed BSC for supplier evaluation: LNG

LEARNING AND GROWTH PERSPECTIVE (LNG)		
Criteria	Measures	
Cultural congruence (CTC)	- Cultural difference	- Feeling of trust
Desire for business (DFB)	- Business growth - Goal attainment	- Development activity - Outlook for future
Domestic political stability (DPS)	- Government shift and term length	- Public policies
Information technology and communication system (ITC)	- Compatibility of system - Ease of communication	- Information sharing - Information technology
Labor relations record (LRR)	- Clarity of job definition - No. of employees	- Occupational education activity - Organization structure
Personnel training and development (PTD)	- Occupational test - Professional education	- Training activity - Training Expense
Safety awareness (SFT)	- Accident statistics - Emergency plans	- Safety equipment and prevention
Terrorism risk (TRR)	- Attacked likelihood	- Emergency plans - State reliance

Table VII The Proposed BSC for supplier evaluation: CSR

CORPORATE SOCIAL RESPONSIBILITY PERSPECTIVE (CSR)		
Criteria	Measures	
Environmental and social responsibility (ENV)	- Design for environment - Environmental competency - Environmental policies	- Pollution discharge and management - Pollution reduction activity - Social expense and donation

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