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A STUDY ON THE EARNED VALUE AS SUPPORT FOR BUSINESS PROCESSES IMPROVEMENT IN THE CONTEXT OF INDUSTRY 4.0

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Abstract
In context of a continuously dynamic global economy, the improvement of the business processes performances becomes mandatory for surviving the strong concurrent environment facing the new technological revolution concept Industry 4.0. The companies need to keep up the paste with the market changes and challenges. They need to adapt, they need to be more performing in bringing on the market new products and services in competitive conditions, and these can be reached only by managing carefully the internal business processes and developing projects.

Managing them as a whole is not the solution neither micromanaging them as single entities will not help. The solution is a mixed one, carefully adapted to the strategic objectives of the companies. This paper examines the scientific literature and the best practices related to multi project management environment and its influence on the performance of business processes. Literature confirms the existing of the concepts and models, thus the use of these on an integrated business environment is difficult. The research identifies the Earned Value analysis as a promoter not only for the improvement of each project performance, but even more as a tool for increasing the performance of the integrated multi project environment and trough this of the organization internal business processes. This can be the basis of an overall integrated Earned Value Management System, used by managers to improve the project management environment in order to enhance the performance of their company.

Keywords: Earned Value Management System, integrated project management, business process, Industry 4.0

INTRODUCTION

Performance is a topic largely addressed and a steady challenge for organizational specialists, being present on large-scale in the scientific literature. (Sandru, 2014; Olaru, 2013) Thus Performance measurement is difficult due to the complexity of setting measurable and achievable business targets. Both practitioners and researchers, agreeing that the setting of the right measurable business targets is the key factor in increasing success and company survival. Setting individual targets and integrated targets is crucial for having a referential to measure against and to give in advance input about the chances to meet the expected and desired results. (Sandru, 2014) Earned Value analysis does not offers only the perspective about the status in the

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in progress projects, but furthermore is forecasting the reaching of the completion complex targets both from timely perspective and also from resource use and budgets.

Integrating the projects and evaluating the business processes is an important process that only a few companies and practitioners master very well. The main reason for this is that the business processes and the projects interactions are not fully understood or implemented by organizations, because of the lack of management maturity (Bayó, 2015) This leading to situations in which the good performance of certain processes are diminished by the poor performance of the others. Overall cumulative reports failing in showing where the weak points are, which the performing ones are and which are holds back from both timely and financial perspective (Dauber, 2012). Not knowing these aspects, not evaluating on short term the actions will decrease the competitive advantage of the organizations

Current approaches in gaining process management performance

In the literature is mainly presented that companies are focused and targeted on financial results as synthetic performance indicator of theirs activity. Challenging only financial indicators in performance analysis is limited and do not offer the needed effect (Maier, 2013). New approaches and trends were developed in order to overpass inefficient classical management systems, “black box” type. New trends for business automation as Industry 4.0 points new challenges. Artificial intelligence AI begins to become a key decisional factor (Sarvari, 2017). In order for the organization to be prepared for these ultimate challenges, it shall be able to have information related to the defined performance target at the lowest level of each activity, and further to be able to integrate these in summarized reports. The information transparency and the decentralized decisions factors are the key of implementing these new organizational systems (Sandru, 2014). This process will induct

- Commercial and technical master plans coalition.
- Improved communication between business processes; business units and project teams.
- Performant time management.
- Conceptual outputs expectations and goals, activities and progress.

New challenges driven by the next major technological revolution Industry 4.0

Industrial revolutions, technological and organizational key points in the development of the today economic environment marked us the way of thinking actual business. With the introduce in the 1700s the steam engine in the industry, followed closely by Henry Ford organizational concepts and then the introduce of electricity and mass production at the start of 20th century was set the basis of the today highly competitive market. All organizations have access quite easily to technology, thus the internal organization and structuring makes the difference. With the third industrial revolution after the World War II market by the large scale use of computers it was offered to the companies the missing link in becoming more performant and competitive,

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the engine to manage the huge amounts of data (Geissbauer, 2016). So the access to analyzed, summarized information becomes way easier. From this point focus was not on how to manage date, it was set in what data I need? How to organize my business processes and project structures in order to have full transparency of their performance.

Once solved these aspects, and defined the rules of managing the processes, the next major step will be automated decisions taking of Organizations. Fully automated and optimized business structures, Industry 4.0.

In this sense Price Waterhouse Coopers a leading player in the consulting industry surveyed more than 2000 companies from all over the world related the level of automation and use of digital processes. It was questioned the current level of integration of automated business sequences and the forecast for the next five years. The astonishment results were surprisingly unexpected and shown without any doubt that the technical digital revolution is happening now.

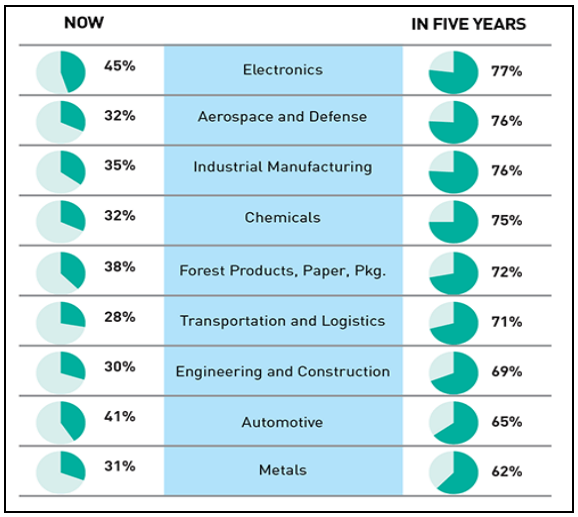

Figure 1 Industry 4.0: Building the Digital Enterprise, (Geissbauer 2018 Study by PWC)

The results show without any doubt the tendency of digitization in operations, production, supply chains and related activities. (Hermann, 2016) The future belongs to the organizations who will understand the new approaches and who will adapt theirs processes in order to be more performant on such market.

RESEARCH METHODOLOGY APPLIED FOR DEFINING THE MODEL OF USING EARNED VALUE METHODOLOGIES FOR THE IMPROVEMENT OF THE PERFORMANCE FOR BUSINESS PROCESSES

The research methodology detailed further in this paper is based on the procedural actions in major investment programs in energy business sector. In order to develop and to set a performing sustainable management concept several research activities were done.

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Documenting related business processes; digitalization; automation; Earned Value analysis; Complex KPI's; Industry 4.0.

Surveying, discussions and audits related the business processes; performance and Industry 4.0 concept

Development of the management model. The resulted model was partially successfully implemented in several organizations. Although it was very good seen by the lead management team, such model was partially rejected by the execution teams due to the fact that the implement of such model will increase the stress and the control of theirs activities.

Thus trough the implement of this model there were observed increased process performance indicators values.

RESEARCH RESULTS RELATED TO BUSINESS PERFORMANCE AND EARNED VALUE.

Performance

Performance is defined by the business researchers as the accomplishment of specific actions measured against planned and agreed standards. These planned and agreed standards will be the further developed completion milestones which will incorporate aspects of completeness, quality and costs. Therefore such milestones, business targets shall be very clear defined in order to be measurable and achievable. Setting the right performance targets will lead the organization with certainty to long-term success obtained through continuous improvement in all aspects. In order to obtain this several concomitant actions and strategies shall be developed. (Olaru 2013)

- Setting the right Target.

  Business targets shall be clear defined, measurable and reachable. These will be developed as a combination from all the factors that lead to performance from the organizational lead perspective including quality, time and financial aspects.

- Covering the entire Scope of Works

  All the business processes of an organization shall be targeted through all the projects they develop. All the elementary projects shall be as well targeted. Driving a road without a destination will lead to nowhere.

- Clear interactions

  Each action, of each project from each business process will lead to the achievement of the targets. Therefore the entire shall be segregated and understood at an elementary level and then integrated in projects, portfolio of projects, business processes and final performance targets. The interactions will

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not happen at the business process level, they will happen at the elementary activity level.

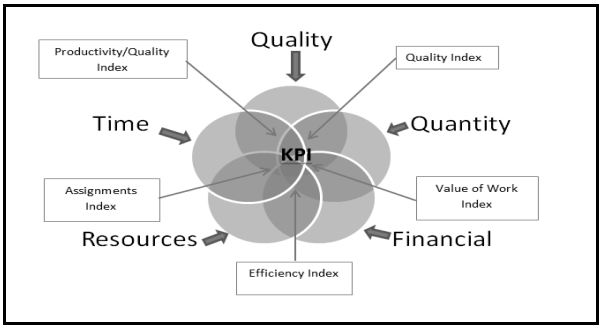

Figure 2 Measurable Target setting (Sandru, M., 2014. Multi Project Management KPI's)

This approach of business performance target settings is as well in line with the Total Quality Management approach and procedures. It will lead to a process of transforming ideas into opportunities and opportunities to competitive advantages trough rational planning to evolutionary business processes (Maier, 2013).This entire process will start with a vision, then the development ideas will be detailed trough several consecutive iterations to a certain level of detail up to specific activity level. These activities will be further analyzed, the logical sequence interactions set, then grouped in projects and assigned to business processes. The resulted project will then analyze, and it will be decided in gate review meetings if it will be budgeted or not. Further the performance targets will be set. Entering in the execution phase the project manager will manage the project following the plan, do check act cycle.

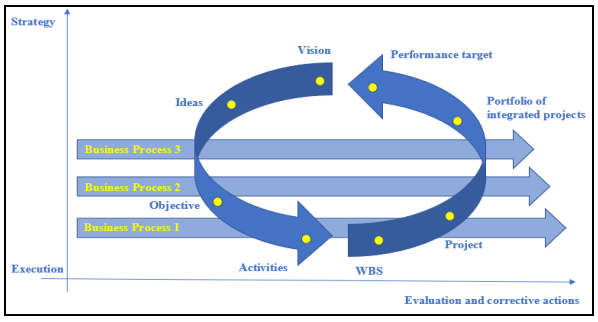

Figure 3 Target setting process (authors own contribution)

Earned Value

Earned value is a tool for analyzing the project, portfolio of projects and business performance against a set and measurable performance target with accent on the project management main axis: scope, time and cost. Using the earned value methodology will improve as well the Scope

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of Works definition as well the overall project and business process performance. For successfully use of the Earned Value methodology some essential features shall be implemented at the project level:

- *A fully detailed project plan* To cover the entire defined scope of works, trough logical linked activities and performance completion targets set;
- *Budgeted cost of work scheduled.*
  A valuation of the entire planned work
- *Budgeted cost of work performed*
  Pre-defined metrics to be able to clearly quantify the accomplishment of work done.

Starting from the basics analysis further more sophisticated analysis can be performed to include indicators and forecasts for financial performance in order to mark the actual status and the weak areas and also to predict the achievement of the completion performance targets. (Fleming 2005). In this sense the earned value analysis can be considered the tool and method to be used on projects to better manage performance. It will ask to the questions related to the health of the projects and portfolio of projects toward the performance target.(Humphreys, 2001) The Earned Value analysis will bring additional answers towards the project analysis. It will offer information way beyond the classical "Progress Planned vs Actual Progress", it will bring beside the quantitative elements also a view on the qualitative development and forecasting of the projects.

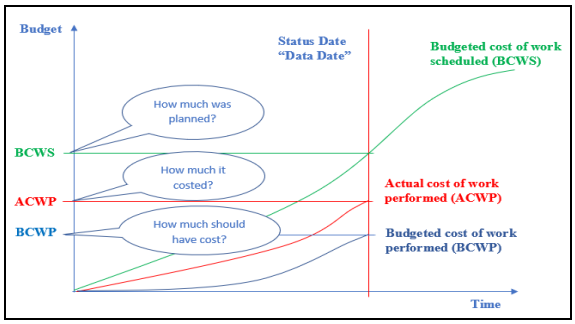

Figure 4 Questions to answer by the Earned Value analysis (authors own contribution)

Once Budgeted cost of work scheduled (BCWS); Actual cost of work performed (ACWP) and Budgeted cost of work performed (BCWP) are in place, new performance factors and indicators can be estimated as:

- Cost Variance (CV)

  CV = BCWP - ACWP

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- Schedule Variance (SV)

  SV = BCWP - BCWS

- Cost Performance Index (CPI)

  CPI = BCWP/ACWP

- Schedule Performance Index (SPI)

  SPI = BCWP/BCWS

A CPI <1 reflects a constant budget overrun.

A SPI >1 and a positive SV more work have been done than was planned, but this meaning not necessarily that the project is ahead schedule. (Humphreys, 2001). For analyzing the timely milestone achievements critical path analysis have to be performed.

Synthetic more detailed analysis can be performed starting from the above mentioned indicators in order to obtain:

- Estimate to Complete (ETC) – Additional costs to complete the scope of works.
- Estimate at Completion (EAC) – Estimate of the total cost when the scope of work is complete.
- Budget at Completion (BAC) – Budget of the project when is completed

All models to estimate EAC are based on three main formulas:

- Overrun to date

  EAC = ACWP + (BAC - BCWP)

- Cumulative CPI

  EAC = BAC/CPI

- Cost; Schedule impact

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EAC = ACWP+((BAC-BCWP)/(CPI x SPI))

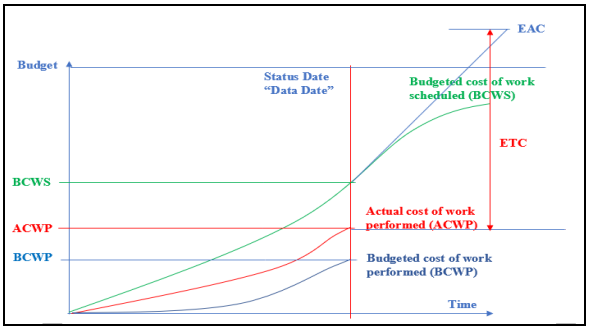

Figure 5 Estimates to reach the performance targets (authors own contribution)

RESEARCH RESULTS RELATED TO BUSINESS PROCESSES

PERFORMANCE TARGETS

An organization can be performant as an entire only if their business processes in overall are performant. Thus this approach is not mean to increase the performance of the organization; this black-box concept is misleading by hiding poor results of some business processes behind the performers. In this sense it was developed by the specialists the concept of business units. But business units are developing their activity in the same environment with the other business units of the organization, so in order to segregate this black-box environment and to manage the interactions of the business units; it shall be implemented working procedures on the concept of provider-customer relationship. Such approach will adjust the budgeting of each business unit as an economical micro entity, having to be competitive in their own actual costs. Else the other business units are not forced to interact with themselves if a comparable product is more performing on the market. Such approach by putting all the business processes through their business units in the market conditions with no other protective measurement, will bring a continuously development of the performing ones and a decline of the uncompetitive processes. (Sandru 2014) In the overall image the organization will have an improved performance. The long-term success of an organization can be achieved only if it will succeed to be competitive on the market.

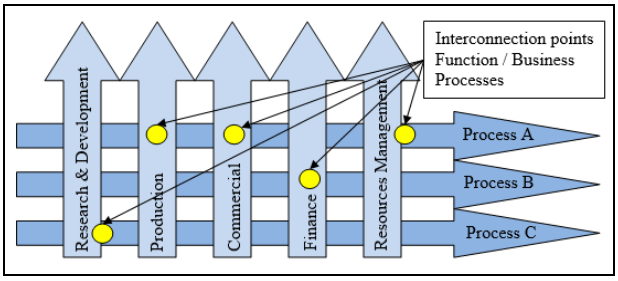

Figure 6 Matrix optimization functions / Business processes

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(Sandru, M., Pirnea, I.C. and Bodemann, M., 2014. Increasing the internal process efficency of the organization through the implementation of the project management concepts in energy field)

CONCLUSIONS

The results of the undertaken research clearly showed that in the current market condition facing a new industrial revolution marked by digitalization and automation, Industry 4.0 the added value for each industry and in special for energy field stays in the power of bringing on market the new innovative ideas. In this approach several factors are relevant, for the performance of this process. So it was developed to following list of to-do for each leader and project manager in the organization.

- Set the right measurable performance goals.
- Carefully plan the achievement of these goals using project management techniques, from the detailed activity level to major portfolios of integrated projects
- Execute with focus of each activity scope of work, time, budgets, resources
- Analyze the performance, the health of each individual project and further more each portfolio.
- Take the right decisions, based on clear analysis and focus on results.
- Analyze again, the effect of the taken decisions; the actual performance status.
- React, fast and efficient. Adjust your actions facing the performance goals.

Research results showed without any doubt that the future belongs to the more innovative, more dynamic and adaptable, more performant organizations. The models for evaluation and management exist, and new ones can be developed by combining the existent analyzing tools to fit the new challenging scope. Thus the implementing of these managerial models is not very simple, facing a lot of negative reactions by the executive part of the business, the executive personnel feels trough these instruments additional stress and insecurity, by being visible and in the direct spotlight all the low performances and misalignments, which now days are to be find in all organizations. So, new challenges for the managerial team in order to build better stronger project teams having the main focus the improvement of the performance of each single activity.

The continuous performance improvement of an organization starts from the bottom, from the performance improvement of each singular activity.

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