

# Improvement of the Key Performance Indicators (KPIs) and Evaluation of Challenges

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**Abstract** - To benchmark the performance of the Bus System (BS), Performance Measurement Systems (PMSs) should be used. In that regard, this contribution reviews the advancement of the standard PMSs used globally: Key Performance Indicators (KPIs). This research will further identify the BS that has a record of effective performance throughout their operations. With reference from the experiences in benchmarking, we have presented a literature review of KPIs and evaluated inputs to confirm that KPIs are a standardized approach used to compare and identify the performances of best practices for BS participation. The practical experience with the systems has potentially identified various critical issues in collecting comparable and consistent data. Dealing with these issues, giving the comparable information and undertaking essential study to comprehend and point out the basis for effective performance is considered a process which provides lessons for considerable benchmarking practices. This paper further evaluates the rules of the benchmarking processes, the PMSs of the BS, the overall challenges faced when collecting data and lastly, the findings of the benchmarking practice.

**Keywords** - Key Performance Indicators (KPIs), Bus System (BS), Performance Measurement Systems (PMSs)

## 1. Introduction

The global Bus Benchmarking Group (BBG) has ten basic bus organizations who are obliged to establish performance measures i.e., Key Performance Indicators (KPIs). These measures are purposed to compare the performances of enterprise across the globe. Referenced from the past experiences and scholastic reviews, KPIs have presented the organizations with exceptional performance in their business operations. The moment these firms are pointed out, case analyses are done to share the best practices that have amounted to the firms' high performance in business.

With that regard, this paper presents the development of the Bus System (BS) to benchmark the performance of the core BS. Literature reviews and practical experiences have been considered in the collection of comparable and consistent data from various research groups from BBG. Although, there are some challenges faced during the process of collecting data and producing the data. To ensure such issues are not reported again, it is fundamental

to comprehend before identifying the good Performance Measurement Systems (PMSs), externalities and constraints that affect the measured performances throughout the process of benchmarking.

The process of benchmarking is meant to establish systems of measurement for the business' internal management scheme; utilize the system of measurement in identifying the best practices; support the process of making decisions within the firm and to provide comparative data for the executive managers and the federation. The process of benchmarking is not typically considered as a mere comparison of information or ranking the firms based on their performance. However, the process is meant to ascertain the best practices in the management and operation sectors, enhance production and ascertain the inquiry lines for executive managers to follow.

Critical evaluation of the firms' performance is therefore fundamental to comprehend the external factors and constraint that affect the performance. Based on this, it is therefore possible to ascertain and implement potential results i.e., strategies, data sharing and best practices in the PMSs. BBG works to evaluate those firms that perform better in the market also draw recommendations and strategies for other firms to emulate to become equally productive. The features of the benchmarking process are standardized KPIs, case evaluations incorporating the analysis and research of key issues, clearing the case studies that include the member-based studies, firm confidentiality and an agreement to protect shared data within BBG.

Every year, information and data are gathered from the BBG's members to provide definitions about PMSs. The information and data models are then utilized to structure the best KPIs measures to undertake the performance comparisons of the firms [1]. Firms then evaluate the trends and provide explanations regarding their performance annually. Based on KPIs, future directions of research regarding the same are presented. The case studies presented every year enables BBG to provide detailed case studies regarding the same topic. The themes of the case studies are identified from the various KPI

results which identify the major variations between the members of the firm who justify detailed analysis or base of certain areas of interest.

The reports are finally produced to present the findings of the research with focus on the practical lessons learned as a resource that will potentially benefit the firms. The clearinghouse studies and systems represent the techniques applied for prompt responses to queries from the executive managers and shareholders. The members of firms can therefore initiate the study about the clearinghouse. Some of the examples of the previous researches are smart card fares, application of tickets, fleet replacement approaches and advertisement contracts. BBG hold meetings every year to structure agendas for the entire year to plan for the execution of the work to be done in that year [2]. The meetings also allow members to participate in the process of sharing their experiences, competencies and data regarding the projects done by their respective firms.

The discussions can then lead to the identification of the common issues which then leads to the conduction of case studies for the BBG. Data is kept confidential and can only be used within the group since the information and data provided might be sensitive and include safety data, workforce data and project planning data. The governing rules of assuring the confidentiality of data include the participants recognizing the complete openness with the BBG and assuring confidentiality outside the group [3]. The involved parties of the case study are required to embrace and follow the agreements that the data released outside the group has to be anonymized to safeguard the proprietary data and information.

The main purpose of KPI improvement process was to advance and ascertain unified indicators for comparison and measurement in the group. KPIs have been structured to combine the sources and means of data. This paper focusses on the improvement of the KPIs within firms. To achieve this rationale, this paper has been organized as follows: Section II provides the background analysis of the study. In Section III, literature review of the study is presented. In Section IV, data gathering and comparability for the KPI model is discussed. Section V provides the findings of the research. Finally, Section VI concludes the paper and provides future directions for the research.

## 2. Background Analysis

### *Improvement of KPIs System*

The core aim and rules of the KPI system is to provide direct comparison and analytical measurement in benchmarking. The performance indicators allow the firms' performance to be compared on an understandable and consistent basis between different firms. Moreover, information is gathered on a progressive basis hence providing the required time-series database which shows the enhancing and diminishing performance within the organization [4]. Through the application of KPIs objectives which are standardized, the compatibility of the business performance at a global level is accomplished,

hence identifying the best performance and high priority challenges in business.

The system for KPIs was initially structured to focus on the relative success dimensions from the balanced scorecard: business process, growth/learning and financial clients. Based on the balanced scorecard, the success dimension stimulated a decision to establish two other dimensions for the BS. Although overlapping both the internal procedures and the customer procedures dimensions, the significance of security and safety was considered fundamental on its own dimension [5]. Moreover, the significance of being friendly to the environment was considered as advantageous as an independent success dimension of KPIs evaluate the environment.

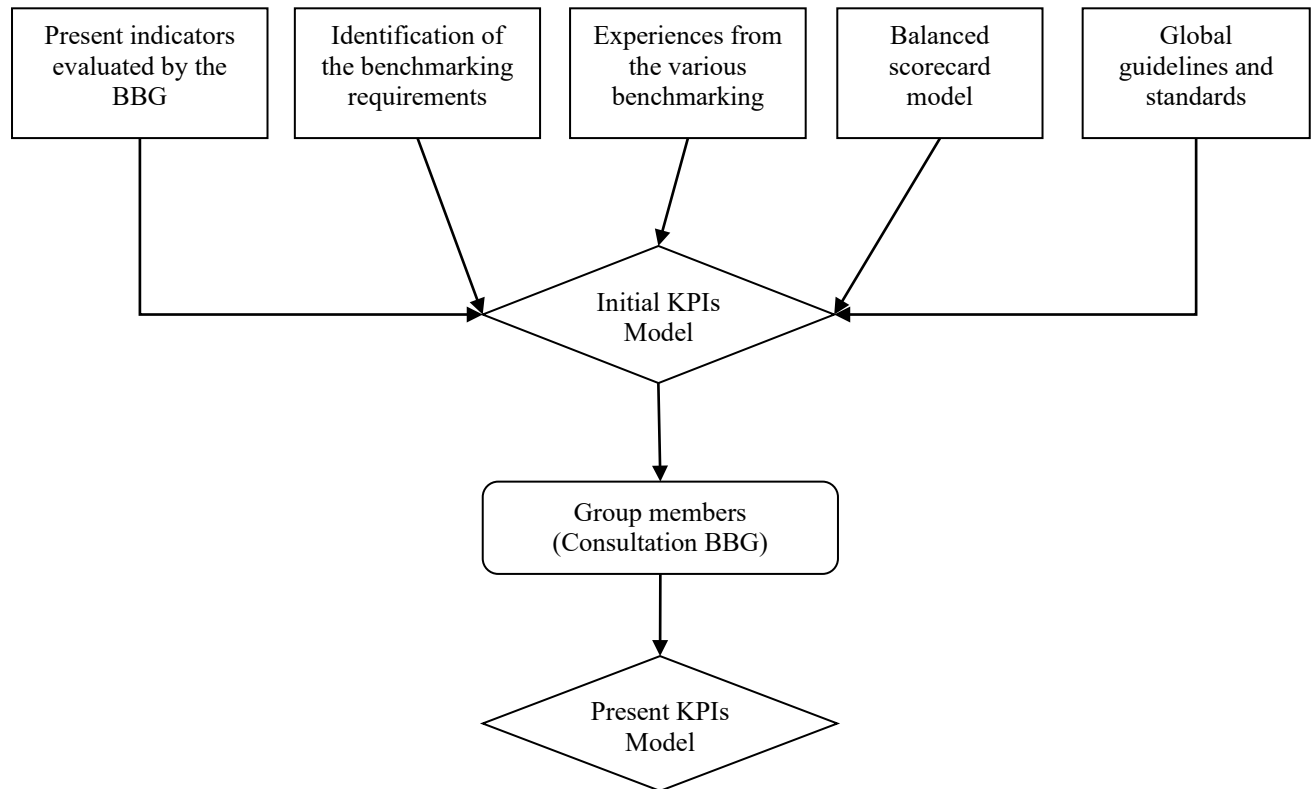
The core purpose of the KPIs improvement process was to structure and acknowledge the standardized indicators for the comparison and measurement across BBG. The system improvement was structured through the inclusion of sources and means of data as indicated in Figure 1 below.

Figure 1 shows the initial improvement process of KPI. The process provides an avenue of flexibility for evolution and transition over a considerable amount of time. Resultantly, this has changed both KPIs and the essential items of data which also incorporates the definitions centred on the inputs of BBFG and the literature reviews. The performance indicators have been removed and changed because of the challenges faced in obtaining comparable and adequate data.

## 3. Literature Review

To identify the various experiences in BS, essential guidelines and standards have to be considered by researchers in [6]. Three various primary sources have been evaluated in literature to define the external basis for BS benchmarking: EN-13816 standard; EQUIP project analysis and EN-13816 quality assurance approach to satisfy the needs of consumers. The segment of measurement centered on the EN-13816 standard was incorporated into KPI framework [7]. Moreover, many benchmarking group members are using this standard in their businesses. The major work in evaluating the fiscal performance of the BS was evaluated in [8] for the transit. Three different areas of measurement had been considered essential for cost performance and productivity.

Cost efficiency reflects the service levels and inputs while service efficiency represents the effectiveness of the services meant to accomplish the needs of the clients. The measures utilized by various fields were evaluated to provide a basis for fiscal effectiveness and efficiency of KPIs. A detailed list of the performance measures done in [9] identified during the scholastic review was structured for the EQUIP project. This detailed list is based on the various aspects of the BS and is utilized to project the coverage over the various balanced scorecard segments by the BS benchmarking groups and KPI model.



**Fig. 1:** Initial improvement process of KPI

The lessons learned from the past benchmarking researches reflect on BS. These significantly focused on the various aspects: defining the variations between the bust operations in various cities based on the overall urban features (split mode and population densities) and the features of the bus services and certain comparison details to compare certain features or to compare the business structure [10]. These researches are different from the obligations of the BS group since they did not cover the various questions or issue a framework for identifying various best practices. The benchmarking researches evaluated the various difficulties in retrieving comparable and consistent data from various operators. These challenges significantly connect to three fundamental segments: issues in retrieving information from the various operators, variation in classification between the various operators and variation in definition of certain performance indicators i.e., service punctuality.

A section of the issues behind the challenges of information comparability is due to the single research done with minimal timescales. This did not permit for the procedures to be defined and refines when the earlier inconsistencies and information shortages were noticed. This does not allow the trend evaluation and identification of enhancement or the negative enhancement overtime. As a segment of the KPIs process improvement, every BBG were requested to provide information regarding the kind of PMSs being used at the moment in the firm. These measures were then utilized as a foundational input for the

enhancement of the projected KPIs system for the BBG [11].

The performance measures utilized ranged depending on the city: Hong Kong was twenty in KMB and 40 in LBSL i.e., London. The members of the group concentrated on the performance measures that evaluated the success dimensions of internal business processes and customers. As for the customer success dimension, the various firms evaluate the dimension in which the real services relate to the planned services based on reliability and punctuality of BS. In the internal processes, the common indicators incorporate availability and reliability of the vehicle fleet which includes the portion of the fleet at the peak season.

The evaluation of accidents as in [12] assures safety for every ten thousand vehicles in a single kilometer. Contrary to that, security is not catered for the individuals' performance measures. Environmental and growth/learning are two various success dimensions catered in the performance measures by the members of the group. The major difference was found in the fiscal success dimensions. Various bus firms' record significant numbers of performance measures whereas other recorded just a few. In some cases, the firm might evaluate the revenue performance and not just evaluating the internal cost performances.

#### **4. KPI Model: Data Gathering and Comparability**

KPI measures are evaluated from the items of data collected per year. Upon information being included in the

model of data, earlier comparisons are structured. This procedure inevitably displays possible challenges that necessitate evaluation. The challenges with information comparability and collection span within the various segment of information. The following part evaluates some of these segments and the overall issues that are

experienced during the process of collecting data. At the highest level, the differentiating condition of the business of the BS can have fundamental implications which are discussed as a factor of information comparability. Figure 2 shows the KPI model.

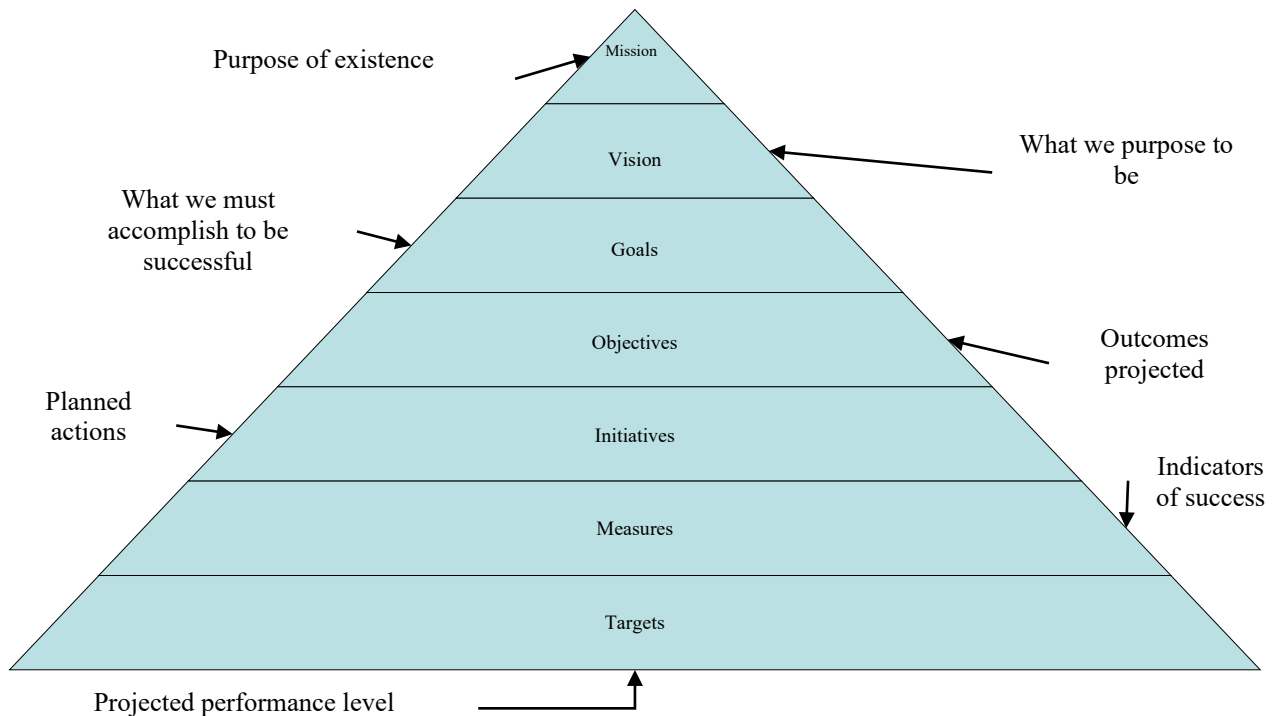


Fig. 2: KPI Model

### *Challenges of KPI Information Collection Output of Services*

KPIs model evaluates the outputs evaluates using both the hours and kilometers, structured down in various ways. In KPIs, information is requested for revenue kilometers, deadheads, layovers and total hours. Both the actual information and the scheduled data are requested to allow the measurement of the planned and actual performances. During the earlier KPIs information collection process, it was noted that not every firm collected the km information. More significantly, about half of its group typically gathers the complete dimension of hours' information, even though hours are recognized as a major factor of BS.

Moreover, firms that still apply manual approach for information gathering has information which were generally less accurate and comprehensive. Hours' information normally tends to require evaluations and follow up queries with the supplying benchmarking members of the group [13].

### *Labor Duration*

Information requested for labor duration is classified between the time spent for the major duties in critical functional category and paid duration for other purposes both work-based and non-work-based. The labor information is utilized for labor production comparison of various forms. Nonetheless, different organizations have labor structures because of work needs and compensation systems which limit the gathering of comparable information.

For instance, TMB provides the drivers with a particular fee for revenue of fare and the duration extended for the tasks which are not tracked. Other firms fail to differentiate the overtime duration for works (late return to garage) and the overtime duration paid for the statutory purpose such as holiday work and weekend work. As time goes, records are also dubious; for example, one firm normally pays and records an hour of the overtime duration for drivers which is more than fifteen minutes duration in garage [14].

### *Safety*

The data for safety, comparability and availability vary significantly. One firm has strict needs for safety broadcasting with random motor scratch broadcasted. For passengers, the firm has the drivers who will present the claimed tickets which will provide the passengers with priority service at the medical facility. For this purpose, the broadcasted motors and passenger accidents rates are significantly higher for certain firms.

#### *Quality of Service (QoS)*

Minimal comparators had been found over the member firms in evaluating QoS. Whereas it is projected that more subjective indicators in the segment of information, cleanliness, comfort and drivers' courtesy would vary, it is challenging to find commonality in evaluating the time-centered performance. Evaluations in time-centered evaluation are significantly affected by the approach of service operations. Many large towns have many BS working in headway and frequency other than the time-based framework.

Therefore, the standardized indicators which is considered as a percentage of the time trip is not broadcasted. Technology as a second fundamental variation with benchmarking BS completely with AVL framework provides effective data to enhance quality and quantity. Other fundamental indicators for evaluating the services to customers incorporated the lost km. The most fundamental elements of data have been recorded. However, no all the firms record this information. Typically, half of the BS evaluate another fundamental indicator which is the missed trips.

#### *Normalization Capacity*

Following KPIs improvement, it was considered that the differences in the sizes of vehicles among the firms affected the performance measures. KMB, LBSL and the Dublin Bus operated on the fleet significantly including the double-decker motors. Various comparisons with reference to the passengers in every vehicle and the consumption of fuel were slanted by being incapable of considering the sizes of vehicles. Moreover, the collection of data on the number of motors, km and person capacities were collected to enhance the comparability aspect of KPIs.

#### *Challenges of KPI information Comparability*

Whereas information collection is a challenge based on the definition and availability of certain items of data, the various forms of data generated by BS have their comparability level affected by numerous strategic elements:

#### *Fiscal Information and PPP Transformation*

For the firm to undertake global fiscal comparison, Purchasing Power Parity (PPP) numerical is applied to change the various currencies to common monetary elements and figures to deal with the various errors about the exchange rates, business growth, inflation over some time. PPP numerical include the relative power of

purchasing various currencies over services and goods of the same equivalence by removing the variations in the levels of prices between various counties. Nonetheless, they cover the general data in the country. The conditional factors in towns can be significantly different based on the various labor prices and other fundamental factors. These do not reflect in the PPP transformation hence making the amounting fiscal measures to be minimal than projected.

#### *Subcontracting*

Contracting and outsourcing influences the comparability of data that amount to the BBG members hence necessitating the gathering or minimal comparability that is to be fundamental. Subcontracting functions range from marketing, fare media, advanced technology, production and sales to administrative services. Production measures necessitate comparable labor information of the BS; contracting and outsourced labor duration which is therefore essential for requesting KPIs information. However, some firms appear to necessitate productivity information or evaluate the resources requirements for contracted elements. Provided the diversified activities over public transportation firms, high-level labor productivity research and cost transformation are influenced by the demerits of comparability.

#### *Global Guidelines and Standards*

The implication of global laws and marketing conditions has to be considered in comprehending some of the information comparison findings. Labor productivity is influenced by the legal limits of work duration annually. Pension systems, medical systems and taxation are also determined while comprehending some of the information comparison results. Labor productivity is affected by the legal limit of work duration. Pension, medical and taxation systems are based on global conditions. The difference in European countries on one hand and where global government gives worldwide publicized coverage for pension and health to American countries where firms are obliged for the significant modest merits which has significant influence on the employment cost [15].

Moreover, the intentions of evaluating the measurement model have to be considered. The regime of taxation is dominant in European countries with individuals paying tax for the fares purchased. Nonetheless, normally BS leaves the implication of taxation in accounting which incorporates the numerical for the fare revenues. As such, the question being presented is: 'Are PMSs supposed to evaluate the revenue fare which the bus firms are gathering as income'? Another question is "Does it include the funds that individuals in every town pay for their fares"? Dependent on the aims of benchmarking evaluation, any numerical may be suitable.

#### *Data Acceptance and Technological Application*

The progressive enhancement of technological frameworks and databases are in progress and continue to provide novel resources for gathering data. For many decades now, there has been significant progress in the availability, accuracy and quantity of data which significantly enhances the benchmarking process. At the same moment, progressive software transformation and fundamental updates have formulated issues in retrieving data for trend evaluation that fundamentally limit information history whenever the time series information is essential.

*Organizational Ecosystem*

Corporate structure, regulation and completion are transforming the functionality and responsibilities of the BS. Re-evaluating can influence the fiscal data and performance data which includes the items such as infrastructure ownership and property rent which includes cost allocation, commercial income and functional units. The parent transportation authority and agency may

assume the standard obligation common to other BS such as the responsibilities for the BS. The respective parties also consider the functionalities such as marketing or fare media distribution, sales and production. As such, this limits the accessibility of information requested in the process of benchmarking which also influences the comparability and availability of data.

**5. Findings**

Whereas many fundamental factors influence the comparability of global PMSs, KPIs demonstrate the variations which identify best performers. The information comparisons still allow more studies to disseminate and comprehend best practices without essential inclusion of effective information comparability. A normal KPI indicated in Figure 3 highlights the percentage of the motors utilized during the peak season service for BS benchmarking process.

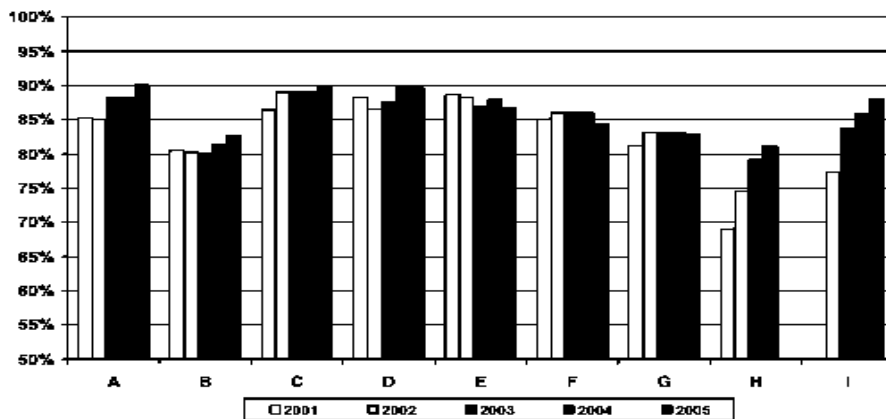


Fig. 3: Motors utilized during the peak season

KPIs information can be indicated in various means. The main purpose of this is to evaluate the various techniques for assessing the information gathered; selecting the correct denominators in normalizing the various forms of BS in comparison of various town environments. The passenger

km and passenger boarding are information items which are a form of growth success dimensions of KPI. Based on two measures it can highlight more data as indicated in Figure 4.

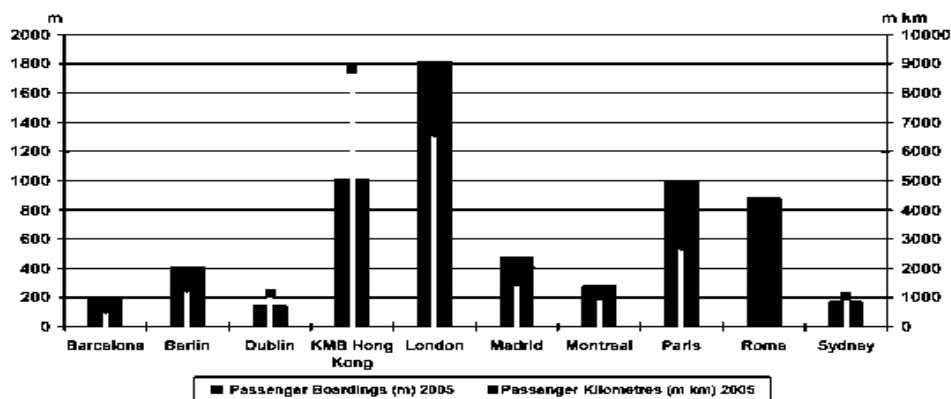


Fig. 4: Passenger km and passenger boarding

BS in Sydney, Hong Kong and Dublin has significantly more passenger trips compared to Paris, London and Berlin. This client usage of the BS has repercussions for planning and operations of BS in every town. Other essential measures include the usage of information which is anonymized for the purposes of establishing

confidentiality. Figure 5 below highlights the findings of the KPIs gatherings for the absence of BS operators. Although absence is significantly due to workplace culture and guidelines, transformation and trends in performance is vital and recommends the lessons for other BS.

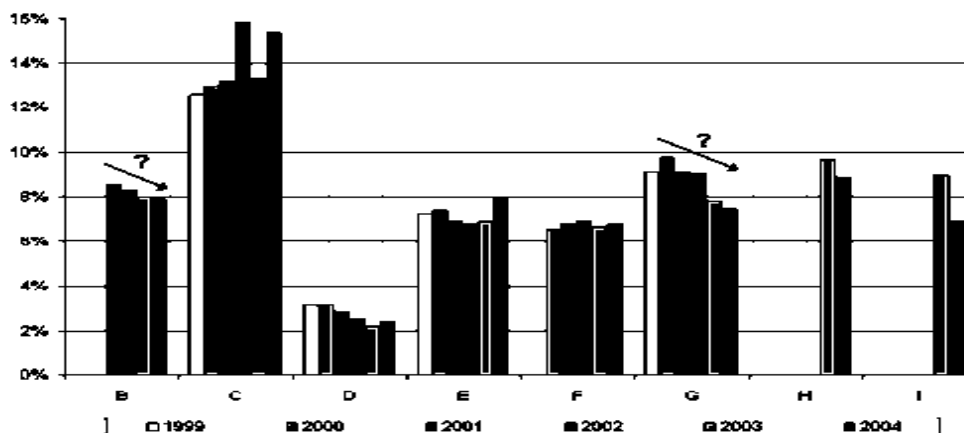


Fig. 5: Findings of the KPIs gatherings for the absence of BS operators

KPIs findings can be utilized to facilitate internal motivation of employees within the business which also helps to prove that activities can be done effectively. Researches and experience shared provide required data for the members of the firm. Due to this, the variation in information accuracy is generally immaterial and minor. The findings of the benchmarking process currently have concentrated on the success of every dimension's success. It is correct to conclude that not every firm is successful in all the business sectors.

Some KPIs results show that just one BBG member has minimized the actual unit costs for about half a decade. Since the group has begun to venture in its third stage, it is projected that the best practices will be shared and identified with the enhancing ease due to the significance from KPIs. Nonetheless, it is fundamental for the members of BBG to comprehend and illustrate the purpose of the essential PMSs. This degree of comprehension is fundamental for global comparison as a result of the variation in regulations and practices in various segments. Moreover, the BBG members have benefited from various aspects of benchmarking sharing data using the case studies initially done and the clearinghouse researches which have been commissioned.

## 6. Conclusion and Future Directions

In conclusion, the process of benchmarking over the years had been considered as a long-lasting process. Progressive improvement of PMSs is essential in ensuring KPIs that are fundamental and developing the comparability, collection and definition of data. Generally, the advent of BS benchmarking has concentrated on the improvement of the comparability and definition of KPIs information. It

has taken considerable efforts to accomplish comparable and comprehensive performance measures with more consistent information. Evaluations of the comparative performance in various case studies is initially done by the groups that have identified the managerial guidelines, procedures and external factors as the basic factors in defining performances. The future of KPIs is based on the shared past and present standards which affect the future of KPIs. The present standards of BS benchmarking: EN-13816 standard; EQUIP project analysis and EN-13816 quality assurance approach to satisfy the needs of consumers that need further comprehension to structure fiscal reporting for businesses. However, the future of KPIs is potentially likely to be distant, but better compared to the present standard dashboards.

## References

- [1]. Y. Polishchuk and A. Ivashchenko, "METHODOLOGY FOR CALCULATING KEY PERFORMANCE INDICATORS (KPIs) FOR USING VARIOUS FINANCIAL AND CREDIT INSTRUMENTS BY SMES", *Efektivna ekonomika*, no. 2, 2019. Doi: 10.32702/2307-2105-2019.2.9.
- [2]. A. BZ, "Key Performance Indicators (KPIs) Impacts in Project Management", *Business and Economics Journal*, vol. 08, no. 03, 2017. Doi: 10.4172/2151-6219.1000316.
- [3]. A. Bala and A. Koxhaj, "Key Performance Indicators (KPIs) in the Change Management of Public Administration", *European Scientific Journal*, ESJ, vol. 13, no. 4, p. 278, 2017. Doi: 10.19044/esj.2017.v13n4p278.
- [4]. I. Hristov and A. Chirico, "The Role of Sustainability Key Performance Indicators (KPIs) in Implementing Sustainable Strategies", *Sustainability*, vol. 11, no. 20, p. 5742, 2019. Doi 10.3390/su11205742.
- [5]. D. Widyaningrum, "Key performance indicators (KPIs) on Vannamei shrimp supply chain performance (a preliminary research)", *IOP Conference Series: Materials Science and Engineering*, vol. 403, p. 012046, 2018. Doi: 10.1088/1757-899x/403/1/012046.

- [6]. A. Koodie, "Performance Partnering and Key Performance Indicators (KPIs) - A UK Perspective", Proceedings of the Water Environment Federation, vol. 2009, no. 9, pp. 6470-6479, 2009. Doi: 10.2175/193864709793956860.
- [7]. K. Konsta and E. Plomaritou, "Key Performance Indicators (KPIs) and Shipping Companies Performance Evaluation: The Case of Greek Tanker Shipping Companies", International Journal of Business and Management, vol. 7, no. 10, 2012. Doi: 10.5539/ijbm.v7n10p142.
- [8]. B. Ioan, A. Nestian and S. Tiță, "Relevance of Key Performance Indicators (KPIs) in a Hospital Performance Management Model", Journal of Eastern Europe Research in Business & Economics, pp. 1-15, 2012. Doi: 10.5171/2012.674169.
- [9]. S. Berg, "Performance Assessment Using Key Performance Indicators (KPIs) for Water Utilities: A Primer", Water Economics and Policy, vol. 06, no. 02, p. 2050001, 2020. Doi: 10.1142/s2382624x20500010.
- [10]. N. Anand and N. Grover, "Measuring retail supply chain performance", Benchmarking: An International Journal, vol. 22, no. 1, pp. 135-166, 2015. Doi 10.1108/bij-05-2012-0034.
- [11]. O. Duru, E. Bulut, S. Huang and S. Yoshida, "Shipping Performance Assessment and the Role of Key Performance Indicators (KPIs): 'Quality Function Deployment' for Transforming Shipowner's Expectation", SSRN Electronic Journal, 2013. Doi: 10.2139/ssrn.2195984.
- [12]. M. Ishaq Bhatti, H. Awan and Z. Razaq, "The key performance indicators (KPIs) and their impact on overall organizational performance", Quality & Quantity, vol. 48, no. 6, pp. 3127-3143, 2013. Doi: 10.1007/s11135-013-9945-y.
- [13]. C. Wu and R. Chen, "KPIs (Key Performance Indicators) in Taiwan Basic Education", Journal of Modern Education Review, vol. 4, no. 8, pp. 565-578, 2014. Doi: 10.15341/jmer(2155-7993)/08.04.2014/001.
- [14]. E. Abu Eid and J. Jirjees, "Application of key performance indicators (KPIs) in the UAE public libraries: An analytical study", QScience Proceedings, vol. 2015, no. 1, p. 2, 2015. Doi: 10.5339/qproc.2015.gsla.2.
- [15]. M. Alvandi, S. Fazli, L. Yazdani and M. Aghaee, "An Integrated MCDM Method in Ranking BSC Perspectives and key Performance Indicators (KPIs)", Management Science Letters, vol. 2, no. 3, pp. 995-1004, 2012. Doi: 10.5267/j.msl.2012.01.024.