Non-technical debt in games development research

John Johansson
Karlstad Business School, Karlstad University
Karlstad, Sweden *john.johansson@kau.se*

John Sören Pettersson
Karlstad Business School, Karlstad University
Karlstad, Sweden *john_soren.pettersson@kau.se*

Abstract

This paper examines how the emerging concept of non-technical debt (NTD), specifically Process, Social, and People Debt, can be utilised to understand and address recurring issues in game development. Drawing from Politowski et al.'s large-scale analysis of 200 game postmortems, we map the top ten industry challenges to NTD as described by Ahmed and Gustavsson. Politowski's analysis showed that many issues, such as unclear vision, misaligned teams, and stress, stem from human and organisational decisions rather than technical limitations. While technical debt is well known, the growing recognition of NTD remains underexplored in game development. We argue that applying an NTD lens during development, rather than after the fact in a post-mortem, can help teams avoid costly issues, particularly in creative and high-pressure environments such as game production.

Keywords: Non-technical debt, Game development, Software development, Game development Research

1. Introduction

The video game industry faces a wide array of challenges as described in Politowski et al.'s [8]. In their article, 200 post-mortems of game development projects show that many challenges depend on the involved humans rather than the technology. Politowski et al. [8] claim that over time, technical and game design problems in the game industry have decreased, while people-related issues, especially team-related and marketing problems, have increased. This indicates a shift from technical challenges toward more human and organisational ones. This is an interesting development, and it should be considered today when so much focus in game development is on AI, cloud, and mobile computing, all very technical aspects. Politowski et al. [8] list typical issues that include an insufficient workforce, stress, unclear vision, communication failures, and misaligned team roles.

Technical Debt was introduced in 1992 by Cunningham [3]. Ahmed and Gustavsson [1] have done a systematic mapping review of the emerging concepts of Non-Technical Debt (NTD). As Ahmed and Gustavsson [1] highlight, NTD can accumulate into technical debt over time, making it essential to address both non-technical and technical issues early through an NTD-informed perspective. Therefore, by increasing our understanding of how NTD arises, we can better understand and mitigate these problems. Although software engineering practices have addressed similar problems through the lens of NTD, this has rarely been systematically applied within game development.

Murphy-Hill et al. [6] claim that game development differs from traditional software engineering primarily due to its emphasis on creativity, the subjective nature of "fun," high uncertainty and different roles in the development process, i.e., as artists, level designers, developers, and sound artists. The effect of diverse skills and complementary roles in game development teams is interesting since complementary skills may lead to both increased creativity but also a higher risk of conflict [5]. Perhaps an increased understanding of how NTD emerges could help teams find creative solutions, secure funding, and avoid unnecessary conflicts.

This paper aims to demonstrate how NTD, comprising Process Debt, Social Debt, and People Debt [1], can effectively categorise, analyse, and mitigate prevalent problems in game development, bridging gaps between theoretical understanding and practical solutions.

This paper argues that a similar focus is needed in games development research regarding NTD. We believe that this emerging concept could help game development teams in their pursuit. Finally, this paper shows the need for further research along these lines of NTD within the systems development research, as ISD has definitive contributions to make to the game's development community if the research so far made can be framed and demonstrated relevant within games development.

2. Theoretical background of the NTD concept

NTD is defined by Ahmed and Gustavsson [1] as the long-term negative consequences arising from short-term decision-making concerning processes, social interactions and people. The time aspect is interesting. Games that have been developed over a longer period, have several parallel teams, and or are maintained over time, run a greater risk of being affected by NTD and technical debt [1].

Ahmed and Gustavsson [1] describe the categories Process Debt, Social Debt and People Debt.

2.1. Process Debt

Process debt refers to inefficient or outdated processes that may offer short-term advantages but cause problems over time. It occurs when processes no longer fit their purpose or are poorly designed, leading to long-term inefficiencies. Examples include meetings that prioritise reporting over collaboration. Process debt can arise from mismatched roles, poor documentation, lack of synchronisation, unsuitable activities, or infrastructure issues. It involves both those who design processes and those who carry them out, with common causes including suboptimal design, divergence from intended use, and tool or infrastructure problems.

Berg Marklund et al. [6] describe that a tension can exist between designers, management, and programmers, as creative ambitions often clash with technical constraints and a perceived underappreciation of the complexity and centrality of programming work. This tension can lead to decisions that build up to an NTD like Complex game design or Lack of fun.

2.2. Social Debt

Social debt in software development refers to problems that build up over time due to decisions about people and their interactions. Like technical debt, it results from compromises, omissions, or poor behaviour that are hard to fix later. It often emerges during scaling or offshoring and affects communication, collaboration, and coordination within teams. Causes include lack of trust, gender bias, poor communication, and weak leadership. Social Debt can lower psychological safety, reduce knowledge sharing, and make teamwork harder, ultimately harming productivity and innovation.

Politowski et al. [8] emphasise environmental problems, to which they count stress and bad atmosphere, as one of the top ten problems in game development. This is clearly an example of Social Debt.

2.3. People Debt

People's debt refers to issues related to people that can delay or hinder development activities in a software organisation. It often stems from a lack of knowledge, experience, or commitment, such as insufficient training, hiring irresponsible staff, or resistance to change. Other factors include management neglecting team needs, such as failing to offer growth opportunities or ignoring diversity and gender equality issues. Low morale also plays a role, as it affects motivation, productivity, and software quality. Overall, People Debt has a direct negative impact on satisfaction and performance in software development.

Politowski et al. [8] list insufficient workforce as another of the top ten problems in

game development, and this is an example of People Debt.

3. Connecting problems in game development to relevant NTD categories

Politowski et al. [8] list their top ten problems from the post-mortems. Here we use the lens of NTD and connect them to the top ten problems. Using the lens of NTD can help us try to find the problems early, mitigate the problems during the development process, and not at the post-mortem.

Table 1 below lists the top ten problems from [8] in decreasing number of occurrences among the 200 post-mortems they investigated. The first two occurred 49 and 48 times, respectively, while the last two were each found in 22 post-mortems. It should be noted that [8] relies on a blend of categorisations from Petrillo et al. [7] and Washburn et al. [10], while we instead emphasise the NTD framework to highlight management aspects of the problems. That is why "process" and "social" come into the fore, while "people" as a recruitment factor naturally also points to project management.

Table 1. Matching game industry problems with NTD categories.

#	**Game Industry Top 10 Problems [8]**	**Description of NTD**	**Matching NTD [1]**
1	Insufficient workforce	Reflects poor planning of team size, skills, and responsibilities. Leads to burnout and communication breakdown.	People Debt
2	Environmental problems (stress, bad atmosphere)	Caused by toxic culture, lack of psychological safety, or mismatched values. Hard to fix once embedded.	Social Debt
3	Wrong marketing strategy	Indicates a flawed or outdated marketing process that doesn't align with audience needs or release timing.	Process Debt
4	Underestimation	Happens when estimation processes lack realism, risk assessment, or iterative learning.	Process Debt
5	Unclear game design vision	Poor coordination and vague roles/responsibilities lead to shifting goals and confusion.	Process Debt
6	Lack of fun	Playtesting and iteration processes may be missing or undervalued, ignoring user experience.	Process Debt
7	Platform and technology constraints	Often rooted in inadequate technology evaluation or rigid development pipelines.	Process Debt
8	Game design complexity	Shows a mismatch between ambition and capacity, often due to unrealistic feature planning.	Process Debt
9	Inadequate or missing tools	Toolchain issues suggest failure in the process of selecting, updating, or adapting tools.	Process Debt
10	Misaligned teams	Cross-team miscommunication and cultural friction cause delays and misunderstandings.	Social Debt

The rationale of each NTD classification in Table 1 is indicated in the third column. Note that the causes for the reported problems are used for the argument, while effects are mentioned to clarify the direct mapping to the typology by Politowski et al. [8]. The connection was made by analysing the description of the problem and the description of the subcategories of NTD, to find the best match.

Educating project managers and game producers about NTDs and how they occur can support early problem identification, facilitate mitigation during development, and reduce reliance on postmortem analysis to uncover issues. For instance, Ahmed and Gustavsson [1] identify prevention strategies for Process Debts, Social Debt, and People Debt (see their Tables 11-13). It remains, though, to research how well such strategies fits games development and how they should be adapted to various phases within game development projects.

4. Concluding remarks on strategies and future research

Politowski et al. [8] note a shift toward more stable technology and increasingly human-centred challenges in game development. Of their top ten recurring problems, only three are directly or indirectly technical; the rest concern the human factor. Berg Marklund et al. [2] similarly emphasise that game development resists standardisation and remains difficult to plan. By applying the lens of Non-Technical Debt (NTD) [1], [3], we can better understand how such issues arise and persist over time. This perspective supports early identification and mitigation of problems during development—rather than relying on generalised wisdom from old postmortems—and would be of high relevance especially in creative and high-pressure environments like games development, where multiple disciplines are expected to work together towards an unclear goal.

In our future research, we will pursue three key directions. First, we aim to empirically validate the NTD perspective across diverse game development contexts to assess its relevance and applicability. Second, we will explore methodologies and techniques—such as Retrospectives [4] [9] made during the game development process—that are specifically adapted to the unique creative dynamics of game projects, to better mitigate the effects of NTD. Third, as argued above, we will investigate the temporal dimension of NTD, with a focus on how such issues emerge and evolve in game development environments.

By embracing NTD concepts and practices, game studios can better manage human-related problems, enhancing both organisational health and creative output quality. For example, early-warning systems based on Process debt would enable game systems developers to adjust in time before a game development goes awry.

5. Acknowledgements

This publication was made possible by the Faculty of Arts and Social Sciences, Karlstad University, Sweden.

References

1. Ahmad, M. O., Gustavsson, T.: The Pandora's box of social, process, and people debts in software engineering. Journal of Software: Evolution and Process, 36(2), e2516 (2024)
2. Berg Marklund, B., Engström, H., Hellkvist, M., Backlund, P.: What empirically based research tells us about game development. The Computer Games Journal, 8, 179-198 (2019)
3. Cunningham, W.: The WyCash portfolio management system. ACM Sigplan Oops Messenger, 4(2), 29-30 (1992)
4. Dantas, C., Massoni, T., Sarmento, C., Rocha, R., Gualberto, D.: The Role of the Retrospective Meetings in Detecting, Refactoring and Monitoring Community Smells. arXiv preprint arXiv:2502.18662 (2025)
5. Horwitz, S. K., Horwitz, I. B.: The effects of team diversity on team outcomes: A meta analytic review of team demography. Journal of management, 33(6), 987-1015 (2007)
6. Murphy-Hill, E., Zimmermann, T., Nagappan, N.: Cowboys, ankle sprains, and keepers of quality: How is video game development different from software development?. Proceedings of the 36th International Conference on Software Engineering – ICSE 2014, pp. 1-11. ACM Press. https://doi.org/10.1145/2568225.2568226. (2014)
7. Petrillo, F., Pimenta, M., Trindade, F., Dietrich, C.: What went wrong? A survey of problems in game development. Computers in Entertain. 7(1), Article No. 13, 1-22. http://dx.doi.org/10.1145/1486508.1486521 (2009)
8. Politowski, C., Petrillo, F., Ullmann, G. C., Guéhéneuc, Y. G.: Game industry problems: An extensive analysis of the gray literature. Information and Software Technology, 134, 106538 (2021)
9. Tannenbaum, S. I., Cerasoli, C. P.: Do team and individual debriefs enhance performance? A meta-analysis. Human factors, 55(1), 231-245 (2013)
10. Washburn, M., Sathiyanarayanan, P., Nagappan, M., Zimmermann, T., Bird, C.: What went right and what went wrong: An analysis of 155 postmortems from game development. Proceedings of the 38th International Conference on Software Engineering Companion – ICSE ’16, pp. 280-289. ACM Press. http://dx.doi.org/10.1145/2889160.2889253. (2016)