Technical Debt-Related Information Asymmetry between Finance and IT

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ABSTRACT

This position paper proposes a new stream of research targeted at technical debt as a source of information asymmetry between finance and IT professionals involved in information technology investment decisions. Finance teams interact with technology teams in several ways, predominantly when business cases require review and during the annual budgeting process. During these discrete interactions, finance teams are required to digest large amounts of technical strategy and architectural information chock-full of technical terminology and diagrams. Typically, the estimates for effort are soft and risk is difficult to measure. It is within this context that finance approves budgets and projects that inevitably result in the accumulation of technical debt. This paper discusses some of the dynamics at work between finance and IT teams within large complex organizations when they meet to make technology investment decisions. In addition, future research is proposed aimed at reducing information asymmetry, thereby leading to improved IT investment decisions and better management of technical debt.[1]

KEYWORDS

technical debt, information asymmetry, IT investment, decision making

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1 INTRODUCTION

This position paper suggests technical debt manifests in information asymmetry between finance and IT teams within large complex organizations and may have a material effect on technology investment decisions. Large and complex in the context of this paper are defined by Arrow as organizations requiring an increasing number of parts to coordinate [1]. The specific research question being explored is:

> How does technical debt contribute to information asymmetries between finance and IT managers, thereby affecting IT investment decisions?

Seaman et al. describe a situation where long term maintenance tradeoffs, such as technical debt, don't often get incorporated into IT prioritization decisions [2]. This shields finance from understanding technical debt and prohibits their participation in discovering how best to plan and manage the debt. Without knowledge of the problem at its genesis, finance is forced to deal with technical debt when rationalizing budgets during subsequent fiscal periods. Intuitively, improving finance's understanding of technical debt at its conception seems to promote better decision making as the information may lead them to incorporate more accurate assumptions and data into their financial forecasts. Avgeriou et al. highlight the importance of technical debt-related concepts when communicating with other decision makers [3]. This paper focuses on decisions made when finance is involved—there are a material number of daily tactical decisions made by IT resources that are not included in the scope of this paper.

This paper is organized as follows. Section 2 describes the research method. Section 3 follows with a discussion of the role of finance in IT investment decisions. Section 4 includes a review of the attributes driving IT behavior and some of the causes for acquiring technical debt. Following section 4, technical debt is discussed in more detail. Section 6 describes information asymmetry as it relates to technical debt and IT investment decision-making. This paper concludes with a review of research-in-progress and suggestions for additional streams of research.

2 RESEARCH METHOD

Preliminary research was conducted to explore the phenomena leading to poor IT investment decisions. Two participants were selected for their unique positions as leaders within IT and the business. While the full results of the study are not included in

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this paper, Table 1 displays the results of the coding and thematic analysis of the interviews. The numbers listed under P1 and P2 reveal the number of comments referencing each sub-grouping. Once complete, the interviews were transcribed by hand and reviewed twice for coding and analysis. The first review focused exclusively on common words and phrasing. A second review was then conducted with a focus on surfacing themes that may exist across each of the interviews. The approach described by Seidman in Interviewing as Qualitative Research (pp. 127-130) was followed for analysing thematic connections within and between the transcripts [4]. A mind map was generated by hand through an iterative process of discovery until the final set of themes surfaced.

Once themes were identified, a hard copy of each transcript was highlighted identifying every relevant experience that related to one of the themes. The highlighted sections were consecutively numbered. The numbers were then placed on the mind map next to the appropriate theme and sub-groupings under the themes surfaced. Table 1 includes a summary of the coding and mind mapping. Information asymmetry surfaced as a global theme related to technical debt and prompted the writing of this position paper.

Variable	Sub-grouping	Participant 1 (P1)**	Participant 2 (P2)**
Communication	Frequency		37
	Collaboration & Trust	5, 18	28, 43, 44
	Negotiation	14	
	Clear Understanding	16, 18, 19	14, 30, 41, 42
	Siloed	1, 7, 11, 18	20, 33, 35
External Stakeholders	Customers	14	1, 2, 7, 21, 31
	Vendors & Partners		3, 7
Organizational Dynamics*	Skill & Domain Competency	2, 3, 4, 6, 7, 19	4, 8, 9, 16, 25, 27
	Leadership Maturity		24, 26, 40
	Location of People		41
Architectural Influence	N/A	8	15, 17, 18, 31. 32
Business Strategy	N/A	11, 14, 15	23
Motivation (IT Managers)	Measures of Work	8, 10, 19	38
	Day-to-Day		19, 22
Governance & Valuation	Financial	9, 10, 14	5, 10
	Intangible Value	10	6, 21
	Requirements	16	29
	Other	8, 12, 13, 17, 19	12, 13, 34, 35, 36, 39

*Other dependencies in the table, while also organizational dynamics, are broken out due to the materiality of the comments
**Numbers listed under each Participant identify lines of coding from each trascript

3 ROLE OF FINANCE IN IT INVESTMENT DECISIONS

Finance organizations typically dedicate a team of Financial Planning & Analysis (FP&A) resources to manage IT investment. These resources are accountable for overseeing the budget process for IT and approving business cases for projects. In most organizations, without their signature of approval, projects and budgets are not approved and must be recast. The finance resources assigned to manage IT investment typically do not have technical backgrounds and many serve in the role as part of a rotation through the various functions within finance. As a result, technical acumen is minimal. In addition to a lack of technical acumen, the finance team overseeing IT investment only sees a project at particular points during the year and doesn't have the bandwidth to stay abreast of weekly developments and tactical decisions. At many critical decision points, IT only has what Seaman and Guo refer to as 'coarse grained estimates' which often end up varying significantly from realized effort and expense [5]. When 'fine-grained estimates' are complete, overall investment expense has already been baked in and decisions are made to minimize negative impacts to budget, which places pressure on resources to incur technical debt.

As part of their role approving IT investment decisions, finance teams within large complex organizations also play the role of overseeing strategic alignment of technology investments. While strategy is commonly defined by a strategy team, strategy teams rarely have enough human capital to assign to IT investment decisions once high-level objectives are set. For example, for companies employing a balanced scorecard approach, once the objectives and metrics are set, they will disengage with IT until the next status reporting period. Though, finance is commonly held accountable to ensure business cases and budgets align to the published enterprise scorecard.

4 IT'S APPROACH TO INVESTMENT

Unlike finance teams, which operate under the primary direction of the CFO and her direct reports, IT leaders serve many primary stakeholders. In addition to needing to satisfy finance when seeking approval of funding, IT managers face the constant pressure of delivering software, hardware, etc. Their primary stakeholders include their immediate managers, business and functional sponsors of work and owners of applications, peers within IT that have commissioned their services, and internal/external customers who experience problems with their solutions. It is within this whirlwind of demand and activity that they sit down at specific points in time with finance teams to seek approval of their investment proposals.

A primary dynamic impacting decisions related to technical debt within large complex organizations is the multiple silos comprising many IT organizations. IT resources compete internally to deliver against their discrete stakeholders' objectives. The problems with this dynamic surface when deadlines can't be met by dependent teams and alternative approaches to delivering on time are chosen. Typically, impacts of elevated delivery pressure are not socialized with finance.

One potentially mitigating role in the IT investment decisions process is that of a project manager. While project managers typically serve as a proxy between IT and finance teams, in many situations they lack the technical acumen and/or financial acumen to play a meaningful role communicating information between the two areas. In addition, they are typically hired by the sponsor and highly incentivized to deliver on time. This predisposes them to making decisions in the interest of delivering on time and incurring technical debt, as they typically have no long-term accountability for the ultimate cost of their decisions in the form of principal and interest payments on the debt. Moreover, project managers are also limited in their interactions with finance personnel, having little opportunity to provide meaningful insight regarding technical debt decisions.

5 TECHNICAL DEBT

Ampatzoglou et al. argue that much technical debt research uses ambiguous terminology and sometimes misuses terms [3]. This confusion adds to the challenge of gaining adoption from IT

professionals. If research and standards don't exist that are clear and meaningful to IT professionals, they are left to their own interpretation of what is important regarding technical debt and what should and shouldn't be communicated to their managers and finance stakeholders. Therefore, it is safe to speculate that it would be a rare occurrence to discover a finance professional familiar with the term. One participant in our preliminary study explained that it requires,

> "really getting into the details and looking under the covers with some of these calculations. You can really sway a business person's perspective of what is their opinion, because that's what it comes down to sometimes, what is the opinion of this TCO number because it's subjective. You can input a lot of variables into a specific cost or you could keep them out and put them somewhere else."

What isn't uncommon, is finding a finance professional who struggles to understand why IT operations and maintenance budgets continue to climb when large capital investments in information technology are approved every year to not only improve capabilities, but in many cases reduce maintenance expense.

While a core group of academics and practitioners are gaining traction defining and socializing the technical debt phenomenon, it remains a nascent discipline without a defined theory. This hinders the ability for IT professionals to effectively communicate as the tools and methods for capturing technical debt items are only just beginning to gain broad adoption. A positive sign is the adoption of standards published in January 2018 by the Consortium for IT Software Quality (CISQ) [6].

6 INFORMATION ASYMMETRIES

Harris et al. found that decentralized organizations suffer from the effects of information asymmetry between not only subunits and headquarter functions—individuals with specialized information and expertise also possess information not shared with others [7]. Some of the information asymmetry is self-inflicted. Our preliminary findings included the following experience of a participant when he attempted to offer input to IT.

> "I continue to be amazed in my current role, where it's like, 'Well you're not in technology'. I understand I'm not in technology, but to totally dismiss all of my prior 13, 14 years of technology experience because I'm now in the business is so short-sighted and foolish."

While opportunities to share information relevant to IT investment decisions exist throughout a calendar year, the preceding sections highlight some of the reasons why information sharing does not regularly occur. It is within this context that information asymmetry plays a role in the quality of IT investment decisions.

7 FUTURE RESEARCH

Research is in progress to discover the types of technical debt that may enhance the overall conversation between IT and finance resources. We propose to add "total technical debt" as a piece of information that effects information asymmetry. This research will address one of the issues highlighted at Dagstuhl Seminar 16162 where Bill Curtis from CAST explained that industry has a broader definition of technical debt than software engineering [2]. One of our objectives is the development of artifacts that ameliorate the impact of technical debt on information asymmetry between IT and finance. The data is being gathered through interviews being conducted at several large complex firms building on the pilot study discussed here. The interviews are with finance, architecture and IT resources that participate in technology investment decisions. In addition to gathering data regarding the types and attributes of debt, an artifact is being created that will be tested in situ with the objective of reducing information asymmetry and improving IT investment decisions. Moreover, evidence may emerge that increasing the participation of architects in discussions with finance, as well as increasing the frequency of discussions, may lead to a reduction in asymmetric information between finance and IT. This recommendation is supported by the findings of the Dagstuhl Seminar 16162 where multiple versions of architectural models are suggested [2]. Bringing architects closer to the IT investment decision process may also prove beneficial in addressing the recommendations of adopting model-driven development techniques offered by Izurieta et al. as the benefits will need to be appreciated by finance teams accountable for ensuring investments in required tools and training mapped to strategy [8].

Along the lines of the research described above, multidisciplinary collaborative research efforts targeted at understanding the impacts of related disciplines on technical debt may prove fruitful. For example, organizational psychology studies examining the climates within finance and IT departments may lead to improvements in communication and reductions in information asymmetry. In addition, a collaboration between accounting and MIS academics may also prove beneficial as technical debt has many intangible costs that a collaborative effort may help define and quantify, including the role of budgetary slack in the IT decision-making process. Slack has been extensively researched within the accounting discipline and cross-disciplinary research may reveal technical debt as a source of asymmetry as being a leading factor in the accumulation of budgetary slack.

Another promising avenue is reflected in research exploring agency theory and the possibility that asymmetric information weighted in favor of IT resources may result in moral hazard as outlined by Arrow's seminal research on the behavior of physicians [9]. IT managers are incentivized to maximize forecasted effort to meet unplanned—and in many cases non-strategic—demands from business sponsors, in addition to addressing technical debt.

Finally, one area of focus for research that would benefit not only the capability to measure and manage technical debt, but also improve organizational forecasting, is data quality. For instance, time capture of resource effort is required for better estimation, with much of the published literature on technical debt recommending tools and methods. Time capture is notoriously poor in many firms. Some of the reasons include project work required to fix defects being captured as a recurring maintenance expense or granular information required for identifying specific types of issues being omitted altogether. Finally, testing by quality teams and business/customer resources may not be recognized, along with support work required to implement defects and enhancements. These are only a few of the typical issues plaguing time capture data.

REFERENCES

[1] Kenneth J. Arrow. 1985. Informational Structure of the Firm. The American Economic Review, Vol. 75, No. 2, Papers and Proceedings of the Ninety-Seventh Annual Meeting of the American Economic Association, May 1985, pp. 303-307.

[2] P. Avgeriou, P. Kruchten, I. Ozkaya, and C. Seaman. 2016. Managing Technical Debt in Software Engineering (Dagstuhl Seminar 16162). Paper presented at the Dagstuhl Reports.

[3] Ar. Ampatzoglou, Ap. Ampatzoglou, P. Avgeriou, and A. Chatzigeorgiou. 2015. The financial aspect of managing technical debt: A systematic literature review. Information and Software Technology, Vol. 64.

[4] Irving Seidman. 2013. Interviewing as qualitative research: A guide for researchers in education and the social sciences.

[5] Y. Guo and C. Seaman. 2011. Measuring and Monitoring Technical Debt. Chapter 2 in Advances in Computers, Vol. 82. DOI: 10.1016/b978-0-12-385512-1.00002-5.

[6] Consortium for IT Software Quality. 2018. Press release retrieved January 22, 2018 from http://it-cisq.org/cisq-produces-standard-for-measuring-technical-debt/.

[7] M. Harris, C.H. Kriebel, and A. Raviv. 1982. Asymmetric Information, Incentives and Intrafirm Resource Allocation. Management Science, Vol. 28, No. 6, June 1982.

[8] I. Griffith, C. Izurieta, and G. Rojas. 2015. Preemptive Management of Model Driven Technical Debt for Improving Software Quality. QoSA 2015, May 04-08, 2015. DOI:https://dx.doi.org/10.1145/2737182.2737193.

[9] Kenneth J. Arrow. 1963. Uncertainty and the Welfare Economics of Medical Care. The American Economic Review, Vol. LIII, December 1963.