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It is No Blame Game! Challenges and Best Practices in Communicating Metrics in Software Development Organizations

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Completed Research Paper

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Abstract

In the realm of software development, the significance of product and process metrics cannot be overstated. These metrics serve as pivotal tools, guiding the evaluation and enhancement of software quality and efficiency. However, despite their undeniable importance, establishing and executing measurement programs often proves to be an intricate endeavor, which often stems from the intricate interplay of human factors that pervade the software development landscape. In this paper, drawing upon data derived from in-depth interviews and interactive workshops involving developers, stakeholders, and managers from four software development organizations, we identify challenges and best practices in communication around metrics. Based on our findings, we provide communication guidelines, which can steer practitioners and stakeholders toward more adept and proficient practices in the communication of metrics.

Keywords: communication, software metrics, communication challenges, best practices.

Introduction

Communication plays a key role in any organization, being the core process of organizing, a mechanism for developing and maintaining relationships, and for getting the work done (Weick, 1979). Within the contemporary landscape of dynamic software development organizations, communication skills are indispensable for fostering successful collaboration in agile development teams (Beck K et al., 2001; Kajko-Mattsson et al., 2010), often spanning across geographical boundaries (Holmstrom et al., 2006), ensuring a swift and top-tier software development process (Purna Sudhakar et al., 2011). Both the teams and management rely on metrics to gauge performance, strategize upcoming tasks, pinpoint and address issues, and instill behaviors that streamline software, product, and service development while mitigating associated risks (Staron & Meding, 2018), and to encourage productive and efficient behaviors for decreasing risks in software, product, and service development (Khraiwesh, 2020). In today's increasingly data-driven, demanding, and competitive world, organizations lean increasingly on metrics to meticulously monitor and assess their performance, aiming at continuous improvement of the quality of their products and production process.

However, the potency of metrics comes with a caveat. While they have the potential to steer and guide companies towards success, tracking inappropriate metrics or mishandling their interpretation and communication can yield counterproductive effects, dampening productivity and disrupting the work

environment (Staron & Meding, 2018). What do we measure, how do we measure, and how to communicate around metrics to employees are important questions to answer for every manager to create value with metrics.

Despite the plethora of studies concentrating on the technical facets of metrics, such as their development (Mitre-Hernández et al., 2014), reliability in measurements, and use (Meding et al., 2021), the human aspects related to metrics, particularly the communication surrounding software measurements and the social dynamics entailed in their implementation, often don't receive the warranted attention in empirical research (Matook & Maruping, 2014).

Understanding that effective communication is a potent force for inspiring and motivating people (Staron & Meding, 2018), acknowledging and developing skills to navigate potential challenges linked with metrics communication is imperative for the successful utilization of metrics in any organization. While the identification of communication challenges stands as the initial stride toward enhancement, the subsequent pivotal step is the formulation of successful strategies to alleviate these impediments.

With this aim in mind, this paper embarks on a two-fold endeavor: (1) based on the analysis of empirical data delineating the challenges entrenched in metrics communication and presenting practices to mitigate them; and (2), providing guidelines to enhance the communication of software metrics. Through this comprehensive approach, we strive to empower managers and stakeholders with actionable insights to harness the true potential of metrics, fostering a culture of informed decision-making and continual improvement within the software development context.

Methods

This study is based on 13 interactive workshops (26 hours in total) and 48 semi-structured interviews (45 hours in total), with developers, stakeholders, and managers from four software development organizations, two in Sweden and two in Germany. The study was conducted in 2019-2022 both on-site and online via Zoom/ MS Teams due to Covid-19 restrictions. The primary focus was on extracting diverse experiences and perspectives regarding metrics communication. The participants were asked about their organization's knowledge landscape concerning metrics, the dynamics of communication around metrics, challenges encountered, and the best practices in navigating these challenges.

All organizations adhered to agile and lean principles of software development. Both Swedish organizations have established metrics teams that include 10-15 developers, who deliver measurements (set of operations having the object of determining a value of a measure), both process-wise (eliciting metrics, developing measurement systems, deploying information products) and competence-wise, assessing the quality of metrics and indicators, optimizing the number of metrics collected (Staron & Meding, 2018). Metrics teams are defined through their roles in ISO/IEC 15939 (ISO/IEC, 2007) such as measurement designer, measurement analyst, or measurement librarian. The German organizations were just initiating the process of establishing metrics teams, and we interviewed the developers who worked with metrics and were planning to be a part of metrics teams. The stakeholders' backgrounds include release content manager, transformation leader, product development leader, packet core representative, DevOps consultant, test leader, release leader, and content owner. The managers include both top management and line managers, scrum masters. See Table 1 below for a comprehensive overview of data distribution.

Company A **Sweden** **> 100 000 employees**	**Company B** **Sweden** **> 4 000 employees**	**Company C** **Germany** **> 25000 employees**	**Company D** **Germany** **> 400 000 employees**
7 metrics team members	11 metrics team members	2 developers	2 developers
7 stakeholders	4 stakeholders	NA[1]	NA
3 managers	4 managers	4 managers	3 managers
17 semi-structured interviews 3 interactive workshops	19 semi-structured interviews 4 interactive workshops	9 semi-structured interviews 1 interactive workshop	3 semi-structured interviews 5 interactive workshops

Table 1. Data overview

Descriptive field notes and transcribed audio recordings of interviews and workshops were pooled and discussed between the researchers to ensure a robust analysis of the empirical material. A qualitative inductive approach was chosen to identify patterns in data in an unprejudiced way. The notes and transcripts were analyzed using thematic content analysis (Braun & Clarke, 2006). The process of familiarization unfolded in several stages: Initially, the author and another researcher involved in the project individually reviewed the workshop and interview transcripts multiple times to form their initial impressions. Subsequently, the team convened to deliberate on these initial impressions and proceeded to independently apply codes to the data. Afterward, the codes were collectively discussed to ensure consistency, refined for precision, and categorized appropriately. Next, these codes were merged in themes, which were subsequently collated into broader overarching themes. The outcomes of this process, including representative quotes, are presented in detail in the Results section below. Furthermore, these themes are further explored and expanded upon in the subsequent Discussion section.

Results

Challenges in metrics communication

We identified the following challenges in relation to communication around metrics which will be presented in details below:

1. Inaccurate or lacking consistency in the terminology related to metrics;
2. Insufficient communication regarding the purpose and utilization of metrics;
3. Delivering negative feedback in relation to measurement results;
4. Unclarity about metrics teams' primary stakeholders and their expectations; and
5. Uncoordinated use of multiple channels in metrics communication.

Challenge 1: Inaccurate or lacking consistency in the terminology related to metrics

The first challenge mentioned by all respondents across companies was inaccurate terminology or lack of its consistency around metrics. A metrics team member comments:

> *One thing is that we have immense challenges with is that different teams seem to name stuff differently. In some cases, there is not even a name for stuff in which case we have to put a name on it! It takes time and makes it difficult to understand each other (Metrics team member).*

All respondents overwhelmingly agreed that the terminological challenges had significant consequences on communication regarding metrics. The interviews vividly highlighted how the lack of consistent

[1] As metrics teams were formally not established, stakeholders were not relevant for Company B and C.

terminology leads to misunderstandings, particularly in interactions between developers in metrics teams—who possess profound knowledge of metrics—and managers and stakeholders with limited insights into metrics. While the developers anticipated clear requests, their stakeholders and managers often encountered difficulties in formulating them. Consequently, the members of the metrics team had to invest additional time and effort in seeking explanations and specifications to fully comprehend the required metrics. The impact of terminological challenges becomes notably frustrating when handling requests through the JIRA ticketing system. Given the brevity of JIRA requests, the absence of shared terminology further complicates the formulation of requests for managers and stakeholders.

Challenge 2: Insufficient communication regarding the purpose and utilization of metrics

Although all respondents possessed a superficial understanding of the purpose and utilization of metrics within their respective organizations—citing metrics to support "management decision making," "developing high-quality software," "driving product development in a favorable direction," and “giving indications if we are on the right track”—they also highlighted that metrics often go unexamined, and discussions concerning their purpose and contributions to product development are largely absent. From the interviews, it becomes evident that fostering awareness and transparency regarding metrics, which involves clarifying what aspects are measured, how calculations are made, why and their impact on the final product is pivotal. According to our respondents, only in this case metrics can provide a valuable guidance for developers and enhance performance. A manager emphasized that such comprehensive understanding is also essential for contributing significantly to product development:

> *But the most important success story comes out of a common understanding of why are we having these metrics? How do we know that they help us in our overall value chain? (Manager).*

In the participating organizations with established metrics teams, the members of these teams have shown a keen willingness to share their experiences and knowledge regarding metrics with the wider organization. They perceive this sharing as beneficial on multiple fronts: first, as a means to showcase the capabilities of their team to the organization, and secondly, as an avenue to engage in discussions with their managers and stakeholders about how the delivered metrics contribute to the overarching product development goals. Their concern predominantly revolves around a feeling of being left in uncertainty—delivering metrics without clarity on if, whether and how the outcomes of their work are being utilized. They were concerned about "being in a limbo," delivering metrics and not knowing if and how the results of their work were used. The absence of feedback about metrics delivery in the context of metrics team-stakeholder contacts acts as a barrier, hindering the metric teams from refining existing metrics and innovating new ones. Consequently, team members harbor a belief that their skills and expertise are being underutilized:

> *Is the customer happy? But we can deliver something more innovative if we can get more information regarding how the metrics are used. Sometimes we need to have additional discussions to go that extra mile – to see what else we can get out of the data. We could cater to needs beyond what we can see but that requires that we work more and better together [with management and stakeholders] (Metrics team member).*

Although a few members of the metrics teams mentioned their efforts to kickstart conversations about metrics, they encountered significant challenges in making their voices heard by stakeholders. Despite stakeholders acknowledging the importance of engaging in discussions with metrics teams regarding product development metrics, a prevailing majority showed reluctance in assuming the responsibility of initiating these conversations. Rather than taking the lead, they anticipated the metrics teams themselves to spearhead these discussions.

Though many stakeholders expressed agreement on the significance of discussing metrics related to product development, they tended to remain passive, expecting the metrics teams to proactively initiate and drive these conversations forward. This passive stance from stakeholders created a situation where despite the acknowledgment of the importance of such dialogues, the impetus for engagement often rested on the metrics teams:

> *I would have liked the metrics teams to not only say "hello, but I would also like you to make a graph that you can update". I would also like them to be good at metrics, what data is needed…e.g., this thing to work with the data…to be conscious about how to use the data and for what purpose. You need to be more proactive to involve us. (Stakeholder).*

Thus, though having a team-stakeholder discussion about metrics was perceived as important, the initiatives to start these discussions were missing.

Challenge 3: Delivering negative feedback regarding measurement results

The developers and managers highlighted the significant hurdle they face when providing negative feedback regarding measurement results to their respective teams. Our respondents commented that in the realm of software development, individuals invest a considerable amount of pride in their contributions, making the delivery of criticism a delicate task that demands a non-judgmental approach—an aspect that proves somewhat challenging to execute effectively.

In practice, the presentation of negative feedback within software development teams requires careful consideration due to the potential repercussions. Metrics, when communicated improperly, can shift from being a supportive mechanism to becoming a catalyst for dysfunction. Instead of aiding the process, they can turn into a pressing and finger-pointing tool, hindering rather than facilitating successful software delivery.

The transformation of metrics into a negative force can significantly impact team dynamics, fostering an environment of tension, blame, and demotivation. As a consequence, the collaborative efforts and productivity essential for successful software development may be impeded. Striking a balance in feedback delivery and ensuring that metrics serve as a constructive tool for improvement remains an ongoing challenge in the software development landscape:

> *Metrics should not be pressing; it should help us. It is to be "un-pressing." We should not end up in people, you know, fading out and saying, okay, they are just judging me, right? (Manager).*

Respondents particularly emphasized the difficulties encountered when comparing defect-related data showcased on dashboards that were accessible to all. Managers recounted instances where conflicts arose, and developers opted to leave their positions due to improper communication practices, such as openly contrasting one team's performance against another. This misuse of metrics has the potential to rapidly transform into a catalyst for blame games and unnecessary rivalry, evident in instances where defect-related data or burndown charts were openly compared.

The visibility of such metrics across teams can unintentionally foster an environment where individuals feel pressured or unfairly judged based on these metrics. Managers were cognizant of these challenges and the adverse effects that stemmed from misusing metrics in this manner.

Inadvertently, the act of publicly comparing performance metrics without context or sensitivity to individual team dynamics can lead to strained relationships, decreased morale, and, at times, even talent loss within the organization. The significance of using metrics as a constructive tool for improvement while avoiding their misuse as a means for comparison remains a crucial aspect in fostering a healthy and collaborative work environment.

> *There is no blame on it [the chart], it was just a fact. But I noticed because I tried to bring up the burndown chart in the middle of the sprint people got puzzled. We need to speak out loud, then the chart is just a tool. Nothing more. So there was no blame in it. I think what we need to establish … a culture of no blame, even though someone is making an error. There is absolutely no blame in pointing out that the person made a mistake. But it is difficult to handle in practice (Manager).*

Challenge 4: Unclarity about metrics teams' primary stakeholders and their expectations

Members of the metrics teams and stakeholders from companies with well-established metrics teams expressed encountering difficulties in identifying their primary stakeholders. Due to their cross-functional nature, the metrics teams found themselves in a perplexing situation, approached by a diverse array of stakeholders, each requesting various metrics. This diversity in demands made it challenging to pinpoint the precise needs and expectations of these stakeholders. Consequently, team members felt inundated with a myriad of tasks, often feeling overwhelmed by the sheer volume of requests, some of which were tangentially related to their capabilities and deliverables.

Navigating through these multifaceted requests posed a complex challenge, as the metrics teams grappled with aligning the diverse stakeholder demands with their team's scope of expertise and deliverables. The absence of a clear delineation of primary stakeholders led to a sense of confusion and an overwhelming workload for team members, as they attempted to accommodate numerous and sometimes disparate requests from various sources:

> *They [Stakeholders] think that we are "The Golden Gate" and that we can provide them with whatever they need and want. Sure thing, we can get the data, but then they say, "I only want this part!". And this goes on and on and then it simply becomes too much. Of course, if you are responsible for a function you want to know as much as possible about it. In one way then it may well be that the expectations are too high - that we can do all of this (Metrics team member).*

The respondents emphasized the pressing need to bolster discussions regarding the role and identity of the metrics team within organizations. They underscored that augmenting these discussions could result in a higher level of engagement for metrics teams within the organizational structure and foster greater clarity regarding their deliverables.

By initiating more comprehensive discussions about the metrics team's function and purpose, organizations can pave the way for a clearer understanding of the team's capabilities and potential contributions. This increased clarity would not only serve to delineate the scope of the metrics team's responsibilities but also aid in establishing a stronger sense of their role within the larger organizational framework.

Consequently, fostering a dialogue about the metrics team's identity could lead to a more pronounced involvement of these teams in organizational processes. It would serve as a catalyst for aligning their objectives with organizational goals and enhancing their effectiveness in delivering valuable insights and support.

Challenge 5: Uncoordinated use of multiple channels in metrics communication

In software engineering workplaces, challenges arising from the uncoordinated use of multiple communication channels—such as JIRA, dashboards, Slack, email, and MS Teams chat—are prevalent, and these issues aren't confined solely to the context of managing metrics. However, the intricacies of metrics comprehension and articulation of requirements to metrics team members exacerbate these challenges.

Numerous stakeholders encounter difficulties understanding metrics intricacies and effectively conveying their needs to the metrics team. Consequently, they resort to utilizing various communication channels, employing a mix of emails, JIRA tickets, or even resorting to in-person interactions. This fragmented approach arises due to their struggle to articulate their needs comprehensively or specify requirements in detail.

In instances where stakeholders find it challenging to articulate their requirements through written mediums like emails or JIRA, they opt for face-to-face communication as they perceive it as a more effective means of explaining their needs. The preference for in-person interactions stems from the belief that verbal communication allows for clearer and more nuanced discussions that might be challenging to convey through written communication alone.

This diverse array of communication channels and approaches employed by stakeholders underscores the need for streamlined communication protocols and strategies within the metrics context. Establishing clearer guidelines and fostering an environment that encourages effective communication practices could

significantly alleviate these challenges and enhance the understanding and fulfillment of stakeholders' requirements by the metrics team:

> *I know only one way that works well to communicate around complex metrics, is to go and talk to the person, face-to-face. It's a little hard when we are sitting in so many different buildings. If we have no problems or unclarities, then then it's no issue, but when I do have problems, working with metrics remotely is hard. When I need to sit down with a developer and I want to explore the information, then that means this Okay, sit next to me, and then let's go together on the computer. And okay, where do we get this information? Can we use it to generate I need to answer this question? (Stakeholder).*

For stakeholders situated in disparate locations, unable to effectively communicate their needs—contrasting with those directly interfacing with the metrics team—it led to a slew of repercussions. These stakeholders experienced conflicts, harbored feelings of being neglected, and perceived delays in the handling of their tickets. This discrepancy in proximity and direct interaction with the metrics team contributed to a sense of being overlooked or marginalized, intensifying their frustration and dissatisfaction with the process.

From the perspective of the metrics team members, this divergence in communication channels and accessibility posed challenges in managing and prioritizing incoming requests. Balancing and prioritizing these requests became increasingly complex due to varying degrees of clarity and urgency in the tickets received. Team members grappled with the task of deciphering and addressing these requests efficiently, further compounded by the absence of clear prioritization criteria and direct interactions with some stakeholders.

The disparities in proximity, communication approaches, and levels of direct engagement with the metrics team underscored the need for a more uniform and inclusive communication framework. Establishing standardized protocols for receiving and prioritizing requests, regardless of stakeholder location or communication method, could mitigate conflicts, streamline ticket handling, and ensure a more equitable and efficient process for all involved parties.

Best practices for metrics communication

Case organizations have gradually developed best practices to address the identified challenges, which are presented below:

1. Promoting understanding and awareness of metrics while cultivating and collaboratively building metrics culture
2. Communicating the development process and share past experiences with stakeholders
3. Balancing achievement and wellness and celebrating wins
4. Introducing management dashboards
5. Conducting stakeholder mapping
6. Developing strategies around using communication channels and creating communication templates

Best practice 1: Promoting understanding and awareness of metrics while cultivating and collaboratively building metrics culture

Developers deeply involved in metrics highlight the critical importance of instigating collaborative dialogues among managers and stakeholders. These discussions aim to delve into the fundamental aspects of metrics, including their core essence, determining the metrics to be formulated, defining what aspects require measurement, and elucidating the rationale behind selecting particular metrics.

Establishing a specialized metrics team stands as a cornerstone in fostering a comprehensive metrics culture within the organizational framework. This dedicated team serves as a linchpin, facilitating these imperative conversations and steering the strategic development of metrics. Their role extends beyond mere implementation, actively engaging in discussions to ensure that the chosen metrics align harmoniously with the organization's overarching objectives. Through this concerted effort, the metrics

team contributes significantly to shaping a culture deeply embedded in the value and strategic use of metrics across the organization:

> *We've had a dedicated metrics team for a year and a half, something like that. And these are some of what I believe, are the most important parts of accelerating this building the culture thing. Everyone wants to be data-driven data is the new oil, and so on and so on. And management is very susceptible to this, of course. So it's not a hard sell, to create the metrics team nowadays (Manager).*

In a proactive effort to mitigate misunderstandings and establish a unified understanding of metrics, developers within one organization took deliberate steps to foster informal discussions between metrics team members and stakeholders. Recognizing the potency of these exchanges in aligning perspectives and preventing misinterpretations, the developers initiated arenas for open dialogues about metrics.

One such initiative was the inception of an informal "data analysis forum" orchestrated specifically for metrics team members and stakeholders. This forum provided a dedicated space for these key stakeholders to convene, deliberate, and engage in comprehensive discussions about metrics and associated terminologies. It functioned as a collaborative arena where ideas were exchanged, questions were addressed, and clarifications on metrics-related concepts were sought and provided.

Through this deliberate facilitation of informal discussions, the organization aimed to bridge the gap in understanding between different parties involved in metrics-related endeavors. By fostering a shared understanding of metrics and terminology, this initiative sought to cultivate a more cohesive and harmonized approach toward utilizing metrics effectively within the organization.

> *It is very important in our case to begin the discussion in person, and we prefer informal discussions. We have started something we call a data analysis forum where we discuss developments – we extend invitations to all of our stakeholders. From there you usually stay a few minutes afterward and we have informed discussions around new metrics. This is really a good place to start. To talk about how we name things. And then from that information discussion, we want to have an official ordering of new metrics in some way through a ticket, whatever (Metrics team member).*

Managers within a specific organization highlighted the practice of conducting "performance dialogues," succinct 10 to 15-minute meetings integrated within various forums such as team retrospectives at both team and Agile Release Train (ART) levels, solution management meetings, and RD (Research and Development) management team meetings. These dialogues were instrumental in fostering a shared comprehension of performance metrics and trends.

These brief yet focused dialogues served as a platform to discuss and elucidate performance-related insights, enabling informed decisions and trade-offs. Managers utilized these moments to impart crucial information regarding performance metrics, thereby facilitating a deeper understanding among the attendees. These dialogues not only provided valuable insights into performance but also contributed to a more transparent environment by ensuring that teams were well-informed about the decisions made and trade-offs considered at various organizational levels.

The respondents perceived these dialogues as a means to enhance transparency, ensuring that teams were apprised of pertinent performance-related information. By integrating these dialogues into existing meetings, the organization fostered a culture of informed decision-making and increased awareness of performance trends, thus nurturing a more cohesive and transparent work environment.

Best practice 2: Communicating the development process and share past experiences with stakeholders

The metrics team members found it advantageous to maintain ongoing communication with stakeholders during the code review process. This continuous interaction allowed them to gain a clear understanding of the specific metrics that needed to be delivered, thereby helping to prevent any potential

misunderstandings. Additionally, this proactive engagement ensured alignment between the stakeholders' expectations and the metrics team's deliverables, fostering a more streamlined and effective process:

> *Then we also think it is important to invite the stakeholders during development to sync back up to implementation – it is extremely important that they are involved in the code review. The metrics are defined by the code. Since they cannot name it properly. To reduce the risk of misunderstanding we always refer back to the code of the metrics – but of course, this is not always easy (Manager).*

Moreover, beyond mere communication, the documentation and dissemination of past experiences play a crucial role in the evolution of the metrics development process and the creation of novel metrics. In a particular organization, stakeholders and members of the metrics team emphasized the significance of numerous informal meetings dedicated to revisiting previous deliveries. These sessions served as platforms for collaborative discussions aimed at comprehending each other's needs, sharing insights gleaned from prior experiences, and fostering a deeper understanding of the nuances surrounding metrics.

During these informal meetings, stakeholders and metrics team members engaged in a dynamic exchange, drawing from their collective experiences to dissect past deliveries. The primary objective was not only to reflect on these experiences but also to extract valuable lessons that could enrich the metrics development process. This exchange of insights and shared knowledge was considered pivotal in identifying areas for improvement and innovation in crafting new metrics.

Furthermore, these interactions were not confined to the immediate team but extended to include managerial stakeholders. Information gathered and insights garnered from these discussions were systematically communicated to managers, thereby ensuring transparency and alignment between the team's efforts and organizational goals. This multifaceted approach fostered an environment conducive to continuous learning and improvement within the metrics development domain.

> *Important to share previous results of metrics development from earlier experiences. Should be an open forum like a blog, their presentation of how the process has been with earlier collaborations/teams. We document how the process was previously and use this in the process of new metrics. Stories from earlier experiences… Helps everybody to get on the same page on what to expect – they know the challenges involved. We have done this recently with great success in my mind. (Stakeholder).*

The dialogues initiated between the metrics team and stakeholders yielded noteworthy improvements, benefiting both parties involved. These discussions facilitated a realization within the metrics team regarding stakeholders' lack of confidence in understanding metrics and articulating their requests effectively. In response, the metrics team dedicated additional time to elucidate the intricacies of metric production, aiming to bridge the gap in comprehension.

By investing extra effort in educating stakeholders about the process of metric generation, the metrics team actively contributed to cultivating a shared understanding. This endeavor was instrumental in addressing the uncertainty among stakeholders, providing them with a clearer insight into the mechanics behind metric development. As a result, stakeholders began to feel more confident in their interactions with the metrics team, displaying a more nuanced understanding of how metrics are formulated and their implications.

The shared understanding fostered through these discussions not only enhanced stakeholders' confidence but also paved the way for more effective communication and collaboration between the metrics team and stakeholders. It served as a stepping stone toward aligning perspectives, establishing clearer expectations, and ultimately bolstering the effectiveness of the metrics development process within the organization.

> *So the conversation has switched from we ask (stakeholders) about data without really knowing how - to somehow them explain to us how they discover and how to do it in the correct way – how to present it in the correct way and us trying to apply it in the correct way so that we can actually use that data. We have had to adapt the conversation so that we could actually understand each other.*

Best practice 3: Balancing achievement and wellness and celebrating wins

The managers underscore the importance of maintaining a delicate balance that encompasses both the well-being of the team and the pursuit of advancements derived from measurement outcomes. They prioritize the holistic health and welfare of the team members while simultaneously acknowledging the significance of leveraging measurement results to drive improvements.

In their approach, these managers recognize that a harmonious equilibrium between these two aspects is paramount. They advocate for fostering a work environment that nurtures the mental and emotional well-being of team members, valuing their contributions and ensuring a healthy work-life balance. Simultaneously, they emphasize the utilization of measurement outcomes to identify areas for growth and enhancement, using data-driven insights as a catalyst for continuous improvement and progress within the team and the organization.

By emphasizing this balanced approach, the managers aim to create a culture that not only values performance and progress but also prioritizes the overall health and satisfaction of the team, thereby fostering an environment conducive to sustainable growth and success:

> *Of course, quality or speed sometimes people want things to happen quickly. But we try to have a balance. What is important, is it quality or the speed where we have the most out of it. And also it's very important to have alignment with the management and have continuous communication about what the teams are doing. Of course, the balance between team wellness, that's very important for me as a project manager. I tried to make a balance between team wellness and the deliveries. (Manager).*

Highlighting and discussing accomplishments, success narratives, and not solely concentrating on challenges proves advantageous in fostering a positive workplace atmosphere. According to one manager, consistently infusing positivity into weekly emails by incorporating uplifting information, success stories, and achievements, rather than solely focusing on critique, significantly contributes to cultivating a positive workplace culture.

By shining a spotlight on achievements and success stories, managers can foster an environment that celebrates accomplishments and acknowledges the hard work and dedication of the team. This practice not only boosts morale but also serves as a source of motivation and inspiration for everyone involved. Moreover, it cultivates a sense of pride and camaraderie among team members, fostering a positive and supportive workplace ambiance.

This deliberate emphasis on positivity in communication channels helps in shaping a workplace culture that values encouragement, resilience, and growth. It enables teams to acknowledge their strengths and successes while maintaining a constructive approach toward addressing challenges. Overall, by consistently highlighting achievements alongside addressing challenges, managers contribute significantly to fostering a culture that thrives on positivity and continuous improvement.:

> *In my e-mails, I focus on mentioning positive things and encouraging developers. Anyone who did a great job? A good report? Anything else? Communicating metrics can be sensitive, and we need to be aware of it (Manager).*

The managers also emphasize the importance of avoiding using metrics for micromanaging:

> *We, management, need to trust our developers to do the right thing. They should not feel like management is hindering them from doing a bad thing rather than allowing them to do the right thing (Manager).*

The metrics teams expressed a crucial perspective regarding their core role within the organization. They highlighted their primary objective as demonstrating the potential and opportunities presented by metrics, rather than singling out individuals for mistakes, especially in public or in front of other employees. This approach stems from the recognition that people often harbor apprehensions about performance measurement.

Understanding the inherent fear associated with being measured or judged solely on metrics, these teams emphasize a different purpose for metrics usage – one that goes beyond fault-finding. Instead, they advocate for metrics to serve as a tool aimed at identifying and rectifying issues, rather than fostering demotivation or creating an environment prone to blame.

By adopting this mindset, metrics become a means to unearth areas for improvement, offering solutions to bridge gaps and enhance performance. This approach fosters a supportive environment, encouraging individuals to utilize metrics not as a means to assign blame, but as a mechanism for continuous improvement. It aims to promote a culture where the focus is on problem-solving rather than attributing fault, thereby motivating employees to address challenges collaboratively and constructively. Ultimately, the goal is to use metrics as a catalyst for positive change and performance enhancement rather than as a source of demotivation or negativity.

Best practice 4. Introducing management dashboards

In a strategic move within one organization, managers introduced a specialized management defects dashboard, accessible exclusively to managerial personnel. The purpose behind this deliberate measure was to circumvent any potential competition or rivalry among the various teams within the organization.

By confining access to this dashboard solely to managerial levels, the intent was to foster a collaborative rather than a competitive environment among the teams. This approach aimed to avert situations where teams might feel compelled to outperform each other, potentially leading to unhealthy competition. Instead, the focus was on providing managers with a consolidated overview of defects and issues without instigating inter-team comparisons or rivalries.

This tactic not only upheld a sense of fairness and impartiality but also promoted a more unified approach to problem-solving. It facilitated a constructive atmosphere where teams were encouraged to concentrate on their individual growth and improvement, free from the pressures of comparison. By limiting the accessibility of this dashboard, the organization aimed to prioritize cooperation, teamwork, and mutual support among teams, thus fostering an environment conducive to collective progress and development, containing any tendencies towards assigning blame or fostering a culture of finger-pointing among the broader teams:

> *It is the page that shows the comparable data between the different parts of the organization. So we would like to have the discussion enabled for the ones who are really responsible in a small round, but we do not want to promote the competition somehow actively in the organization." (Manager).*

This deliberate limitation served a dual purpose. Firstly, it provided a controlled environment where discussions about defects and issues were handled within a smaller, more adept managerial circle, minimizing the spread of negative attributions or fault-finding within the broader team landscape. This containment helped mitigate the potential for demoralization or disunity among the teams.

Secondly, by centralizing access to this information among managers, it afforded the management team the necessary time and space to meticulously interpret the data and deliberate before making decisions or communicating with the broader teams. This cautious approach aimed to ensure that decisions made based on the dashboard insights were well-considered, informed, and effectively conveyed to the teams, avoiding any unnecessary panic or misconceptions.

By streamlining the process in this manner, the organization sought to maintain a balanced and constructive approach to addressing defects and issues, focusing on collaborative problem-solving rather than fostering a culture of blame or competition among the teams. This approach allowed for informed decision-making while preserving a cohesive and supportive environment conducive to organizational growth.

> *That's exactly also one thing that we would be suspicious to see, right? If we see that there is a really some outliers that look strange, it could be a data quality problem, it could be maybe testing problem that they are not you know doing it the right way or they're just testing and finding a lot of issues that they are not tracking in the system*

that is supposed to be used for this or whatever. You need time to dive into it, before talking to the teams (Developer).

Best practice 5: Conduct stakeholder mapping

When organizations are in the initial phases of establishing metrics teams, there exists a crucial need to clarify the identity, scope, and primary stakeholders associated with these teams. According to the feedback gathered from respondents, this strategic clarification serves a dual purpose: aligning expectations and effectively managing priorities when handling requests within the metrics team's purview.

An instrumental step in this process involved conducting workshops aimed at facilitating discussions among metrics team members, stakeholders, and managers. The primary objective was to collectively define and understand the metrics team's identity, identify the scope of work, and pinpoint the key stakeholders. In these workshops, participants identified primary stakeholders such as developers, architects, project managers, and product owners. Additionally, they recognized the involvement of other critical teams in the organization, such as configuration managers, maintenance teams, and customer support, as being essential stakeholders.

Further delving into these workshops, the focus shifted to identifying the specific information needs unique to each stakeholder category. Participants outlined their expectations regarding the quality of information, desired information products, access levels for different teams, and perspectives on prioritizing requests. This detailed examination allowed for a comprehensive understanding of the diverse requirements and priorities among various stakeholders within the organization.

The workshops were well-received by the respondents, who appreciated the opportunity to step back and engage in open discussions about their challenges. This collaborative approach not only facilitated a deeper understanding of stakeholder needs but also fostered an environment conducive to addressing challenges and fostering alignment among different teams. Overall, these workshops played a pivotal role in establishing clarity, alignment, and a shared understanding among stakeholders, ultimately contributing to the effective establishment and functioning of metrics teams within these organizations.

It was useful to sit together and discuss our experiences. To hear what management, stakeholders, and other teams think about metrics, stakeholders' needs, and how to meet them (Developer).

Best practice 6: Developing strategies for using communication channels and creating communication templates

Crafting explicit strategies pertaining to the utilization of communication channels for metrics communication holds immense importance in maintaining equitable prioritization among tasks and requests. This sentiment was succinctly expressed by the stakeholders involved in the process. Effective strategies related to communication channels play a pivotal role in establishing a level playing field when it comes to determining priorities within an organization. By delineating clear guidelines on how communication channels are employed, teams can ensure that requests are handled fairly and that priorities are set transparently and impartially.

Such strategies aid in avoiding preferential treatment or biases that may arise due to inconsistent communication practices. They help create a standardized framework for managing requests, ensuring that each request is evaluated and prioritized based on predetermined criteria rather than subjective or ad hoc decision-making.

Moreover, by establishing clear strategies around communication channels, stakeholders can enhance collaboration, minimize miscommunications, and streamline the process of handling requests. This not only fosters a more efficient workflow but also cultivates an environment where priorities are set fairly and comprehensively, contributing to overall organizational success.

The metrics team needs to decide whether they want us to communicate through Jira or not - but they will have to decide! The clarity needs to be on their side (Stakeholder).

The metrics team within Organization A implemented clear guidelines for their stakeholders, emphasizing the initial step of initiating communication through JIRA tickets. This proactive approach was met with positive reception from the stakeholders, as it established a structured and standardized method of communication between the teams. By stipulating the requirement for JIRA tickets as the primary means of communication, the metrics team ensured that requests and inquiries were well-documented and efficiently managed within the system.

Recognizing the potential complexities associated with using the ticketing system, particularly JIRA, one of the teams took an additional step to facilitate smoother communication. They developed a template specifically designed to assist stakeholders in formulating and structuring their requests effectively within the JIRA framework. This template aimed to streamline the process, providing a structured format that guided stakeholders in articulating their needs more clearly and comprehensively. This strategic initiative not only simplified the process of creating requests but also standardized the information provided, enhancing clarity and reducing ambiguities. It served as a helpful tool for stakeholders less familiar with JIRA, ensuring that their requests aligned with the metrics team's requirements. As a result, this approach streamlined communication channels, minimizing potential misunderstandings and expediting the handling of requests within the JIRA system. Overall, these strategies significantly contributed to fostering efficient and effective communication practices between the metrics team and their stakeholders in Organization A:

> *in my team, we have made a template for support, in which you can write a JIRA issue where we have defined a template with the information you want us to feel. So I'm not sure if all the last team has such type of templates in which they have already ambition, or how they want people to communicate with them when they ask for a formal request (Metrics team member).*

Guidelines for communication around metrics in organizations based

The study conducted an in-depth analysis of the communication challenges encountered by metrics team members, stakeholders, and managers in the context of software metrics. The challenges highlighted in the study encompass a spectrum of issues, including but not limited to terminological discrepancies, uncertainty about metric purposes, difficulties in formulating clear requests, complexities in using communication channels like JIRA, and the delicate balance required in delivering negative feedback based on metric results.

To offer comprehensive guidance based on the study's findings, the research divided the best practices into two distinct categories: challenge-specific, designed to address particular obstacles (best practice 2-6), and transversal (best practice 1), which are universally useful for mitigating all identified challenges. This organizational structure is graphically depicted in Figure 1, allowing for an accessible overview of these challenges and their corresponding best practices:

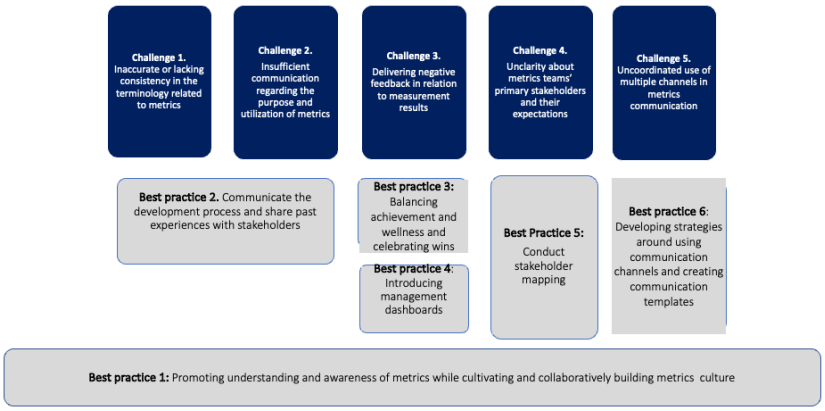

Figure 1. Best practices for addressing the identified challenges

To address these multifaceted challenges, the study elucidated specific best practices tailored to individual challenges. These challenge-specific strategies (Best practices 2-6) provide targeted solutions aimed at resolving each identified issue effectively. For instance, strategies aimed at enhancing terminological consistency, fostering a shared understanding of metric purposes, and providing structured guidelines for formulating requests. In contrast, transversal best practice (Best practice 1) serves as an overarching solution, valuable in mitigating various communication challenges holistically. These universal strategies focus on fundamental aspects of communication.

The graphical representation in Figure 1 serves as a useful reference point, allowing stakeholders and practitioners to gain a comprehensive overview of the challenges and corresponding best practices. This structured approach facilitates a more nuanced understanding and implementation of communication strategies, tailored to address specific challenges while also encompassing broader, overarching solutions for enhanced communication within metrics teams and their stakeholders.

The primary step in improving communication around metrics is to develop metrics culture (best practice 1). The identified challenges indicate that there is a lack of developed metrics culture in the participating organizations. Shein (1996) defines culture as "the basic tacit assumptions about how the world is and ought to be that a group of people share and that determines their perceptions, thoughts, feelings, and, their overt behavior." Culture is reinforced by a system of values that unite employees around a shared purpose. Terminological challenges (Challenge 1) expressed limited knowledge about metrics' role in product development (Challenge 2) and unclarity concerning stakeholders (Challenge 4) indicate the need to develop a shared understanding of the purpose around metrics. Further, though delivering negative feedback is in general sensitive (Challenge 3), developing a positive culture around the value of metrics can potentially contribute to handling this challenge. In addition, clarity concerning metrics and stakeholders can contribute to more structure in communication using different channels and improvements in formulating metrics requests (Challenge 5).

While better organizational culture results in better communication, communication can be a tool for creating and developing metrics culture, enabling sharing of experiences among stakeholders, management, and developers, and creating opportunities for learning. Continuous dialogue and feedback help to keep everyone on the right track and also supports metrics team developing understanding of how the results of their work are used in practice. Our findings indicate that through formal and informal discussions about metrics were perceived as useful for improving communication and understanding of metrics, neither teams nor stakeholders were willing to take responsibility for initiating them. This indicates a need for strong leadership for taking responsibility for creating these arenas for experience sharing.

For communication to be successful, it is also essential that the person who has an idea or message to communicate (sender) is aware of who receives the message (the receiver) in order to put the message in a way that the receiver can understand (Shannon, 1948). If a metrics team (sender) doesn't know who its stakeholders (receivers) are, creating meaningful communication is complicated. Thus, identifying stakeholders, their needs, and priorities by conducting stakeholder mapping is an essential step for aligning expectations and prioritizing multiple stakeholders' demands (Pikkarainen et al., 2008).

Using the right channels in the right way is another important factor for communication to be successful in any organization. Being consistent and timely, especially in case of urgent issues, is essential to avoid communication breakdowns.

Finally, as metrics communication can be sensitive, developing strategies and routines for delivering information is essential. Showing success stories and limiting comparisons among teams can potentially contribute to metrics acceptance in an organization and the development of a positive working environment.

Concluding remarks

Software development measurement programs are becoming increasingly important for modern software organizations. Applying appropriate strategies to communicate around metrics is essential for the proper use and acceptance of metrics in the organization. This paper identifies several challenges and best practices in communication around metrics. Though our research focused specifically on metrics communication,

the identified challenges and best practices can be applied in other contexts as well, e.g., developing organizational culture is central to any organization and stakeholder mapping can be used in any organization initiating a new team, especially a cross-functional team, which often has to work with a variety of unidentified potential stakeholders.

One recommendation for practitioners is to establish mutual ground on information requirements, resources, schedules, and collaborative approaches. This necessitates fostering early collaboration between metrics teams and stakeholders throughout the measurement process.

Additionally, investing time in cultivating a metrics-centric culture, delineating the metrics team's role, and identifying key stakeholders can aid in defining the team's scope of work, setting priorities, and improving clarity in communication around metrics.

A vital suggestion stemming from this study is for management to support the creation of a constructive alliance among metrics teams, stakeholders, and management. Involving metrics teams in realistic planning can alleviate unnecessary frustrations.

The study also underscores the importance of agreeing on communication tools, particularly for urgent matters, when engaging stakeholders. Establishing clear communication guidelines within organizations can prevent breakdowns in communication.

Lastly, practitioners are advised to establish small communication spaces to foster dialogue between teams and stakeholders about metrics, promoting a shared understanding of expected outcomes and enabling timely feedback—a practice aligned with agile methodologies.

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Conflict of interests

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