

Digital PPAP as Constitutive Communication Practice: Constructing Quality and Customer Alignment in the Automotive Semiconductor Industry

Candra Dewi Prasetyaning Susanti¹, Anita Rosana², Emmanuel Aman Benjamin³

^{1,2}LSPR Institute of Communication & Business, Indonesia

³International School of Management, Germany

Submitted: April 2026, Revised: June 2026, Accepted: July 2026

ABSTRACT

The automobile semiconductor business has a high-quality and traceability requirement whereby the approvals of the customer are based not merely on technical compliance but on the credibility of the processes employed to show preparedness. Manufacturers most commonly use the Production Part Approval Process (PPAP) as a technical compliance process to demonstrate their manufacturing capability. In this paper, it is suggested that digital PPAP can be considered a broader concept of communicative infrastructure in which organizational coordination, approval authority, quality legitimacy, and alignment with customers are established. The article is based on Communication as Constitutive of Organization, which explains why strategic business communication, customer relationship management, and the communication practices involved in a self-service digital PPAP environment, where internal organizing and external customer-facing outputs are created, inform the research. This study conducted a qualitative single-case study using the quality management of Infineon Technologies AG, Germany. Semi-structured interviews with five individuals in key workflow roles, along with organizational documents, workflow logic, and non-confidential system artifacts, triangulated the data. The findings indicate that the continuity of digital workflow continues to depend on communicative work to help clarify the validity of documents, remove ambiguity in ownership, and re-link fragmented records between systems. Approval is also a performative action that creates organizational readiness, rather than technical readiness. It takes constitutive communication for digital quality management.

Keywords: *digital ppap; communication in organizations; quality legitimacy; customer alignment; automotive semiconductor.*

INTRODUCTION

The automotive semiconductor industry operates in one of the most demanding quality environments in contemporary manufacturing because it must meet strict automotive quality management requirements (IATF, 2021). Semiconductors now support critical vehicle functions, including sensing, power management, control logic, connectivity, infotainment, and advanced driver-assistance systems (ISO, 2021). As these functions become more connected to vehicle safety, performance, and user satisfaction, customer approval can no longer depend only on component characteristics (AIAG, 2018).

Suppliers must also show that products have been properly developed, validated, documented, approved, and communicated through controlled quality processes (IATF, 2021). In this context, quality depends on how organizations organize evidence, coordinate activities, justify decisions, and demonstrate readiness to customers (Leonardi & Treem, 2020).

The Production Part Approval Process, or PPAP, is one key process for demonstrating this readiness (AIAG, 2018). In the automotive industry, PPAP shows that customer requirements have been translated into controlled, repeatable, and auditable production conditions (AIAG, 2018). A valid PPAP package includes design records, control plans, validation results, process evidence, and risk documentation (AIAG, 2018). The process appears straightforward because customer needs are recorded, evidence is created, documents are checked, and readiness is confirmed (Belu et al., 2013). In practice, PPAP depends on communication because approval work requires interpretation, coordination, and shared understanding among involved actors (Hakoniemi, 2022). Actors must interpret documents, define ownership, identify missing information, align expectations, and make credible approval decisions across internal functions and customer-facing interfaces (Hermans & Liu, 2013).

Digital PPAP makes this communication issue more visible because digital systems expose workflow gaps, missing evidence, and approval delays (Hoblos et al., 2024). Many organizations use digital PPAP platforms to reduce fragmented work, accelerate approvals, and improve transparency and traceability of PPAP status (Kim & Cho, 2023). These platforms integrate workflow distribution, document management, approval status, and customer submission into one digital environment (Hoblos et al., 2024). However, digitalization does not remove the need for communication because digital tools change how people coordinate, interpret information, and organize work (Leonardi & Treem, 2020). People still need to interpret documents, resolve discrepancies, find missing evidence, clarify roles, and connect system outputs to a credible approval narrative (Hakoniemi, 2022). Therefore, digital PPAP should be understood not only as a digital quality tool, but also as a communication environment where organizational readiness becomes visible and credible (Leonardi & Treem, 2020).

In recent years, organizations have adopted digital PPAP platforms as part of wider digital transformation in manufacturing and quality management (Verhoef et al., 2021). These systems integrate documentation, approval activities, and customer engagement into one digital solution (Hoblos et al., 2024). This shift reflects the Industry 4.0 movement toward paperless documentation, cross-regional coordination, team communication, and real-time process visibility (Kraus et al., 2021). Digital transformation also improves information exchange and process transparency across functions (Dias et al., 2022). This trend matters in the automotive semiconductor industry because product approval depends on technical evidence, supplier accountability, responsiveness, and readiness, which support customer trust (Deszczyński, 2021).

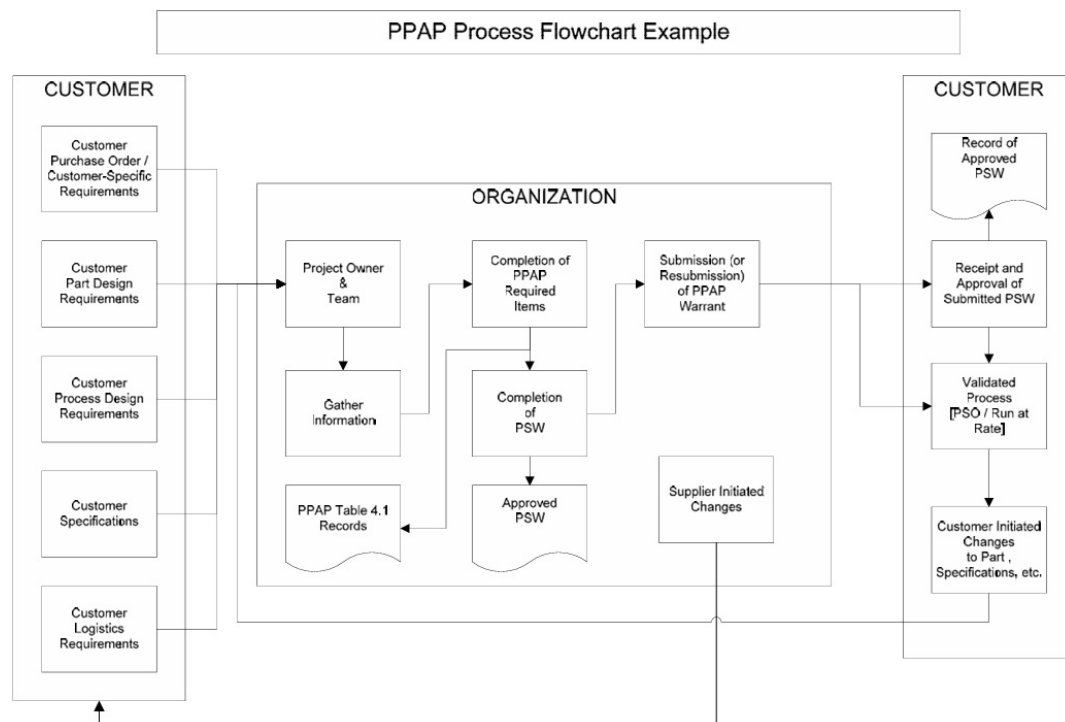


Figure 1. Flow cycle of PPAP process to explain the approval situation in the study.

Source: Adapted from AIAG (2006)

Although digital PPAP is increasingly important, it is still often treated as a technical enabler of quality control and process efficiency (Hoblos et al., 2024). This view is useful but limited because it does not fully explain how approval work depends on interpretation, coordination, and customer-facing meaning (Leonardi & Treem, 2020). In business-to-business contexts, quality approval also helps establish organizational legitimacy and customer trust (Deszczyński, 2021). Document storage and approval routing alone cannot create quality legitimacy (Alper, 2024). Legitimacy emerges when actors interpret documents as valid, define roles, explain deviations, assert approval authority, and translate internal quality evaluations into customer-facing readiness (Alper, 2024).

This study interprets digital PPAP as a technological system and a communicative space that shapes structure, authority, and customer relationships (Leonardi & Treem, 2020). It uses Communication as Constitutive of Organization, or CCO, to analyze how communication practices in digital PPAP construct quality, legitimacy, and customer alignment in the automotive semiconductor industry (Kuhn, 2021). This approach is relevant because organizations are not static places where communication simply occurs (Basque et al., 2022). They are continuously shaped through interactions among people, texts, routines, technologies, and institutions (Schoeneborn et al., 2025).

Existing PPAP studies mainly examine the process from quality management, engineering, and digitalization perspectives. They focus on efficiency, document accuracy, production readiness, compliance, and technical integration. Hermans and Liu (2013) describe PPAP as a strategic quality management tool for new product

development, with emphasis on design validation, risk reduction, and interdisciplinary coordination. Belu et al. (2013) highlight the role of PPAP documentation, especially Control Plans, in stabilizing production processes and supporting continuous quality improvement. These studies are valuable, but they treat communication mainly as support, not as a process that creates authority, legitimacy, and customer confidence.

Määttä (2022) moves closer to the communication issue by identifying coordination and alignment problems between engineering and quality teams. However, this work still frames communication mainly as a coordination gap that procedural integration can solve. It does not fully explain how communication builds roles, approval authority, and quality legitimacy in PPAP work. Schmidtman (2025) explains the shift from paper-based PPAP to digital PPAP and highlights efficiency, sustainability, and global visibility. Yet this study still frames digital PPAP mainly as a technological or decision-support system (Schmidtman, 2025).

These studies reveal a clear research gap. PPAP literature provides limited attention to communication as a central process in product approval. Most studies view PPAP as a quality tool, engineering control mechanism, or digital workflow system. This leaves the communication dimension underdeveloped, even though PPAP depends on interpretation, clarification, documentation, approval authority, and customer-facing justification. Määttä (2022) directly addresses coordination between engineering and quality teams but does not position communication as a constitutive process that produces authority, legitimacy, and customer alignment. This gap matters because digital PPAP is not only a document repository. It is a space where “approved” quality is produced through interactions among people, records, workflows, system statuses, and customer-facing communication (Basque et al., 2022).

This research addresses the gap by reorienting digital PPAP from a technical quality management system to a constitutive communication practice. It examines how communication creates organizational structure, legitimizes quality decisions, and supports customer alignment in digital PPAP (Schoeneborn et al., 2025). This focus differs from studies that emphasize efficiency, compliance, and technological improvement. The communication practices examined include approval processes, standardized digital documents, system-mediated conversations, document interpretation, clarification practices, and customer-facing documents (Hoblos et al., 2024). The study therefore positions PPAP as communicative infrastructure that organizes roles, evidence, authority, and customer trust.

Combining digital PPAP with strategic business communication management and business-to-business customer relationship management also clarifies its strategic role. Strategic business communication management explains how communication supports legitimacy, coordination, and stakeholder value (Alper, 2024). Customer relationship management explains how continuous communication supports visibility, responsiveness, trust, and relationship stability (Deszczyński, 2021). From this perspective, technology does not automatically create transparency or customer trust.

These outcomes depend on structured, traceable, responsive, and credible communication (Hoblos et al., 2024).

This issue is relevant in the automotive semiconductor industry, where customer relationships depend on trust in both the product and the process behind it. Automotive customers expect transparency, quick turnaround, traceable documentation, and logical approvals during product launches, audits, and regulatory pressure (Hoblos et al., 2024). Even when technical compliance is achieved, delayed approval, unclear ownership, missing documents, or weak explanations can damage customer trust. Digital PPAP can therefore be interpreted as both a quality-control process and a communication space where coordination, legitimacy, and customer alignment are built (Leonardi & Treem, 2020).

Through the CCO lens, digital PPAP becomes a space where coordination is generated, authority is legitimized, and quality legitimacy is produced through communication between human and nonhuman actors (Kuhn, 2021). Templates, approval processes, records, alerts, workflow statuses, and system restrictions are not only signs of organizational order. They also help produce that order (Basque et al., 2022). They shape what evidence is valid, who is authorized to approve, who is accountable, and how credibility is established with customers (Schoeneborn et al., 2025).

Based on this framework, the study addresses two research questions. First, what is the relationship between communication practices and internal organizational coordination, approval authority, and quality legitimacy in the automotive semiconductor industry? Second, what impact do these practices have on transparency, organization-customer fit, and trust in the relationship? These questions shift the focus from digital PPAP efficiency to its communicative effectiveness. They also allow the study to examine how documents, work activities, system constraints, approval roles, approval processes, and customer relations influence organizational outcomes (Leonardi & Treem, 2020).

This article offers a communication-based view of digital PPAP. It does not treat digital PPAP as a technical system for storing documents and approvals. Digital PPAP serves as a communicative infrastructure, co-producing organizational order and customer credibility. This view explains why workflow platforms still need follow-up, interpretation, clarification, escalation, and informal repair after implementation. It also shows that customer trust is created upstream, before the final PPAP package reaches the customer (Deszczyński, 2021).

This study contributes empirically by examining digital PPAP as a communicative arena where humans, institutional texts, workflow rules, and digital systems participate in organizing. It contributes theoretically by extending the CCO perspective into the under-researched area of digital quality management systems (Kuhn, 2021). It also links organizational communication theory with current industrial practice. This contribution responds to the limited attention given to communication as a constitutive process in PPAP research (Schoeneborn et al., 2025).

To achieve these objectives, this study investigates the automotive quality-management environment of Infineon Technologies AG in Germany through a qualitative single-case study. Data were gathered via semi-structured interviews with informants occupying critical workflow positions, supplemented by organizational documents, workflow logic, and non-confidential system artifacts. This approach is appropriate because the study focuses on communication practices rather than technical measurement. The article aims to show how communication contributes to coordination, approval decisions, and customer alignment in a regulated business-to-business industrial environment (Stevens, 2022).

LITERATURE REVIEW OR RESEARCH BACKGROUND

PPAP and Digitalization in the Automotive Semiconductor Setting

a. Controlled Quality Conditions in PPAP

Quality approval in the automotive semiconductor industry involves technical conformity as well as the ability to demonstrate process discipline, traceability, and documentary credibility (Rudolf & Roszak, 2022). In this context, the Production Part Approval Process, or PPAP, functions as a formal procedure through which suppliers show that customer engineering and quality requirements have been translated into controlled, repeatable, and auditable manufacturing conditions (AIAG, 2018). PPAP is therefore not only a compliance instrument but also a mechanism through which product credibility and customer confidence are established through formal approval processes (Hermans & Liu, 2013).

b. The Relevance of Digital PPAP

PPAP changes significantly when it becomes digital because approval activities move from fragmented manual routines into more integrated workflow environments (Hoblos et al., 2024). Traditional approval processes often depend on fragmented documents, email-based coordination, spreadsheets, and decentralized storage (Kim & Cho, 2023). Digital PPAP is introduced to address these weaknesses by improving workflow transparency, traceability, and process discipline (Hoblos et al., 2024). This shift reflects the broader movement of digital transformation in which organizations redesign processes through digital technologies and data-based coordination (Kraus et al., 2021). However, digitalization does not remove communicative complexity because digital transformation also changes how people coordinate, interpret information, and organize work (Nadkarni & Prügl, 2021). Digital systems still require actors to bridge workflow gaps by interpreting requirements, retrieving missing records, validating documents, and coordinating across functions (Leonardi & Treem, 2020). Digital PPAP is therefore not only a technical change but also a reorganization of communication within the quality process.

Existing research focuses on digital quality management and the Production Part Approval Process (PPAP).

a. Research Emphasizing Process Preparedness and Alignment

The reviewed literature shows that several studies position PPAP and Advanced Product Quality Planning, or APQP, as important tools for readiness, validation, and structured quality work. Hakoniemi (2022) shows that PPAP can support new product design, coordination, and production preparedness. Tokmakova et al. (2022) explain how PPAP documentation helps translate customer requirements into production control and defect prevention. Määttä (2022) argues that PPAP can be implemented more effectively when it is integrated into product development. Gertsson and Lindberg (2023) emphasize that structured preparation strengthens quality planning and supports better process alignment. Rudolf and Roszak (2022) also connect PPAP with disciplined quality planning and controlled production readiness. Srinivasan et al. (2024) show that structured quality planning can improve coordination and preparedness in manufacturing systems. These publications demonstrate that PPAP is a valuable tool in industrial quality management, but they mainly emphasize process discipline and technical control.

b. Studies on Digital Integration and Capability

Other studies extend the discussion to digital transformation and digital capability. Srinivasan et al. (2024) show that structured digital planning can strengthen quality coordination. Gertsson and Lindberg (2023) emphasize that better integration can improve quality preparation. Kim and Cho (2023) show that digital transformation in semiconductor ecosystems depends on organizational capability and adaptation. Antony et al. (2023) connect digital quality management with operational improvement and quality performance. Chiarini and Kumar (2022) explain that digital transformation supports quality management by improving integration, visibility, and process control. Dias et al. (2022) show that digital technologies can strengthen coordination and information flow in industrial systems. Liu et al. (2023) explain that digital transformation improves manufacturing capability through data integration and process visibility. Sader et al. (2022) show that digitalisation can support quality management by improving transparency and operational control. Elock Son and Breka (2023) add that Industry 4.0 digitalisation can create supply-chain value, but implementation barriers still affect digital transformation. Taken together, these studies confirm the usefulness of digital infrastructure in industrial quality systems, including digital PPAP. However, they still tend to frame digitalization mainly as integration, capability, and system improvement rather than as a communication process (Leonardi & Treem, 2020).

c. The Unresolved Communication Issue

Although previous studies address coordination, planning, and integration, they do not sufficiently explain communication as a constitutive process within digital PPAP. In most cases, communication is treated as an enabling factor rather than as the process through which approval authority, quality legitimacy, and customer alignment are created. This is the key gap identified in this study. Digital PPAP has largely been discussed as a

technical, procedural, or system-based improvement, while its communicative role remains under-theorized (Orlikowski, 2007). Basque et al. (2022) argue that communication should be viewed as a process that actively organizes people, texts, technologies, and institutional arrangements. Leonardi and Treem (2020) further show that digital technologies shape organizational communication by structuring visibility, coordination, and interaction. Therefore, digital PPAP should not only be studied as a digital quality tool. Studying it as a communication environment that produces quality evidence, authority, accountability, and customer trust is also essential.

Theoretical Foundation of the Present Research

a. The primary lens for this research is communication as constitutive of organization

To address this gap, this study uses communication as a constituent of organization, or CCO, as the main theoretical lens. CCO argues that organizations do not exist first and then use communication merely as support. Instead, communication continually creates organizations (Kuhn, 2021). Applied to digital PPAP, this perspective means that coordination, approval, accountability, and quality legitimacy are produced through the interaction of actors, records, workflow rules, and digital systems. According to Basque et al. (2022), the interaction of people, texts, practices, and material arrangements shapes organizational realities. Schoeneborn et al. (2025) further position communication as central to how organizations become visible, legitimate, and stable. This makes CCO particularly suitable for understanding digital PPAP beyond its technical workflow function.

b. Strategic Business Communication Management as a Supporting Perspective

Strategic Business Communication Management complements CCO by defining communication as a strategic organizational resource that supports coordination, legitimacy, and stakeholder relationships (Cornelissen, 2023). In the digital PPAP context, this perspective helps explain how workflow communication, documentation systems, and approval structures are managed to support both internal quality objectives and external customer expectations. Alper (2024) emphasizes that strategic communication supports legitimacy by connecting organizational actions with stakeholder expectations. This is especially relevant in the automotive semiconductor industry, where visibility, responsiveness, and consistency directly influence supplier evaluation and customer confidence.

c. CRM as a Relationship Concept

This study uses Customer Relationship Management, or CRM, as a relationship concept rather than as a stand-alone theory. CRM helps explain the connection between internal quality communication and customer alignment (Deszczyński, 2021). The quality of communication embedded in the digital workflow shapes transparency, responsiveness, and trust in customer-facing interactions in digital PPAP. Customer alignment is

therefore not only the result of technical compliance. It is also the outcome of communication practices integrated into the digital quality system.

Research Gap and Study Positioning.

a. Research Gap

The reviewed literature shows that PPAP and digital quality systems have been widely discussed in relation to compliance, process efficiency, integration, and documentation accuracy. However, researchers have paid less attention to how communication practices in digital PPAP actively support internal organizational coordination, approval legitimacy, and alignment with external customers. This gap is significant because technology alone does not produce approval, credibility, and customer trust. Communication among people, documents, systems, and organizational routines constitutes these outcomes (Basque et al., 2022). Existing PPAP research therefore remains limited because it mainly explains PPAP as a quality tool, engineering control mechanism, or digital workflow system. The communication dimension remains underdeveloped, even though PPAP approval depends on interpretation, clarification, documentation, responsibility, and customer-facing justification. Among the reviewed PPAP studies, Määttä (2022) is the only study that moves closer to the communication dimension by discussing coordination and alignment between engineering and quality teams. However, Määttä (2022) still treats communication mainly as a coordination issue rather than as a constitutive process that builds roles, authority, legitimacy, and customer confidence. This study addresses that limitation by enriching PPAP literature through a communication-based perspective.

b. Positioning of the Study

Based on this gap, the present study positions digital PPAP as a communicative infrastructure rather than merely a technical approval tool. With CCO as the central theoretical framework, this study examines how communication practices shape quality processes and customer relationships in the automotive semiconductor industry (Kuhn, 2021). Strategic Business Communication Management supports this positioning by explaining how communication creates legitimacy, coordination, and stakeholder value (Cornelissen, 2023). CRM supports this positioning by explaining how continuous communication strengthens transparency, responsiveness, trust, and customer relationship stability (Deszczyński, 2021). This positioning gives the study practical relevance for digital quality management and theoretical relevance for organizational communication research. It also indicates that digital PPAP should no longer be understood only as a tool for storing documents and routing approvals. Instead, digital PPAP should be understood as a communicative space where organizational order, quality legitimacy, approval authority, and customer alignment are continuously produced.

METHODOLOGY

This research used a qualitative single-case study to examine how communication practices in digital PPAP shape organizational coordination, approval legitimacy, and customer alignment in the automotive semiconductor sector (Stevens, 2022). This approach was suitable because the study did not measure variables or test statistical relationships. It examined how people, documents, workflow guidelines, and digital systems interact in a real organizational setting to produce quality-related outcomes. Case study research is appropriate for studying a contemporary organizational process within its real-life context, especially when the phenomenon and context are closely connected (Creswell & Poth, 2024). This design supported the analysis of digital PPAP as practiced in a document-intensive and highly regulated environment.

A constructivist orientation informed the study. The research examined how organizational interaction creates and stabilizes meanings of readiness, approval, document validity, and customer alignment. In digital PPAP, workflow statuses, records, approvals, and system outputs do not carry meaning by themselves. They become meaningful when actors interpret, justify, verify, and act on them. Kuhn (2021) argues that communication, rather than a pre-existing fixed structure, produces organization. Basque et al. (2022) show that actors, texts, technologies, routines, and institutional arrangements shape organizational processes. Schoeneborn et al. (2025) emphasize that communication contributes to organizational authority, legitimacy, and structure. Leonardi and Treem (2020) show that digital technologies shape organizational communication, visibility, and coordination.

The study was conducted in the quality-management environment of Infineon Technologies AG, Germany, within the automotive semiconductor sector. This setting was selected because digital PPAP operates within a formal industrial quality system that requires traceability, documentation discipline, and customer approval. The case was analytically relevant for three reasons. First, the sector follows strict quality, traceability, and customer approval standards. Second, the company had implemented a self-service digital PPAP environment to improve visibility, workflow discipline, and responsiveness. Third, the PPAP workflow connected several critical functions in a traceable process, allowing the study to examine communication across internal functions and toward the customer. The study used only non-confidential process details and excluded proprietary product data, confidential customer records, and protected technical specifications.

The study used three data sources: semi-structured interviews, organizational documents, and non-confidential system artifacts. Interviews were needed because workflow logic alone could not explain the communicative work in digital PPAP. The study analyzed how participants interpreted absent evidence, addressed ambiguity, managed delays, and rendered approval decisions. Organizational documents were included because PPAP is a text-based approval process. Basque et al. (2022) explain that records, templates, approvals, and workflow files form part of the communication process through which readiness is asserted and legitimized. Non-confidential system

artifacts were reviewed to understand how the digital environment structured workflow visibility, routing logic, and document access.

Informants were selected through purposive sampling based on their formal involvement in the digital PPAP workflow. The aim was analytical relevance, not numerical representativeness. The selected informants held roles related to package creation, approval, customer interface, process coordination, and tool ownership. These roles provided access to key communicative areas where documents, workflow decisions, system constraints, and interfunctional coordination intersected.

Table 1: Informants Profile

Informant Code	Informant Role in Workflow	Primary communicative responsibility	Relevance in Study
Y1	QM-QSC Manager	Compiles PPAP packages, checks document completeness, and requests clarification from other functions.	Shows how workflow continuity depends on document-centered communication.
Y2	BU QM Manager Director	Interprets package readiness, approves or rejects submissions, and legitimizes quality decisions.	Shows how authority and quality legitimacy are constituted.
Y3	QSC Senior Specialist	Receives customer requests, communicates timelines, and submits finalized PPAP to the customer.	Shows how internal process quality affects external alignment.
Y4	PPAP Process Owner Manager	Connects PAT, PPAP databases, and PLM Windchill; tracks availability and traceability of records.	Shows how fragmentation is bridged through communicative coordination.
Y5	DSP PPAP Tool Owner Director	Maintains the PPAP tool, supports workflow functionality, resolves tool-related issues, and coordinates system changes with relevant functions.	Shows how tool governance and system support influence workflow continuity and communicative coordination.

Semi-structured interviews were conducted with five informants to allow comparison across roles while still exploring role-specific experiences. Each interview lasted about 45 to 60 minutes. The interview guide followed the research questions and covered document handling, workflow administration, approval practices, role interaction, system limitations, escalation, and customer-related implications. This format helped examine both operational practices and participants’ interpretations.

Interview data were triangulated with organizational documents, workflow records, and visible system logic to strengthen credibility.

Workflow-related documents included process references and non-confidential organizational files connected to the digital PPAP environment. These texts were treated as contextual materials and communicative artifacts because they shaped how work was organized and how approval could be obtained. System artifacts included non-confidential workflow structures, database links, metadata relationships, and workflow outputs from the PPAP Automation Tool and master data environments. These materials showed how the digital system organized communication, created visibility, and still required manual follow-up, clarification, or interpretive repair.

Data analysis used thematic analysis supported by qualitative coding. Interview transcripts, documents, and system artifacts were read repeatedly to identify recurring patterns in the digital PPAP process. Initial coding identified operational issues such as missing records, outdated evidence, version uncertainty, manual search, delayed escalation, and repeated clarification. Focused coding grouped these issues into broader categories linked to the conceptual framework, including constitutive communication practice, conversation-text relations, non-human agency, performativity, legitimacy, and customer alignment. Pattern coding then connected internal communication patterns with external outcomes, especially transparency, responsiveness, and customer alignment. Miles et al. (2020) point out that qualitative analysis moves from descriptive codes to analytical categories and conceptually grounded explanations. Saldaña (2021) also emphasizes coding as an iterative process that develops meaning from repeated engagement with the data.

A clear coding trail was used to improve analytical reliability. Codes were developed from both empirical material and the theoretical framework. Operational issues, such as missing files or unclear ownership, were first coded descriptively. These codes were then interpreted through the CCO lens to explain how communication practices produced coordination, approval authority, and quality legitimacy. This process moved the analysis beyond workflow problems and explained digital PPAP as communicative infrastructure.

Data validation was strengthened through triangulation across interviews, documents, and system-related evidence. This reduced dependence on a single source and allowed participant accounts to be compared with process logic and documentary traces. Credibility was supported through repeated reading, comparison across informant roles, and consistency checks between interview statements and non-confidential workflow evidence. The study did not seek statistical generalization. Creswell and Poth (2024) explain that qualitative case studies support contextual understanding of a real-life phenomenon. Miles et al. (2020) support analytical explanation through systematic comparison of qualitative evidence. This study therefore used one organizational case to explain how communication practices shape digitally mediated quality systems in a complex industrial setting.

Ethical considerations were applied throughout the research process. Participation was based on informed consent, and informants were identified only through codes. The study did not use proprietary product data, confidential customer information, or protected technical specifications. Organizational documents and system artifacts were limited to non-confidential materials relevant to the digital PPAP workflow. These boundaries protected organizational confidentiality while allowing the study to examine how communication shapes coordination, approval legitimacy, and customer alignment in practice. The methodology was deliberately limited to one organizational case, one quality-management environment, and one digital PPAP process. This scope supported depth of analysis and kept the focus on communication practices rather than technical system performance or confidential product specifications.

RESULTS AND DISCUSSION

Presenting the Results

The findings suggest that digital PPAP provides a more formal structure for workflow management, yet the process still depends heavily on communication at every stage. Across the five interviews, a consistent pattern emerged: the system defined the formal sequence of the workflow, but actual progress depended on continuous follow-up, clarification, and document repair. Missing files, expired records, unclear ownership, version differences, and fragmented storage created the need for manual communication among workflow participants. Digital PPAP was therefore not an entirely autonomous system. It functioned as an organized digital environment that still required continuous communicative action to sustain workflow continuity.

This pattern appeared across different workflow roles. Informants involved in PPAP package creation reported that they spent considerable time tracing records, checking document completeness, and consulting other functions before a package could move forward. Informants involved in approval emphasized that formal readiness was not enough; the available evidence also had to be interpreted as valid, current, and authoritative. Customer-facing informants indicated that the internal discipline of document handling, timing, and workflow control directly affected customer commitments. The process owner and tool owner also explained that the digital system made workflow stages more visible, but it did not eliminate the need for manual coordination across disconnected sources of information.

The interview data support this pattern. The PPAP creator explained that most communication was triggered by missing or incorrect documents, while the approver emphasized that approval delays were often caused by document availability rather than product quality issues. The customer-facing informant also indicated that missing or expired documents had to be explained to customers, which shows how internal workflow instability became visible at the customer interface.

“Most communication is triggered by missing or incorrect documents. When I cannot find a document in the PPAP database, I must contact PPOO, who then

contacts FE or BE. This manual process significantly extends the PPAP turnaround time” (Informant Y1).

“Approval is often delayed not because of quality issues but because documents are not readily available in the system” (Informant Y2).

“I frequently need to explain delays caused by missing or expired documents” (Informant Y3).

These findings show that system routing alone does not make the digital PPAP workflow automatic. Progress depends on actors who clarify requirements, locate supporting records, close information gaps, request missing evidence, and align what exists in the system with what is required for approval. In this sense, the digital environment increases visibility, but it does not remove communicative labor. Workflow continuity depends on the ability of participants to connect people, records, and system logic into a coherent package of production readiness.

The process owner and tool owner confirmed this point by describing how system fragmentation shaped the workflow. One informant stated that the role of the process owner was to compensate for system fragmentation, while the tool owner explained that PPAP Automation Tools (PAT) structured the formal workflow but could not guarantee the actual availability or correctness of required documents. These statements clarify why the findings should be understood as representative of the communicative work required in the Digital PPAP process.

“My role is to compensate for system fragmentation” (Informant Y4).

“The system defines who should act and when, but it cannot guarantee that the required documents exist in the correct version” (Informant Y5).

The findings are organized into five analytical dimensions. These dimensions were developed from the interview data and interpreted through the theoretical framework of communication as constitutive of organization, sociomateriality, and strategic communication.

Table 2: Dimensions of Analysis Used to Interpret the Digital PPAP Findings

Analytical dimension	Indicative evidence from case data	Constitutive implication
Communication as organizing	Workflow continuity depended on follow-up for missing, expired, or inconsistent documents. Informant Y1 stated that missing or incorrect documents triggered most communication and extended PPAP turnaround time.	Internal coordination was accomplished through communication, not guaranteed by the tool itself.
Conversation-text relationship	Informal clarifications through calls and e-mails were later converted into formal PPAP records, approvals, and audit-ready evidence. Informants described this translation as manual and verification-dependent.	Texts did not simply record action; they stabilized and redirected subsequent action.

Agency of non-human actors	PAT blocked progress when required evidence was absent, but could not automatically retrieve or validate that evidence. Informant Y5 described PAT as a gatekeeper that controls progress without resolving document gaps.	System rules exerted agency by structuring pace, visibility, and escalation.
Performativity and legitimacy	Approval and rejection were described as decisions about whether documentation was sufficiently credible under time pressure. Informant Y2 noted that approval delays often reflected document availability rather than product quality issues.	Quality legitimacy was enacted through communicative decisions rather than merely discovered.
Customer alignment and trust	Customers saw lead time, submission quality, corrections, and the clarity of explanations, not the internal struggle behind them. Informant Y3 reported having to explain delays caused by missing or expired documents.	External trust depended on the stability and credibility of internal communication.

Taken together, these results demonstrate that digital PPAP is not only a technical procedure for managing documents. It is a communicative space where actors, documents, workflow rules, and system outputs jointly create internal organizing, approval legitimacy, and customer-facing quality credibility. The following discussion interprets these findings through the theoretical framework and relevant literature.

Discussion

Internal Communication as Organizing Practice

The first finding shows that digital PPAP operates as an organizing process because communication connects, repairs, and sustains the workflow. The platform defines phases, roles, and routing logic, but coordination does not happen automatically. It occurs when actors identify missing information, assign responsibility, and judge whether documents are credible enough to move the package forward. Kuhn (2021) explains that organization is not fixed but continuously produced through communication. Basque et al. (2022) show that organizing emerges through interactions among actors, texts, technologies, routines, and institutional arrangements. Schoeneborn et al. (2025) emphasize that communication helps produce organizational authority, legitimacy, and structure. Leonardi and Treem (2020) show that digital technologies shape organizational communication, visibility, and coordination.

Digital PPAP may appear to be a technical approval chain, but the case shows that it works through distributed communication. The PPAP creator, approver, customer-facing function, process owner, and tool owner each support the workflow's continuity. Some actors clarify documents, while others confirm readiness, manage customer expectations, or translate system limits into operational decisions. The formal workflow makes the process visible, but communication makes it workable.

This interpretation extends prior PPAP research. Hakoniemi (2022) shows that PPAP supports new product design, coordination, and production preparedness. Määttä (2022) identifies coordination and alignment issues between engineering and quality

teams in PPAP work. Tokmakova et al. (2022) explain that PPAP documentation helps translate customer requirements into production control and defect prevention. The present findings build on these studies by showing how readiness and coordination are achieved in practice. Therefore, communication plays a primary role in the workflow. It is the mechanism that makes the workflow organizationally coherent.

Approval, Authority, and Quality Legitimacy

The second finding concerns the nature of approval itself. The case material shows that approval was not a neutral or mechanical verification step. It was a decision about whether the available documentation was valid, current, traceable, and meaningful enough to support a credible claim of production readiness. Digital PPAP approval is therefore not only a technical checkpoint. It is a performative act that formally recognizes organizational readiness.

This finding shifts approval from compliance checking to legitimacy production. A PPAP package becomes “ready” only when the approving authority judges the documentation as credible. Rejection, delay, or rework also creates an organizational reality by marking the package as incomplete, inconsistent, or insufficiently justified. Approval therefore helps define what the organization can present as valid, traceable, and customer-ready.

The finding also shows the link between communication and authority. In digital PPAP, authority does not come only from position or role. It becomes stronger when actors provide valid records, explain their interpretation, and connect decisions to accepted workflow logic. Authority weakens when evidence is missing, outdated, or difficult to trace. Quality legitimacy is therefore produced through documentary discipline and communicative interpretation. The system can show whether a field is complete or a route is blocked, but it cannot judge substantive credibility. That judgment still depends on human actors.

Basque et al. (2022) explain that texts, records, and material arrangements participate in organizing action. Leonardi and Treem (2020) show that digital systems shape organizational visibility and interaction while still requiring human interpretation. In this case, records, templates, workflow gates, and approvals did not merely reflect readiness. They helped produce it. Quality legitimacy was not only documented. It was enacted through communication.

Non-Human Agency and the Boundaries of Digital Workflow

The third finding concerns the role of the digital system itself. In the case, PPAP automation tools and other system components influenced workflow speed, visibility, and escalation. The system could stop progress when required evidence was missing. It could also sequence tasks and make delays or absent evidence visible to participants. In this sense, the digital platform had agency in the process. It shaped what had to move, what had to be completed, and where attention had to shift when a stage was blocked.

At the same time, the system’s agency was limited. It could signal absence, but it could not automatically resolve ambiguity. It could route action, but it could not

guarantee document validity or coherence. This situation makes digital PPAP a sociomaterial setting where human actors, digital tools, documents, and workflow rules jointly shape organizational action (Orlikowski, 2007). The system contributes to organizing, but it does not replace interpretation, judgment, and coordination.

The findings therefore show that digitalization changes the role of communication. It does not eliminate communication. A digital workflow makes communication more visible and connects it to records, status, system prompts, and platform restrictions. However, interpretation, clarification, and follow-up remain necessary. This is especially true in partially integrated environments where information may still be distributed across databases, folders, and systems. In such situations, the digital platform does not remove communicative complexity. It redistributes it. Participants still rely on explanation, document tracing, and informal coordination to bridge gaps that the formal system cannot fully resolve.

This finding aligns with broader studies of digital work and sociomateriality. Hoblos et al. (2024) show that digital PPAP platforms can improve workflow visibility and process control. Kim and Cho (2023) explain that digital transformation in semiconductor ecosystems depends on organizational capability and adaptation. Kraus et al. (2021) connect digital transformation with redesigned organizational processes and new forms of coordination. Nadkarni and Prügl (2021) argue that digital transformation changes organizational structures, routines, and interaction patterns. Leonardi and Treem (2020) show that digital technologies influence organizational communication but do not determine it. Orlikowski (2007) argues that organizational action emerges through the relationship between social and material elements. The present study extends this argument by showing that tool visibility and workflow control are important but insufficient. The digital system frames action, while communication provides meaning to what the system displays and enables action where the system creates or reveals gaps.

Customer Alignment, Transparency, and Traceability

The fourth finding shows that customer alignment in digital PPAP is shaped upstream by internal communication. Customers do not see the backstage work of document tracing, role clarification, missing-record reconstruction, or system repair. They see its outcomes: submission quality, lead-time consistency, documentation reliability, responsiveness, and credible explanations when delays occur. Customer trust therefore depends on stable internal communication before the final PPAP package reaches the customer.

This finding connects digital PPAP with strategic business communication management and relationship-based customer management. Transparency does not only mean sharing information. It means the organization can explain what has been completed, what remains pending, why a delay occurred, and what the next step will be. Traceability is also more than a technical audit trail. It is the ability to reconstruct and justify decisions in a way that internal and external stakeholders can accept.

Customer communication becomes credible when workflow movement is predictable and document control is coherent.

Alper (2024) explains that strategic communication supports legitimacy by connecting organizational actions with stakeholder expectations. Cornelissen (2023) emphasizes that business communication contributes to coordination, stakeholder value, and organizational credibility. Deszczyński (2021) shows that customer relationship management depends on continuous communication, responsiveness, trust, and relationship stability. Digital PPAP is therefore both an internal quality mechanism and a customer-facing communication process. In the automotive semiconductor environment, responsiveness, traceability, and trust are central to supplier legitimacy. Customer alignment is not only the result of technical compliance. It is built through communication practices that organize quality work internally and make that work credible externally.

Integrating the Findings

Together, the findings support the main argument of this article: digital PPAP should be understood as communicative infrastructure, not merely as a technical approval tool (Leonardi & Treem, 2020). Internal organizing, approval legitimacy, and customer alignment are interrelated outcomes of the same communication environment. Documents, system rules, workflow sequences, approvals, and interactions shape what the organization recognizes as ready and what the customer perceives as trustworthy (Basque et al., 2022).

The findings also show how communication practices connect internal coordination, approval authority, quality legitimacy, transparency, and customer trust. The CCO perspective explains that communication among actors, texts, technologies, and routines produces organizational outcomes (Kuhn, 2021). The key issue was that communication remained necessary after digitalization because system visibility exposed the manual repair still required when records were dispersed. This interpretation is analytical rather than statistical because the study examined one organizational case (Stevens, 2022).

This analysis also explains why workflow platforms do not automatically simplify digital quality management. The issue is not only whether a system exists but also whether its communication architecture is coherent. When digital structure and communicative practice are misaligned, informal repair is needed to sustain the formal workflow. This creates hidden workload, reduces predictability, and weakens customer transparency. Digital quality management should therefore be treated not only as a technological project but also as a communication design challenge (Hoblos et al., 2024).

Problem and Solution Mapping Using the Star Model

The findings also indicate a practical improvement agenda. To clarify this agenda, the results were translated into a Star Model mapping. The Star Model links organizational problems to interdependent elements: strategy, structure, processes, rewards, and

people (Galbraith, 2014). The mapping shows that software changes alone cannot improve digital PPAP performance. The case reveals problems in organizational design, communication ownership, workflow governance, performance expectations, and role-based knowledge.

Table 3: Mapping of Problems and Solutions Using the Star Model

Star model element	Problem identified in the case	Recommended solution direction
Strategy	Digital PPAP is still interpreted too narrowly as a compliance tool rather than as a strategic communication infrastructure for customer trust.	Reframe digital PPAP as part of quality strategy and customer-alignment strategy, with executive ownership for visibility, responsiveness, and trust.
Structure	Responsibility is formally assigned but communicative ownership remains fragmented across QSC, QM, legal compliance, process owner, and tool owner.	Define end-to-end ownership, clearer escalation routes, and explicit document accountability at each approval stage.
Processes	Manual retrieval, fragmented storage, weak integration, and version ambiguity force repeated clarification and delay.	Integrate PAT with PPAP databases, PLM Windchill, and customer-facing systems; automate linkage, validity checks, and workflow notifications.
Rewards	Teams are pushed by urgent customer deadlines, but the process does not consistently reward first-time-right submission quality and document discipline.	Add process KPIs such as document validity, approval cycle time, on-time submission, and resubmission rate to reinforce desired behavior.
People	The workflow depends heavily on tacit know-how and informal follow-up, making continuity vulnerable when experience is uneven.	Provide communication playbooks, role-based training, and shared process literacy so actors can escalate, justify, and submit consistently.

The Star Model mapping confirms that digital PPAP performance depends on more than software. It requires alignment among strategy, structure, process governance, performance measures, and people. Without this alignment, digitalization may improve visibility while leaving the communication problems behind the workflow unresolved.

CONCLUSION

This paper explored the role of communication practices in digital PPAP and their impact on internal organizational coordination, approval legitimacy, and customer alignment in the automotive semiconductor industry. The results indicate that digital PPAP is more than a mechanism for obtaining technical approval or maintaining digital records. It functions as a communicative infrastructure that produces workflow continuity, approval authority, and customer-facing credibility (Basque et al., 2022). This confirms that communication is not an external support function in the quality process. It is a

central mechanism through which the process becomes functional, valid, and credible (Leonardi & Treem, 2020).

The analysis yields several conclusions. First, digitalization does not remove the need for internal communication in digital PPAP. The workflow progresses not only because the system routes tasks, but also because actors interpret requirements, verify document validity, clarify ownership, retrieve missing evidence, and reconnect fragmented records across systems (Orlikowski, 2007). Second, approval in digital PPAP is not merely a technical gateway. It is a performative organizational act through which readiness receives formal recognition and quality legitimacy (Basque et al., 2022). Third, the stability of internal communication shapes customer alignment upstream. Transparency, responsiveness, traceability, and trust do not automatically emerge from system implementation. They depend on the consistent organization of communication within the approval process (Deszczyński, 2021).

Taken together, these findings indicate that digital PPAP creates value when communication design, document governance, and workflow visibility are managed together with the underlying technology. A digital platform may improve visibility, but visibility alone does not guarantee legitimacy or trust. Actors still need to interpret records, explain decisions, justify approval logic, and translate internal quality work into credible customer-facing communication (Cornelissen, 2023). This finding supports the communication as constitutive of organization perspective, which argues that organizational order is produced through communication rather than simply supported by it (Kuhn, 2021). It also confirms that people, texts, technologies, routines, and institutional arrangements jointly shape organizational processes (Schoeneborn et al., 2025).

The study contributes to the research area in two ways. Theoretically, it applies the communication as constitutive of organization perspective to a digital quality-management setting and shows how communication constitutes coordination, approval authority, and quality legitimacy in digital PPAP (Basque et al., 2022). It also demonstrates how strategic business communication management can explain the role of communication in legitimacy, coordination, and stakeholder value (Alper, 2024). In addition, customer relationship management helps explain the connection between internal quality communication and external customer relationships (Deszczyński, 2021). Practically, the study suggests that organizations should not treat digital PPAP as a software implementation alone. They should define clearer roles, strengthen document ownership, improve escalation logic, align internal and customer-facing communication, and build stronger process literacy among workflow actors (Cornelissen, 2023).

This study has practical implications for automotive semiconductor suppliers and other organizations using digital quality systems. To improve digital PPAP performance, organizations should design communication structures around the platform, not just configure the platform itself. This includes clearer responsibility for document validity, stronger coordination between quality and customer-facing functions, more consistent

approval explanations, and better integration between workflow systems and quality records. Such improvements can reduce hidden manual repair work, improve submission quality, and strengthen customer trust.

Future research can extend this study by examining digital PPAP in other industrial contexts, across multiple organizations, or in customer-facing approval environments. Further studies may also investigate how deeper integration between quality systems, product lifecycle management platforms, and customer portals affects communication, legitimacy, and trust over time. A comparative study across industries or suppliers would help test how far the communicative role of digital PPAP applies beyond the automotive semiconductor sector.

BIODATA

Candra Dewi P.S., A.Md., S.T., is a quality management professional and lead auditor with over two decades of experience in the automotive and semiconductor industries. She serves as Quality Manager Automotive Microcontroller at Infineon Technologies AG, Munich, Germany. She is pursuing postgraduate study in Business and Communication Management at LSPR Institute of Communication & Business and holds certifications in ISO 9001:2015, IATF 16949:2016, AIAG/VDA PPAP, Six Sigma Green Belt, and project management.

Dr. Anita Rosana, BA., MA., is a lecturer and academic in media and communication with expertise in advertising and marketing communication. She currently serves as Lecturer of Corporate Communication and Secretary of the Doctoral Program in Communication at the London School of Public Relations (LSPR) Institute of Communication & Business. She earned her Doctoral Degree in Communication from Universitas Sahid, Jakarta, and a Master's degree from Birmingham City University, UK. With prior experience as an entrepreneur in a production house and advertising agency, she brings strong practical insight into academia, particularly in customer value development and strategic communication.

Aman Benjamin Emmanuel, B.Tech, MS, is an AI enthusiast and a data scientist. He is currently serving as a Business Analyst at Infineon Technologies AG, Munich, Germany. He recently completed his Dual degree programme, which is an M.Sc. in Business Intelligence and Data Science from International School of Management (ISM) Munich, Germany and a M.Sc in Business Management from Edinburgh Napier University, Edinburgh, Scotland.

REFERENCES

- AIAG. (2006). Production part approval process (PPAP) (4th ed.). Automotive Industry Action Group. <https://webstore.ansi.org/standards/aiag/aiagppap2006>
- AIAG. (2018). Production part approval process (PPAP) manual. Automotive Industry Action Group. <https://www.aiag.org/quality/automotive-core-tools/ppap>
- Alper, D. Ö. (2024). Public relations discourse on X (Twitter) and analysis of public relations. *Journal of Communication and Public Relations*, 3(1), 14–26. <https://doi.org/10.37535/105003120242>
- Antony, J., Sony, M., McDermott, O., Jayaraman, R., & Flynn, D. (2023). An exploration of organizational readiness factors for Quality 4.0: An intercontinental study and future research directions. *International Journal of Quality & Reliability Management*, 40(2), 582–606. <https://doi.org/10.1108/IJQRM-10-2021-0357>
- Basque, J., Bencherki, N., & Kuhn, T. (Eds.). (2022). *The Routledge handbook of the communicative constitution of organization*. Routledge. <https://doi.org/10.4324/9781003224914>
- Belu, N., Al Ali, A. R., & Khassawneh, N. (2013). Application of control plan - PPAP tool in automotive industry production. *Quality - Access to Success*, 14(136), 68–72.
- Chiarini, A., & Kumar, M. (2022). What is Quality 4.0? An exploratory sequential mixed methods study of Italian manufacturing companies. *International Journal of Production Research*, 60(16), 4890–4910. <https://doi.org/10.1080/00207543.2021.1942285>
- Cornelissen, J. (2023). *Corporate communication: A guide to theory and practice* (7th ed.). SAGE Publications.
- Creswell, J. W., & Poth, C. N. (2024). *Qualitative inquiry and research design: Choosing among five approaches* (5th ed.). SAGE Publications.
- Deszczyński, B. (2021). Firm competitive advantage through relationship management: A theory for successful sustainable growth. Palgrave Macmillan. <https://doi.org/10.1007/978-3-030-67338-3>
- Dias, A. M., Carvalho, A. M., & Sampaio, P. (2022). Quality 4.0: Literature review analysis, definition and impacts of the digital transformation process on quality. *International Journal of Quality & Reliability Management*, 39(6), 1312–1335. <https://doi.org/10.1108/IJQRM-07-2021-0247>
- Elock Son, M., & Breka, J. N. (2023). Digitalization and Industry 4.0 within the supply chain: A review of contributions and barriers. *Revue Française de Gestion Industrielle*, 37(2). <https://doi.org/10.53102/2023.37.02.953>
- Gertsson, H., & Lindberg, H. (2023). Integration of advanced product quality planning in quality preparation for an original equipment manufacturer in the automotive industry: A case study at Volvo Group Trucks Operations Powertrain Production in Skövde [Master's thesis, Luleå University of Technology].
- Hakoniemi, P. U. M. (2022). Evaluation of production part approval process: ABB IEC LV Motors division [Master's thesis, University of Vaasa].

- Hermans, J., & Liu, Y. (2013). Quality management in the new product development: A PPAP approach. *Quality Innovation Prosperity*, 17(2), 37–51. <https://doi.org/10.12776/qip.v17i2.150>
- Hoblos, N., Sandeep, M. S., & Pan, S. L. (2024). Achieving stakeholder alignment in digital transformation: A frame transformation perspective. *Journal of Information Technology*, 39(4), 630–649. <https://doi.org/10.1177/02683962231219518>
- IATF. (2021). IATF 16949:2016: Quality management system requirements for automotive production and relevant service parts organizations. International Automotive Task Force. <https://www.iatfglobaloversight.org/iatf-169492016/>
- ISO. (2021). ISO 9001:2015 quality management systems: Requirements. International Organization for Standardization. <https://www.iso.org/standard/62085.html>
- Kim, D., & Cho, K. (2023). Digital transformation characteristics of the semiconductor industry ecosystem. *Sustainability*, 15(1), Article 483. <https://doi.org/10.3390/su15010483>
- Kraus, S., Jones, P., Kailer, N., Weinmann, A., Chaparro-Banegas, N., & Roig-Tierno, N. (2021). Digital transformation: An overview of the current state of the art of research. *SAGE Open*, 11(3). <https://doi.org/10.1177/21582440211047576>
- Kuhn, T. (2021). (Re)moving blinders: Communication-as-constitutive theorizing as provocation to practice-based organization scholarship. *Management Learning*, 52(1), 109–121. <https://doi.org/10.1177/1350507620931508>
- Leonardi, P. M., & Treem, J. W. (2020). Behavioral visibility: A new paradigm for organization studies in the age of digitization, digitalization, and datafication. *Organization Studies*, 41(12), 1601–1625. <https://doi.org/10.1177/0170840620970728>
- Liu, H.-C., Liu, R., Gu, X., & Yang, M. (2023). From total quality management to Quality 4.0: A systematic literature review and future research agenda. *Frontiers of Engineering Management*, 10, 191–205. <https://doi.org/10.1007/s42524-022-0243-z>
- Määttä, K. (2022). Production part approval process (PPAP) framework integration into product development process [Bachelor's thesis, Oulu University of Applied Sciences]. <https://urn.fi/URN:NBN:fi:amk-202205139036>
- Miles, M. B., Huberman, A. M., & Saldaña, J. (2020). *Qualitative data analysis: A methods sourcebook* (4th ed.). SAGE Publications.
- Nadkarni, S., & Prügl, R. (2021). Digital transformation: A review, synthesis and opportunities for future research. *Management Review Quarterly*, 71, 233–341. <https://doi.org/10.1007/s11301-020-00185-7>
- Orlikowski, W. J. (2007). Sociomaterial practices: Exploring technology at work. *Organization Studies*, 28(9), 1435–1448. <https://doi.org/10.1177/0170840607081138>
- Rudolf, Ł., & Roszak, M. T. (2022). Tools of product quality planning in the production part approval process. *Archives of Materials Science and Engineering*, 118(2), 67–74. <https://doi.org/10.5604/01.3001.0016.2591>

- Sader, S., Husti, I., & Daróczy, M. (2022). A review of Quality 4.0: Definitions, features, technologies, applications, and challenges. *Total Quality Management & Business Excellence*, 33(9–10), 1164–1182. <https://doi.org/10.1080/14783363.2021.1944082>
- Saldaña, J. (2021). *The coding manual for qualitative researchers* (4th ed.). SAGE Publications.
- Schmidtman, J. (2025, May 22). How digital material data exchange is transforming PPAP. LinkedIn. <https://www.linkedin.com/pulse/how-digital-material-data-exchange-transforming-ppap-jens-schmidtman-2gr4e>
- Schoeneborn, D., Vasquez, C., & Kuhn, T. (2025). Communication-as-constitutive perspectives on organization. *Academy of Management Collections*, 4(1), 1–19. <https://doi.org/10.5465/amc.2023.0007>
- Srinivasan, U., Mittel, D., Lemberger, D., & Perzylo, A. (2024). Structured product engineering: Ontology-based advanced product quality planning. *Procedia CIRP*, 138, 1109–1114.
- Stevens, P. A. J. (Ed.). (2022). *Qualitative data analysis: Key approaches*. SAGE Publications.
- Tokmakova, T. V., Vysotskaya, V. I., Tokmakova, E. N., & Malikov, S. B. (2022). Improving product quality by APQP and PPAP. *Russian Engineering Research*, 42(3), 286–287. <https://doi.org/10.3103/S1068798X2203025X>
- Verhoef, P. C., Broekhuizen, T., Bart, Y., Bhattacharya, A., Dong, J. Q., Fabian, N., & Haenlein, M. (2021). Digital transformation: A multidisciplinary reflection and research agenda. *Journal of Business Research*, 122, 889–901. <https://doi.org/10.1016/j.jbusres.2019.09.022>