Interpretation of the results of a Case Study about Impacts and Influences of Exogenous Variables in the planning of Chronogram and Budget in Software Projects.

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ABSTRACT

This paper is focused in the interpretation of a Case Study results. This Case Study was based in an article, of the same author of this paper, presented in an international congress (IMCIC 2015) held in Orlando - Florida / USA in March of 2015. This article obtained the Best Paper Award (http://www.iiis.org/bestpapers.asp?year=2015) of the Technical Session which it was presented in IMCIC 2015. Besides to have been included in IMCIC 2015 proceedings, as a complementary award, this same article was published in an Academic Journal.

The 2 (two) main points of this Case Study were:

1. Evaluate if the capture of the data to register in the Formulary proposed, by the IMCIC 2015 article, was easy or had some difficulties;

2. Evaluate the accuracy between the data captured, under the rules of the IMCIC 2015 article proposal, and the reality found in 9 (nine) Organizations that were involved in this Case Study survey.

Keywords: Project Management; Strategic Planning; Time; Cronogram; Budget; Costs; Impacts; Exogenous Variables; Decision-Making Process.

1. INTRODUCTION

As already described in Abstract, this paper is focused in the interpretation of a Case Study results. This Case Study was based in an article, of the same author of this paper, presented in an international congress (IMCIC 2015) held in Orlando - Florida / USA in March of 2015. This article obtained the Best Paper Award (http://www.iiis.org/bestpapers.asp?year=2015) of the Technical Session which it was presented in IMCIC 2015.

Besides to have been included in IMCIC 2015 proceedings, as a complementary award, this same article was published in an Academic Journal [1].

The intention of this Case Study, focus of this paper, was to evaluate the proposal of the mentioned article presented in IMCIC 2015 which was based in a revision of the PMBoK© - Project Management Book of Knowledge [2] edited by PMI - Project Management Institute – in its disciplines of Time and Costs – and also in some approaches of Vielmond [3]. This IMCIC 2015 article studied the perception of some Exogenous Variables which can interfere in Deadlines and Budgets initially planned for the implementation in projects. Thus, it is strongly recommended the reading of the IMCIC 2015 article before the reading of this paper.

The main 2 (two) points of this Evaluation, objective of this paper, were:

- 1st. Point: evaluation if the capture of the data to register in the Formulary proposed by the IMCIC 2015 article (included in this paper in Fig. 1 in Appendix A) was easy or had some difficulties in Phase 3 - Data Capture of this Case Study (described in 3. Methodology section)

- 2nd. Point: evaluation the accuracy between the data captured, in Phase 3 - Data Capture of this Case Study (described in 3. Methodology section), as previous prevision, and the data retrieved in the real world found in Phase 4 - Data research (described in 3. Methodology section)

The exposition of the text of this paper will follow the below Nomenclature Table and its Sections.

2	Author expertise
3	Methodology
4	Case Study procedures
5	Results presentation
6	Conclusions
7	Final considerations

2. AUTHOR EXPERTISE

The perception of those Exogenous Variables, which were the focus of the study done in IMCIC 2015 article, was the result of the accumulation of experiences throughout the professional career of more than 40 (forty) years of the author of this paper in projects of various types, besides their additional Technical Certifications in the field of Project Management (PMP© - Project Management Professional/PMI© - Project Management Institute) and System Testing (CTFL© - Certified Tester Foundation Level/ISTQB© - International Software Testing Quality Board).

As result of their assessments and surveys in this theme, the author identified and classified the Exogenous Variables perceived between 2 (two) Aspects, which are, the Circumstantial Aspects of the Project and the Specific Aspects of the Team. For each of the 2 (two) Aspects (which are defined in the text of IMCIC 2015 in details), 3 (three) Topics are treated (and also defined in the same IMCIC 2015 article with precision).

The perception of the existence of those Variables Exogenous, which can interfere in Deadlines and Budgets initially planned for the implementation in projects, was also consolidated in academic studies and research articles (the author is Master in IT - Information Technology and Ph.D. in Production Engineering) those resulted in publications in National Congresses in Brazil (such as, the ENEGEP - National Meeting in Production Engineering, sponsored by ABEPRO - Brazilian Association of Production Engineering) and International Conferences abroad (such as, WMSCI - World Multiconference on Systemics, Cybernetics and Informatics, sponsored by IIIS - International Institute of Informatics and Systemics).

In fact, studies on this subject made by the author of this paper began in 1985 [4], when he presented a paper (in a National Conference in Brazil) where he addressed his concerns about the impact of Exogenous Variables on the expected results in projects and in effective response to the commitments undertaken by their Managers. This paper, of 1985, describes a method called by the

author as MMFV - *Método de Medição de Fatores e Variáveis* (Measurement Method of Factors and Variables) that defines how to apply his theory.

In sequence, in 1989 [5], the same author presented a second edition of the 1985 article (in an International Congress still in Brazil) further deepening the Exogenous Variables that should be retrieved and studied to improve the evaluation of their impacts and risks identified. Much more recently, it means the year of 2014, the author used these 2 (two) his theories to build papers for 2 (two) Events [6][7] (one in Brazil end one abroad) regarding those others 2 (two) articles (of 1985 and 1989) that were mentioned in prior paragraphs of this same 2. Author expertise section.

3. METHODOLOGY

The Methodology to construct this paper was based in some theories and approaches presented by Statke[8]. The Phases, of this Case Study, were:

- Phase 1- Article revision: revision of the IMCIC 2015 article, already mentioned in 1. Introduction section, in order to adequate its propositions to be applied in real organization environment as a Case Study

- Phase 2- Training and Capacitation: training and capacitation of the Organization employees invited and involved in the participation in this Case Study in instructions how they can use the proposal presented in IMCIC 2015 article

- Phase 3- Data capture: the Organizations filled the Fig. 1 Formulary (and in Excel® datasheet as well) with the Prevision of the impacts in Time and Costs in its Projects

(under the rules exposed in IMCIC 2015 article proposal in its pages 3 to 4)

- Phase 4- Data research: research (in each Organization) the real data retrieved after the Project, under inspections, were closed

- Phase 5- Results analysis: evaluate of the final results shown in following 5. Results section

4. CASE STUDY PROCEDURES

The application of the Case Study, mentioned as the basis of this paper, was done from May of 2016 to October of 2016 in 9 (nine) Organizations and covered 3 (three) types of businesses: Services, Production and Financial.

For each type of industry, there were 3 (three) Organizations representing each one type and around of 30 (thirty) employees (among managers, leaders and technicians) were involved.

The timeline schedule of this Case Study is the picture shown in Fig. 2 with more some little details than how it is exposed in prior text in the 3. Methodology section.

5. RESULTS PRESENTATION

The results are presented in graphic way in next figures (in Appendix B of this paper). It is possible to find the results of Services, Production and Financial area, in this order, meaning Fig. 3 for Services, Fig. 4 for Production and Fig. 5 for Financial, respectively.
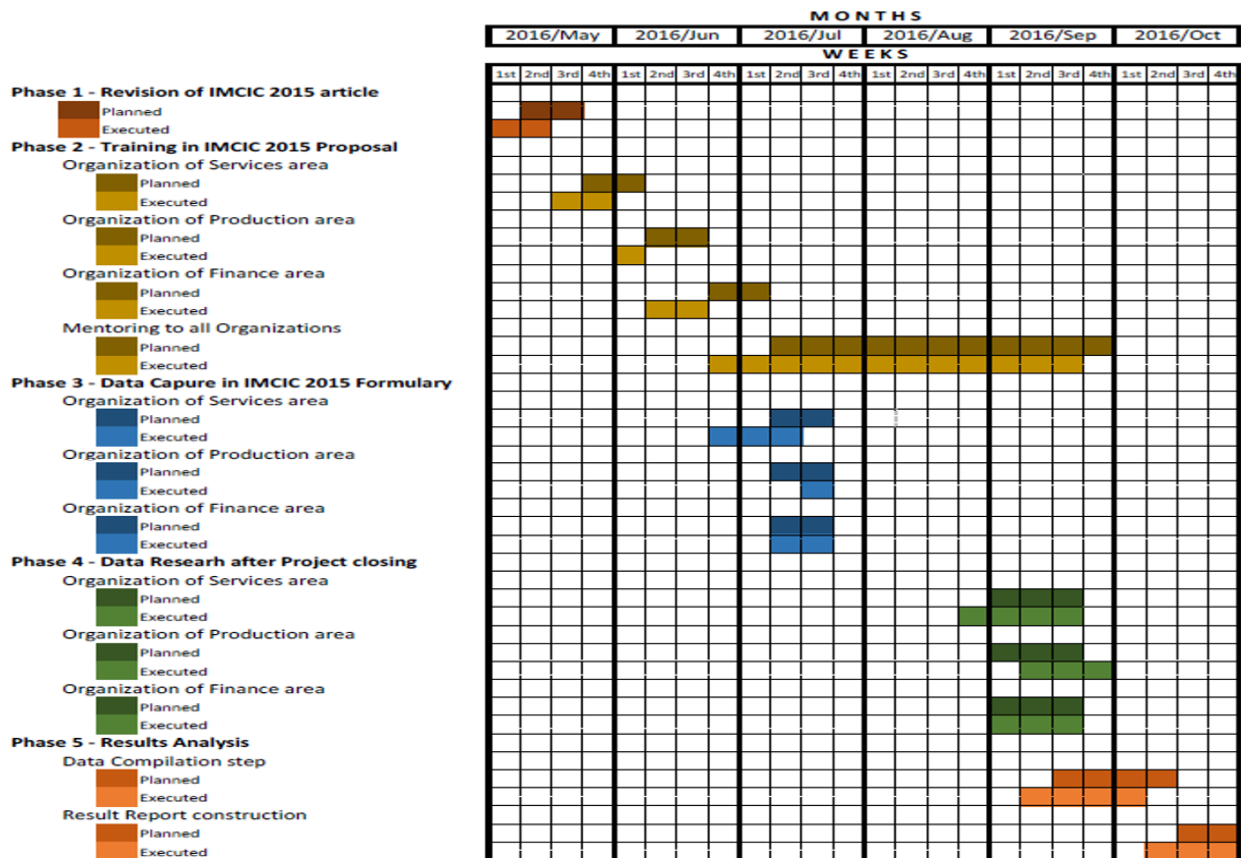

Fig. 2. Case Study Chronogram

There are 5 (five) Graphics Types:

- Graphic Type 1 (letter "a") in Figures: shows the Total of Projects that were considered in this Case Study divided in 2 (two) groups: "Organization" (that means Projects that were developed to answer and support Internal Sectors of company in its needs) and "Clients" (that means Projects that were developed to answer and support External Sectors of company in its needs)

- Graphic Types 2, 3, 4, 5, 6 e 7 (letters "b", "c", "d", "e", "f" e "g") in Figures: shows columns (named as "Budget Value" and "Project Duration" which are the impacts linked to Projects) with "Estimated" and "Adjusted" sub-columns. In the top of "Estimated" sub-column, is shown the Total of Projects (which were supposed to have impacts in its previous Schedule or Budget) that was possible to capture this data (to support the evaluation defined in 1. Introduction section as 1st. Point of the two objectives of this Case Study), when the Formulary of Fig. 1 was filled. In the top of the "Adjusted" sub-column, is shown the Total of Projects (which really had impacts in its previous Schedule or Budget) that had its real data retrieved and the precision between this data retrieved and the "Estimated" sub-column checked (to support the evaluation defined in 1. Introduction section as 1st. Point of the two objectives of this Case Study) when the survey conducted by this Case Study was done. The percentages in these "Estimated" and "Adjusted" sub-columns are rounded in the scale of 10. Letters "b", "c" and "d" are referenced for the Aspect Group "Circumstantial Aspects of the Project" and letters "e", "f" and "g" are referenced for the Aspect Group "Specific Aspects of the Team" (see Fig. 1 for more detail).

- Graphic Type 8 (letter "h") in Figures: shows the Total of Projects that were considered in this Case Study, divided in 2 (two) groups: "Organization" (that means Projects that were developed to answer and support Internal Sectors of company in its needs) and "Clients" (that means Projects that were developed to answer and support External Sectors of company in its needs), that matches ("Estimated" and "Adjusted" sub-columns) summarized from the previous 6 (six) Graphic Types. The criteria applied, to consider as "matching", is a range of 5%, to more or to less, in data values.

As an example of how interpret the data in Graphic Types 2, 3, 4, 5, 6 e 7, in reference of "Budge Value" column in the Fig. 3 in the letter "b", the 80% (in "Estimated" column with 26 Projects) means that this Percentage of the Total of Project (in Fig. 3 in the letter "a" equal to 32 Projects) was possible to have the information about prevision of the impacts in Costs captured and registered (in the Formulary of Fig.1) and the 90% (in "Adjusted" column with 29 Projects) means that this percentage matches the data retrieved (about the impacts in Costs) with the real data registered in end of the project in this Case Study.

6. CONCLUSIONS

The following analysis and conclusions are divided in the main 2 (two) points, which are the objectives of this paper defined in 1. Introduction section, renewed below and also described by Services, Production and Financial in the conclusions text.

- 1st. Point: evaluation if the capture of the data to register in the Formulary (and in Excel® datasheet as well), proposed by the IMCIC 2015 article (included in this paper in Fig. 1),

was easy or had some difficulties in Phase 3 - Data Capture of this Case Study (described in 3. Methodology section)

- 2nd. Point: evaluation the accuracy between the data captured, in Phase 3 - Data Capture of this Case Study (described in 3. Methodology section), as previous prevision, and the data retrieved in the real world found in Phase 4 - Data research (described in 3. Methodology section)

Services area, according to 1st. Point, confirmed (as was expected) that this business area had more Projects been developing comparatively with industries of Production and Financial areas. It can be explained since it is an area that is always been impacted by changes in the market besides living in constant market concurrence.

Also, to more justify this information, in the group of the 3 (three) Organizations that were surveyed in Services area, there were 2 (two) those work in IT - Information Technology support, developing specifics IT Projects for its clients. Hence, Fig. 3 (in letter "a") shows data in both "Organization" and "Clients" piece of the Pie Graphic.

It was identified that the most difficult data to be captured, to be inserted in "Estimated" sub-column (both for "Budget Value" and "Project Duration" columns), were "Degree of Availability" for Aspect Group "Circumstantial Aspects of the Project" (see Fig. 3, letter "d", for more detail) and "Motivation of Group" for the Aspect Group "Specific Aspects of the Team" (see Fig. 3, letter "g", for more detail).

The values captured in "Estimated" sub-columns, both for "Degree of Availability" and for "Motivation of Group", means that a very low number of Projects could specify these 2 (two) data. Even with this occurrence, the precision and accuracy obtained in the evaluation of 2nd. Point (second objective focused by this Case Study) could be kept ("Adjusted" sub-columns).

Maybe the reason for that, what must be checked in future studies, is because these data are very subjective and non-mathematical for being defined by the technicians interviewed. So, there is no metrics that could be applied until some historical series be available (for being used as knowledge base).

Services area, according to 2nd. Point, confirmed (as was also expected) that this business area had more projects which the prevision (using IMCIC 2015 article proposal) matches with the real data retrieved in the field of the research. It means that the impacts expected really happened in Time and Costs previously planned (Fig. 3, letter "h").

Maybe, the reason why for this evidence is that this Services area have more professionals certified in project techniques than the other 2 (two) areas, Production and Services, since it depends heavily of a strong great performance in project management and construction.

Production area, according to 1st. Point in Fig. 4 (in letter "a"), can be interpreted that this business area was the second area with more projects developed and completed during the research time period of the Case Study object of this paper.

As would be normal and expected, all identified projects were to meet the needs of Internal Sectors (defined as "Organization") because this type of activity (Project Management), in this kind of area, focus its Project Development resources in the application of results in its core activity in order to adjust the industrial process of the Organization to the competitive market standards.

The same issues, related to the difficult to capture data to be inserted in "Estimated" sub-column (both for "Budget Value" and "Project Duration" columns), were identified as also were identified for Services area (see Fig. 4, letters "d" and "g", for more detail). It means that there was not differences between these 2 (two) areas (Services and Production) according the way to apply subjective and non- mathematical metrics to measure this data.

Production area, according to 2nd. Point in Fig. 4 (in letter "h"), can be interpreted that this business area had a high number of projects which the prevision (using IMCIC 2015 article proposal) matches with the real data retrieved in the field of the research. This number is a little bit minor than Services area but is still very significant to evaluate the effectiveness of the method proposed in IMCIC 2015 article.

Analyzing the Financial area, according to 1st. Point and focusing in Fig. 5 (in letter "a"), can be perceived that this Financial area ranks in third position in the number of projects under development and subsequent completion during time period of the application of the Case Study presented in this paper.

As the same as Production area, its projects always aimed to support Internal Sectors and their needs, because the Financial area does not provide external services in this mode (namely, Project Development) for their clients (similarly, also not, as the Production area).

Also, no differences were found, among Services and Production areas and this Financial area, to what is related to the difficulties of insert "Estimated" sub-column (both for "Budget Value" and "Project Duration" columns) data (see Fig. 5, letters "d" and "g", for more detail).

Analyzing the Financial area, according to 2st. Point and focusing in Fig. 5 (in letter "h"), can be interpreted that this business area had also (as the Production area, but minor) a high number of projects which the prevision (using IMCIC 2015 article proposal) matches with the real data retrieved in the field of the research (even, as the same as the Production area, that not had specialists in Project Management). This number is still very significant (as well the same that happened with Production area) to evaluate the effectiveness of the method proposed in IMCIC 2015 article.

The explanation of the reason why Financial area had the minor number of projects which matches prevision X real (even being a high number as the same of Services and Production area), could be that it is a sort of business that always is having changes in its processes (in many cases, by Legal exigencies), what drives the projects to be always in "Revision Mode" regarding to Time and Costs original planning.

In reference to all Case Study results, the Organizations which were participating in this activity – in the end and in fact – have defined that they were very reliable with these results and have expressed that their prior expectations were reached in the real world and in the situation prospected.

7. FINAL CONSIDERATIONS

Despite of the Case Study was done only in 9 (nine) Organization, as were surveyed 3 (three) group of Organizations that represents each one Services, Production and Financial business areas, the conclusions can be scaled statically to other Organizations which fits to one of these 3 (three) group of Organizations.

In other hand, the researches must continue to refine more the results already obtained and became these as benchmarking of ratings that can be used as benchmarking.

Indeed, by the supervised manner with that this work was built (assembly and survey), it is possible to verify the usefulness of the proposal presented in IMCIC 2015 article and also to be concluded that it can be considered as effective management and planning tool in corporate real world and, in additional, how practical this proposal is for the reality of Organization in its day-to-day activities.

Among suggestions for future work, after new results captured in the field and in new utilizations, the target is to explore more Exogenous Variables that can impact the previous planning of projects.

8. REFERENCES

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Appendix A

Evaluation of Impacting Factors in Deadlines and Project Costs

Business Organization (Significance Value)> ☐

Budget Value: ☐ / Currency: ☐ Project Duration (in Days): ☐ Evaluated: by _____ in ___ / ___ / ___

1. Circumstantial Aspects of the Project: Project Name/Code: ☐

a. Power of Policy (importance for the Organization):

High	☐ = ... % => Budget Value: ☐	X .... % / 100% = ☐	Project Duration: ☐	X .... % / 100% = ☐
Medium	☐ = ... % => Budget Value: ☐	X .... % / 100% = ☐	Project Duration: ☐	X .... % / 100% = ☐
Low	☐ = ... % => Budget Value: ☐	X .... % / 100% = ☐	Project Duration: ☐	X .... % / 100% = ☐

Rmk: ☐

b. Degree of Availability (of Stakeholders in the success of the Project):

High	☐ = ... % => Budget Value: ☐	X .... % / 100% = ☐	Project Duration: ☐	X .... % / 100% = ☐
Medium	☐ = ... % => Budget Value: ☐	X .... % / 100% = ☐	Project Duration: ☐	X .... % / 100% = ☐
Low	☐ = ... % => Budget Value: ☐	X .... % / 100% = ☐	Project Duration: ☐	X .... % / 100% = ☐

Rmk: ☐

c. Level of Knowledge (of Stakeholders to contribute with the success of the Project):

High	☐ = ... % => Budget Value: ☐	X .... % / 100% = ☐	Project Duration: ☐	X .... % / 100% = ☐
Medium	☐ = ... % => Budget Value: ☐	X .... % / 100% = ☐	Project Duration: ☐	X .... % / 100% = ☐
Low	☐ = ... % => Budget Value: ☐	X .... % / 100% = ☐	Project Duration: ☐	X .... % / 100% = ☐

Rmk: ☐

2. Specific Aspects of the Team:

a. Base of Technique (related to the solution to be built):

High	☐ = ... % => Budget Value: ☐	X .... % / 100% = ☐	Project Duration: ☐	X .... % / 100% = ☐
Medium	☐ = ... % => Budget Value: ☐	X .... % / 100% = ☐	Project Duration: ☐	X .... % / 100% = ☐
Low	☐ = ... % => Budget Value: ☐	X .... % / 100% = ☐	Project Duration: ☐	X .... % / 100% = ☐

Rmk: ☐

b. Experience of Work (in previous Projects of the same nature):

High	☐ = ... % => Budget Value: ☐	X .... % / 100% = ☐	Project Duration: ☐	X .... % / 100% = ☐
Medium	☐ = ... % => Budget Value: ☐	X .... % / 100% = ☐	Project Duration: ☐	X .... % / 100% = ☐
Low	☐ = ... % => Budget Value: ☐	X .... % / 100% = ☐	Project Duration: ☐	X .... % / 100% = ☐

Rmk: ☐

c. Motivation of Group (related to engagement in the activity):

High	☐ = ... % => Budget Value: ☐	X .... % / 100% = ☐	Project Duration: ☐	X .... % / 100% = ☐
Medium	☐ = ... % => Budget Value: ☐	X .... % / 100% = ☐	Project Duration: ☐	X .... % / 100% = ☐
Low	☐ = ... % => Budget Value: ☐	X .... % / 100% = ☐	Project Duration: ☐	X .... % / 100% = ☐

Rmk: ☐

Rmk: ☐

Fig. 1. IMCIC 2015 article Formulary

Appendix B

(b) Power of Policy; (c) Degree of Availability; (d) Level of Knowledge; (e) Base of Technique; (f) Experience of Work; (g) Motivation of Group
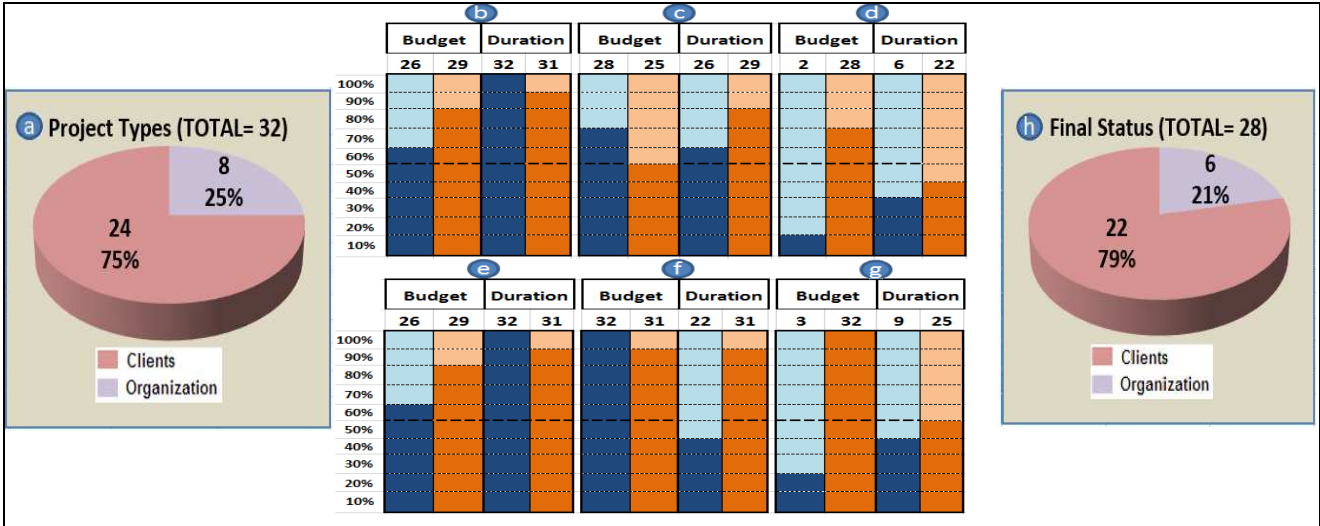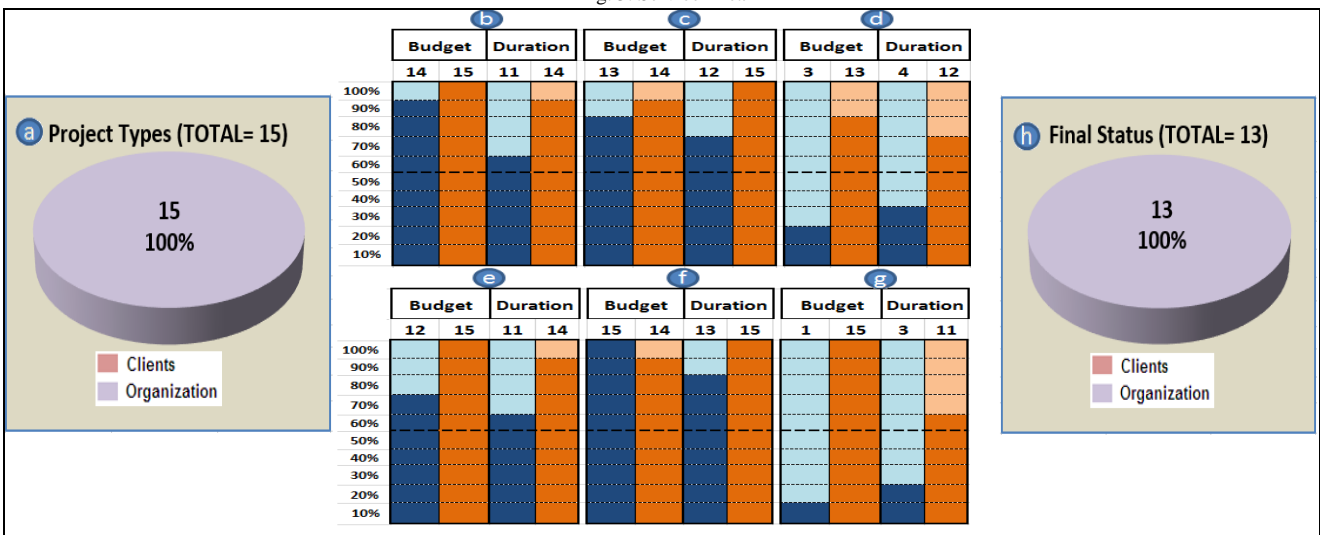

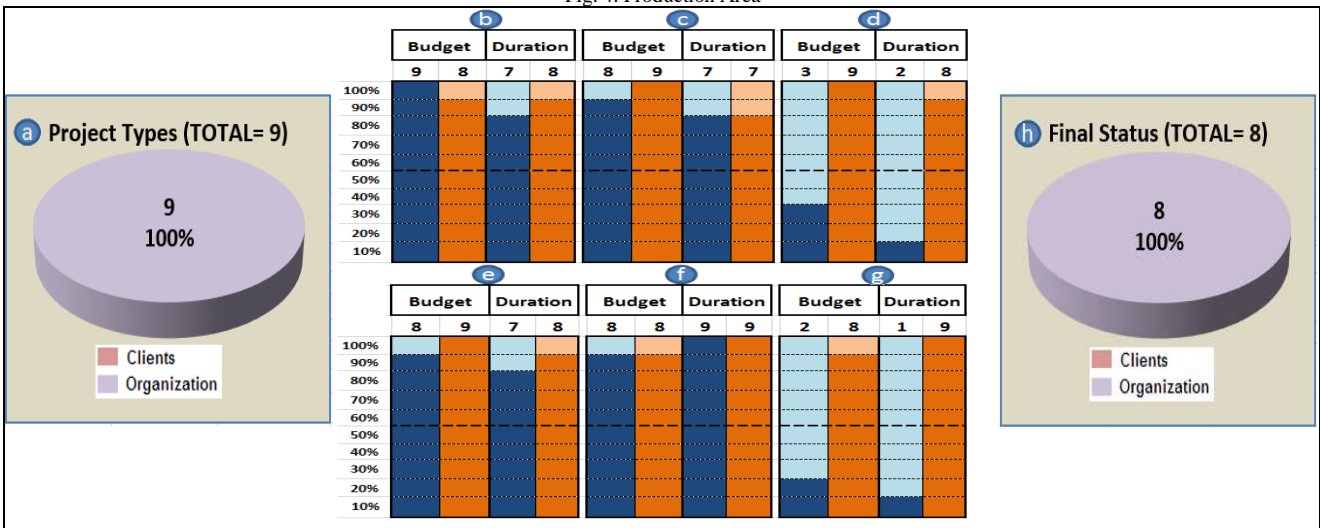Fig. 3. Service Area

Fig. 4. Production Area

Fig. 5. Financial Area