Digital Transformation in Financial Services: What Cost Estimation Methodology to Choose?[1, 2]

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ABSTRACT

In a rapidly changing digital world, the financial services industry is struggling to stay competitive through digital transformation projects. Indeed, financial institutions today are engaging in huge digital transformation projects to stay up to date and create value. However, many of them fail in their digital transformation projects, mainly due to cost overruns. This paper discusses the reasons leading to the projects' failure through a root cause analysis, followed by a presentation of the different alternatives to the main problem, then an analysis is established of the different alternatives through the multi-decision attribute model and a non-dimensional weighting technique to narrow down the alternatives to one best solution that can be applied to our problem. Finally, a Force-Field analysis is used to determine the forces supporting and hindering the application of our solution.

Key words: Cost estimation, Financial Services, Digital Transformation, Top-Down, Fintech, Budget Methodologies, Contract, Project, Consulting

INTRODUCTION

In a world where technologies are rapidly evolving, the economic model has transformed in a very competitive way, and businesses are striving to keep up with the digital change and to create a significant competitive advantage. Indeed, "two-thirds of business leaders believe their companies will lose competitiveness if they don't become significantly more digitized. The pace and volatility of digitization opportunities make it more difficult for IT leaders to help their

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companies exploit emerging digital opportunities"[3]. Taking this into account, organizations in different industries understood well that they should integrate digital technology into all areas of business, resulting in fundamental changes in how the business operates and delivers value to customers.[4]

Among all industries, the financial services industry, which can be simply defined as the services offered by financial and banking institutions, is struggling to optimize cost-effectiveness and profitability following the last decade's downturn[5]. As such, this industry is particularly concerned with and affected by the digital transformation and process optimization through different financial technologies, or as they are commonly called, Fintech. Implementing new technologies require a huge investment from the financial institutions. In 2017, they have invested more than $13 billion on Fintech and digital transformation.[6] This number is significantly important compared to the other industries.

However, as much as the rewards can be promising and fruitful, the risk of the Digital Transformation failure is very high. Indeed, 84% of companies fail at digital transformation[7], including financial services institutions. A real example of this kind of failure is Co-op Bank, which has invested £300 million in 2007 in the modernization of its IT systems. Four years later, the whole investment went to waste and the digital transformation was deemed a failure.[8] One of the main reasons leading to this failure was "underdeveloped plans in continual flux and poor budgeting"[9].

However, if we take a closer look into the failing digital transformation projects, we can see that they have followed traditional funding and budgeting models that have closely impacted the failures.[10]

[3] CEB, The new IT Operating Model for Digital, 2017, Retrieved from https://www.infoq.com/articles/Digital-Transformation-Guide-1
[4] The Enterprises Project, *What is digital transformation?* Retrieved from https://enterprisersproject.com/what-is-digital-transformation
[5] Oracle Financial Services, A Strategic Approach To Cost Efficiency in Banking Industry, September 2017. Retrieved from http://www.oracle.com/us/industries/financial-services/strategic-approach-efficiency-wp-3886143.pdf
[6] Deloitte Center For Financial Services, Fintech by the numbers, 2017. Retrieved from https://www2.deloitte.com/content/dam/Deloitte/us/Documents/financial-services/us-dcfs-fintech-by-the-numbers-web.pdf
[7] Bruce Rogers & Michael Gale Interview, Forbes, *why 84% Of Companies Fail at Digital Transformation.* January 2016. Retrieved from https://www.forbes.com/sites/brucerogers/2016/01/07/why-84-of-companies-fail-at-digital-transformation/#58bd3665397b
[8] Rolin Zumeran, *A Look Back at Digital Transformation in Financial Services (and Digital Transformation in General) in 2017*, January 2018. Retrieved from https://www.openlegacy.com/blog/a-look-back-at-digital-transformation-in-financial-services-and-digital-transformation-in-general-in-2017
[9] Martin Gill, *Why Do Digital Business Transformations Fail?* April 2015. Retrieved from https://go.forrester.com/blogs/15-04-01-why_do_digital_business_transformations_fail/
[10] Mark Lamoureux, *How Budgeting Impacts Digital Transformation*, April 2018. Retrieved from https://www.veriday.com/blog/budgeting-impacts-digital-transformation/

Indeed, the classical budgeting models such as the Top-Down cost estimating approach, have been proven to be inefficient in digital transformation projects. The Top-Down approach takes into consideration the different costs starting from the final deliverable, breaking it down into smaller work packages, and allocate the adequate budget for each package. It identifies tasks quickly and is efficient when there's a clear insight into the details of a project[11]. However, in a digital transformation project, the emphasis should be put on the word "Transformation", because it implies change. Implementing new technologies to replace the previous ones requires an agile environment and operating models[12]. The transition into that kind of models require another investment in business agility, and this is what the classical cost estimation approaches do not take into consideration, which leads to budget and schedule overrun and very often to the project failure.

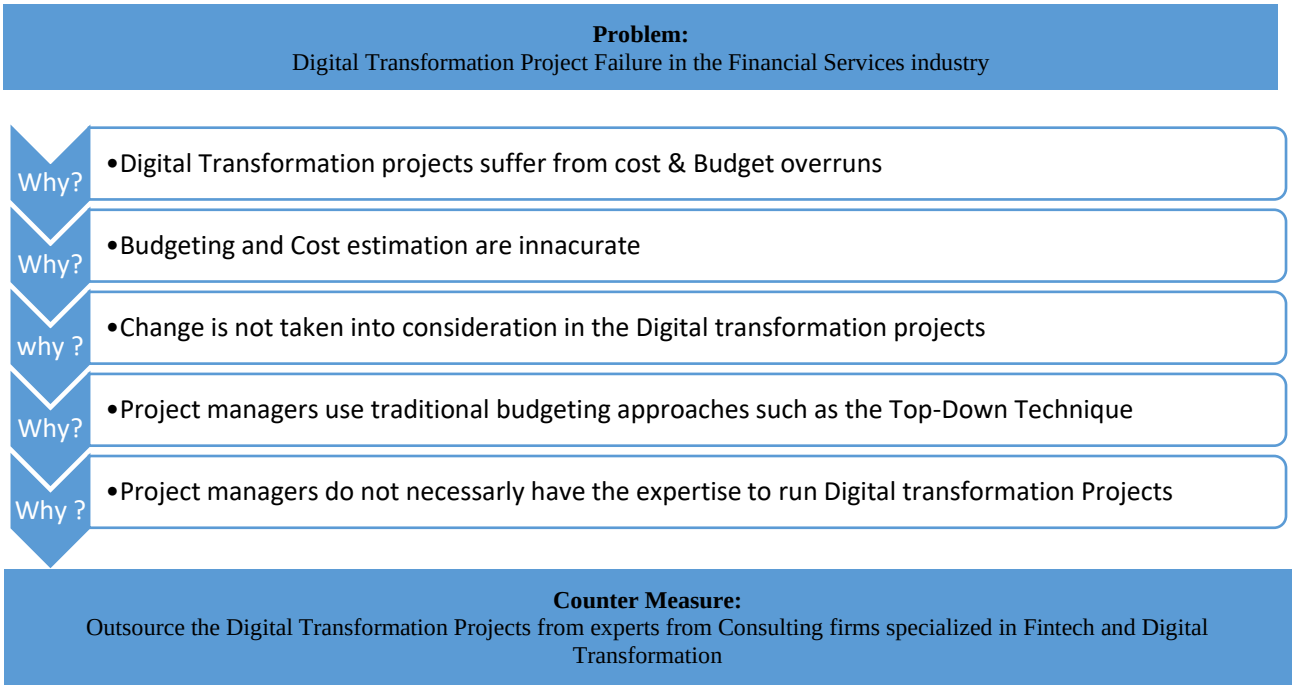

Figure 1: Five Whys Analysis Diagram

Thereby, this paper's goal is to understand the lack of accuracy of the Top-Down cost estimation technique in the digital transformation context, and how does this impact the financial services sector digitalization. Then, we will suggest a better approach that can help the financial institutions leveraging their digital transformation investment and transforming it into a solid competitive advantage, such as contracting with consulting firms specialized in Fintech and Digital Transformation.

[11] Andy Makar, *Top-Down vs. Bottom-Up Project Management Strategies*, August 2018. Retrieved from https://www.liquidplanner.com/blog/how-long-is-that-going-to-take-top-down-vs-bottom-up-strategies/

METHODOLOGY

In this section, we are going to redefine clearly the subject of this paper, then suggest and evaluate some alternatives to the problem defined. We are going then to compare the alternatives in order to rank order them. Finally, we are going to determine a set of criteria to help us choose an alternative solution to our problem.

Step 1: Problem Recognition, Definition & Evaluation

As we have mentioned in the introduction, digital transformation today is crucial for the financial services industry. The investment might be enormous, but the returns are tangible and guaranteed for the long term. However, as the digital transformation projects are more complex than usual ones, several projects suffer from cost overruns which might lead to their failure (Figure 2).

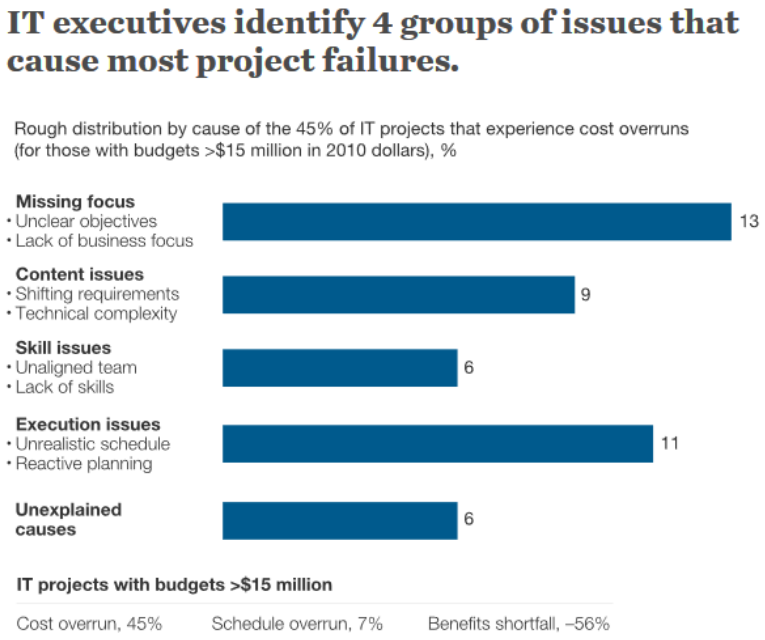

Figure 2 Causes of project failure: Cost overruns[13]

Several approaches are followed by project owners to establish their cost estimation before starting a project. Our focus in this paper is going to be on the Top-Down cost estimation techniques and its impact on the project success. Our problem then is: **How can we avoid the digital transformation failure in the financial services industry?**

[13] Michael Bloch, Sven Blumberg & Jürgen, McKinsey & Company, *Delivering large-scale IT projects on time, on budget, and on value*. October 2012. Retrieved from : https://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/delivering-large-scale-it-projects-on-time-on-budget-and-on-value

Step 2: Feasible Alternative Solutions

In order to find a solution to our problem, we are going to study the different alternatives allowing a better approach to estimating the cost of digital transformation.

In digital transformation costing, the hardest part is to estimate the cost of the digital solution or software that is going to be implemented. Since the software development field is rapidly changing, costs related to this field are getting higher and it gets harder to accurately estimate.[14]

There are two main categories of techniques to estimate a software cost:

- Algorithmic Techniques
- Non-Algorithmic Techniques

We are going to explain the difference between both.

1- Algorithmic Techniques

Algorithmic techniques are based on models and formulas that combine related cost factors involved in the software estimation, which are based on historical data and research and use inputs such as design methodology, skill-levels, risk assessments, etc.[15] They are also referred to as the Parametric Estimating Techniques.

Many algorithmic models have been developed by researchers such as:

- COCOMO Model
- Putnam Model
- Function Point Analysis

2- Non- Algorithmic Techniques

Non-Algorithmic techniques do not require a mathematical formula to estimate the cost of the digital solution[16].

- Top-Down Estimating Model
- Bottom-Up
- Estimating by Analogy (Top-Down)

[14] Pfleeger S.F., WU F., Lewis R., RAND Corp., PROJECT AIRFORCE, Software Cost Estimation and Sizing Methods, 2005. Retrieved from: https://www.rand.org/content/dam/rand/pubs/monographs/2005/RAND_MG269.sum.pdf

[15] Yansi K. Manish B. Shashank S. Aditya T., IJERT, Software Cost Estimation Models and Techniques: A Survey, 2014. Retrieved from: https://www.academia.edu/9219119/Software_Cost_Estimation_Models_and_Techniques_A_Survey

[16] Project Management Skills, *Project Cost Estimating tools & techniques*. Retrieved from: https://www.project-management-skills.com/project-cost-estimating.html

- Expert Judgement
- Vendor Bid Analysis

Our initial problematic questions the efficiency of the Top-Down estimation model. Before developing the alternative solutions, let's start by explaining the Top-Down estimating model as a non-algorithmic technique for cost estimation.

The Top-Down approach is a technique based on the historical data concerning similar projects. It's best used when the typology of work within the project is similar to the previous ones. The advantages of this technique are the rapidity of the estimation process and that it can be relatively accurate if the conditions of the project are similar. However, the extrapolation of historical Data can be inaccurate due to different market conditions, especially in complex projects such as digital transformation.

In the following step, we will develop in more details the Algorithmic and non-algorithmic alternatives to Top-Down cost Estimation listed above.

Step 3: Development of feasible alternatives

1- Algorithmic Alternative Techniques

a. COCOMO Model

COnstructive COst MOdel is one of the most commonly used algorithmic software cost models. It's based on the following formula:

$$\text{MAN-MONTHS} = K1 * (\text{Thousands of Delivered Source Instructions})^{K2}$$

Where K1 and K2 are two parameters dependent on the application and development environment.

Figure 3: COCOMO MODEL

The model takes into consideration the complexity of the project through several factors linked to the digital software solution to be implemented such as[17]:

- Required Reliability
- Size of Data Base
- Memory and Execution time
- Analyst and programmer Capability
- Experience of the team in the application area
- Experience of the team with the programming language and computer
- Use of tools and software engineering practices

[17] Liming Wu, University of Calgary, The comparison of the software Cost Estimating Methods, 1997. Retrieved from: https://www.computing.dcu.ie/~renaat/ca421/LWu1.html

However, there are two main problems linked this model.

- Very limited accuracy in the early phase of the system life-cycle due to uncertainty. According to Kemerer's research, the error percentage of SLIM, a COCOMO model-based method, is 601%[18].
- Necessary recalibration as the estimation is based on the analysis of 63 selected projects

b. Putnam Model

It's a parametric cost estimation model based on the following formulas:

Technical constant $C = size * B^{1/3} * T^{4/3}$

Total Person Months $B = 1/T^4 * (size/C)^3$

T= Required Development Time in years

Rating: C=2,000 (poor), C=8000 (good) C=12,000 (excellent).

Figure 4 PUTNAM MODEL

Where C is a parameter dependent on the development environment and determined based on the historical Data of the past projects.

It is sensitive to the time that the development phase of the solution might take: The shorter is the development time the greater the person months are needed.

However, as it is based on being able to accurately estimate the size of the software solution to be developed, cost estimation can be very inaccurate in such an uncertain environment.

According to Kemerer's research, the error percentage of SLIM, a Putnam based method, is 772.87%[19].

[18] Kemerer, C.F. "An Empirical Validation of Software Cost Estimation Models", CACM, May 1987. Retrieved from: https://www.computing.dcu.ie/~renaat/ca421/LWu1.html
[19] Kemerer, C.F. "An Empirical Validation of Software Cost Estimation Models", CACM, May 1987. Retrieved from: https://www.computing.dcu.ie/~renaat/ca421/LWu1.html

c. Function Point Analysis[20]

As the COCOMO and Putnam models are based on the software size (SLOC[21]), Function Point Analysis is rather based on the functions that the systems deliver to the user. ESTIMACS and SPQR/20 estimation approaches are based on this model[22].

There are two steps in counting function points[23]:

- Counting the user functions: It's based on a function that sums and weights according to the complexity level the following components: external inputs, external outputs, external inquiries, logic internal files, and external interfaces, which gives us a number called Function Counts (FC)
- Adjusting for environmental processing complexity: in this step, we multiply the FC by an adjustment factor, that allows the FC to be adapted to the environment by +/- 35%.

This method allows a cost estimation in an early phase of the development and is independent of the implementation tools, language, and methodologies.

ESTIMACS estimation method, for example, allows the development is the cost estimates at the conception stage of the project. From Kemerer's research, the mean error percentage of ESTIMACS is only 85.48% compared to the COCOMO and Putnam models.

2- Non-Algorithmic Alternative Techniques

a. Bottom-Up

It's a technique based on approximating values of cost or schedule for smaller components of the project by breaking it down and using the sum total of these values as the overall value of the project.[24]

The main advantage of this technique is the accuracy of estimation, since each department responsible for generating the estimation of a sub-value, its expertise and specialized knowledge for that purpose. It also increases the overall motivation of the project team members as everyone feels involved in the project.

[20] Liming Wu, University of Calgary, "The comparison of the software Cost Estimating Methods", 1997. Retrieved from: https://www.computing.dcu.ie/~renaat/ca421/LWu1.html
[21] Source Lines of Code
[22] Project Management Skills, *Project Cost Estimating tools & techniques*. Retrieved from: https://www.project-management-skills.com/project-cost-estimating.html
[23] Liming Wu, University of Calgary, "The comparison of the software Cost Estimating Methods", 1997. Retrieved from: https://www.computing.dcu.ie/~renaat/ca421/LWu1.html
[24] Stephen Meyer, Business Courses, Chapter 6, lesson 5: Bottom-Up Estimating: Definition, Disadvantage & Examples. Retrieved from : https://study.com/academy/lesson/bottom-up-estimating-definition-disadvantage-examples.html

However, the budget can sometimes be overestimated if too many details are considered, or underestimated if managers are inexperienced to give accurate estimations. The budget estimation process t might also take a long time according to the level of details considered and the number of people and department involved in the estimation.

b. Expert Judgement

It's a technique in which the knowledge and the experience of experts in specific areas are used to estimate the cost of a project. It first requires the selection of the activity in which we need the expertise, then a list of statements or issues to be answered are raised. The next step would be selecting experts. They can be groups or individuals such as[25]:

- Units within the organization
- Consultants
- Stakeholders
- Professionals and technical associations, etc.

After the experts are selected, they approach the statements and issues raised and give answers and solutions, documented by a report shared with the stakeholders.

c. Vendor Bid Analysis

It's the technique that allows the definition of the cost of a project by comparing different bids submitted by many suppliers, through already defined selection criteria that the bid for tenders should respect. They can be cost, schedule, resources, and references related.
It has the advantage of receiving specific and justified budgets from different experts (bidders) within a determined deadline but carries the risk of not including the entire scope of work in the cost estimation if the tender issuer was not very specific about it, which might impact the accuracy of the estimates. [26]

In order to compare the alternatives, we will consider that the three algorithmic models are in fact one single methodology, referred to as Parametric. Thus, the comparison will include:

- **Parametric Models**
- **Bottom-Up**
- **Expert Judgement**
- **Vendor Bid Analysis**

[25] Mauro Sotille, ProjectManagement.com, *Expert Jugement*, 2016. Retriever from: https://www.projectmanagement.com/wikis/344587/Expert-judgment
[26] Thomas Franchina, ProjectManagementForum's Blog, The management Consulting Project, 2010. Retrieved from : https://projectmanagementforum.wordpress.com/2010/09/30/the-management-consulting-project/

After understanding some of the most important alternatives to the Top-Down costing in digital transformation, we will select in the next section the most relevant attributes to our problem that can allow a real comparison between the different solutions.

Step 4: Selection Criteria

In order to compare different cost estimation methodologies, we are going to refer to the Guild of Projects Controls as the main reference for this purpose.

According to the Guild of Project Controls[27] Cost Estimate Classification System, there are several levels of Estimate class that serve different purposes, with different applied methodologies and thus, different levels of accuracy.

Estimate Class	Primary Purpose (What is the estimate used for)	Methodology (Estimating Tool / Technique)	Scope Definition As a % Complete of Total Scope of Work	Expected Accuracy Ranges Allowable Variance
Level 1	1 Conceptual Screening (Idenfity the Feasible Options)	Capacity Factored, Parametric Modeling, Expert Judgement or Analogy (Top Down)	< 2% ("back of an envelope" or "Conceptualization")	-50% to + 100% from Mean (P50) value
Level 2	2 Study or Feasibililty (Make or Validate the Business Case)	Equipment Factored, Parametric Model or Expert Judgement	1% to 15% (pre-FEED, Schematic or Criteria Design)	-30% to + 50% from Mean (P50) value
Level 3	3 Budget Authorization or Minimum Control Level	High Level Unit Costs, (Ratio or % Factored) Assembly Cost Estimating	10% to 40% (FEED or Detailed Design)	-20% to + 30% from Mean (P50) value
Level 4	4 Ideal Control Level (Owner) Bid or Tender (Contractor(	Detailed Unit Costs, (Square Foot, Cubic Meter, Per Ton etc) Work Package Cost Estimating	30% to 70% (Detailed Design, Construction or Implementation Design)	-15% to + 20% from Mean (P50) value
Level 5	5 Check Estimate (Owner) Bid or Tender (Contractor)	Detailed Unit Costs, (Square Foot, Cubic Meter, Per Ton etc) Activity Based Cost Estimating (Bottom Up)	>70% ("Approved for Construction" or Shop Drawings)	OWNERS -10% to + 15% CONTRACTORS -5% to + 5% from Mean (P50) value

Figure 5 Level of Cost Estimation from Various Guidelines

We notice that for each estimate class level, there's a methodology that requires a certain level of project scope definition and has an expected accuracy range (The wider, the less precise).

We also notice that for each level, we can associate one of the selected alternatives.

Level 1 corresponds to **Expert Judgment**; Level 2 corresponds to **Parametric Models**; Level 4 corresponds to **Vendor Bid Analysis** and level 5 corresponds **to Bottom-Up.** Based on this, we can already choose the following criteria:

- **Purpose:** It means what is the estimation methodology used for.
- **Scope Definition:** It means how much details concerning the project does the costing methodology need to provide an estimation.
- **Accuracy:** It means how accurate the results of the estimation using a certain methodology can be.

[27] Guild of Projects Controls Compendium and Reference, Chapter 8: Managing Cost Estimating & Budgeting. Retrieved from : http://www.planningplanet.com/guild/gpccar/introduction-to-managing-cost-estimating-budgeting

However, we should also consider in addition to the Accuracy level, the **Reliability,** and **Precision** levels, as they are the main three quality control metrics to have a valid cost estimation approach. We can understand the different case scenarios in the figure below[28].

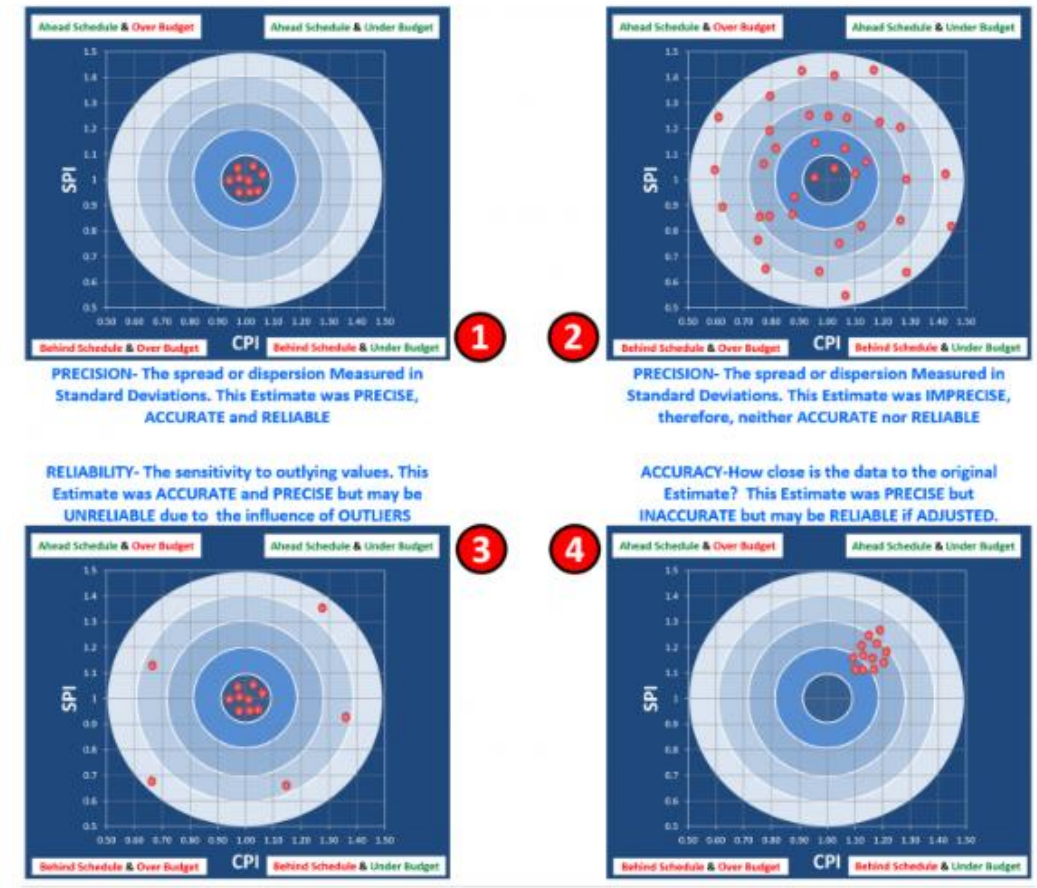

Figure 6 Accuracy VS Reliability VS Precision

In addition to these attributes, by comparing the accuracy range and the scope definition, we can be able to determine for each of our alternatives the allowed variance between the estimated cost and the actual cost at the end of the project (Figure7[29])

[28] Giammalvo, Paul D (2015) Course Materials Contributed Under Creative Commons License BY SA v 4.0. Retrieved from : http://www.planningplanet.com/guild/gpccar/introduction-to-managing-cost-estimating-budgeting
[29] Guild of Projects Controls Compendium and Reference, Chapter 8: Managing Cost Estimating & Budgeting, Figure 12. Retrieved from : http://www.planningplanet.com/guild/gpccar/introduction-to-managing-cost-estimating-budgeting

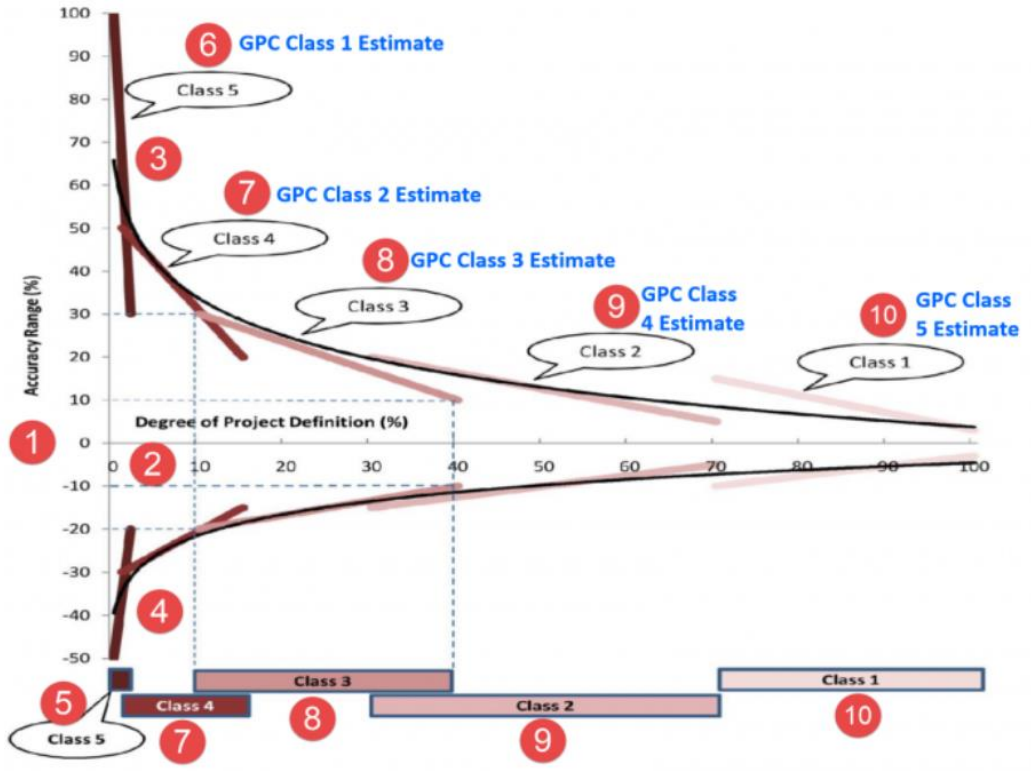

Figure 7 Range Cost Estimate Data Showing Accuracy Ranges VS Scope Definition

This figure shows that given a mean cost estimate for a given project, as the scope definition approaches 100%, the acceptable variance approaches zero in terms of the difference between the estimated cost and actual cost at the end of the project. We would consequently consider Allowable Variance as another criterion.

- **Allowable variance:** It's the variation between the estimated cost and the actual cost of the project according to accuracy and scope definition

Also, we should consider the amount of work and expertise required by each methodology to provide a cost estimation.

- **Level of Preparation Effort:** It means the amount of work required by a methodology to provide an estimation
- **Required Expertise:** It means the level of expertise required for the project managers to use a costing methodology

We will compare the chosen alternative solutions in the following table. This process is based on the acquired knowledge of the author during the research phase. We are looking for the optimal solution that takes into consideration a good part of the project scope, with a high level of accuracy, precision, and reliability, with the minimal effort and expertise and the adequate purpose to the digital transformation projects.

Alternatives Attributes	Expert J VS Parametric M	Expert J VS Bottom-Up	Expert J VS Vendor Bid	Parametric M VS Bottom-Up	Parametric M VS Vendor Bid	Bottom-Up VS Vendor Bid
Purpose	Worse	Worse	Worse	Better	Better	Worse
Scope Definition	Worse	Worse	Worse	Worse	Worse	Better
Accuracy	Worse	Worse	Worse	Worse	Worse	Better
Reliability	Worse	Worse	Worse	Worse	Better	Better
Precision	Worse	Worse	Worse	Worse	Better	Better
Allowed Variances	Worse	Worse	Worse	Worse	Worse	Better
Preparation Effort	Better	Better	Better	Better	Worse	Worse
Required expertise	Better	Better	Better	Same	Worse	Worse

Figure 8 Dominance Table[30]

In order to go deeper into the analysis, we are going to apply the Multi-Attribute Decision-Making method to have a better insight about the best alternative.

The following table is a grading system allocating numbers from 1 to 4 to each solution, as 1 = No Impact, 2 = Low Impact, 3 = Medium Impact and 4 = High Impact.

[30] By Author

Alternatives Attributes	Parametric Estimation	Expert Judgement	Bottom-Up Estimation	Vendor Bid Analysis
Purpose	**4**	**2**	**3**	**3**
Scope Definition	**3**	**3**	**4**	**3**
Accuracy	**4**	1	**4**	**3**
Reliability	**3**	2	**4**	**3**
Precision	**1**	1	**4**	**3**
Allowed Variance	**2**	1	**3**	**4**
Preparation Effort	**2**	**4**	**1**	**4**
Required expertise	**4**	**1**	**2**	**4**
Total	**23**	**15**	**25**	**27**

Figure 9 Quantitative Multi-Attribute Decision-Making Method[31]

The next step is the analysis of the finding.

[31] By Author

FINDINGS

In this section, we are going to analyze and compare the alternative solutions, select a preferred one and finally do a post evaluation of the results.

Step 5: Analysis and Comparison of the alternatives

In the previous section, we have established a dominance table and a quantitative multi-attribute Decision-Making table in order to understand which solution should enhance the cost estimation process for the financial services institutions in the digital transformation projects. We could see that bottom-up Cost estimation Methodology and the Bid Vendor were the ones getting better rankings compared to the other methodologies. To confirm this matter, we will proceed by ranking the attributes and weighting each alternative in order to select the best-ranked alternatives and produce a non-dimensional Additive Weighting table.

	Purpose	Scope Definition	Accuracy	Reliability	Precision	Allowed Variance	Preparation Effort	Required Expertise	Sum	Rank
Purpose		0	0	0	0	0	0	0	0	8
Scope Definition	1		0	0	0	0	1	1	3	5
Accuracy	1	1		1	1	1	1	1	7	1
Reliability	1	1	0		1	1	1	1	6	2
Precision	1	1	0	0		1	1	1	5	3
Allowed Variance	1	1	0	0	0		1	1	4	4
Preparation Effort	0	0	0	0	0	0		1	1	7
Required Expertise	1	0	0	0	0	0	1		2	6

Figure 10 Pair-Wise Comparison of attributes[32]

According to the Pair-Wise comparison of attributes, the ranking is as follows:

1- Accuracy
2- Reliability
3- Precision
4- Allowed Variance
5- Scope Definition
6- Required Expertise
7- Preparation Effort
8- Purpose

The next step is to quantify each alternative against the attributes (Figure 11). The scale used to allocate points is shown below. The Total Score that will be inferior to 4 will be eliminated because it would not demonstrate dominance.

[32] By Autor

Attribute	Parametric	Expert Judgemer	Bottom-U	Bid Vendo
Purpose	0.5	0.5	0.5	0.5
Scope Definition	0.5	1	0	0.5
Accuracy	0.5	0	1	0.5
Reliability	0.3	0	1	1
Precision	0.3	0	1	0.5
Allowed Variance	0.3	0.3	1	0.5
Preparation Effort	0.3	1	0	1
Required Expertise	0.3	1	0.3	1
Sum	3	3.8	4.8	5.5

Scale	Best	Neutral	Maybe	Worse
Score	1	0.5	0.3	0

Figure 11 Quantitative Method of Multi-Attribute Decision-Making Model[33]

We have demonstrated that the alternatives demonstrating dominance regarding the selected attributes would be the **Bottom-Up** and the **Bid Vendor** approaches since their score is superior to 4. The next section will help us narrow down our choice **to one best alternative.**

Step 6: Selection of the preferred alternative

If we take into consideration the ranking of attributes (Figure10) and the scores allocated to the selected alternatives (Figure11), we are now able to do the Non-Dimensional Weighting Technique (Figure12) to select the preferred alternative.

	Step 1	Step 2			Bottom-Up		Bid Vendor	
Attribute	Relative Rank	Normalized Weight (A)			(B)	(A) x (B)	(C)	(A) x (C)
Purpose	8	8/36	=	0.22	0.5	0.11	0.5	0.11
Scope Definition	5	5/36	=	0.14	0	0.00	0.5	0.07
Accuracy	1	1/36	=	0.03	1	0.03	0.5	0.01
Reliability	2	2/36	=	0.06	1	0.06	1	0.06
Precision	3	3/36	=	0.08	1	0.08	0.5	0.04
Allowed Variance	4	4/36	=	0.11	1	0.11	0.5	0.06
Preparation Effort	7	7/36	=	0.19	0	0.00	1	0.19
Required Expertise	6	6/36	=	0.17	0.3	0.05	1	0.17
Sum	36	sum	=	1	sum =	0.44	sum =	0.71

Figure 12 Non-Dimensional Weighting Technique[34]

[33] By Author
[34] By Author

Based on this final finding**, the Bid Vendor analysis is the best technique that financial institutions might use to avoid cost overruns linked to digital transformation projects.** Indeed, with a score of 0.71 compared to a score of 0.44 for the Bottom-up approach, the comparison of several bids of specialized consulting institutions is the alternative that answered the best to our criteria.

Step 7: Performance monitoring and post evaluation results

After defining the best alternative for our problematic, we need to understand the forces that might drive or resist the application of our solution. For that purpose, we are going to use Kurt Lewin's Force Field Analysis. We will allocate to each force a score from 1 to 4 according to how strong can the influence of the factor be on our suggested change, 1 being weak and 4 being strong (Figure 13).

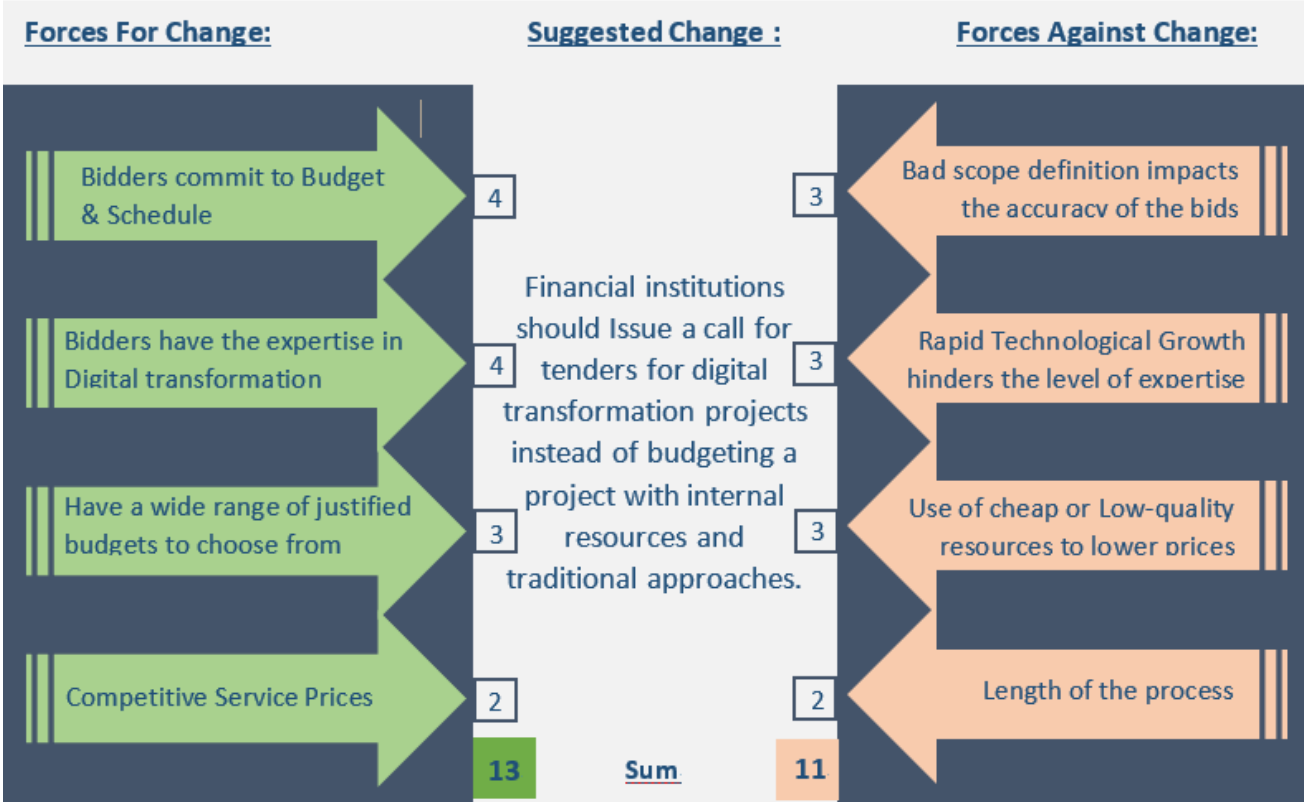

Figure 13 Force Field Analysis[35]

According to the Force Field Analysis above, we have indeed proven that the financial institutions have more reasons to use a call for tender for the digital transformation projects than to rather not to. The most impacting supportive forces are the ability of the bidders to commit to the budget and schedule indicated in their bids, which can prevent for cost AND schedule overruns. Also, we have initially said that one of the reasons the cost estimation for that this kind of

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projects is the lack of expertise in the digital transformation area. Indeed, project managers are not necessarily up to date in terms of technologies deployed in digital transformation, while bidders are always trying to be up to date by hiring consultant experts in that area of expertise. Also, through the call for tenders, the financial institutions get to analyze, compare and choose from a wide range of bids according to some already established criteria (Budget, Schedule, and Technologies deployed), and get competitive prices since the bidders are trying to win the contract.

However, if while issuing the call for tender, the financial institutions do not define properly the scope of the project, there's a chance that they will fall into the same mistake of facing cost overruns. The rapid growth of technologies might make it difficult sometimes to find an expert in a certain new technology if required by the financial institution. Also, the competitiveness of the prices might hide low-quality resources or tools used to implement the wanted solution, which might also have a negative impact on the schedule and budget of the project.

CONCLUSION

The initial objective of this paper was to analyze the link between the choice of the cost estimation methodology in digital transformation projects led by the financial institutions, and the rate of failure of these projects due to cost overruns.

We have first identified the problem through a root cause analysis and explained what leads to cost overruns. We understood then that the traditional methodologies such as the Top-Down cost estimation deployed by the financial institutions do not provide enough accuracy and lead to cost and schedule overruns.

In our analysis, we have first explained the different alternative cost estimation methodologies used in digital transformation projects. We have categorized them into Algorithmic and Non-Algorithmic methodologies. Then, we have chosen to work on 4 alternatives: Parametric Estimation (representing the algorithmic techniques), the Bottom-Up approach, the Expert Judgement and the Bid Vendor Analysis solution.

The next step was to define the criteria on which we will base our decision to choose an alternative. The selected criteria were the purpose of the methodology, the required scope definition, effort and expertise, the accuracy, reliability, precision and the allowed variance precision of the estimation methodology.

After a first analysis based on the criteria ranking and the multi-attribute Decision-Making tools, we have eliminated the Parametric and the Expert Judgement alternatives as they did not show enough dominance regarding our selection criteria. We have decided then to establish a second analysis based on the Non-Dimensional weighting Technique, that allowed us to score the remaining alternatives (Bid Vendor Analysis and the Bottom-Up Approach) according to the

weight and the ranking of the selected criteria. This process allowed us to narrow down the alternatives to one solution, which is the Bid Vendor analysis as it had the highest score.

Finally, we have studied the forces for and against the chosen solution through Kurt Lewin's Force Field Analysis, and concluded that it is more advantageous for the financial services industry to take advantage of the expertise of the consulting firms specializing in digital transformation, in order to manage properly their budgets and avoid cost and schedule overruns.

Our recommendation would be for the financial institutions to be careful while defining the scope of the project to the bidders, and while choosing the selection criteria for the bids, at they might negatively impact the quality, cost, and schedule of the bids.

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