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# Nudging Agile Innovation: Improving Agile Collaboration Progress Tracking in Product Development Utilizing Nudging

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**Abstract**

This research effort investigates the effectiveness of nudging techniques when applied to progress measurement challenges in agile product development and design environments. While nudging has demonstrated significant success in various domains, its application within the specific context of agile progress tracking remains unexplored. The authors developed and deployed a multi-phase methodology beginning with a comprehensive survey to identify critical challenges and problem areas in agile progress measurement. Based on these findings, targeted improvement approaches and specific nudging strategies for application in product design were developed. The validation process took place within an agile team, where the customized nudge workshop methodology was applied to determine team-specific goals and boundary conditions. A key aspect of this methodology is its transparent and participatory co-design process, in which teams collaboratively develop interventions while remaining aware of the nudging mechanisms involved. This approach enhances ethical soundness and fosters stronger commitment to the resulting interventions. This participatory approach resulted in three tailored nudging interventions, which were subsequently implemented and evaluated through application testing. Results demonstrate that behavioral nudging techniques have a measurable positive influence on progress measurement practices in agile product development and design. Particularly notable improvements were observed in sprint execution efficiency and team goal orientation. The findings confirm that principles of behavioral economics, when appropriately adapted to the agile context, can effectively address persistent challenges in progress measurement. This research contributes to both theoretical understanding of behavioral interventions in agile product design environments and provides practical implementation guidance for product development teams seeking to enhance their progress measurement capabilities without implementing disruptive procedural changes or complex technical solutions.



*Keywords:* Nudging; Agile; Collaboration; Innovation; Product Development; Progress Tracking; Decision Making

## 1. Introduction

### *1.1. Behavioral Economics and Nudging*

Nudging refers to subtle behavioral measures that guide individual or group actions in predictable ways without restricting freedom of choice [1]. Rooted in behavioral economics, these techniques are increasingly applied across domains such as politics, finance, health, and consumer protection [2–4]. A central concept is *choice architecture*, which denotes the design of the context in which decisions are made. The *choice architect* shapes the environment, and as Thaler and Sunstein argue, truly neutral choice architecture does not exist, with everyday examples including a physician presenting treatment options or a parent outlining educational opportunities for a child [5].

The theoretical foundation of nudging is closely linked to the dual-process theory, which distinguishes between two modes of thinking: System 1, characterised by fast, intuitive, and automatic processes, and System 2, defined by slow, deliberate, and analytical reasoning [6]. Evidence suggests that nudges are most effective when System 1 predominates,

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whereas conscious, analytical thinking in System 2 reduces their influence [7].

In (neo-)classical economics, the model of *homo economicus* assumes fully informed, rational individuals concerned solely with maximising utility [8]. Insights from psychology and behavioral economics, however, demonstrate systematic deviations from this ideal, showing that people frequently commit cognitive errors and depart from rational decision-making [9].

Within this framework, *digital nudging* represents a specific form of behavioral influence. Weinmann et al. [10] define digital nudging as the use of design elements in digital user interfaces that guide user behavior in digital decision-making environments. As increasing numbers of decisions are made through websites, online shops, and mobile applications, digital nudging is gaining importance [11]. The present study focuses on this context, examining nudging in online video conferences of virtual teams. Compared to physical nudges, digital approaches offer several advantages: they can be implemented more quickly and cost-effectively, adapted to individual users through tracking data, and refined via A/B testing to identify the most effective option [12, 13]. Current findings further indicate that nudging is most effective in low-stakes decisions, where individuals devote less cognitive effort. In contrast, for high-stakes choices, people engage more consciously in the decision-making process, reducing susceptibility to nudges, but increasing reliance on biases and heuristics in everyday, less important decisions [14, 15].

Another important research question concerns the role of transparency. Several studies investigate whether the effectiveness of nudges decreases when target groups are informed about them in advance. Evidence suggests that transparent nudges are generally not perceived as threats to autonomy and often remain effective [16, 17].Nevertheless, general findings cannot be applied indiscriminately to specific decision-making contexts. The effectiveness of nudges varies depending on individual characteristics and situational factors [18]. Choice architects must therefore understand their target groups and contextual conditions to tailor nudges accordingly [19]. Acceptance rises when a nudge aligns with personal goals and values, making transparency – alongside preserving choice – a key factor in effective interventions [20].

The aim of this research effort is to examine nudging approaches that are both transparent and reflective, thereby addressing concerns about manipulation from the outset. To support this, clear success criteria for evaluating the effectiveness of nudges are defined.

### *1.2. Progress measurement and nudging in agile product development*

In 2001, 17 software developers published the *Agile Manifesto* [21], which laid the foundation for subsequent research on agility and marked a turning point in software development. The manifesto shifted priorities towards collaboration, functional products, customer focus, and flexibility, thereby replacing rigid, plan-based processes and extensive documentation.

Continuous monitoring and measurement of progress is a central principle of agile methodologies. Progress measurement – defined as the collection of quantitative or qualitative metrics to evaluate processes or results – plays a key role in frameworks such as Scrum [22]. The use of progress metrics enhances decision-making, promotes accountability, increases transparency and supports the elimination of inefficiencies [23, 24].

Qualitative metrics include measures such as team or customer satisfaction, which are particularly relevant in agile contexts [25, 26]. Quantitative metrics commonly used in Scrum include velocity, cycle/lead time, and burndown or burnup charts [27]. Progress can also be assessed through the achievement of sprint goals or the share of uncompleted tasks. Continuous monitoring enables teams to detect weaknesses or bottlenecks at an early stage, initiate improvements, and make evidence-based decisions [28].

In product development, initial studies show that nudging can improve decision-making accuracy and reduce biases such as overconfidence in task estimation. Given the uncertainty and complexity of this context – where heuristics like representativeness or relative evaluation frequently arise – targeted nudging interventions become particularly relevant [29]. These interventions can support more realistic judgments by product developers and thereby increase project success. Research further shows that integrating behavioral-economic insights into product development improves decision quality and strengthens innovation processes [30].

These findings are consistent with behavioral economics and underline the potential of nudging within product development. Empirical studies demonstrate that nudges can directly and indirectly influence multiple phases of project management, contributing to optimizations in time, cost, and quality [31]. Nudging further offers advantages of cost efficiency and scalability while preserving employee autonomy, which has contributed to its growing use in corporate contexts [32]. These examples illustrate the versatility of nudging as a management approach. Recent findings also suggest that nudging has positive effects on agile processes and innovation [33]. Accordingly, nudging can improve both team dynamics and outcomes in agile as well as broader business contexts.

## 2. Research Gap & Methodology

Nudging has become established across numerous disciplines, with scientific interest steadily increasing as reflected in the growing number of publications since its initial conceptualisation [34]. Early studies in product development indicate that nudging can improve decision-making accuracy and mitigate cognitive biases such as overconfidence in task evaluation [35, 36]. Further research has examined which behavioral-economic factors influence decision quality in this context [37].

However, the specific effects of nudging on progress measurement in agile product development remain largely unexplored. Agile environments are characterised by decision-making under uncertainty and complexity, conditions that

foster reliance on heuristics and biases such as representativeness and relative evaluation [38]. Despite its importance, progress measurement is often neglected in practice, leading to missed opportunities for continuous improvement and reduced productivity [39, 40].

Nudging offers a potential remedy: targeted, minimally invasive prompts can increase awareness of the value of progress measurement and promote its consistent application. Against this background, the aim of this research effort is to design, implement, and validate nudging approaches that enhance progress measurement in agile product development. In doing so, it seeks to address an existing research gap and contribute to the practical optimization of agile processes by enabling the early identification of obstacles and the timely initiation of improvements.

### *2.1. Research Questions*

To address the outlined challenges, this study investigates the following research questions, which aim to bridge the identified gap and guide the subsequent analysis:

1. What are the key challenges in measuring progress in agile product development teams, and which approaches to improvement exist?

2. How can nudges be applied to enhance progress measurement in agile product development while meeting defined success criteria?

3. To what extent does the use of nudges improve progress measurement, and in which areas are the strongest effects observed?

### *2.2. Research Design*

This study applied the *Design Research Methodology* (DRM) developed by Blessing and Chakrabarti [41], which provides a structured conceptual framework for implementation and orientation. DRM ensures systematic progression through four phases: Research Clarification, Descriptive Study 1, Prescriptive Study, and Descriptive Study 2.

The first phase focused on a systematic literature review to refine the research focus and gather initial evidence for existing assumptions and hypotheses. Concentrating on nudging and agile product development, the review employed a keyword matrix that progressed from broad to increasingly specific terms.

The second phase addressed the first research question through an online survey, marking the start of empirical data collection. Its objectives were to identify challenges in measuring agile progress and to explore starting points for optimization through nudging. To ensure context-specific insights, the survey targeted practitioners with agile and product development experience. Additionally, an online workshop with the agile team later used for validation was conducted to identify team-specific challenges and contextual factors for deriving suitable nudging interventions.

The third phase addressed the second research question by developing a solution concept. Nudging approaches for improving progress measurement were designed by synthesizing empirical findings with practical requirements, drawing on survey results and workshop insights to create measures that were theoretically sound, feasible, and tailored to the target audience.

The final phase evaluated the developed solutions in relation to the third research question. Validation was conducted with an agile team from the Hamburg Institute for Smart Engineering and Machine Elements (ISEM), which operates in research, design, teaching, and product development. Following a two-step process, digital team meetings were recorded over three weeks to establish a baseline, after which the nudging approaches were implemented and meetings recorded for another three weeks. Quantitative transcript analysis then assessed the effectiveness of the interventions, providing a comprehensive picture of their impact and contribution to the intended objectives.

## 3. Findings

The findings follow the structure of the three research questions, with each question answered in its own section.

### *3.1. Critical challenges and problem areas in agile progress measurement*

A comprehensive online survey was conducted to collect data for this research project. The survey revealed several key challenges, including insufficient prioritization of progress measurement, ambiguity in the definition of metrics, low motivation to conduct measurement activities, and limited transparency regarding project progress.

Based on participant responses, three approaches emerged as especially effective for addressing these challenges. Positive feedback systems were highlighted as a means to reinforce goal achievement, providing targeted recognition when a team or individual completes a defined task. Such reinforcement could take the form of public acknowledgment during meetings, points-based reward systems, or automated notifications within project management tools signaling milestone completion. Progress visualization was identified as another promising approach, making goal attainment transparent through visual elements such as colour-coded progress bars. Each completed task extends the bar and gradually changes its colour, for example from red to yellow to green, thereby providing an intuitive representation of progress. Finally, regular reminders were considered valuable for maintaining awareness of project status. These reminders can be delivered via email, calendar entries, or project management tools, and can be combined with visualization to reinforce attention to progress.

Collectively, these optimization approaches provide practical mechanisms for improving progress measurement in

agile teams, enhancing both transparency and motivation while supporting goal-oriented behavior.

### 3.2. Nudging approaches for optimising agile progress measurement

Based on the survey findings, three nudging approaches were developed and refined in collaboration with the agile team that later served as the validation environment. To tailor the interventions as closely as possible to the team's needs, a dedicated workshop was conducted to identify the team's framework conditions, clarify goals, and align the nudges accordingly. During this workshop, participants emphasized two key priorities: a stronger focus on sprint goals and a clearer structure for the Daily Scrum to improve both task coordination and goal tracking.

Drawing on these insights, three nudges were designed to address both general challenges in agile progress measurement and specific issues faced by the team. The first, the *Daily Guide*, is a default nudge that automatically posts a structuring message in the meeting chat at the start of each Daily Scrum. The message covers three categories: progress toward the sprint goal, mutual support, and open issues. These recurring prompts provide a clear meeting structure and anchor discussions around sprint goals, directly addressing two optimization approaches identified in the survey: goal orientation and transparency. The expected outcomes include higher completion rates of tasks and sprint goals, earlier detection of obstacles, and strengthened team support dynamics.

The second nudge, the *Visual Kick-off*, functions as a reminder. At the beginning of each Daily Scrum, an image is displayed to prompt participants to open the task board. The visual can appear as a background or in the meeting chat, and in this study, humorous, meme-like formats were chosen to enhance engagement. This nudge reinforces progress awareness by serving as a daily reminder and promoting visualization of progress at both individual and team levels. By keeping the sprint goal visible, it supports a key objective defined in the workshop. Anticipated effects include a higher number of tasks discussed per meeting and more consistent attention to sprint goals.

The third nudge, the *Challenge Column*, acts as an anchor. A new column is added to the task board containing a series of tasks whose titles collectively form a challenge, such as "X sprint goals open, X open tasks in backlog, X tasks in progress. At the end of the sprint, this column should be longer than the one for open tasks." Introduced at the end of the sprint in this study, but adaptable for ongoing use, this playful anchor motivates the team to complete outstanding tasks and achieve sprint goals. It operationalizes the third optimization approach identified in the survey by enabling visual progress tracking. The expected effect is a reduction in unfinished tasks and a stronger sense of achievement upon successful completion.

### 3.3. Validation results on the effectiveness of nudges

The formulation of success criteria served a dual purpose in this study: first, to evaluate the results at the conclusion of the research process, and second, to guide targeted development throughout the project. The criteria for evaluating the nudges were derived from relevant literature and grouped into two main dimensions: applicability and effectiveness. Applicability required, for example, that nudges be intuitively understandable, easily integrated into existing structures, and ethically compliant. Effectiveness, in turn, emphasized that nudges should reliably produce the intended behavioral changes, be grounded in solid evidence, and avoid unintended negative effects.

To evaluate the developed nudges, effectiveness was assessed through systematic analysis of task board changes, meeting transcripts, and coded behaviors. Table 1 shows the areas of impact that can be verified based on the collected data, as well as the corresponding operationalized indicators for measuring effectiveness.

Table 1. Areas of impact and operationalized indicators.

| Areas of impact | Operationalized indicators |
|---|---|
| Degree of goal achievement | Proportion of completed sprint goals/tasks |
| Goal orientation | Frequency of sprint goal mentions |
| Collaborative behavior | Number of mutual offers or requests for support |
| Communication intensity | Number of substantive topics discussed |
| Degree of participation | Number of topics raised per individual |

The degree of goal achievement was measured by the proportion of sprint goals completed and the number of open tasks remaining at the end of each sprint. Overall, goal achievement increased significantly across all nudges. To analyze this effect, the development of the proportion of completed sprint goals was considered first. Since Nudge 2 ("Visual Kick-off") and Nudge 3 ("Challenge Column") were implemented simultaneously, their presentation and analysis are combined. The results indicate that all applied nudges significantly improved sprint goal achievement. Nudge 1 increased success rates from 15% to nearly 70%, while Nudges 2 and 3 raised them from 15% to almost 50%.

Goal orientation was measured by the frequency of sprint goal mentions during meetings. Without nudges, sprint goals were mentioned on 36% of meeting days, averaging 0.36 mentions per session. With the introduction of nudges, the frequency increased substantially: Nudge 1 ("Daily Guide") averaged 2.14 mentions per meeting, while Nudges 2 and 3 averaged 2.2 mentions, representing more than a sixfold increase. Moreover, the content of discussions shifted, with fulfilment of the sprint goal accounting for 73% of mentions under nudging, compared to a more evenly distributed focus without nudges on organisational matters or clarifications before, indicating a sharper focus on progress.

Collaborative behavior was measured by the number of mutual offers or requests for support per meeting. This figure increased from just under 2.5 to more than 3.5 instances per

meeting, indicating that the introduction of nudges led to a clear, though more moderate, rise in supportive exchanges among team members.

Communication intensity, measured as the number of substantive topics discussed per meeting while excluding greetings or private exchanges, increased across all nudges, though the effect was slight for Nudge 1 and more pronounced for Nudges 2 and 3. Due to variability and reliability considerations, no significant effect could be confirmed in this area.

The degree of participation was assessed by the share of team members contributing at least one topic per meeting and by the number of topics raised per individual. Overall, nudges boosted active participation, with Nudge 1 showing the strongest effect – raising participation from 50% to nearly 80% of team members per daily meeting. Although individual variation persisted, Nudge 1 substantially increased contributions for almost all participants, as reflected in the number of topics addressed per person per daily meeting in Figure 1, whereas Nudges 2 and 3 showed no consistent effects at the individual level.

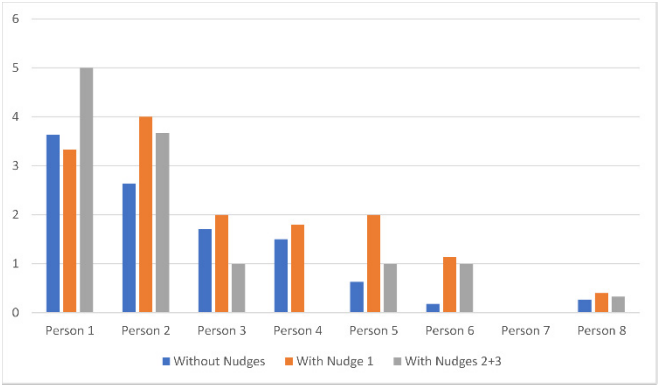


Fig. 1. Number of topics addressed per person per daily meeting.

## 4. Conclusion

The aim of this research effort was to identify, implement, and validate nudging approaches that improve progress measurement in agile product development. To achieve this, a systematic multi-step research design was employed.

The first research question, which focused on the key challenges of progress measurement, was examined through a survey. The findings highlighted several critical issues, emphasizing the need for progress measurement practices that are resource-efficient, adaptable to diverse project contexts, and grounded in clearly defined key performance indicators that accurately reflect actual project progress. Moreover, the survey highlighted three promising directions for optimization: positive feedback systems, visualization of progress and performance, and regular reminders.

Building on these insights, three nudging approaches were developed to address the second research question. Their validation and subsequent evaluation provided answers to the third research question. The results demonstrated that nudges had a particularly strong impact on goal achievement and goal orientation, while more moderate but still positive effects were observed for collaborative behavior and participation. This suggests that nudging can foster not only individual goal attainment but also teamwork and engagement.

In practice, the developed nudging approaches proved effective across multiple levels of agile progress measurement. The evidence suggests that nudging can help teams work more goal-oriented, identify obstacles earlier, and respond more effectively. Over the long term, this may contribute to higher productivity and stronger motivation within agile teams.

Overall, this research effort demonstrates that nudging can effectively improve progress measurement and team dynamics in the context of agile product development. By focusing on a single agile team and a three-week validation period, the study enabled an in-depth, context-rich exploration of the use of nudging in progress measurement. The descriptive evaluation aligns with this exploratory objective, providing clear, practical insights while opening avenues for future large-scale and long-term research. Furthermore, the study emphasizes the value of a transparent, participatory co-design process in which the team consciously helps shape the nudges. This strengthens ethical accountability, improves acceptance, and offers a replicable basis for ethically aligned behavioral interventions in agile settings.

## 5. Outlook

This research effort demonstrates that nudging approaches in agile product development provide a promising means to enhance progress measurement, thereby improving team efficiency and motivation. The study contributes both to the theoretical understanding of behavioral interventions in agile product design and to practical guidance for product development teams seeking to optimise progress measurement without introducing disruptive process changes or complex technical solutions.

The validation conducted represents an initial successful step, yet several avenues remain for future research to enhance the effectiveness and generalisability of the developed nudging approaches. Refinement of nudging methods, for example, could involve optimising the digital nudging workshop used in this study through the integration of new digital tools, additional interactive elements, and extended participatory formats. Extending the investigation to other agile frameworks would further increase the generalisability of the results, as this study focused on specific teams within a single framework. Similarly, contextual validation across teams of varying size, experience, and project challenges is necessary to ensure that the approaches are broadly applicable.

An important aspect for future research is the exploration of long-term effects. The current study evaluated nudging over a three-week period, providing only short-term insights. Investigating the sustainability of behavioral changes, long-term team performance, and potential impacts on product quality is crucial to understanding the enduring value of these interventions. With increasing digitalisation and the growing integration of artificial intelligence in product development, new opportunities are emerging to deliver nudges in real time based on project data. Automated systems could provide targeted reminders, feedback, or goal adjustments, which

would be particularly valuable for larger teams or more complex project structures.

In summary, this study highlights the potential of nudging as an effective tool for improving progress measurement and supporting positive team dynamics in agile product development. By further validating these approaches in diverse contexts, examining their long-term effects, and integrating them with emerging digital technologies, the full potential of nudging to enhance team performance, goal orientation, and productivity can be realised.

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