How using business intelligence can improve SCPMS project maturity: an empirical investigation in large sized Moroccan companies

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Abstract

Business analytics tools in supply chains have become an essential support for their performance measurement system (SCPMS); therefore they are considered as a critical success factors for a project of designing and implementing SCPMS.
However, there is a lack of studies addressing the issue of the contribution of Business intelligence tools in improving SCPMS project maturity. In response, we conduct a quantitative survey-based study to examine the relationships between SCPMS project maturity and using BI tools. Statistical analysis of data collected from 39 Moroccan companies ranked among the top of 500 companies is combined with the use of descriptive statistics.
Findings reveal that The Business analytics tools are a key for achieving a high level of SCPMS project maturity.

Keywords*: *Business intelligence, SCPMS project maturity.

I- Introduction

Many firms look to continuous improvement as a tool to enhance their core competitiveness using SCM and IT technology. Indeed the information systems (IS) literature has long emphasized the positive impact of information provided by business intelligence systems on decision-making, particularly when organizations operate in highly competitive environments like internationals Supply Chains [1]. So Supply chains tend to make greater use of balanced and integrated performance measurement systems by adopting Business intelligence tools.
Shepherd and Gunter argues that despite considerable advances in the literature in recent years, a number of important problems have not yet received adequate attention, including: the factors influencing the successful implementation of performance measurement systems for supply chains; the forces shaping their evolution over time; and, the problem of their ongoing maintenance [2]. Also Olugu and Wong support that there is still a gap in knowledge in the area of supply chain performance measurement [3]. Besides, Even if the manufacturing industry in developing countries has been already a part of global supply chains for a long time as the raw material supplier and also manufacturer of the final product, there is a lack of significant study of SC practices and its performance in developing countries [4], in general and morocco, in particular. In consequence, this study tried to overcome this drawback by addressing the issue of the BI tools as a key factor of a successful implementation of performance measurement systems in large sized Moroccan companies
Although measuring the bottom-line contribution of information technology (IT) has long been seen as a major challenge for researchers and professionals [5], we try to address the issue of the contribution of Business intelligence tools in improving SCPMS project maturity.
The organization of this paper is structured as follows. Section 2 presents in general Business intelligence concept. General concepts components of Supply chain performance measurement are outlined in Section 3. Further, section 4 reviews Supply chain performance measurement maturity. The contribution of Business intelligence to improve SCPMS project maturity is discussed in section 5. The section 6 present a quantitative survey among 180 Moroccan companies ranked among the top of 500 companies in order to measure empirically the contribution of Business intelligence to improve SCPMS project maturity. Finally, Section 7 concludes with a summary of paper.

II-Business intelligence

Today, information and knowledge represent the primary capital of an organization. Enterprises try to utilize this wealth to gain competitive advantage when making important decisions. Enterprise software and systems include Enterprise Resource Planning (ERP), Customer Relationship Management (CRM), and Supply Chain Management (SCM) systems [6]. With the potential to gain competitive advantage when making important decisions, Business Intelligence (BI) can be embedded in these enterprise systems [7]. Thus, BI market has experienced high growth and BI technologies have consistently received attention by many Chief Information Officers. BI was the top-ranked technology for 2012 as CIOs are combining analytics with other technologies to create new

capabilities [8]. For example, analytics plus supply chain for process management and improvement, analytics plus mobility for field sales and operations, and analytics plus social for customer engagement and acquisition [8]. Also research and industry developments in BI have been growing in recent years due to the growing amounts of business data and the widespread use of the Internet as a medium of communication [9].

In the 1990s, BI entered the decision support lexicon. BI, in particular, has been used as an umbrella term to describe the technologies, processes and applications for supporting decision making. The concept of BI can be decomposed into three parts: Data Capture/Acquisition, Data Storage and Data Access & Analysis. Today, the word analytics is often used as an umbrella term [10].

According to Wixom and Watson, BI is a broad category of technologies, applications, and processes for gathering, storing, accessing, and analyzing data to help its users make better decisions [11]. Also BA is defined as an application of various advanced analytic techniques to data to answer questions or solve problems related to enterprise management. BA is a group of approaches, organizational procedures and tools used in combination with one another to gain information, analyze that information, and predict outcomes of problem solutions [12]. While BI helps find information, business analytics (BA) taps into statistical and quantitative data for explanatory and predictive modeling [13]. Indeed BA can be defined as a specialized subset of the BI systems commonly used by companies today [14].

BI technology aims to help people make "better" business decisions by providing accurate, current, and relevant information available to them when they need it [15]. Olszak and Ziemba support that the major objective of a BI application is to embrace intelligent exploration, integration, aggregation and a multidimensional analysis of data originating from various information resources [16]. So "information from many different sources is integrated into a coherent body for strategic planning and enhanced decision support" [17]. Indeed BI systems enable organizations to understand their internal and external environments: (i) To support understanding of internal data, one class of BI systems manipulates massive operational data to extract essential business information; (ii) Another class of BI systems tries to systematically collect and analyze information from the external business environment to assist in organizational decision making [9]. Nevertheless Technologies to support the second class of BI systems are in general less matured than those for the first class. Although BI are becoming an important tool to improve the efficiency, competitiveness and profitability of businesses; their positive impact is not self-assured though thus the center of discussion moved to how to best realize the opportunities of BI use [18]. Thus a company may adopt a strategic approach to BI in addition to specific tactical approaches, to achieve potential efficiency gains [14].

Khan and Quadri summarize the main approaches in adopting BI: (i) The traditional approach to BI is concerned with, data aggregation, business analytics and data visualization, (ii) The integration of business processes on BI to bridge the gap between the business process management to the business strategy (iii) Adaptive BI is concerned with self-learning adaptive systems, that can recommend the best actions, and that can learn with previous decisions, in order to improve continuously [15]. Also Wixom and Watson noticed the BI project planning and implementation always involve a significant amount of resources and various organizational stakeholders over a period of years [11].

BI has permeated various industries including retail, insurance, banking, finance and securities, telecommunications, and manufacturing; so many enterprises have successfully implemented BI to improve their customer loyalty and increase their return on investments [19]. However other organizations have not been as successful in utilizing BI to increase their profit and achieve their expected performance [20].

III- Supply chain performance measurement

Supply Chains are interdependent in such a way that an individual company's performance affects the performance of other members of the supply chain [21]. Since, a supply chain involves many players and different practices and policies, those complexities result in higher degrees of uncertainty and dynamics within a supply chain [22].

The measurement of the SC performance can be handled in two different ways [23]:

• The SC performance is the result of, respectively, the intra-organizational performance of the different companies implied in the SC and, the performance of the interaction between the different companies of the SC,

• The SC is conventionally seen as a particular process, and its performance is thus expressed with respect to the process recommendations of the ISO 9000 standard.

For the measurement of supply chain performance the efficiency or the effectiveness of an outcome of a supply chain activity is analyzed [24]. Efficiency describes an input/output relation while effectiveness shows how well supply chain goals have been achieved [25]. In this sense, supply chain performance can be seen as a function of the utilization of supply chain resources or as a function of supply chain results as compared to supply chain targets [26].

Measuring supply chain performance can facilitate a greater understanding of the supply chain, positively influence behavior, and improve overall performance [2]. Besides, the question of the overall performance resulting from the process performance of the supply chain (Plan, Source, Make, Deliver, return) is rarely approached [23]. Indeed, performance indicators are associated to each process of SCOR and the provided

performances are independently defined, as each process is separately evaluated from the others. So Berrah and Clivillé developed a frame work which links elementary performance expression to the overall performance in a supply chain. Aggregation was done using Choquet integral operator [23]. Their framework allows comparison of situations conventionally considered as "incomparable".

Lai et al. exerted that lack of adequate performance measurement has been identified as one of the major obstacles to efficient supply chain management [27]. So in order to improve supply chain effectiveness and realize a smooth flow of resources within it, there is a need to measure its performance [28].

A Performance Measurement System is defined w.r.t. a global objective and at the end, provides one or a set of performance expressions in order to quantify the satisfaction of this objective [23]. SCPMS describes the feedback on operations which are geared towards customer satisfaction and strategic decisions and objectives [29]. In fact developing a SCPMS is a critical task for a supply chain and its members in order to examine their current status and identify improvement opportunities for steering their future direction.

Although, various theories in supply chain management research have been proposed, the predominant view from these studies suggests use of resource-based view (RBV) for supply chain performance measurement system (SCPMS) [4]. Therefore a good supply chain performance measurement system needs to be in place for improvement in supply chain performance [30]. The supply chains tend to make greater use of balanced and integrated performance measurement systems, and, in turn, they will be able to perform at a higher level. Thus SCPMS as a resource can provide a sustained competitive advantage for a firm [4].

Stone summarize the aspects of performance that must be included in SCPMS like Speed of response to customer demand, financial performance, quantitative performance measures (cost, profit, fill-rate etc), Resources, Output and Flexibility [21]. While Neely et al. suggest that there are two basic types of performance measure which should be included in any such system; those that relate to results (Competitiveness, financial performance) and those that focus on the determinants of the results (quality, flexibility, resource utilization and innovation) [31]. Also Hines puts performance measures into five key performance areas; cost, speed, quality, reliability and flexibility [32].

Balanced and multidimensional frameworks and methodologies have therefore been proposed to support SCPMS, such as the SCOR, the balanced scorecard and ABC [33]. In addition Shepherd and Gunter noticed that the SCOR model is considered sufficiently robust that all measures can be examined using it [2]. Indeed The Supply-Chain Operations Reference (SCOR) provides a standard description of supply chain processes, performance metrics, best practice and enabling technologies. It offers a comprehensive methodology to improve supply chain operations.

Najmi et al. suggested that the PMS should be dynamic and has to be reviewed and updated frequently (Ongoing, periodic, overall) [33]. The ability of keeping the PMS continuously updated is a challenge for every SC, which need to be extremely flexible and reactive to market changes. Really a project of designing, implementing, using and continuously updating performance measurement systems must be launch incessantly in the SC.

IV- Supply chain performance measurement Maturity

The project management maturity model, as the framework and tool to evaluate the level of organizational project management capability，has aroused widespread concern of experts in recent years [34]. The project management maturity models provide means of identifying some crucial steps to be taken, the tasks that are necessary to accomplish and the sequence of events needed to realize significant and quantifiable results [35]. Pullen define a maturity model as a structured collection of elements that describe the characteristics of effective processes at different stages of development and also it suggests points of demarcation between stages and methods of transitioning from one stage to another [36].

The project maturity aims to integrate, assess, and improve project management practices. Therefore measuring maturity in project management is often linked to how well an organization can manage its projects, but not how well it selects the right projects.

The concept of the process maturity was born in the Total Quality Management movement and it was widely adopted in Capability Maturity Model (CMM) for software organizations. The successful application of in the software industry inspired the experts internationally from project management fields in the heated research on and development of the maturity evaluation model of project management. So this concept migrated to organizational process and project management [37]. Consequently many models of maturity project appear for general and specific project management such as Capability Maturity Model Integration, Project Management Maturity Model, Organizational Project Management Maturity model, and others that are available for companies to improve their Projects Management.

Wettstein and Kueng noticed that the maturity model for Performance Measurement Systems implies that a PMS are evolving or can be transformed from one level to the next. They cited four forces that initiate and accelerate evolution of the PMS: Rivalry among competitors; Information needed from managers; Company-external requirements and IT capabilities [38]. On the basis of empirical data and an analysis of previous maturity models, they developed a PMS maturity model for assessing existing PMS in firms. They describe the development of a PMS over time,

following an evolutionary pattern through four maturity levels (Ad-hoc, Adolescent, Grown-up and Mature). This model is characterized by the progressive development along six dimensions (Scope of Measurement, Data Collection, Storage of Data, Communication of Performance Results, Use of Performance Measures, and Quality of Performance Measurement Processes) [38].

Najmi et al. developed a framework for PMS in terms of strategic relevance of measures as well as efficiency and effectiveness by using different tools (EFQM self-assessment process, affinity diagram, prioritization grid) and identifying three review stages (ongoing, periodic, overall) [33].

Cocca and Alberti concluded that the maturity grids seem to be the most suitable approach to develop an effective tool for a PMS assessment in SMEs. Based in performance best practices and other PMS maturity model, they developed a PMS self assessment tool for SMEs that consists of some scorecards series. Each scorecard contains three areas which describe three stages of development of practice with consideration following an evolutionary path: level 1 is elementary practice while level 3 corresponds to a good practice [39].

After a literature review, Okar et al. propose following steps for a project of designing and implementing SCPMS: Project initiation; Human resources preparation; Choice of SCPMS framework and defining indicators; Launch SCPMS; Improve SCPMS. Also they summarize a few critical success factors for each project life cycle stage of designing and implementing SCPMS. Finally they develop a SCPMS project maturity model that is built upon the following three dimensions: Maturity level dimensions (Ad-hoc, Adolescent, Grown-up and Mature); Life cycle stages of project of designing and implementing SCPMS; The critical success factors (CSFs) for a project of designing and implementing SCPMS. The suggested Maturity Model makes it possible for a firm to see where it stands and how it can improve its SCPMS. Thus, it provides a methodology for a company to develop an improvement roadmap to his SCPMS project [40].

V- Contribution of Business intelligence to improve SCPMS project maturity

In the last decade, BI has evolved as one of the critical applications in organizations to provide useful insight, support decision-making, and drive organizational performance [19]. In the other hand, supply chains are complex systems with silos of information that are very difficult to integrate and analyze. The best way to effectively analyze these disparate systems is the use of BI tools [41]. Thus the BI will guarantee the information sharing in the SC. Information sharing significantly contributes in reducing supply chain costs, improving partner relationships, increasing material flow , enabling faster delivery , improving order fulfillment rate thus contributing to customer satisfaction, enhancing channel coordination, and facilitating the achievement of competitive advantage [42].

Okkonen et al. noticed that the primary reason for using performance measurement and BI is to manage and improve the performance of an organization [43]. Principally, a PMS does not necessarily include Information Technology. However, for a PMS to be efficient and effective, the use of IT is required [38]. Wettstein and Kueng identified five basic elements of a PMS: people, procedures, data, software, and hardware [38]. Therefore, Supply chains which already have a sophisticated IT infrastructure and well developed corporate information architecture are likely to find their ability to develop and support PMS is greatly enhanced. Besides Sharma and Djiaw conducted a research in the strategic impact of BI tools and find that strategic performance management requires the use of BI in order to be sound [7].

Recently, many studies have been carried in the Application of BI to improve supply chain management. Fan et al. take an electronic company as case study to enhance its supply chain management by applying concepts and guidelines from Supply Chain Council (SCC) as well as BI tools [44]. (Kar et al., 2010) conducted a study on using BI for improving marketing efforts. Trkman et al. investigate the relationship between analytical capabilities in the plan, source, make and deliver area of the supply chain and its performance using information system support and business process orientation as moderators. They find the existence of a statistically significant relationship between analytical capabilities and performance [12].

Okar et al. have identified the BI as a critical success factor for a project of designing and implementing SCPMS, they suggest the use of the BI as a platform to communicate SCPMS reports [40].

After a literature review we noticed that okar et al. model is the only existing model for assessing SCPMS project maturity [40]. So we will adopt it to measure the Contribution of BI to improve SCPMS project maturity.

So based on this model using the BI tools will improve automatically the maturity of project of designing and implementing SCPMS in two stages: Launch SCPMS and Improve SCPMS. Also the experience of the company in large project like BI project will ensure some maturity of the others stages of SCPMS project: Project initiation; Human resources preparation; Choice of SCPMS framework and defining indicators. Indeed using BI tools was a sign of information system maturity. Knowing that the information system is the support of SCPMS, this will increase the maturity of SCPMS project.

On this basis, we pose ours hypothesis:

H: Using BI tools as platform to communicate indicators performance increase the maturity of SCPMS project.

VI- Research Design , Methodology and Results

We have chosen for our study the top 500 Moroccan companies ranked by turnover. We hope that in this category of companies, the project management, performance management and information system are more developed to success our empirical investigation.
Over the past decade, Morocco has embarked on an ambitious program of structural reforms in several fields, aiming to further liberalize its markets and enhance the competitiveness of its economy.
However Morocco is not a leader in the area of supply chain management, the country is significant in terms of internal markets and international trade. Therefore, there are many international world-class supply chain service providers participating in different Moroccan economic sectors [40].
In this section we will try to give an answer, with reference to the context investigated, to the following research question: How using BI tools can improve SCPMS project maturity?
The research question will be answered through hypotheses testing. For this question we propose one hypothesis:
H: Using BI tools as platform to communicate performance indicators increase the maturity of SCPMS project.
In order to examine the above research question, a survey method was selected rather than the case study approach because while case study research is used to explore build definitions and generate hypotheses, survey research allows testing of hypotheses and theory construction [45].
The total population investigated was constituted of the top 500 Moroccan companies ranked by turnover. Through a stratified random sampling, dividing the population into strata according to wide range of industry settings and size, a probabilistic sample of 180 companies was obtained. The sample is composed of companies from different economic sectors. This includes manufacturing, construction, retail, graphics, mining, communication, information technology, utilities and distribution industries.
The maturity model of SCPMS project presented by okar et. al [40] was used in developing a survey in order to evaluate the level of maturity of SCPMS project in large Moroccans companies. The survey was sent to the colleague's searchers in order to give their feedback about the instrument and to test that the questionnaire will accomplish the study objectives.
To reach the respondents, an electronic self administered survey was conducted. The survey is sent to sample of 180 large Moroccan companies by email attachment in WinWord format. Within each company the survey was addressed to one person at management level (Supply chain manager, CEO, IT manger, Production manager, Management controller, Commercial Manager, Human resources Manager).
From the 180 questionnaires mailed, only 39 completed responses were returned. The response rate is 21.67%, which meets Malhotra and Grover's 20% response rate hurdle [46].

The majority of enterprises in sample operate in the Agribusiness 28% followed by 18% of Distribution. 40% of the companies were international companies; while 82% were a filial of group. 31% of the companies were international companies; while 77% were a filial of group.

Table 1: Companies' division

	Frequency	Pour cent
Agribusiness	11	28%
Motor vehicles	5	13%
Building	2	5%
Electricity	2	5%
Others	5	13%
Paper / Cardboard	2	5%
Textile	3	8%
Transportation	2	5%
Distribution	7	18%
Total	39	100%

The profile distribution frequency of the respondents was then examined. All profiles of the respondents of the surveys are managers. As shown in Table 2, 38% of the respondents were supply chain managers and 36% were Management controller. Indeed, these profiles are more concerned with the performance of the supply chain.

Table 2: Position by the respondents

	Frequency	Pour cent
Supply chain Manager	15	38%
IT Manager	4	10%
Production Manager	4	10%
Management controller	14	36%
CEO	1	3%
Commercial Manager	1	3%
Total	39	100.0

Only 20.5% of companies in sample use BI tools as a platform of SCPMS. So we will compare the maturity of the SCPMS project in the tow categories of companies in order to catch the contribution of BI tools.
As exposed in table 3, it was found that using BI tools as platform to communicate indicators performance increase the maturity of the different stages of life cycle SCPMS project (about one level). Indeed using BI tools as platform to communicate indicators performance increase the level of maturity SCPMS project by 0,83.
The "launch SCPMS" stage benefits most from the use of BI tools, the level of maturity increases with 1.21, followed by the "Choice of SCPMS framework and defining performance indicators" stage with 1,06. Thus Using BI tools will ensure a mature level "launch SCPMS" stage and grown-up level for "Choice of SCPMS framework and defining performance indicators" stage.
While the use of BI tool increases the maturity level of the "Human resources preparation" stage with only 0,54.

From the analysis of SCPMS project maturity results, it emerged that 100% of companies how are using BI tools have a maturity level between 2 and 3. While 71% of companies how are not using BI tools are at level 1 of maturity.

Table 3: Maturity level for each stage of life cycle SCPMS project

	Life cycle SCPMS project											
Maturity level	Project initiation		Human resources preparation		Choice of SCPMS framework And defining performance indicators		Launch SCPMS		Improve SCPMS		SCPMS Project	
Using BI tools	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Level 1 Ad-hoc	0%	29%	0%	38%	0%	35.5%	0%	6,5%	0%	61,3%	0%	71%
Level 2 Adolescent	25%	51,6%	75%	51,6%	12,5%	35.5%	0%	54,8%	75%	38,7%	87,5%	29%
Level 3 Grown-up	62,5%	19.4%	25%	9,7%	75%	29%	37,5%	29%	25%	0%	12,5%	0%
Level 4 Mature	12,5%	0%	0%	0%	12,5%	0%	62,5%	9,7%	0%	0%	0%	0%
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Mean	2,87	1,90	2,25	1,71	3,00	1,94	3,63	2,42	2,25	1,39	2,12	1,29
Std. Deviation	0,64	0,81	0,46	0,64	0,53	0,81	0,52	0,76	0,46	0,50	0,35	0,46

VII- Conclusion and Future Research

The paper's contribution is that it facilitates a better understanding of the impact of BI on SCPMS project maturity. Our research sought to learn from organizations that have implemented BI tools where we examined the contribution of using BI tools in improving SCPMS project maturity through cross-sectional data.

Our findings provide some interesting insights into the interrelationships between using BI tools as platform of SCPMS and increasing SCPMS project maturity (see table 3). The "launch SCPMS" and "Choice of SCPMS framework and defining performance indicators" stages of SCPMS project are benefiting the most of the using BI technology.

As with any study, there are some caveats to the broader application of our work. First, the number of the sample is limited. It is very interesting to repeat this study with large sample. Secondly, the significant correlation between using BI tools and SCPMS project maturity does not necessarily imply a causal relationship or that more investment in that area would further enhance SCPMS project maturity. Thirdly, Morocco is not a leader in the area of SCPMS project and BI tools.

While doing some works in the future, the impact of BI in improving SCPMS project maturity should be examined with other empirical studies in different contexts. Also there is a challenge on how to investigate the interrelationships between the maturity of BI system and SCPMS project. Longitudinal case studies that analyze how using BI can improve SCPMS project maturity would be valuable to further validate the need for a different focus.

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