Designing a Performance Measurement System: a case study at the Oil and Gas Sector

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Abstract

Performance Measurement System is already a consecrated tendency among companies concerned with an entire and solid set of metrics, process and system to support performance assessment efficiently. Both academics and practitioners have been interested in the subject in the last decades. However, the academic literature offers few empirical studies at the oil and gas sector. The goal of this paper is to analyze the PMS design at the Downstream Logistics Division of a multinational company in the oil and gas sector based on empirical findings of a longitudinal field study. The paper does not only focus on the system itself (technological parameters), but rather, it examines and highlights the knowledge obtained from designing and preparing the implementation of the PMS, supporting the description of a set of lessons learned through this initiative. The adoption of some practices during design phase in order to anticipate possible implementation problems is also evaluated.

Keywords
Logistics, performance metrics, empirical study

1. Introduction

Competition between companies became a hard reality for successful businesses: resources, space, information are constantly disputed to face the challenge of serving clients needs more efficiently, and raise in market share. In order to proactively respond to these challenges, management requires up-to-date and accurate business performance information [1]. Within this context, performance measurement (PM) became an important element of operations management [2]. It is also an accepted fact that businesses perform better if they are managed through formalized, balanced and integrated PM [3].

Organizations measure their performance in order to check their position, communicate their position, confirm priorities, and compel progress [4]. There is a need to define and measure performance [5] and to be able to drilldown to different metrics and different levels of detail in order to understand the causes of significant deviations of actual performance from planned performance [2]. A Performance Measurement System (PMS) is a system (software, databases, and procedures) to execute PM in a consistent and complete way [2, 6, 7]. According to [8], PMS should provide data for monitoring past and planning future performance, and provide a balanced picture of the business, evidencing the relation between metrics and decisions taken.
The development of a PMS may conceptually be separated into phases of design, implementation, use and reviewing/updating [1, 9, 10]. The design phase is about identifying key objectives and designing metrics. In the implementation phase, systems and procedures are put in place to collect and process the data that enables the measurements to be made regularly. In the use/review phase, managers review the measurement results to assess whether operations are efficient and effective, and the strategy is successfully implemented [9]. The review aims to constantly update the PMS [2, 12]. In accordance to [9], the PMS phases are conceptual because they can overlap as different individual metrics are implemented at different rates. Thus, some metrics can be implemented before all the metrics have been completely designed.

The review conducted by [12] indicated an increased focus on real-life studies in the last decade. However, the academic literature offers few empirical studies at the oil and gas sector. The goal of this paper is to analyze the PMS design at the Downstream Logistics Division of a multinational company in the oil and gas sector based on empirical findings of a longitudinal field study. The paper does not only focus on the system itself (technological parameters), but rather, it examines and highlights the knowledge obtained from designing and preparing the implementation of the PMS, supporting the description of a set of lessons learned through this initiative.

The studied Downstream Logistics Division is responsible for all transportation and storage of crude oil and oil products through the supply chain: from platforms or refineries to the customers. It plans and programs all logistics activities, and executes the operations. With the significant increases in oil production and in the overall refining capacity of the company, a change in everyday routine of this division became eminent and transportation and inventory capacity needed to be adapted for the future. An alert has been given with the diagnostic that the division was partially and poorly measuring its performance. This motivated the design of a PMS, object of the current study.

This paper is structured in five sections, being the first one the introduction; the second the literature review; the third the case study; the forth the overall evaluation and the fifth chapter the main conclusions of the research.

2. Performance Measurement System Design

The literature offers many definitions for PM. However, due to its clarity and objectiveness, the definition of PM adopted in this paper and also in many other academic works, for instance [1, 2, 3, 10, 12, 13] is the one presented by [14]: “the process of quantifying the efficiency and the effectiveness of an action”. Efficiency is a measure of how economically the firm's resources are utilized when providing a given level of customer satisfaction, while effectiveness refers to the extent to which customer requirements are met.

According to [9, 14], a PM which takes into account a set of performance metrics is called as a PMS, defined as a set of metrics used to quantify the efficiency and the effectiveness of actions. All PMS consist of a number of individual performance metrics and there are various ways in which these performance metrics can be categorized [14]. A set of key characteristics that a PMS must have, divided in features, roles and processes, are offered in [13] as follows: (i) features: elements or properties that make up the PMS – e.g. performance metrics, strategic goals and supporting infrastructure; (ii) roles: purposes or functions that are performed by the PMS – e.g. measure performance, strategy management, communication, influence behavior and learning and improvement; (iii) processes: series of actions that combine together to constitute the PMS – e.g. information provision, measure design and selection and data capture. Four characteristics of a good PM systems are highlighted in [7] as being: (i) it contains a balanced mix of financial and non-financial metrics; (ii) it helps you predict what is about to happen to your business, as well as enable you to understand what has happened; (iii) it encourages people to do things you want them to do; (iv) it is an integral part of a systematic process for reviewing the metrics and ensuring they stimulate purposeful action. According to these authors, a PMS can be examined at three different levels: (a) the individual performance metrics; (b) the PMS as an entity; and (c) the relationship between the PMS and the environment within which it operates. A relevant aspect to highlight is the direct effect a PMS has over communication processes. PMS designers and users must emphasize the importance of generating a system supported by two-way communications to encourage knowledge-sharing, generate trust, and avoid resistance [12].

According to [13], if a company does not have a specific process for selecting the metrics it is going to use to assess its performance (even if those metrics are imposed by external stakeholders); if it does not have a process for capturing the data to calculate its selected performance metrics; and if it does not have a process to distribute the results of the PM exercise (even if it is with a simple MS Excel ® spreadsheet); then, it could be argued that this company does not have a PMS.
The design stage identifies the customers and stakeholders’ needs and considers business objectives and a framework for adequate performance metrics and their attributes [9]. Four elements to be considered in the design process are proposed in [6] as being: (1) Point of entry (or launch) – this is how the design and implementation of performance metrics is introduced to the business; (2) Participation – this is who should be involved in the workshops; (3) Procedures – these are the set of tools and techniques which the management team work through together as a group during the workshops; (4) Project management – this is the administration support, facilitation and co-ordination required to progress the project. According to [8], firms which employ formal processes for PMS design find it significantly easier than those that do not to decide what they should be measuring and how they are going to measure it, collect the appropriate data and eliminate conflict in their measurement system.

The literature presents different approaches for designing a PMS, for instance [6, 15, 16], and/or helpful tools used for this purpose [17]. The methodologies usually differ in the number of steps and/or in the way those steps are followed; nevertheless all of them demonstrate a special concern about connecting the system with strategic matters of the company, always regarding operational issues (such as information technology and processes). The main relevant aspects in the design phase are described next. According to [18], the choice of performance metrics is one of the most critical challenges facing organizations in all business sectors and there is an immense value in the act of deciding what to measure [17]. Define the metrics has been detached by many authors as an important stage during PMS design phase, for instance [2, 6, 9, 10, 14, 15, 16, 19].

Much broader than a framework composed by performance metrics, the Supply-Chain Operations Reference Model (SCOR), developed by the Supply Chain Council (SCC), provides a unique framework that links business process, metrics, best practices and technology into a unified structure to support communication among supply chain partners and to improve the effectiveness of supply chain management and related supply chain improvement activities. SCOR was conceived to allow evaluations and comparisons among supply chains, their activities and performance. It configures supply chain processes in five: Plan, Source, Make, Deliver and Return; and its attributes (characteristics of the supply chain that permit it to be analyzed and evaluated against other supply chains with competing strategies) are focused on the customers (1, 2 and 3) and on the company (4 and 5): (i) Reliability - achievement of customer demand fulfillment on-time, complete, without damage etc.; (ii) Responsiveness - the time it takes to react and fulfill customer demand; (iii) Agility - the ability of supply chain to increase/decrease demand within a given planned period; (iv) Cost - objective assessment of all components of supply chain cost; (v) Assets - the assessment of all resources used to fulfill customer demand.

Performance metrics are described by a series of attributes (such as name, objective or purpose, target, frequency, etc.) which are responsible to define metrics’ functions, the moment and the way of using each metric [6].

Approaches for designing PMSs use various ways to gather information, and there is much attention for an iterative process in which metrics are developed and adjusted as more information becomes available about strategy, customers, processes, and the availability of data. It is useless to design a PMS where data are difficult to obtain or are unavailable [2]. Therefore, document the sources of information and check them out to confirm that the metrics will be calculated with the best data available is essential.

Besides the availability of data, according to [15], there are five other major issues which have to be dealt with in establishing measurement procedures: (i) units of measurement – the purpose of the metric can be expressed by different variables with distinct unit of measure (volume, speed, weight, etc. and/or a relation between two variables); (ii) level of aggregation – performance can be measured either on an individual or a group level, the higher the aggregation level in the measurement, the lower the cost attached to the measurement, but there is a reduction in the reporting accuracy and in the ability of management to detect quickly the source of the operational problem and to respond accordingly; (iii) measurement accuracy – the discrepancy between the reported value and the actual one, and the period of time elapsed from the time when the measured event took place to the time it was reported; (iv) cross-check mechanisms – generating a conflict of reporting interest between divisions is a possible way to increase measurement reliability; (v) data collection and analysis media – two possibilities: data collection as part of the process and it does not depend on goodwill (automated), or data collection has to be initiated whenever needed and is not part of the process.
According to [9], the data collection, analysis and reporting should be automated as much as possible to save time and effort as well as to provide consistency.

Once PM metrics were established, the design phase should assign their targets. A target is defined as the satisfactory level of performance and one must be established for every performance metric [15]. The presentation of a metric should be accompanied by an indication of the target to be achieved; specific numeric standards, or goals, should be established challenging but realistic, and once they have been reached a new target (more difficult) should be set [20, 21]. Six possible techniques for assigning standards to performance metrics are presented in [15]: (i) Work measurement techniques as time study, predetermined time standards and work sampling; (ii) Analyzing of past organizational performance – past performance data for each metric may show not only deviations but also trends that can be depicted by a learning curve; (iii) Management by objectives approach – based on different considerations such as needs and availability of resources; (iv) Data comparison between organizations with similar characteristics such as type of business, technology or environment (benchmarking); (v) Economic considerations – profits may be obtained if expenses do not exceed a certain level, this level may be considered a standard; (vi) Legal considerations – the law may state required performance levels for specific metrics.

Confirming the second item of Globerson’s suggestion, many authors evoke the use of historical data to calculate the metrics, validate its results and assign targets [2, 10, 19], especially for new metrics. Nevertheless, according to [12], targets must have high strategic alignment, controllability, timeliness, and technical validity (especially when used for compensation purposes).

According to [2], during the establishment of goals, feedback on the PMS is more useful if real data is used. In the case of dummy data, users are less motivated to explore the possibilities of the system and its shortcomings. Similarly to Globerson’s forth suggestion, external benchmarks are also a considerable source of trustful targets [6]. The PMS design task goes beyond the selection and definition of an appropriate and practical set of metrics; it involves their integration both with one another and the wider environment, constituting the rest of the organization and indeed the market place itself. For the authors, once it is decided what should be measured, it must be decided: how the metrics will be taken, the collection of the appropriate data and the elimination of conflicts in the measurement system [8]. During the design phase and under initial measuring stage, an important decision is the use (or not) of a prototype. The validation of metrics and procedures can be supported by the use of prototypes for visualizing deviations in the results and tendencies that can be represented by a learning curve [15].

As previously mentioned, a PMS is a system (software, databases and procedures) to execute PM in a consistent and complete way [2], and as so, the procedure to evaluate performance must integrate the system, and help answer the proper questions for that purpose. For [15], constant comparison between actual performance and standards is an essential part of every PMS, therefore a feedback loop to respond to discrepancies between standards and actual performance needs to take place in the PMS design phase [10]. Causes for deviations lie either in the plan or in its execution. Hence, in order to eliminate undesired deviations, some action has to be taken and changes have to be introduced to the plan and/or the execution. According to [15], corrective actions may be executed, either through an automated mechanism which is based on a set of procedures which define how to respond in different circumstances or through voluntary initiative (usually less structured than automated one). Nevertheless, some of the corrective actions may have undesired impact on coworkers and, as such, a manager may not feel comfortable to initiate them by himself.

In accordance to an automated mechanism to execute corrective actions, [22] argues that the requirements for well-defined procedures, and simple tools and techniques are significant. Managers like to see the stages of the process explicitly stated. The requirement for a written record of the process is to ensure that data and assumptions can be revisited at future dates. This will be useful both at subsequent formal strategy reviews and, more importantly, as a strategic management tool which can be used to assess the likely impact of changes in the business environment, or incremental policy changes.

Management information systems (MIS) play a vital role in the upward flow of information. Haag, MIS is designed to deliver many results and benefits [1]. However, in the context of PM, according to [17], MIS is required to deliver one or more of the following: (a) Data collection, analysis and storage; (b) Improving operational control, speed and flexibility and hence improve efficiencies of business operations; (c) Improving communications, supporting the efficient and effective running of business processes. In fact, many companies have failed to manage the most
critical determinant of MIS, for instance, how people use it for PM and management. According to [1], change management plays a significant role in making the PM intervention successful. A PMS changes the way people interact with information before and after implementing the system and it is very important to well communicate the information [3].

3. Research Method
The nine-step research method from [16] was adapted into three main steps to design the PMS for the logistics division, as the practical approach was more generalist. The research steps are presented next.

Step 1: Evaluation of the context of work, data gathering and action planning: As each organization has its own reality, culture, strategy and goal, in order to design and implement a useful PMS, it is vital to well comprehend the context of the business, its internal processes and people. This is usually the very first step of many PM researchers [2, 6, 17]. The subject studied in this paper was carried out by a team composed by two direct employees (one of them is an author of this present study) and four external consultants full time dedicated to the project. Initially the team was expected to review all existing metrics in order to select and/or adequate the most significant ones. This first step was planned to last 6 months and comprised data gathering from existing processes, systems and metrics, like used metrics, names of responsible people, connections and interfaces among activities. Interviews and data collection from internal reports were important sources of information, as declared by [10]. After the first diagnostic of how performance was measured, it became clear what were the changes needed and a plan for the PMS design phase was established with: actions, responsible and term. This general evaluation is not directly mentioned by [16], but it can be considered implicit as the authors describe the third step as developing an understanding of each functional area’s role.

Step 2: The design phase and its deployment: Design phase was planned to last 26 months and could counter with a special regimen of governance. The project was in line with [7] regarding the two important elements that, in their point of view must be considered in order to have a successful PMS design: point of entry and participation. The senior executive was directly sponsoring the initiative, what lead to a compulsory entrance, and since the beginning regular meetings with the design team and the Consultant Committee (formed by 11 Downstream Logistics’ managers) were established for validations. Managers’ personal involvement was an important element to accelerate the decisions, especially during the design phase. Top management commitment is also mentioned by [23] as a special driver to success in PMS design. The design plan consisted of establishing metrics purposes, drawing the process of performance monitoring and defining requirements for the technological support tool. Beyond the definitions, initial tests were needed to assess consistency between theoretical concepts and practical results, as well as the efficiency of the MIS proposed, as, according to [2], it is important to spend a time in reflecting on differences caused by strategic actions that have been formulated to achieve the objectives. Interviews with managers, coordinators and analysts (18 people involved) throughout design and a workshop to align concepts with the managers were the main methodological tools adopted to support this phase. This second step comprehends some of the steps proposed by [16], more precisely steps 1, 2, 4 to 9.

Step 3: Evaluation: This phase was planned to last approximately 3 months and was constituted by surveys with participants and clients of the process and reflexions of the design team members about the progress of the initiative, lessons learned and feedback for key stakeholders. It is similar to the last step proposed by [16]: “Periodically re-evaluate the appropriateness of the established PMS in view of the current competitive environment”.

4. Case Study: the design Phase
The design phase started after the approval by the managers, as affirmed by [1]: “senior managers’ commitment is essential for the involvement of all the teams”. The board of managers involved gave some orientations and two premises of work were established: 1) existing metrics needed to be taken into account and 2) SCOR Model should be used as reference.

After research in the literature and in a base of practices owned by the consultants, the concept of PMS started to be considered by the design team. More than just a set of metrics, it was necessary to draw an efficient process to measure performance and to design a software tool to assist the process, as highlighted in [13]. Some indications of technology and metrics appeared, nevertheless the need of a main goal, or target for Downstream Logistics, was clearly one of the first things to be arranged. There was a lack of clear strategy for the Division.
The components of Downstream Logistic PMS are described next, as well as how choices and decisions were taken and communicated. In order to facilitate the description, the subject performance metrics is considered apart, although it was treated simultaneously with the process design and system (tool) selection during the design phase, as, in practice, one influences the other. In sequence, it is presented how theoretical validations were done.

To confirm Downstream Logistics’ perspectives and purpose, during a meeting with seven managers, outside the consultant Committee, it emerged a definition for the Logistics’ mission. That is to serve the clients, with the lowest cost, using efficiently the assets, as planned. After that consensus it became possible to verify the adherence between this purpose and the existing performance metrics. Therefore, in accordance with Downstream Logistics mission, it was defined that there were four big classes of metrics to be considered: Costs, Service level, Assets management and Planning Deviation. These four classes of metrics became four clusters of metrics association, inspired by the clustering methodology used by [2], inspired in the BSC model. There was a common effort to define the main objectives of measure for each cluster, and they were established as: cost, service level, asset management and planning deviation.

A complete research about all existing metrics in Downstream Logistics was conducted. In the end there were 15 metrics, among the existing ones, that were considered relevant and coherent with the purpose of the PMS. Nevertheless, after a deeper analysis, it was concluded that the way those 15 metrics were calculated could not provide a mechanism to drilldown to different levels of detail, in order to understand the causes of significant deviations. According to [2], being able to drilldown in metrics parcels makes the difference to compare actual and planned performance. The disaggregation of the existing metrics and/or the revision of weighting criterion already adopted were facilitated by the tool component chosen for the technological solution which is explained in detail in the next section called “Other components of the PMS”. Besides the need for adaptations in existing metrics, the 15 selected were not enough to provide a complete diagnostic of Downstream Logistics performance. Thereby other metrics needed to be further developed and implemented. Each cluster was examined considering the SCOR Model, and it revealed opportunities to improve the set of metrics for the PMS. Measures as Perfect Order Fulfillment, Current Internal Capacity Utilization and a huge diversity of cost metrics became candidates to compose the System.

In general, it was observed that each supply flow coordinated by Downstream Logistics (crude oil and oil products) had a set of particular aspects related to the nature of operations required; crude oil has strict intrinsic quality parameters to observe when being exported, while oil products no. On the other hand, oil products deliveries in national market are surveyed by a target of service level agreed in commercial contracts, while national crude oil mostly supplies the refineries that belong to the company. Thus, the selection of metrics would be explicit in accordance to the supply flow, composing two different set of metrics for the four clusters of the PMS. A detailed study and selection of metrics were developed for each cluster, considering existing measures already approved and SCOR metrics. A brief description of that selection phase is detailed next:

In total, the PMS contains 89 metrics, what makes their process of analysis quite complex. In order to organize and simplify metrics analysis, [2] propose a hierarchy of metrics, as “it is impossible for a manager to make decisions on the basis of 100 unstructured metrics”. The hierarchy inside each cluster has from two to three levels of metrics. Examples for metrics for oil products flow regarding cost are: cost of maritime transportation; cost of pipeline transportation; cost of maritime terminal operation; cost of delivering abroad; cost of quality giveaway; inventory cost; stock out cost. Examples for metrics for Oil Products’ flow regarding service level are: Lost in refining production caused by logistics problems (oil products); time order for importation; perfect order fulfillment in exportation: internal client’s supply; service level in inland deliveries; service level in coastal deliveries; service level for filling up vessels. Examples for metrics for Fleet Management regarding assets management are: vessels availability; tanks capacity utilization; time charter equivalent; deviation in the number of vessels planned. Examples for metrics for the cluster Planning Deviation are: production accuracy; delivery accuracy; importation accuracy; exportation accuracy.

Metrics are one of PMS’ components, and in the study the revision of the available metrics at the time was the starting point for the design. After the first research for adherence among the present metrics and the identification of PM gaps, the design team started to search for IT solutions in PM. The scorecard proposed by [2] became a good inspiration for PMS because of all functionalities presented in the author’s case study system: general dashboard, gauges, historical data, and easy access to lower metrics inside a cluster.
Moreover the resources previously presented, the adoption of the tree maps brought the agility needed for metrics’ results analysis, as it combines two metrics’ parameters (e.g. volume and price) in one easy display. For example, in a metric of vessels’ availability, the result (80%) can be seen in parcels, as a certain number of vessels (60) are considered in the period of analysis. Every vessel is represented by a rectangle whose color represents the result of its performance in relation to the target (green is on the target; yellow is out of goal but inside a tolerance; red is totally out of goal – e.g. 100% is green, from 99 to 85% is yellow and under 84% is red) and the size of the rectangle represents the level of importance attributed to that vessel, in this case, the cost of its hire. It means, inside this tree map, expensive vessels appear in big rectangles, from top to bottom from left to right. The level of importance established among the elements was initially used as a weighting criterion in the final metric result shown in the gauge. Drill down in details inside a metric result was mentioned by [15] and by [2] as an important characteristic of an efficient PMS, and in the studied case the use of the tree map made the difference for deeper result analysis. In order to use a tree map, all metrics needed to be largely detailed as well as their databases and components. As a consequence, the metrics already in use in the Downstream Logistics needed to be modified because they were not calculated as a weighting average and normally parcels were not visible in the existing system.

Since the beginning of the study, the design team identified a gap of continuous improvement vision in the Downstream Logistics, based on a culture of limited responsibility (typical thought of doing only what is under your own department’s responsibility, and this thought compromises a general and wide vision for the business). The following up of the as-is diagnostic needed to change the status of a passive performance gap identification for an active approach to solve the problem (if possible) or avoid future occurrences. There was a need for people involvement in the PM process and a clear description of the sequence of activities to follow in order to proportionate a valuable analysis. Regarding the PMS and its metrics, the frequency of results’ updating needed to be defined: all metrics could be calculated monthly, while just some related to planning deviation and inventory management could be updated weekly. Hence two procedures were designed:Weekly monitoring and Monthly monitoring, distinguished by the number of metrics involved and the direct result – a report is produced monthly and every week there is the proposal of only a presentation. Another procedure was designed with the purpose of promoting the continuous improvement vision, called the Corrective Planning Supervision.

The Performance Monitoring procedure can be categorized as the control function loop, as described by [2]. It was designed to be executed by a team of six people, whose activities are divided following the PMS metrics’ clusters (one responsible and one person as back for each cluster), and the system depends on external sources of data (systems or informal information coming from meetings). The Corrective Planning Supervision procedure focuses on proposing an action to correct relevant deviations and following it up.

One manager and his team were assigned as responsible of the PM process result, and, therefore, the main executers of the activities. This had been detached by [2] as an important lesson learned from a PMS successful design: the election of a PM Manager. The PM macro process was called Monitoring Process.

5. The overall evaluation
The PMS design process at Logistics Division was conducted by a formal design team full time dedicated and followed a structured plan divided into phases lasting 29 months. During the plan’s execution the design team faced various challenges that affected the final result of the PMS. At the beginning of the project, consultant Committee deliberated that the initial schedule previewed could not be changed as that plan had been approved by the director and there was a contract with a consulting company for this initiative. Therefore there was pressure on showing a concrete result at the end of the period.

Even though many difficulties happened challenging the compliance plan, the unroll of the activities lead to believe that [8] were right in affirming that companies which employ formal processes for PMS design find it significantly easier than those that do not to decide what they should be measuring and how they are going to measure it, collect the appropriate data and eliminate conflict in their measurement system. If the formal process had not been adopted, it would be certainly more difficult to develop the Downstream Logistics’ PMS. The under estimation of time led to an adaptation of the milestones for the deployment of the initiative: the milestones were overlapped one by another, and an inferior final result was obtained, as detailed next.
Initially previewed to last 12 months, the Design Phase part 1 (definition of metrics, process and initial research for a technological solution) in terms of metrics’ definitions it lasted approximately 20 months. The definition of the metrics and the process happened simultaneously, with time enough for process definitions and the beginning of technological solutions’ research. After the first 8 months, the design team started meetings with the IT Division and two months later all initial plan needed to be revised, as the IT and the design team opted to internally develop the metrics calculation database (design team responsibility) and sophisticate the visualizing tool of the new system (IT responsibility). That was when the decision of adoption a temporary prototype was taken. The possibility of changing plans because of IT limitation had been advised in some previous studies, for instance [9] and was confirmed in studies case. The large number of metrics selected to be part of the PMS also impacted the original project schedule, and contributed to the continuity of design phase part 1 during the second part.

Design Phase part 2 (system development and final theoretical validations was planned to last for 8 months planned and to be in sequence of the previous phase at the end were anticipated, due to the prototype’s decision. It means design phase part 2 overlapped design phase part 1. Finally 10 months were necessary for IT to develop the partial solution for the new system (only a platform for metrics’ visualization), while it took almost 3 months for the design team to construct a database in Access ® to be used as a temporarily database for tests. All activities from Design Phase part 2 occurred while metrics’ definitions were still in progress (which were already consuming more time than previewed). Nevertheless, the new system development pressed metrics’ resolutions (a complete list of all metrics’ parameters and the election of each weighting criterion) because according to some data there was a need for adjustments in the technological tool. Even though the design phase part 2 helped accelerating some discussions, system development managed to last less than the previous phase, and thus the design team decided not to include some metrics initially in the PMS, as they were still not mature in terms of data source, for example. During this time, theoretical validation was partially done and demands for changes and corrections in the system also contributed to the delay of this phase. The use of the prototype and the way database and visualizing system were conceived required an adaptation in the original design for the Performance Monitoring Process. The Performance Monitoring process would no longer count with data automatically generated, and thus, the data collection and the information upload activities needed to be added to the process.

After the prototype’s conclusion, the practical validations (tests) were done almost at the same time with some theoretical ones (data source and metrics calculation’s rules). This phase was supposed to last 6 months and lasted 10 at the end, invading the following phase. The first 4 months were used for training the performance analysts in the new tool, to check data migration for the PMS visualizing platform, to explore the resources available and to verify if Downstream Logistics’ employees consulted agreed with the way metrics´ parcels were obtained and contributed to the final result. Some divergences appeared, mistakes were gradually treated and requests for changes were submitted to the managers’ Committee. During six months the team of analysts responsible for PM started to test the execution of the entire process: from the data collection until the divulgation of the monthly performance report to a selected public (only two managers). Over that time, adaptations in the process became necessary to the achievement of the expected result and it contributed to lengthen the duration of that phase.

The evaluation of the system phase was supposed to happen during the project, with the participation of all members of the design team. However with the overall delay, the external consultants finished their contract when practical validation ended. The evaluation was conducted only by employees, hard-pressed to officially launch the monthly performance report to all departments in the Downstream Logistics. Three months would already be a short time for a complete evaluation of the new system, but at the end it lasted a month and a half, with a small analysis result.

Summarizing it all, the design team did not count with flexibility on time available to review and update the initiative’s schedule. Anytime a new problem emerged, the sequence of activities was adapted to run during the months or weeks previewed, always compromising the following task. Therefore at the end the design team could not fulfill what had been mapped in the action plan derived from the as-is diagnostic. Instead of having a complete automated system, the designers (with the managers’ approval) opted to develop a prototype of the system, allowing time for the maturity of metrics’ concepts and the exercise of the new process routine.

6. Conclusion
The purpose of reporting and discussing a practical design experience in this paper is to bring empirical matter for PMS specialists in academy and industry, exemplifying important considerations and decisions. It is not the
The implementation of a PMS requires a long phase of design, susceptible to many different challenges to its full success. Although some of the challenges arising were already known by the company before the design project started (e.g. people’s involvement and resistance, the existence of too many unstructured data sources, and a culture of justifications without a corrective plan), and thereby the design team had previewed to deal with them during the initiative, in practice the development and implementation of the PMS has demonstrated to be very difficult, corroborating the reports of several authors on the subject.

The final result was less than expected by the workforce because it had a temporary prototype with manual data collection and without the definition of all the metrics of the system. There were many factors that interfered in the project’s progress with a direct impact in this final result, and most of them were related to failures in the project management, such as the lack of a dynamic evaluation of the milestones’ advance, a constant revision of internal deadlines, a map with all stakeholders involved and the relevance of their participation in meetings for validation, or a good management of the scope defined and its revision according to the risks presented. Meanwhile the result obtained with the design certainly could have been better, it brought important cultural changes, especially in what concerns the focus of continuous improvement. The PMS represented a huge progress for company’s Logistics Division to assess performance in a complete and efficient way: the proposition of metrics to evaluate performance along the supply chain, a system that shows the results in an easy visualizing platform which facilitates the identification of the main deviations, and a process to investigate the root cause of the problems and to propose corrective action plans. A real PMS brought a formal and structured way to report operational performance, causing admiration of other divisions of the company.

The PMS design helped the design team and all employees more directly involved in the new system to learn a set of important lessons that will certainly be helpful in several other projects, even in a later revision phase of this system. The benefits obtained by the commitment of top managers, the selection of change management practices, the use of a prototype and the early involvement of IT Division as a partner in such complex initiative should not be neglected in future occasions, as they were key aspects for the development of the design phase and they certainly helped to prepare the implementation phase with its own challenges.

Nowadays the Logistics division is working on the implementation of the PMS, what means the revision of all specifications for the definitive system solution (unique and automated) with the whole set of metrics incorporated to the scorecard. This present phase comes up with challenges but they are more easily accepted by the employees because the process and part of the technological solution are no longer new for them and they already perceive more tangible benefits coming from the system.

The study presented in this paper contributes to fill an identified gap in the literature, the lack of PMS empirical and longitudinal studies embracing the oil and gas sector. The underlying study provides evidence of a logistics’ division of a single firm with a specific product group, which limits the extent to which the findings can be generalized across a wider range of divisions, product groups and industries. As comparable studies in the literature are still amiss this investigation cannot claim to be anything more than an initial step towards the study of a topic that is likely to grow in importance as firms continue to expand their efforts in the development of PMS in their operations. Future studies might want to test and expand on the paper’s findings, which go beyond the design phase, detailing the concrete results and lessons learned during the deployment of the PMS design, helping future initiatives, considering other energy companies, as well as companies from other industries.

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