

# DEVELOPING PERFORMANCE MEASUREMENT SYSTEM IN FOOD INDUSTRY: A LITERATURE REVIEW

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## ABSTRACT

Every company needs to understand its performance in order to develop good strategies. To know its performance, an appropriate performance measurement system (PMS) should be proposed. Performance measurement system is a brief and exact set of measures (financial and non-financial) that support the decision-making process of a firm by gathering, processing and analyzing qualified data of performance information. The aim of this study is to develop suitable and potential framework of performance measurement system in food industry using literature review analysis. The measures are then classified into groups. Interestingly, they are fit into the four perspectives of the balanced scorecard (BSC), except a few measures, which cannot be put into these four perspectives. These measures are unique for the food industry and are classified into a new perspective called "Food Quality perspective." Hence, the proposed performance measurement system for the food industry contains Customer perspective, Financial perspective, Internal process perspective, Learning and growth perspective, and Food quality perspective.

**Keywords:** Performance measurement system (PMS), Balanced scorecard (BSC), Food industry, Food quality perspective

## 1. INTRODUCTION

Performance measurement systems are defined as strategic expert systems by which firms observe and measure their intangible performance elements in the form of qualitative and quantitative assessment. In addition, performance measurement system is a brief and exact set of measures (financial and non-financial) that support the decision-making process of a firm by gathering, processing and analyzing qualified data of performance information (Fried, 2010).

It is very vital to select an effective and suitable performance tool not only to evaluate performance, but also to help management assess strategic plans and minimize planning errors (Zin *et al.*, 2013). Recent studies that many efforts have been develop the performance measurement for many types of industry. Aramyan *et al.* (2007) developed essential framework for performance measurement in agri-food supply chain, which comprises four main categories such as efficiency, effectiveness, responsiveness and food quality.

In 1992, Kaplan and Norton developed the balanced scorecard (BSC) which is involving in many companies, moved by the growing dissatisfaction with traditional financial measures as a main measure for company's performance. The BSC is a tool for aligning business activities to the vision and strategy of the firm, improving internal and external communications and monitoring firm performance against strategic goals. It includes diverse performance indicators such as

financials, customer perspective, internal-business processes and learning and growth (Bigliardi and Bottani, 2010). Currently, the BSC is a global management tool. Ittner and Larcker (2001) observed that it is the popularity for both practitioners and academics as the worldwide.

Food industry is very important because it represents one of the largest sectors in the global market (Mattevi and Jones, 2016). The food sector plays an important role to satisfy the needs of consumers and contributes every year in excess of 600 billion Euros to the EU economy (Manzini and Accorsi, 2013). The worldwide food and beverage industry is growing at around 5% a year and worldwide expenditure on food products by customers is expected to reach US\$20 trillion by 2030 (KAI, 2013). Moreover, consumers in Western-European markets have become more demanding and place new demands on attributes of food such as quality (guarantees), integrity, safety, diversity and associated information (services) (Van, 2014). Different food companies use different perspectives and measures to assess their performance and to respond to the need of the industry. As the food industry has its unique characteristics and demands, the research questions are 1). How to measure its performance? and 2). What are specific measures for the food industry? Therefore, this research is interested to identify and appropriate performance measurement system for commonly use in the food industry.

## 2. LITERATURE REVIEW

### 2.1 Performance Measurement System

Performance measurement system (PMS) is determined as a system that enables a firm to monitor the suitable performance indicators of products, production processes, and services in the proper time frame. Performance indicators are the criteria in which the performance of products, services and production processes can be classified. In addition, performance indicators are operationalized process characteristics, which compare the effectiveness and/or efficiency of a system with a target value.

PMS consists of systematic methods of setting business goals together with periodic feedback reports that illustrate progress against those goals. PMS informs decision makers whether customers are satisfied, whether they are meeting their goals, and whether and where improvements are necessary (Aramyan *et al.*, 2007).

According to Bititci *et al.* (1997), the integrated PMS is the information system that is at the heart of the performance management process and it is of critical importance to the efficient and effective functioning of the PMS. Currently many studies have shown that food industry lack of accurate indicators of performance for comparison, benchmarking and decision-making. Benita (1999) concluded that current PMS of food industry are insufficient because they depend on the use of costs as a primary indicator. In addition, Gunasekaran *et al.* (2001) concluded that there is no balanced approach with regards to financial as well as non-financial indicators and the number of performance indicators to be measured.

### 2.2 Balanced Scorecard

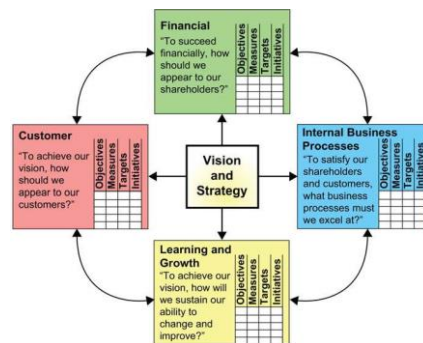
Kaplan and Norton introduced the balanced scorecard (BSC) in 1992 which provide a framework for choosing multiple performance measures focused on critical aspects of business (Ekmekçi, 2014). The phrase “balanced scorecard” was invented in the early 1990s but the concept originates from the beginning performance management work of general electric in the 1950s and the work of French process engineers who developed a tableau de board (an “instrument panel” or “dashboard”) method of measuring performance in the early 20th century (Houck *et al.*, 2012).

Many firms are using the BSC as the basic for their strategic management system. Some

managers have utilized it to align their businesses to new strategies, moving away from cost reduction and towards growth opportunities depended on more customized, value-adding services and products (Bhagwat and Sharma, 2007).

In 1992, balanced scorecard has been implemented in many firms of all types, sizes, and in many countries around the world due to its initiation. For instance, according to Gray (2001), in North America 50% of the 'Fortune 1000' firms are using the tool, in Europe between 40-45% and in Australia about a 35% of the firms (Cardemil-Katunaric, 2015).

In addition, balanced scorecard acknowledges managers to look at the business from four essential perspectives. It provides answers to four fundamental questions, which is shown in Figure 1, such as how do customers see us? (Customer perspective), what must we excel at? (Internal business perspective), can we continue to improve and create value? (Innovation and learning perspective) and how do we look to shareholders? (Financial perspective) (Lokanandha *et al.*, 2007).



**Figure 1.** Balanced scorecard model (Kaplan and Norton, 1992)

The BSC can be implemented as a tool for measuring and evaluating industry performance. It is categorized into four different perspectives of performance measures:

- **Customer:** it is a famous indicator that assists the firm evaluates customer satisfaction with its services or brand. Customers will ultimately find other suppliers that fit their needs if customers are not satisfied. This is essential to ensure powerful customer loyalty besides drawing attention to new customers. Even if the current financial picture looks good, lack performance from this perspective is a leading indicator of future decline.
- **Internal processes:** it focuses on the internal operations of the firm, enabling managers to judge their businesses efficiently. If compared to other traditional performance measures, this perspective is what makes the BSC unique. It provides managers to understand how well their business are operating, and whether its services/products correspond to customer requirements.
- **Learning and growth:** it determined the areas of excellence or competencies (e.g. information capital, human capital, organizational capital) that firm has to achieve value establishment. The main purpose is to examine the infrastructure that helps reaching the objectives of the other three perspectives in order to establish a long-term growth of the firm.

• Financial: this perspective indicates the traditional need for financial data. It plays an important role to define the financial performance of a firm with the implementation and execution of the company's strategic plans as well as evaluating the firm's profitability (Zin *et al.*, 2013).

### 2.3 Key Performance Indicator Using In Food Industry

From literature review key performance indicators used in food industry are varied. According to Bigliardi and Bottani (2010), the suitable key performance indicators in food industry can be listed in the balanced scorecard, such as financial, customer, internal business process and learning and growth perspectives.

Even though, the BSC has been widely investigated in literature, researchers were paid little attention to adopt in the food industry (Bigliardi and Bottani, 2010). The list of key performance indicators from literature review is shown in Table 1. There are 37 key performance indicators were listed from 16 academic journals.

**Table 1.** Key performance indicators used in food industry from literature review

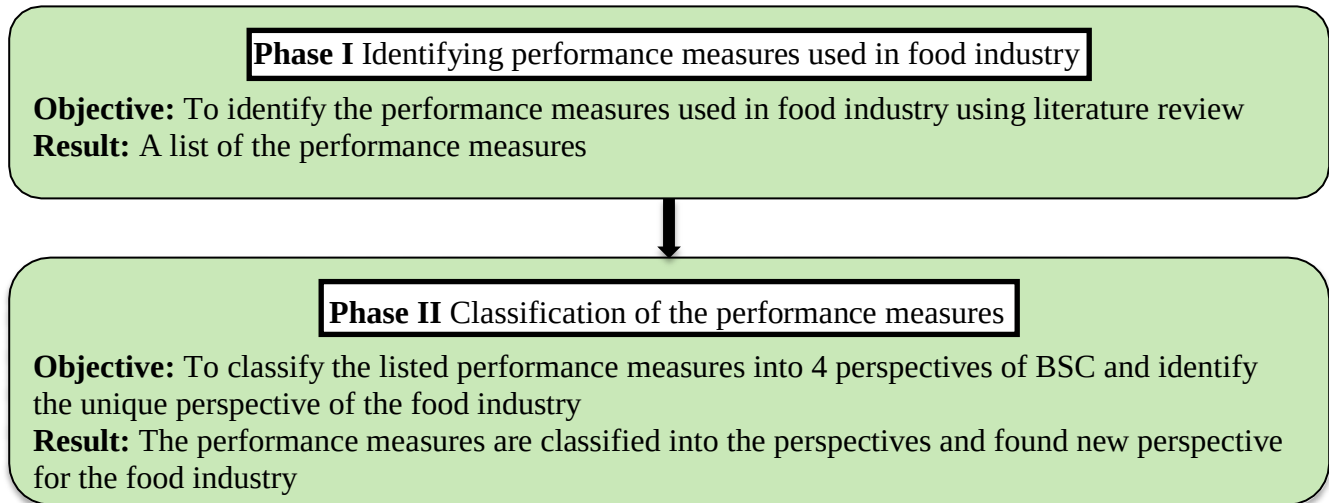
| Authors                                            | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | Total |
|----------------------------------------------------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|-------|
| KPIs                                               |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |       |
| 1. Customer query time                             | x |   |   |   |   |   |   |   |   |    |    |    |    | x  |    |    | 2     |
| 2. Level of customer perceived value of product    | x | x |   | x | x | x |   |   |   |    |    |    |    |    |    |    | 5     |
| 3. Order lead time                                 | x |   |   |   |   | x | x | x |   |    |    |    |    |    |    |    | 4     |
| 4. Service flexibility                             | x |   |   | x |   | x |   |   |   |    |    |    |    |    |    |    | 3     |
| 5. Delivery lead time                              |   |   |   |   |   | x | x |   |   |    |    |    |    |    |    |    | 2     |
| 6. Effectiveness of delivery invoice methods       | x |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    | 1     |
| 7. Delivery reliability                            | x |   | x | x |   |   | x | x | x |    |    |    |    |    |    |    | 6     |
| 8. Responsiveness to urgent deliveries             | x |   |   |   |   | x |   | x |   |    |    |    |    |    |    |    | 3     |
| 9. Effectiveness of distribution planning schedule | x |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    | 1     |
| 10. Achievement of defect free deliveries          | x |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    | 1     |
| 11. Range of products and services                 |   |   |   | x |   |   |   |   |   |    |    |    |    |    |    |    | 1     |
| 12. Customer response time                         |   | x |   |   | x | x | x |   |   |    |    |    |    |    |    |    | 4     |
| 13. Order fill rate                                |   |   |   | x |   |   | x | x |   |    | x  |    |    | x  |    |    | 5     |
| 14. Distribution performance                       | x |   |   |   |   | x | x | x |   |    |    |    |    |    |    |    | 4     |
| 15. Market share                                   |   | x |   |   | x | x |   |   |   |    |    | x  |    |    | x  |    | 5     |
| 16. Customer satisfaction                          |   | x | x |   | x |   | x |   |   |    |    |    | x  |    |    |    | 5     |
| 17. Delivery flexibility                           |   | x |   |   | x |   | x |   |   |    |    |    |    |    |    |    | 3     |
| 18. Accuracy of forecasting techniques             | x |   |   | x |   |   |   |   |   |    |    |    |    |    |    |    | 2     |
| 19. Purchase order cycle time                      | x |   |   | x |   |   |   | x |   |    |    |    |    |    |    |    | 3     |
| 20. Planned process cycle time                     | x |   |   | x |   |   |   | x |   |    |    |    |    |    |    |    | 3     |
| 21. Effectiveness of master production schedule    | x |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    | 1     |
| 22. Capacity utilization                           |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    | x  | 1     |
| 23. Manufacturing lead time                        |   |   |   |   | x | x |   | x |   |    |    |    | x  |    |    |    | 4     |
| 24. Inventory accuracy                             |   |   |   |   |   |   |   | x |   |    |    |    |    |    |    |    | 1     |
| 25. Total profit                                   |   | x |   |   |   | x | x |   |   |    |    |    |    |    |    |    | 3     |
| 26. Total inventory cost                           | x | x |   |   | x | x | x |   |   |    |    |    |    | x  |    |    | 6     |
| 27. Return on investment                           | x | x | x | x | x |   | x | x |   |    | x  | x  |    | x  | x  | x  | 12    |
| 28. Variations against budget                      | x | x |   |   |   |   |   |   |   |    |    |    |    |    | x  |    | 3     |
| 29. Cost per operation hour                        | x |   |   | x |   |   |   |   |   |    |    |    |    | x  |    |    | 3     |
| 30. Investment in training per year                |   |   | x |   |   |   |   |   |   |    |    |    |    | x  |    |    | 2     |

|                                         |   |   |  |   |   |   |   |   |   |   |  |  |  |  |  |  |  |   |
|-----------------------------------------|---|---|--|---|---|---|---|---|---|---|--|--|--|--|--|--|--|---|
| 31. Order entry methods                 | x |   |  |   |   |   |   |   |   |   |  |  |  |  |  |  |  | 1 |
| 32. Level of information sharing        | x |   |  |   |   |   | x |   |   |   |  |  |  |  |  |  |  | 2 |
| 33. Volume flexibility                  |   | x |  |   | x |   | x |   |   |   |  |  |  |  |  |  |  | 3 |
| 34. Product development cycle time      |   |   |  | x |   |   |   | x | x |   |  |  |  |  |  |  |  | 3 |
| 35. Sensory properties and shelf life   |   | x |  |   | x | x | x | x |   |   |  |  |  |  |  |  |  | 5 |
| 36. Product safety and health           |   | x |  |   | x | x | x |   | x | x |  |  |  |  |  |  |  | 6 |
| 37. Product reliability and convenience |   | x |  |   | x |   | x |   | x | x |  |  |  |  |  |  |  | 5 |

**Note:** 1. Bigliardi and Bottani (2010), 2. Chaowarut *et al* (2009), 3. Afonso and Cabrita (2015), 4. Sara *et al* (2016), 5. Aramyan *et al* (2007), 6. Gellynck *et al* (2008), 7. Chopra *et al* (2017), 8. Van (2014), 9. Luning *et al* (2010), 10. Wang (2013), 11. Rapee *et al* (2018), 12. Katchova and Enlow (2013), 13. Pinna *et al* (2018), 14. Shashi *et al* (2018), 15. Brezuleanu *et al* (2015), 16. Paustian *et al* (2015)

### 3. METHODOLOGY

The research methodology used in this paper is divided into 2 phases as shown in Figure 2.



**Figure 2.** Research methodology framework

### 4. FINDING

#### 4.1 Performance Measures for Food Industry

To answer research question 1. How to measure the food industry performance, 16 literatures with respect to the performance measurement system used in food industry were reviewed. There are 37 measures were mentioned in the literatures including customer query time, level of customer perceived value of product, order lead time, service flexibility, delivery lead time, effectiveness of delivery invoice methods, delivery reliability, responsiveness to urgent deliveries, effectiveness of distribution planning schedule, achievement of defect free deliveries, range of products and services, customer response time, order fill rate, distribution performance, market share, customer satisfaction, delivery flexibility, accuracy of forecasting techniques, purchase order cycle time, planned process cycle time, effectiveness of master production schedule, capacity utilization, manufacturing lead time, inventory accuracy, total profit, total inventory cost, return on investment, variations against budget, cost per operation hour, investment in training per year, order entry methods, level of information sharing, volume flexibility, product development cycle time, sensory properties and shelf life, product safety and health, and product reliability and convenience. The measures applied in those literatures were

counted and the repetition was removed. Then 21 measures were listed down as the common performance measures used in the food industry with the cut of at 3. After, the selected key performance indicators for the food industry are defined as shown in Table 2.

**Table 2.** Key performance indicators using in food industry with definition

| <b>KPIs</b>                                     | <b>Definition</b>                                                                                                                                                                                                                                                                    |
|-------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Level of customer perceived value of product | Perceived level of product quality relative to the price paid                                                                                                                                                                                                                        |
| 2. Delivery reliability                         | Percentage orders delivered on time and in right quantity                                                                                                                                                                                                                            |
| 3. Order fill rate                              | Percentage of units ordered that are shipped on a given order to customers                                                                                                                                                                                                           |
| 4. Responsiveness to urgent deliveries          | The percent of responsiveness to urgent customer's order performance that can accommodate without incurring high costs                                                                                                                                                               |
| 5. Market share                                 | Percentage of the industry's total sale that generated by a company                                                                                                                                                                                                                  |
| 6. Delivery flexibility                         | The ability to change planned delivery dates                                                                                                                                                                                                                                         |
| 7. Distribution performance                     | Length of promised order cycle times for base-line/in-stock products, manufacturer's performance in meeting promised delivery dates, fill rate on base-line/in-stock items, advance notice on shipping delays to customers                                                           |
| 8. Purchase order cycle time                    | The total amount of time taken to process a purchase order                                                                                                                                                                                                                           |
| 9. Planned process cycle time                   | Total time taken to plans to launching new process of new product                                                                                                                                                                                                                    |
| 10. Manufacturing lead time                     | Total amount of time required to produce a particular item                                                                                                                                                                                                                           |
| 11. Product development cycle time              | The average development time for the portfolio of products developed by an organization                                                                                                                                                                                              |
| 12. Volume flexibility                          | The ability to change the output levels of the products produced                                                                                                                                                                                                                     |
| 13. Total profit                                | The positive gain from an investment or business operation after subtracting all expenses                                                                                                                                                                                            |
| 14. Customer satisfaction                       | The degree to which the customers are satisfied with the products or services                                                                                                                                                                                                        |
| 15. Total inventory cost                        | Inventories range from raw materials, subassemblies and assemblies to finished products, as well as inventories held up in transit                                                                                                                                                   |
| 16. Variations against budget                   | Variance between actual profit amount and budgeted profit amount                                                                                                                                                                                                                     |
| 17. Return on investment                        | A measure of a firm's profitability and measures how effectively the firm uses its capital to generate profit                                                                                                                                                                        |
| 18. Cost per operation hour                     | Expenses related to operations of a business per hour                                                                                                                                                                                                                                |
| 19. Sensory properties and shelf-life           | Appearance and taste. The length of time a packaged food will last without deteriorating                                                                                                                                                                                             |
| 20. Product safety and health                   | Product does not exceed an acceptable level of risk associated with pathogenic organisms or chemical and physical hazards (Good Manufacturing Practices (GMP) or Hazard Analysis Critical Control Point (HACCP) and ISO certification) for guarantee products healthy and nutritious |
| 21. Product reliability and convenience         | Refers to the compliance of the actual product composition with the product description. The information provided on the packaging is useful, complete and easy understandable                                                                                                       |

#### 4.2 Classification of the Performance Measure

To answer research question 2. What are specific measures for the food industry, the list of common performance measures was classified into 4 perspectives of the balanced scorecard. They are "customer perspective", "internal business process perspective", "financial perspective", and "learning and growth perspective". However, some measures seem not belong to any of these 4 perspectives and therefore were then classified into a new perspective. The new perspective is now

called “food quality perspective” which is specific to the food industry performance measurement. The list of measures and its classification is shown in Table 3.

**Table 3.** Classification of key performance indicators

| KPIs                                            | Classification            |
|-------------------------------------------------|---------------------------|
| 1. Level of customer perceived value of product | Customers                 |
| 2. Delivery reliability                         | Customers                 |
| 3. Order fill rate                              | Customers                 |
| 4. Responsiveness to urgent deliveries          | Customers                 |
| 5. Customer satisfaction                        | Customers                 |
| 6. Delivery flexibility                         | Customers                 |
| 7. Distribution performance                     | Customers                 |
| 8. Purchase order cycle time                    | Internal Business Process |
| 9. Planned process cycle time                   | Internal Business Process |
| 10. Manufacturing lead time                     | Internal Business Process |
| 11. Product development cycle time              | Learning and Growth       |
| 12. Volume flexibility                          | Learning and Growth       |
| 13. Total profit                                | Financial                 |
| 14. Market share                                | Financial                 |
| 15. Total inventory cost                        | Financial                 |
| 16. Variations against budget                   | Financial                 |
| 17. Return on investment                        | Financial                 |
| 18. Cost per operation hour                     | Financial                 |
| 19. Sensory properties and shelf-life           | Food Quality              |
| 20. Product safety and health                   | Food Quality              |
| 21. Product reliability and convenience         | Food Quality              |

The overall finding from the study is that the proposal performance measurement system for the food industry contains 21 performance measures in 5 perspectives including 1) customer perspective, 2) internal business process perspective, 3) financial perspective, 4) learning and growth perspective, and 5) food quality perspective. The “food quality” perspective is considered as the unique perspective of the food industry is shown in Figure 3.



**Figure 3.** Five perspectives of performance measurement system in food industry

## 5. CONCLUSION

For food industry in order to get competitive advantages in new markets as well as global market, it needs to focus on establishing a strong performance measurement system. The KPIs defined for this system should be aligned with the company strategy, which supports the overall vision of the firm. In this case food industry is a special industry that needs to produce foods for summer to consume. So, this research was figured out the most relevant KPIs for food industry based on balanced scorecard perspectives such as customer perspective, internal business perspective, learning and growth perspective, financial perspective, and food quality perspective. Food quality perspective is a unique perspective for food industry, in addition to the other 4 common perspectives.

In this case, if company adapted those kind of KPIs, it will lead company to meet their long-term objective because BSC is a tool for aligning business activities to the vision and strategy of the firm, improving internal and external communications and monitoring firm performance against strategic goals. Recommendation for future study is to validate the performance measurement system with the real food companies such as SMEs in the food industry. Then priority should be set in order to let the company to form their improvement and to allocate appropriate finding to improve their specific performance.

## 6. ACKNOWLEDGEMENT



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