

REVIEW OF PERFORMANCE MEASUREMENT ON SUPPLY CHAIN MANAGEMENT

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Abstract: The purpose of this paper is to find out the extraordinary features of the public sector in developing nations and the impact of reforms in this sector. Describes the improvement and testing of a structured methodology for the design of performance measurement systems. It became clear that a good deal of the writing about performance measurement so far has been very superficial, neglecting the complexity involved in the actual design of measurement systems. Performance measurement is in the stage of identifying difficulties and pitfalls based totally on practitioner experience with some published research studies. This paper is aimed at small and medium businesses and large corporations and proposes a research agenda for the future. The results of the literature review expose a certain maturity of the literature pertaining to large companies and a significant lack of PMS for SMEs. It additionally discusses PMS in the context of an emerging enterprise environment such as globalization, servicing, and networking in the context of a multicultural environment. The place of PMS has been heavily researched and but some of the basic standards of PMS, especially the particular meaning and software of PMS characteristics, data, measurement residences including measurements, metrics and indicators, and size methods continue to be unclear.

Keywords: Performance Measurement System, Supply Chain, Service quality, Productivity.

I. INTRODUCTION

Management of the supply chain is a technique used by businesses to make sure their supply chain runs smoothly and cheaply. A company's supply chain consists of all the processes involved in turning raw materials into a finished product. We'll go through the five building blocks of SCM below: [1]

Plan:- Businesses need to develop a plan to coordinate the many resources used in product development and service delivery. Planning and establishing a set of KPIs is where supply chain management really shines. [2]

Develop (Source): - The next phase, after preparation, is development or sourcing. At this point, our primary focus is

on solidifying our partnerships with the raw materials providers. The process begins with the search for reliable suppliers and continues with the formulation of various strategies for the product's shipment, delivery, and payment. **Make:-** The third step in the supply chain management process is the manufacturing or making of products that were demanded by the customer. In this stage, the products are designed, produced, tested, packaged, and synchronized for delivery. [3]

This stage is considered as the most metric-intensive unit of the supply chain, where firms can gauge the quality levels, production output and worker productivity. [3]



Figure 1 The five building blocks of supply chain management

Deliver:- The fourth stage is the delivery stage. Here the products are delivered to the customer at the destined location by the supplier. This stage is basically the logistics phase, where customer orders are accepted and delivery of the goods is planned.

Return:- The last and final stage of supply chain management is referred as the return. In the stage, defective or damaged goods are returned to the supplier by the customer. Here, the companies need to deal with customer queries and respond to their complaints etc.

Performance measures

Performance measurement is the process used to assess the efficiency and effectiveness of projects, programs and initiatives. It is a systematic approach to collecting,



analyzing and evaluating how “on track” a project/program is to achieve its desired outcomes, goals and objectives. [5] Performance measures provide the information to assist in making strategic decisions about what an organization does and how it performs. Performance measurement frameworks are flexible and can be used to measure the effectiveness of a pilot project, a multi-year program or a strategic planning process and can be applied to a new or existing initiative. [6]

Benefits of performance measures

Other benefits of performance measures include: [3]

- (i) Creates “buy-in” through stakeholders setting targets and goals together.
- (ii) Develops “best practices” and “lessons learned” that can be applied to future initiatives.
- (iii) Increases accountability by demonstrating the effectiveness and value of plans and activities in achieving desired goals/outcomes.
- (iv) Informs decision-making including budgeting and resource allocation in an environment where there may be competition over limited resources.

Performance measurement framework

A performance measurement framework identifies the indicators required to monitor and gauge the performance of a program. Its purpose is to: [7]

- (i) identify measures
- (ii) methodology for connection and analysis
- (iii) roles and responsibilities
- (iv) reporting by using a logic model

Process

- Stage I - prepare for measuring performance**
- Stage II - identify outcomes using a logic model**
- Stage III - create performance measures**
- Stage IV - collect, analyze and communicate the results**



Figure 2 Strategic Plan

SCM - Performance Measures

Supply chain performance measure can be defined as an approach to judge the performance of supply chain system. Supply chain performance measures can broadly be classified into two categories –

Qualitative measures – For example, customer satisfaction and product quality.

Quantitative measures – For example, order-to-delivery lead time, supply chain response time, flexibility, resource utilization, delivery performance.

II. LITERATURE REVIEWS

The study makes use of focus group discussion by assembling eight experts and practitioners in the field of e-supply chain to come up with the measures and metrics. A questionnaire is designed with these measures and metrics and is sent to about 300 electronic component manufacturing companies in Malaysia to obtain feedback from the industry practitioners. Appropriate reliability and validity tests are conducted to measure the reliability of the instrument and validity of the constructs. Through the focus group discussion, this study identifies six metrics and 21 measures. Further validation through the industry practitioners, reveals that these measures are important and some are in use by the industries. The six metrics are: web-enabled service, data reliability, time and cost, e-response, invoice presentation and payment and e-document management metrics.[14]

The purpose of the thesis is to develop a structured framework for creating and evaluating supply chain performance indicators with the aim of facilitating organisations’ efforts when measuring supply chain performance. The theoretical framework, focusing on relevant aspects when measuring supply chain performance, was formed and used in order to develop a new framework for measuring supply chain performance. To investigate the functionality of the framework it was tested in a case study at Swedish Match. The empirical data builds on eight interviews made with the head of each function within the Global supply chain department at Swedish Match as well as on documents and observations. The data consists of information regarding what measures Swedish Match is currently using, as well as how it categorise, and share these performance measures. [15]

This paper introduces a predictive supply chain performance management model which combines process modelling, performance measurement, data mining models, and web portal technologies into a unique model. The results show that these models give very accurate KPI projections and provide valuable insights into newly emerging trends, opportunities, and problems. This should lead to more intelligent, predictive, and responsive supply chains capable of adapting to future business environment. [16]

Interest in the topic of supply chain performance measurement has notably increased in the last two decades



and considerable research has been conducted in this area. The objective of this paper is not just to review the advancements in theory on supply chain performance measurement per se, but rather to provide a taxonomy with which research in the field can be mapped and evaluated. The need for a structured topological approach to the development of supply chain performance measurement frameworks and methods is addressed. Findings are based on the analysis of a huge number of publications including the most recent reviews conducted in the contemporary literature (books, theses, journal articles and conference papers). The researchers believe that currently existing supply chain performance measurement frameworks can be classified into nine different types grouped according to the key criteria of measurement. This research reveals that most of the already existing approaches are static, inflexible and lack continual improvement which constitutes a gap between the theory and their potential application. Thus, future contributions to the topic are essential and possible. [17]

This concept paper has been developed with the overall purpose of evaluating the contextually existing Supply Chain Performance Measurements in Literature and its influence on supply chain partnerships. Therefore, an initial review has been undertaken by the researcher to review supply chain performance followed by the contextual supply chain performance methods and models that exists that could be effectively applied and deployed. Thereafter, based on both past research findings as well case study reviews, how the performance and effectiveness of supply chain partnerships can be undertaken to measure, paper attempts to develop a simple combined view of how supply chain partnerships can be effectively measured by giving special reference to the concept of supplier-buyer behavior. Also this paper focuses on future research areas that could be undertaken in the light of this concept of performance measurements of Supply Chain Partnership's (SCP's). [19] Supply Chain Management (SCM) has gained significance as one of the 21st century manufacturing paradigms for improving organizational competitiveness. Supply chain ensures improved efficiency and effectiveness of not only product transfer, but also information sharing between the complex hierarchies of all the tiers. The literature on SCM that deals with strategies and technologies for effectively managing a supply chain is quite vast. In recent years, organizational performance measurement (PM) and metrics have received much attention from researchers and practitioners. In this paper the performance is evaluated on five important links of the supply chain management system like inbound logistics, manufacturing, outbound logistics, marketing and after sales service. This paper describes a framework for performance measurements in supply chains. In addition, a multi-attribute decision-making technique, an analytic hierarchy process (AHP), is used to make decision about weak link based on the priority of performance

measures. On the basis of questionnaire collected for each level from Indian industries. The mean rating (both level) is utilized, as the input data to compute the pairwise comparisons of criteria. [20]

Performance measurement models are evolving fast in recent years, many research studies have been done regarding the nature and the methodologies of measuring performance in organizations. The present global economic environment of continuous change is demanding new business models and competitive strategies. These new models are being characterized by integration, and new technologies adoption, their operations are being forced to look not only in individual company, but also in their entire set of operations networks. The present challenge is to extend the performance management and measurement models developed for isolated companies to supply chains. This article aims to systematically review the literature on supply chain performance management and measurement in order to map the trends and behaviour of scientific production developed in the field. [21]

While companies have transformed their supply chain to Integrated Supply Chain, they have in need of a tool which will show the combined performance of the supply chain, the final outcome of the efforts of all integrated members, new improvement areas through the supply chain, and whether the supply chain is improved or not. This needed tool is a supply chain performance measurement system. In this thesis, a new performance measurement framework is proposed. In this framework, in addition to Customer Satisfaction Perspective and Financial Perspective a new perspective with respect to new trends in Supply Chain Management is defined. This new perspective is Supply Chain Collaboration Perspective. Furthermore, the necessary steps to be followed during the implementation of a performance measurement in automotive industry are identified. The supply chain performance measurement in a leading automotive manufacturer in Turkey is also discussed within this framework. [22]

Research on performance measurement has mostly focussed on the single company. However in the last few years focus has shifted to incorporate a supply chain perspective with several supply chain performance measurement systems (PMS) proposed. Implementing such a system proves difficult due to the complexity of supply chains. This paper presents criteria for the development of supply chain performance measurement systems proposed in literature. The criteria are evaluated in two industry cases. Based on findings from the case studies, we discuss the criteria and outline three factors to be dealt with to further enhance the implementation of PMS in supply chains. The factors are: lack of supply chain strategy, lack of implemented supply chain process models and lack of management systems supporting the PMS. We suggest that definition of supply chain strategies and processes along with development of



ICT tools for integrated PMS as first steps in addressing these factors. [23]

Supply chain performance measurement – the process of qualifying the efficiency and effectiveness of the supply chain. The aim of this study is to create a supply chain measurement framework for manufacturing industry, define what data should be measured and verify the measurement framework in the case company's supply chain. The research approach is hermeneutic and the research was a qualitative, constructive single case study research. The case company operates in the steel industry and provides prefabricated products for customers. The case supply chain was defined to be one supply chain in a plant where prefabricated products are produced. There is a review of the current understanding of supply chain management and literature related to supply chain performance measurement and the study creates a framework for supply chain measurement. This study presents the main theory framework of supply chain performance measurement. The key elements for the measurement framework were defined as time, profitability, order book analysis and managerial analysis. The measurement framework is tested by measuring case supply chain performance. The measurement framework is a valid framework for supply chain performance measurement in manufacturing industry. [24]

Supply chain management (SCM) is one of the biggest contributors to overall value creation for any organization. Considering this, organizations are focusing on strengthen their supply chains more efficient and competitive. Since opportunities always invite challenges and hence supply chain is not an exception. Currently, SCM is facing multiple challenges such as visibility, cost reduction, innovation, relationship among the stakeholders. The research objective was set to be “Impact assessment of CRM practices on supply chain management performance in Indian automobile industry”. The study found few gaps between expectations (agreement) and perception (adoption) of CRM practices. The study was conducted in major three automobile clusters namely northern, western and the southern clusters in India. For the purpose of data collection, a well-designed & structured questionnaire cum interview methods were used. The research has used quantitative method to collect data through a well-defined questionnaire. The analysis is done using MS Excel as well as IBM's SPSS. The results imply that industry has high level of expectations but industry is either unable to implement the best CRM practices or industry is unable to utilize benefits of CRM practices at most, hence this research has recommended monitoring operational functions carefully to improve the perception. The limitation of the research was the dependence on the unpaid cooperation of the respondents. This study is related to automobile companies however it may provide a direction to other industries. [25]

Based on the information and communication technology revolution are characterized by Internet usage in various

fields, the business environment also does changing by applying the concept of Electronic Commerce (e-commerce) on its process. Like business activities in general, e-commerce also requires the involvement of various parties, which are referred to Supply Chain Management (SCM). The challenge is while the Supply Chain (SC) performance measurement, that generally conducted in the company with non e-commerce, applied on e-commerce business process. Otherwise, only a few literature studies discuss partially dimension of performance measurement in e-commerce. Therefore, it is important to conduct a literature study about key performance indicators (KPIs) for measuring SC performance in e-commerce dimensions, and it would be explained in this paper. The contribution of this paper proposed the KPIs' that could be used for measuring SC performance in an e-commerce business process in order to be a new approach on the development of SC performance measurement models. [26]

In today's fierce global environment, continuous performance measurement is the key mantra for any kind of business successes. The performance measurement system is a framework to measure the efficiency of the supply chain. The purpose of this paper is to review the dearth of research into performance measurement systems in the context of the supply chain by reviewing the contemporary literature for the last two decades and evoking the potential avenues for future research. For this purpose, the authors have considered and classified the supply chain performance measurement systems as approaches and techniques and followed a systematic literature review procedure. Finally, this paper discloses that simulation techniques are more suitable than other performance techniques and approaches for the supply chain performance measurement in a volatile environment. The study also provides a strong basis for future researchers and academicians in applying the performance measurement systems in the context of the dynamic supply chain. [27]

A performance measure is used to determine the efficiency and/or effectiveness of an existing system, or to compare competing alternative systems. An important element in supply chain modelling is the establishment of appropriate performance measures. Supply chains are usually complex entities that aim to deliver the materials, parts and products from the suppliers to the end users. The management of supply chain means planning, coordinating and controlling the material, information and financial flows. The decisions are made at strategic, tactical and operational levels throughout the supply chain. [28]

In response to increasing demands on improved environmental performance, companies need to develop their capabilities in assessing the environmental performance of their operations. Knowledge among practitioners as well as solid research results in this area lacks. This paper aims to present a framework of dimensions important to consider regarding environmental



measurement in supply chain management. The paper also aims to present a practical example on how environmental performance measurements can be a success by applying these dimensions. The paper outlines important aspects to consider in the design of environmental performance measurements in supply chain management and identifies shortcomings in existing research. The case presents successful examples of how environmental performance measurements can be applied across managerial levels as well as company borders in a supply chain. [29]

The work relies on experiences, case studies and other literature related to performance measurement in environmental supply chains. It seeks to integrate works in supply chain management, environmental management, and performance management into one framework. A systems framework forms the discussion outline with a focus on controls/pressures, inputs, tools, and outputs as major categories for evaluation and review. Provides an integrative framework for study, design and evaluation of green supply chain management performance tools. The findings also identify a number of issues that need to still be addressed. [30]

Supply chain management is being envisaged as an extended enterprise connecting business in different places and facilitating allies to propel competitive advantage in the era of globalization. Substantial research has been undertaken along with literatures on supply chain performance management from cost and non-cost standpoint, strategic, functional or emphasis on operational aspects; perspectives from commercial as well as financial arenas. In order to gratify customer orders rapidly and efficiently than competitors, supply chain needs to warrant continuous upgradation of its processes and competitive strategies and to apprehend how supply chain contests? it is indispensable to realize the overall performance of the supply chain. However, still many companies miscarry to acquire effective performance measurement tools and techniques to attain integrated supply chain management (SCM). The rationale of this paper is to evaluate the literature on performance measurement for supply chain to apprehend current practices, recognize gaps and advocate future research itineraries. The paper also offers a synopsis and appraisal of the performance measurement used through different supply chain models. [31]

The performance measurement revolution started in the late 1970s with the dissatisfaction of traditional backward looking accounting systems. Since then, the literature in this field is emerging. Most of the focus was on designing performance measurement system (PMS), with few studies illustrating the issues in implementing and using PMS. Although Management Information Systems (MIS) and change management are important enablers of PMS, their role is not very well understood. Hence the objective of this paper is to review literature on the role of MIS and change management throughout the lifecycle of performance

measurement, i.e. design, implementation and use stages. This paper not only discusses the role of MIS and change management throughout PMS lifecycle but also discusses PMS in the context of emerging business environment such as globalization, servitization, and networking in the context of multi-cultural environment. Finally it identifies research challenges for PMS in the emerging business environment. [32]

Despite the increasing attention to the service supply chain management by both practitioners and academics, the performance measurement of service supply chains still remains unexplored. Most service firms realize that, in order to evolve an efficient and effective service supply chain, service supply chain management needs to be assessed for its performance. A literature review was conducted on performance measurement issues of service supply chains. This paper develops a framework of service supply chain performance measurement. Based on the strategic, tactical and operational level performance in a service supply chain, measures and metrics are discussed. The emphasis is on performance measures dealing with service supply chain processes such as demand management, customer relationship management, supplier relationship management, capacity and resource management, service performance, information and technology management and service supply chain finance. And to prioritize service supply chain performance measurement indicators to improve service supply chain performance, a methodology based on the extent fuzzy analytic hierarchy process is stressed. The developed framework of service supply chain performance measurement is applied to the hotel supply chain. The results of this study are useful both to practitioners in the service supply chain and to researchers carrying out further studies in the field. [33]

The objective of the present study is to investigate how forces located outside focal firm boundaries influence the evolution of performance measurement systems in supply chains. An evolutionary and dialectic approach is applied, acknowledging that change may be the result of collective action and of opposing influences and forces. Using a longitudinal case study approach, the emergence, proliferation and reconfiguration of three varied yet interrelated performance measurement systems designed to manage a supply chain in the hearing aid industry are explored. The case shows how the evolution of performance measurement systems in supply chains may be informed by multiple influences, some of which are external to the firm. Specifically, 'interconnectivity of performance measures', 'availability and ownership of performance information' and 'performance representations' are all found to be important factors influencing the evolution of the observed performance measurement systems. The framework of the proposed factors here builds on and extends previous research, which has not explicitly incorporated the potential influences of external entities and the supply chain context.



Thus, the findings expand our knowledge on how performance measurement systems develop over time in supply chains. With this new knowledge, managers should be better equipped to develop robust and enduring performance measurement systems in supply chains. [34]

The purpose of this paper is to adopt a supply chain performance measurement (SCPM) framework as proposed by Dweiri and Khan (2012) to model a novel supply chain performance measurement indexing (SCPMI) system to measure and improve supply chain performance. The adopted SCPM framework developed by Dweiri and Khan (2012) is used to model a generic SCPMI framework aided by Analytic Hierarchy Process (AHP) method and inputs from industrial experts. To exemplify the applicability and efficiency of the generic SCPMI system, an automobile assembling company from an emerging economy was utilized. This SCMPI system is used to measure, improve and measure post- improvement supply chain performance (SCP) guided by DMAIC (Define, Measure, Analyze, Improve and Control) methodology. The proposed generic SCPMI framework aided by AHP-DMAIC has been successfully implemented in a case company. After implementation, managers and decision makers saw an improvement in their SCP. The proposed SCPMI system and results can be useful for benchmarking by manufacturing organizations for continuous SCP improvement. [35]

The evaluation of a supply chain is a major priority of companies; it is a task that remains difficult due to the complexity of these systems. This evaluation involves a selection of performance measurement indicators, which are appropriate to the management of this chain. It is then necessary to have a structured approach and adequate methodological tools [2]. Indeed, we propose in this paper a practical method that will model in the first place a Moroccan automotive supply chain, according to the SCOR® model (Supply Chain Operations Reference), proposed by the Supply Chain Council. This method will also identify at each level the appropriate indicators for the performance evaluation depending on the strategic vision. In this context our research problem is made, it is interested in the contribution of the business modelling to improve logistics performance. To the best knowledge of the authors, this is the first work that proposes a case study believed to be easy to understand, practical and suitable for the automotive sector. In short, this study is a real application leap to resolve the problematic unanswered of practical SCOR® model using an industrial application in the Moroccan automotive sector. [36]

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review of the current understanding of supply chain management and literature related to supply chain performance measurement and the study creates a framework for supply chain measurement. This research is qualitative case study research. This study presents the main theoretical framework of supply chain performance measurement. The key elements for the measurement framework were defined as time, profitability, order book analysis and managerial analysis. The measurement framework is tested by measuring case supply chain performance. [37]

The purpose of this study is to examine performance measurement and evaluation in supply chain management in the healthcare industry considering a case of a pharmaceutical company and its supply chain partners in the donor sector. The specific objectives of the study were to explore integration of supply chain management in healthcare, to investigate supply chain evaluation approaches and explore the key performance indicators for the health care supply chain programs. The study employed a qualitative research approach. This was because the study aimed at obtaining specific information concerning measuring and evaluating performance in the donor funded supply chains administered by Phillips Healthcare Services Limited. [38]

In the era of globalization requires companies to start revolutionizing supply chain performance measurement system for their businesses. Supply chain management is one of the important issues that are a concern for companies that want to continue to increase consumer satisfaction, increase payment utility, and save expenses. For this reason, a supply chain performance measurement system is needed. The purpose of this paper is to build a supply chain performance measurement framework using the supply chain operation reference (SCOR) model as a tool for supply chain performance measurement. One of the causes of various failure of improvement programs in the supply chain is the inability to obtain an overview of the current condition of the company, including its cultural aspects. The use of the SCOR model in building the concept of supply chain performance measurement makes companies able to evaluate supply chain performance holistically in monitoring and knowing where an organization is relative to competitors. This paper focuses on the application of the SCOR model for supply chain performance measurement in manufacturing companies. Some tools are described in this paper as a proposal to build a performance measurement framework in optimizing value in the supply chain. [41]

The real challenge for managers is to develop and implement a suitable supply chain performance framework that not only helps in making right decisions but also facilitates the benchmarking of their internal supply chain. The main purpose of this study was to develop a framework based on the performance metrics such as (1) total length of the supply chain, (2) supply chain inefficiency ratio and (3)



supply chain working capital productivity. Case study approach is used to benchmark the SCM performance of two paint companies. Further, in order to examine the relationship between SCM practices and SCM performance measures, an empirical analysis has been done by formulating research hypothesis. Results show strong support for linkage between SCM practices and selected performance metrics. [42]

III. OBJECTIVE

Following are the objectives of the present study:

1. To study performance measurement and supply chain managements.
2. To evaluate the impact of performance measure on efficiency of on supply chain management.
3. To suggest methods to improve the performance measures for supply chain management.

IV. METHODOLOGY

Research design

It is the research design that serves as a road map for how data collection, measurement, and evaluation will be carried out in order to answer the research topic.

So, one of the most typical mistakes researchers do is to begin their studies before they have thoroughly considered the information needed to answer the study challenge. The entire study problem will not be fully addressed if these design concerns are not addressed in advance, and any results produced will be weak and unconvincing. This will have a negative impact on the study's overall validity.

Data collection

It is the process of gathering and evaluating data for research purposes using established and proven methods. The obtained data may be used to assess a researcher's hypothesis. Regardless of the subject matter, gathering data is usually the first and most crucial phase in any research project. Depending on the nature of the research, multiple methods of data gathering are used.

The most important goal of data collecting is to gather data that is rich in information and dependable for statistical analysis, allowing researchers to make data-driven choices about their work.

Research's integrity depends on proper data collection, regardless of the study's focus or the preferred method of defining data (quantitative vs qualitative). Data gathering instruments (existing or modified) and instructions on how to use them correctly are less likely to cause mistakes if they are chosen carefully and explicitly.

Consequences from improperly collected data include

- Accuracy in research questions is a problem
- Failure to repeat and confirm the research
- Inaccurate results lead to a loss of time and money.

- Convincing other researchers to go down the wrong path in their own study.
- Compromises in public policy decision making
- Causing injury or death to study participants, including humans and animals

Regardless of the discipline or nature of the study, improper data gathering has the potential to create disproportionate damage when utilised to accept public policy proposals.

Primary source data

The data gathered by the researcher from original sources is called primary data. Surveys, experiments, interviews, etc. are some of the major data collection methods. Data that comes straight from the source is known as primary data, and it's believed to be the most valuable. The main data is picked based on the specific needs of a certain research project. Choosing the data collecting method and the specific population to be studied should be done with the goal of the study in mind. This study includes data from primary source only.

Questionnaire design

In order to acquire information from respondents, a questionnaire consists of a set of questions or items. Quantitative and qualitative data may be collected through questionnaires.

Sample designing

To generate a representative sample of a particular population, one must first devise a sampling strategy, or sample design. Technique or method relates to how the researcher selects things for the sample. The likelihood of each element/respondent included in the sample is known.

A sampling frame representing the target population must be established before a sample can be taken. When a sample frame is used, it may be the same as the population, or it may be a subset of it and thus be prone to under-coverage (e. g. the population is preschool children and the frame is a listing of preschools).

V. CONCLUSION

Within a workplace, understanding the value and importance of performance management is key for a company to meet its business objectives and goals. Managers who understand what performance management is and how they can effectively implement it possess a competitive advantage. This is because effective performance management helps businesses ensure that they are getting the most out of their employees, resources, and any systems that they have in place.



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